**Thematic Poster - Athletic Skills Post ACL Reconstruction**

**Wednesday, May 27, 2020, 9:30 AM - 11:30 AM**

**Room: CC-2009**

**Chair:** Susan M. Sigward. University of Southern California, Los Angeles, CA.  
(No relevant relationships reported)

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**Board #1**

**May 27 9:30 AM - 11:30 AM**

**Kinetic Asymmetry During Squatting And Landing Are Associated In Anterior Cruciate Ligament Reconstructed Patients**

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(No relevant relationships reported)

High kinetic asymmetry during landing is associated with an increased risk for sustaining a second anterior cruciate ligament (ACL) injury in athletes returning to sport following ACL reconstruction (ACL-R). While previous literature has found that ACL-R patients have more kinetic asymmetry than healthy controls during both landing and bilateral squatting, it is currently unknown if landing asymmetry and squatting asymmetry are related in ACL-R patients. **PURPOSE:** Determine the relationship between landing kinetic asymmetry and squatting kinetic asymmetry in ACL-R patients. **METHODS:** 34 ACL-R patients (19 male; 73 ± 16 kg; 174 ± 10 cm; 6 ± 1.5 months post-operative) signed informed consent and participated in the study. All participants completed one set of 15 bilateral squats and then ten bilateral stop jump trials, while 3D lower extremity kinematics and kinetics were recorded at 240 Hz and 1920 Hz, respectively. Peak knee extension moment (KEM) and vertical ground reaction force impulse (GRFI) were computed during the descending phase of both tasks. The descending phase was defined between squat initiation and the minimum position of the pelvis during each squat and between initial contact and the minimum position of the pelvis for each stop jump. A limb symmetry index (LSI) was computed for peak KEM and GRFI as the difference between the surgical and non-surgical leg divided by their average during each squat and each stop jump, and then the LSI was averaged across trials. Peak KEM LSI and GRFI LSI were then compared between the stop jump and squat trials using Pearson’s correlations. **RESULTS:** There was a significant relationship between both stop jump kinetic asymmetry outcomes and both squat kinetic asymmetry outcomes (Table 1). **CONCLUSION:** Kinetic asymmetry during squatting and bilateral landing are associated in ACL-R patients, which indicates that biofeedback retraining during bilateral squatting could result in improvements in bilateral landing symmetry.

### Table 1: Mean ± standard deviation for both outcomes on the squat and stop jump trials, and the relationship between kinetic asymmetry during squatting and stop jump landing

<table>
<thead>
<tr>
<th></th>
<th>Peak KEM LSI</th>
<th>GRFI LSI</th>
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<tbody>
<tr>
<td></td>
<td>45.8% ± 24.6%</td>
<td>42.8% ± 26.0%</td>
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<tr>
<td>Squat</td>
<td></td>
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<tr>
<td>Peak KEM LSI</td>
<td>r = 0.693</td>
<td>r = 0.555</td>
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<tr>
<td>p = 0.001</td>
<td>p = 0.001</td>
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<tr>
<td>GRFI LSI</td>
<td>r = 0.428</td>
<td>r = 0.479</td>
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<tr>
<td>p = 0.012</td>
<td>p = 0.004</td>
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</tbody>
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**Board #2**

**May 27 9:30 AM - 11:30 AM**

**Individualized Training Improves Inter-limb Joint Kinetic Symmetry During Jump Landing After ACL Reconstruction**

Audrey RC Elias, Ryan L. Mizner. University of Montana, Missoula, MT.  
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(No relevant relationships reported)

Most athletes with unilateral ACL reconstruction present with reduced knee and hip flexion and asymmetrical vertical ground reaction force (VGRF) and internal knee extension moment during two-legged jump landings. This landing movement pattern is associated with low scores on self-reported outcome surveys and may contribute to the increased risk of re-injury in athletes with ACL reconstruction. The capacity for correction of inter-limb asymmetries during landing remains understudied. **PURPOSE:** To determine whether jump training can correct asymmetrical limb loading and whether corrections are retained over time. **METHODS:** An 8-camera motion analysis system with dual force plates collected kinematic and kinetic data in a 30cm drop vertical jump to screen 48 potential participants with unilateral ACL reconstruction. Twenty-three athletes (14 women, 23 ± 5 years old, 20 ± 15 months post-surgical, Tegner score: 7 ± 2) presented with below-average knee loading symmetry in landing and poor clinical outcomes, and participated in 8 weeks of twice-weekly high-repetition progressive jump landing training. Subjects re-tested at 4 and 8 weeks. Retention testing was performed after 8 weeks post-training. Changes in hip and knee kinematics and kinetics including limb symmetry indices (percent of the uninjured limb) over time were assessed with paired t-tests. **RESULTS:** Peak hip and knee flexion angles in the involved limb increased significantly in the drop vertical jump after 4 weeks of training (hip: 78 ± 22 to 92 ± 20, p < 0.001; knee: 86 ± 11 to 96 ± 16, p = 0.001). Symmetry in peak VGRF between limbs during landing increased after the full 8-week training period (83% ± 18% to 91% ± 16%, p = 0.005). Changes in joint flexion and VGRF were retained for at least 8 weeks after the final training session. Symmetry in knee movement between limbs did not reach a statistical improvement until final retention tests (Pre: 80% ± 17%, Post: 86% ± 12%, p = 0.47; Retention: 94% ± 21%, p = 0.004). **CONCLUSIONS:** Individualized jump training results in normalization of limb loading symmetry during jump landings. Visible kinematic changes occur early in training, but symmetry in loading of the limb and knee specific kinetic measures take more time to achieve as they integrate into an athlete’s movement pattern.

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**Board #3**

**May 27 9:30 AM - 11:30 AM**

**Quadriiceps Strength And Rate Of Torque Development Are Associated With Countermovement Jump Knee Kinetics Post-aclr**

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(No relevant relationships reported)

Quadriceps neuromuscular dysfunction is ubiquitous after anterior cruciate ligament reconstruction (ACLCR) and can impair knee function during athletic activities. While peak quadriceps strength is often measured, time-dependent metrics such as rate of torque development may be important to sports performance. **PURPOSE:** To determine the relationships between quadriceps strength, rate of torque development, time since surgery, and knee joint kinetics during jumping in collegiate athletes up to 2 years post-ACLCR. **METHODS:** 31 Division I athletes (age 20.3 ± 1.3, BMI 26.1 ± 3.9 kg/m², 17 female) performed countermovement jumps (CMJ) on force plates while whole body kinematics were recorded and computed maximal and rapid voluntary isometric knee extension (KE) contractions. Sagittal plane KE impulses were computed for concentric (CON) and landing (LAND) CMJ phases; KE peak torque (PT) and rate of torque development from 20-80% of peak torque (RTD) were extracted from isometric KE efforts. Limb symmetry indices (LSI) were computed and clinically relevant cutoffs of 90% LSI were investigated. A mixed effects model accounted for repeated measurements and assessed the relationships of PT, RTD, and time from surgery with CON and LAND. All possible pairwise interactions were tested. **RESULTS:** Among 31 athletes, 81 tests were completed 4-24 months post-surgery. PT and RTD were significantly correlated with CON (PT: p < 0.001, RTD: p = 0.044) and LAND (PT: p = 0.009, RTD: p = 0.008). No significant pairwise interactions between PT, RTD, and time from surgery were detected. Among 24 instances of PT LSI ≥ 90%, mean CON and LAND LSI were 87.3% and 94.2%, respectively. In comparison, among 15 occurrences of RTD LSI ≥ 90%, mean CON and LAND LSI were 93.0% and 102.2%, respectively. Among the 22 assessments completed ≥ 1 year post-surgery, mean CON and LAND LSI were 82.4% and 83.3%, respectively. However, when CON and LAND LSI were ≥ 90%, mean PT was 94.5 ± 94.7% and mean RTD was 85.1 ± 85.3%. **CONCLUSIONS:** Both peak and rapid knee extensor torque development are strongly associated with symmetrical sagittal plane CMJ knee mechanics. CMJ knee...
kinetic asymmetries did not resolve over time, independent from quadriceps function. Restoring maximal and rapid quadriceps torque capacity appears to be an important step in recovering symmetrical CMJ mechanics post-ACLR.

The ability to return to sport (RTS) after an anterior cruciate ligament reconstruction (ACLR) return to sport is due to many factors. To date, few studies have considered the role of poor biomechanics to predict RTS status. Potentially, higher ground reaction forces (GRF) and better frontal plane knee alignment at a 6 month follow up may indicate an athlete who is able to return to sport at their pre-injury level. However, this has never been formally tested.

Purpose: To determine the biomechanical factors at six months that predict return to sport at pre-injury level following ACLR.

Methods: 21 subjects, (13 F, 10 male; 16±1.4 years) underwent a six months (190.6 ± 15.3 days) following ACLR, ran on an instrumented treadmill during three-dimensional assessment. Visual 3D was used to analyze peak GRF, impact peak, and frontal plane knee angle. Subjects were contacted at 4.5 ± 2.1 years post-surgery to answer a questionnaire regarding RTS. Logistic regression model selection was performed using the Feasible Solutions Algorithm with AIC as a criterion. p-values presented here are based on the main effect significance tests from the selected model.

Results: Of the 21 subjects, 62% returned to sport at their pre-injury level. Subjects who returned to sport had significantly higher peak GRF (RTS 2.1 ± 0.24 BW, No RTS 1.98 ± 0.18 BW, p<0.03), impact peak (RTS 1.6 ± 0.3 BW, No RTS 1.4 ± 0.16 BW, p<0.04), and maximum frontal plane knee angle (RTS 5.2 ± 3.0°, No RTS 3.3 ± 3.3°, p<0.04).

Conclusion: This data indicates that athletes who run with greater axial loading and whose knee is in a more adducted position are more likely to RTS at pre-injury level. We speculate that athletes who land with greater impact forces are more confident in their knee function and, thus, are more likely to return to sport. In addition, positioning the knee in more adduction may help the athlete feel more secure in their knee and, consequently, return to playing sport. Rehabilitation efforts should focus greater impact loading and improved frontal plane alignment of the knee during running to increase the likelihood of RTS at pre-injury level.

Relationship Between Dynamic Limb Symmetry And Subjective Limb Confidence Post ACL Reconstruction In Youth Athletes

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Limb symmetry index (LSI) of dynamic movement is used as return to sport criteria for athletes who have undergone an anterior cruciate ligament reconstruction (ACLR).

The relationship between an individual’s perception of confidence and dynamic performance is poorly understood. PURPOSE: To discern a relationship between dynamic limb symmetry during a drop landing (DL) and single leg hop (SLHOP) task with subjective limb confidence in athletes who have had an ACLR. METHODS: 23 subjects (13 female, 10 male; 16±1.4 years) underwent a biomechanical assessment, including a DL and SLHOP task, at around 7±1 months post op ACLR. Subjects were outfitted with a custom marker set and recorded with a 3D camera system while performing tasks on 2 force platforms. To examine dynamic limb symmetry, kinematic variables of peak hip flexion, knee flexion, and ankle dorsiflexion, with kinetic variables of peak hip extension moment, knee extension moment, ankle plantar flexion moment, and vertical ground reaction force (GRFz) were collected and analyzed as an index between the involved and non-involved limb. Subjects completed questionnaires for limb confidence. Significant correlations were retained for a regression analysis. RESULTS: A significant strong relationship was found between LSI of DL mechanics and IKDC (86±12, r=0.84, p<0.05). Among predictor variables, peak GRFz (LSI 79.21, p=0.05) was significant in its explanation of IKDC scores. Independent regressions showed significant moderate correlations between IKDC and LSI for peak hip extension moments (LSI 107±24, r=0.56, p<0.01), knee extension moments (LSI 80±23, r=0.51, p<0.05), and GRFz (r=0.62, p<0.01). No significant relationships were found for SLHOP and IKDC scores, or with TSK for either dynamic test. CONCLUSIONS: Subjective limb confidence demonstrated a strong relationship with limb symmetry of sagittal plane mechanics with a 1% difference in LSI of GRFz corresponding to a 0.4% difference in IKDC scores during a DL and not SLHOP task. Symmetry in mechanics during a bilateral task may be more reflective of patient confidence in utilizing the affected limb prior to return to sport after ACLR.

Effects Of A 4-week Vibration-induced Hamstrings Fatigue Intervention On Quadriceps Weakness After ACL Reconstruction

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Athrogenic muscle inhibition (AMI) results from an inability to voluntarily activate all motor units in the quadriceps due to ongoing neural inhibition. This may be due to changes in small diameter afferent activity that increase the excitability of the flexor withdrawal pathway, causing over-excitation of the hamstrings and reciprocal inhibition of the quadriceps. Reciprocal inhibition of the quadriceps from Ia afferents in the hamstring may be reduced with prolonged muscle vibration of the hamstrings via fatigue of the intrafusal muscle fibers. PURPOSE: To determine the effects of vibration-induced hamstring fatigue on AMI after ACL reconstruction (ACLR). METHODS: Seven adults (28.7 ± 8.2 yrs) with unilateral ACLr (time since surgery: 19.4 ± 9.7 months) were recruited. Participants received a 4-week long (3x/week) training program. Vibration-induced fatigue of the hamstrings consisted of 20 minutes of prolonged vibration applied directly to the hamstrings. Then, a cuff was placed on the proximal thigh and inflated to 150 mmHg to trap the metabolites in the muscle, and maintain hamstrings fatigue. Participants performed 4 sets of 15 reps at 30% 1-repetition maximum (RM) unilateral knee extension (KE). Quadriceps strength and quadriceps inhibition were assessed before and after the intervention using KE 1-RM normalized to body weight, and the central activation ratio (CAR) measured by a superimposed burst. The co-activation of the hamstrings was assessed using hamstring EMG during KE. Paired t-tests were used to examine the effect of prolonged vibration on KE strength, quadriceps CAP, and hamstrings co-activation before and after the intervention.
RESULTS: KE strength increased significantly by 38.5% (from 0.45 ± 0.1 to 0.62 ± 0.2 %BW, P = 0.004); quadriceps CAR also increased significantly by 5.8% (from 93 ± 0.1% to 98 ± 0.8%, P = 0.02). Finally, co-activation decreased by 34% (from 12 ± 1.3% to 8 ± 0.9%, P = 0.03).

CONCLUSIONS: These results suggest that quadriceps weakness may be due to over excitation of the hamstrings which results in reciprocal inhibition of the quadriceps. Vibration-induced hamstrings fatigue can be used as a rehabilitation strategy to restore normal quadriceps function following ACLR by reducing the hamstrings over-excitability and enabling full quadriceps activation.

A-19 Thematic Poster - Caffeine

Wednesday, May 27, 2020, 9:30 AM - 11:30 AM
Room: CC-2007

77 Chair: Eric E. Hall, FACSM. Elon University, Elon, NC.
(No relevant relationships reported)

78 Board #1 May 27 9:30 AM - 11:30 AM

Effects Of Caffeine On Physiological Responses To Exercise And Time-trial Performance: Influence Of CYP1A2 Genotype.

Mark Glaister, FACSM, Kiran Chopra, Ana Pereira De Sena, Cassie Sternbach, Yiannis Mavrommatis. St Mary’s University, Twickenham, United Kingdom.
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(No relevant relationships reported)

PURPOSE: The aim of this study was to investigate the influence of CYP1A2 genotype (which influences the rate of caffeine metabolism) on the effects of caffeine on physiological responses to submaximal exercise and cycling time-trial performance. METHODS: Eighty six cyclists were screened for their CYP1A2 genotype before being separated into two groups (AA [wildtype] versus AC or CC variant). Seventeen participants from each group (age: 45 ± 9 yrs; height: 1.81 ± 0.07 m; body mass: 76.4 ± 9.9 kg; VO2max: 4.02 ± 0.46 L min^-1) were then matched for self-reported endurance ability before taking part in a randomised, double-blind, placebo controlled study. In Trial 1, participants completed incremental cycling tests to establish the VO2max output relationship and VO2rest. In trials 2 and 3 participants ingested a capsule containing 5 mg·kg-1 of caffeine or placebo one hour before completing a submaximal incremental cycling test (4-min stages) at 40, 55, 70, and 85% of VO2rest, followed by a time trial (~ 30 mins). 95% confidence limits (CL0.05; mean difference: 0.013; CL0.24 mmol·L-1; CL95: 0.11 – 0.37 mmol·L-1). However, the responses were not resulted in significant reductions in heart rate (mean difference: 2.4 b·min^-1), with effects dissipating as exercise intensity increased. Caffeine suppression and increased energy metabolism. Caffeine affects perceived effects of caffeine-use during HIFT in unknown.

Purpose: To compare perceived and actual responses to caffeine during HIFT between low and high caffeine users.

Methods: Seventeen HIFT-experienced men were recruited (age = 26.9 ± 6.5 years, weight=84.7 ± 10.1kg). Participants were randomized in a double-blind, crossover, design to consume 5 mg·kg body mass of caffeine pills or placebo 60-minutes prior to a HIFT workout. Perceptions of caffeine's effect, successful vs. unsuccessful, and symptoms after caffeine supplementation (positive and negative).

Results: Nine participants were low-users (< 200 mg caffeine/day), and 8 high-users (> 200 mg caffeine/day). Chi-square tests were non-significant (p > 0.05). Descriptive: 2 low-users and 0 high-users perceived negative-effects, while 4 low-users and 7 high-users perceived positive-effects of caffeine use at baseline. One low-user perceived both positive- and negative-effects. Four participants from each group correctly identified the caffeine condition. After study caffeine consumption, 1 participant from each group reported negative-symptoms, while 2 low-users and 4 high-users reported positive-symptoms.

Conclusion: No significant differences in perceived and actual responses to caffeine supplementation were found between low and high caffeine-users. However, we found that caffeine supplementation may result in negative-symptoms, so individual effects should be considered. Future studies should investigate perceived and actual responses for popular caffeinated pre-workout supplements on; specifically for negative symptoms.

Funding: Kansas State University College of Human Ecology

COFFEE VOLUME DOES NOT SUPPRESS APPETITE OR CHANGE PERCEIVED HUNGER IN HABITUAL CAFFEINE CONSUMERS

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(No relevant relationships reported)

Caffeine is a psychoactive drug that decreases perceived effort and improves exercise tolerance. Yet, high-doses of caffeine can result in negative symptoms, which may affect exercise performance. High caffeine users likely perceive positive effects with caffeine use. While high intensity functional training (HIFT) has expanded rapidly, the perceived effects of caffeine-use during HIFT is unknown.

Purpose: To compare perceived and actual responses to caffeine during HIFT between low and high caffeine users.

Methods: Seventeen HIFT-experienced men were recruited (age = 26.9 ± 6.5 years, weight=84.7 ± 10.1kg). Participants were randomized in a double-blind, crossover, design to consume 5 mg·kg body mass of caffeine pills or placebo 60-minutes prior to a HIFT workout. Perceptions of caffeine’s effect, successful vs. unsuccessful, and symptoms after caffeine supplementation (positive and negative).

Results: Nine participants were low-users (< 200 mg caffeine/day), and 8 high-users (> 200 mg caffeine/day). Chi-square tests were non-significant (p > 0.05). Descriptive: 2 low-users and 0 high-users perceived negative-effects, while 4 low-users and 7 high-users perceived positive-effects of caffeine use at baseline. One low-user perceived both positive- and negative-effects. Four participants from each group correctly identified the caffeine condition. After study caffeine consumption, 1 participant from each group reported negative-symptoms, while 2 low-users and 4 high-users reported positive-symptoms.

Conclusion: No significant differences in perceived and actual responses to caffeine supplementation were found between low and high caffeine-users. However, we found that caffeine supplementation may result in negative-symptoms, so individual effects should be considered. Future studies should investigate perceived and actual responses for popular caffeinated pre-workout supplements on; specifically for negative symptoms.

Funding: Kansas State University College of Human Ecology

COFFEE VOLUME DOES NOT SUPPRESS APPETITE OR CHANGE PERCEIVED HUNGER IN HABITUAL CAFFEINE CONSUMERS

Vanessa A. Salama, Takudzwa A. Madzima, Eric Hall, FACSM, Svetlana Nepoaczyh. Elon University, Elon, NC. (Sponsor: Eric Hall, FACSM)
Email: ness1534@gmail.com
(No relevant relationships reported)

Caffeine is a heavily consumed substance that has several benefits, including appetite suppression and increased energy metabolism. PURPOSE: To determine the effect of caffeine amount and coffee volume on appetite profile, affective response, cognitive function, blood glucose levels and subsequent energy intake in female habitual caffeine consumers. METHODS: 19 female participants (age: 24 ± 8.8BFI; 24 ± 5.1) habitually consume caffeine 255 ± 122 mg/day) ingested coffee of different volumes and caffeine amounts on four different occasions (C1: 237 ml/4 mg/kg; C2: 237 ml/6mg/kg; C3: 473 ml/4mg/kg; C4: 473 ml/6mg/kg) in a single blind, randomized, crossover design. Participants completed a visual analog scale (VAS) of appetite profile at pre, 0, 30 and 60 minutes. Affective response and cognitive function were assessed using the Activation-Deactivation Adjective Checklist (AD-ACL), Trail Making (TM) and Stroop tasks (ST) before and after the test drink. Blood glucose levels were measured at pre, 30 and 60 minutes. In addition, ad libitum breakfast was consumed at 60 minutes and 24-hour self-reported energy intake was recorded. A repeated measures
Ageing is associated with neurodegeneration and loss of muscle function, driving to adverse age-related health events and decreasing quality of life. Of the many contributors to the ageing process, decreased skeletal muscle function plays a large role, but physical, nutritional, and ergogenic interventions can have positive effects on muscle function. For example, evidence suggests that a low dose of caffeine may act on the central nervous system and may improve force-generating capacity. However, the majority of these studies have focused in young individuals, and no study has compared the effects of caffeine on strength between older and younger individuals.

**PURPOSE:** To compare the effect of caffeine on force-generating capacity between older and young adults.

**METHODS:** 21 older (68 ± 6 years) and 22 young men (25 ± 5 years) were tested for older and young adults.

**RESULTS:** Caffeine increased PT (3.2%, p = 0.07) and CL100-200(0.7%, p = 0.03) in older men, but not in young (CL100-200 0.3%, p = 0.51). On the contrary, caffeine increased PT (0.6%, p = 0.01), and CL100-200 (0.7%, p = 0.006) in young men, but not in older (CL100-200 0.2%, p = 0.14). The standardized mean differences for caffeine versus placebo in both older and younger individuals.

**CONCLUSIONS:** Caffeine did not increase rapid torque output (i.e. CI 0-50 and CI100-200) in older individuals (2.7%; p = 0.19) and in young (3.4%; p = 0.14). Caffeine increased plantar flexion peak torque in young but not in older individuals. Caffeine did not increase rapid torque output (i.e. CI0-50 and CI100-200) in either young or older individuals. However, a small effect was observed in favor caffeine against placebo in both groups.
Neuromuscular electrical stimulation (NMES) is frequently used in physical rehabilitation as a muscle strengthening modality; however, little research exists on QoL outcomes in response to NMES. PURPOSE: The aim of this study was to determine changes in QoL and physical function in older adults after 4 weeks of NMES. METHODS: Eighty older adults (68.9 ± 2.4 years) completed 12, 40-min NMES training sessions of the quadriceps muscles on each leg over 4 weeks with the aim of improving QoL dimensions. Results: There was a significant decrease in time to complete TUG (8.38 ± 0.60s vs 7.40 ± 0.45s, p = .007), indicating this global dimension may take longer to change. There was also a statistically non-significant increase with small to large effect sizes: self-efficacy for physical function, time to complete TUG, and physical activity, 1-6 scale), physical self-concept (1-6 scale), and intention to be physically active (1-7 scale). Physical function of the lower body was assessed pre and post intervention with a timed up and go test (TUG). Paired sample t-tests were used to test for differences over time (pre, post) for TUG and QoL dimensions. Cohen’s d was calculated for effect size. RESULTS: The following QoL dimensions showed a statistically non-significant increase with small to large effect sizes: self-efficacy (97.80 ± 0.84 vs 98.97 ± 0.17, p = .17, d = 0.83), intention (5.91 ± 0.72 vs 6.59 ± 0.27, p = .38, d = 0.49), coordination (5.10 ± 0.20 vs 5.30 ± 0.20, p = .12, d = 0.36), and physical activity (3.64 ± 0.54 vs 4.22 ± 0.39, p = .20, d = 0.29), pre vs post, respectively. Physical self-concept showed no effect (4.58 ± 0.44 vs 4.67 ± 0.36, p = .74, d = 0.07), indicating this global dimension may take longer to change. There was a significant decrease in time to complete TUG (8.38 ± 0.60s vs 7.40 ± 0.45s, p = .002, d = 0.62). CONCLUSION: TUG times showed significant improvement and QoL dimensions trended toward improvement after 4 weeks of NMES. Enhanced physical function from NMES treatment may help improve overall QoL by increasing confidence and willingness to perform physical activities, potentially decreasing risk of sarcopenia.

Higher levels of fitness are associated with preserved cognitive function in older adults. Preserved cognition is linked to better mobility and reduced risk of falls. However, it remains to be explored whether cardiovascular fitness (CF) influences the link between cognition and mobility in individuals with cardiovascular disease burden and risk of dementia. PURPOSE: We explored whether CF influences the relationship between cognition and mobility in older adults with hypertension and subjective cognitive decline. These individuals are at higher risk of dementia due to cardiovascular disease burden and early signs of cognitive impairment. METHODS: Older adults (n = 118, age 70.1 (SD = 6.7) years, 62% males) underwent CF assessment (Bruce protocol treadmill stress test) and were grouped based on Bruce protocol stage completion into low (stage 1 (n = 31), average (stage 2 (n = 57)), and high (stage 3 ≥ (n = 30)) CF groups. Cognition was measured via the Cambridge Brain Sciences battery; mobility (usual and dual-task gait [naming animals]) was measured using the GAITRite walkway system. We conducted hierarchical regression models adjusting for sex, age and years of education to determine whether CF modulated association between cognition and mobility. RESULTS: For usual gait, cognition was positively associated with gait velocity in high CF (Change statistics: F(1,50)=14.3, p<.001, R²=.35), as well as step length in high CF (F(1,25)=10.8, p<.003, R²=.27) and average CF (F(1,50)=4.4, p=.04, R²=.08), and gait variability in average CF (F(1,48)=9.8, p<.003, R²=.17). For dual-task gait, cognition was positively associated with gait velocity in both high CF (F(1,25)=9.15, p<.016, R²=.26) and average CF (F(1,49)=5.8, p=.02, R²=.10), as well as step length in both high CF group (F(1,25)=7.2, p=.01, R²=.21) and average CF group (F(1,49)=7.2, p<.01, R²=.13). CONCLUSIONS: Cognition was positively associated with mobility outcomes in individuals with average and high

Age-associated reductions in muscle strength and power are associated with decrements in functional performance. It is unclear which neuromuscular factors that contribute to strength and power (e.g. muscle mass, contractile speed) and limb fatigability (activity-induced reduction in strength and power) are predictive of functional performance among older adults. PURPOSE: The aim was to determine the contribution of lower limb fatigability and neuromuscular factors to decrements in functional performance tests among older adults. METHODS: Eighty-one adults (39 females, 42 males: 61 - 93 years, 73 ± 7.7 years, body mass index = 26.4 ± 4.1 kg/m², body fat = 34.7 ± 7.8 %) participated in sessions to assess; 1) Physical function including a 6-minute walk, chair-rise (5x), timed stair-climbing and balance (Berg balance); 2) Dual-energy X-ray absorptiometry to access the body composition; and, 3) Fatigability of the knee extensor muscles which involved 80 maximal velocity concentric contractions (1.5 s) with a load of 20% of the maximal voluntary isometric contraction. Voluntary activation and contractile properties of the knee extensors were assessed with transcranial magnetic stimulation and peripheral nerve stimulation before, and after the fatiguing task. Correlation analysis and regression analysis were performed to determine which variables were predictive of physical function.

RESULTS: Distance walked over 6 minutes was associated with younger age, greater power, more thigh lean tissue and lower knee extensor fatigability (R²=0.55, P<.001). Faster chair-rise time (5x) was associated with younger age, less body fat, and lower fatigability (R²=0.44, P<.001). Both a faster stair-climb (R²=0.3, P<.001) and a higher Berg balance score (R²=0.43, P<.001) were associated with younger age and less body fat. CONCLUSIONS: Our findings demonstrate that younger age, greater power and lower fatigability of a dynamic fatigue task were strong predictors of lower limb functional performance tasks that are common to daily activities among older adults. Our results also suggest that interventions to offset age-related declines in lean mass and increases in body fat will aid in maintenance of functional performance with advancing age.

Abstracts were prepared by the authors and printed as submitted.
90 Board #4
May 27 9:30 AM - 11:30 AM
12-week Of Tai Chi Training Improves Cognitive Function In Older Adults With Mild Cognitive Impairment
Angus, Pak Hung Yu, Ray, Yiu Pan Wong, Edwin, Chun Yip Chin, Danny, Ju Cheng Yu, Parco, Ming Fai Sui, FACSFM. The University of Hong Kong, Hong Kong, Hong Kong. (Sponsor: Dr. Parco, Ming Fai Sui, FACSFM)
Email: aphyu@connect.hku.hk

PURPOSE: This study aims to examine the effectiveness of Tai Chi training in improving cognitive function in older adults with MCI.

METHODS: This randomized controlled trial was conducted between October, 2018 and May, 2019. In this two-arm, single-blinded randomized controlled trial, 20 Chinese adults aged ≥50 years with MCI [Score of Montreal Cognitive Assessment Hong Kong Version (MoCA-HK) ≤74th percentile of the age and education-corrected normative data of Hong Kong] were randomly assigned to Control (CON, n=10, received no intervention) and Tai Chi (TC, n=10, received 12-week Tai Chi training) groups. Global cognitive function was the primary outcome which was assessed by MoCA-HK 12 weeks after post-randomization. Secondary outcomes including executive function, working memory, long term memory, and attention were assessed by trial making test A and B, digit span, 30-min delay recall test and attention network test respectively. Data were analyzed by generalized linear model with baseline as a covariate.

RESULTS: TC provoked a robust improvement in MoCA-HK score compared with CON (TC: +24% vs CON: +9%, P<0.001). TC participants also performed better in 30-min delay recall test (TC: +52% vs CON: -8%, P=0.005) and trial making test B/A ratio compared with CON (TC: +21% vs CON: -2%, P=0.028). No statistical difference was observed in forward and back digit span. There was no statistical difference in reaction time, accuracy, alerting network and orienting network between the two groups. However the change in executive network was significantly different between TC and CON (TC: +19% vs CON: -24%, P=0.001).

CONCLUSIONS: A 12-week Tai Chi training can improve global cognitive function in older adults with MCI. Tai Chi improves executive function and long-term memory and alters the attention network.

91 Board #5
May 27 9:30 AM - 11:30 AM
Effect Of Low Intensity Resistance Exercise Training On Cognitive Function In Middle-aged And Older Individuals
Keigo Tomoo1, Kento Dora1, Takeshi Sagimoto1, Okubo Sahomi1, Keigo Katayama1, Akifumi Maeda1, Hayato Tsukamoto2, Takeshi Hashimoto, FACSFM. 1Ritsumeikan University, Kusatsu, Japan. 2University of South Wales, Pontypidd, United Kingdom. (Sponsor: Takeshi Hashimoto, FACSFM)

PURPOSE: Many studies have reported that aerobic exercise training improves cognitive function (CF), even with low-intensity (e.g. walking) (Kramer et al. 1999; Hillman et al. 2008). Alternatively, moderate (MRT) to high intensity RT (60-80% 1RM) improves CF (Chung et al. 2012). However, older individuals and patients with chronic disease often have difficulty with higher exercise loads due to declining cardiovascular and musculoskeletal systems. The purpose of this study was to examine the effect of low intensity resistance exercise training (LRT) on CF in middle-aged and older individuals. Given that an acute bout of even low intensity resistance exercise improves CF albeit less effective than higher intensity training, we hypothesized that LRT would improve CF although its effect might be lower than higher intensity training.

METHODS: Fifty healthy middle-aged and older individuals (age: 50 to 77 years) were randomly classified into three groups (control (CON), LRT (40%1RM), and MRT (60%1RM)). Resistance exercise programs were leg extension, seated leg curl, leg press, and chest press. For each exercise, all participants performed 14 repetitions for three sets with 2 minutes interval. LRT and MRT participants completed all exercise for three times per week and CON participants maintained their conventional lifestyle. CF (working memory (WM), short memory (SM), and inhibitory control (IC)) were determined with reading span task, face-name matching task, and word-color Stroop task respectively. Each task was performed at baseline and post-intervention (at 12 weeks, and 24 weeks of the intervention period).

RESULTS: There was significant interaction for the IC score (p = 0.021). As compared with the PRE, the IC at the 12W did not change in the MRT (p = 0.184), while tended to improve for the LRT (p = 0.065), and significantly declined in the CON (p = 0.020). At the 24W, the IC score did not change significantly for all conditions as compared with the PRE. The score of WM and SM did not change significantly for all conditions throughout the intervention.

CONCLUSIONS: The finding suggests that even with a lower load, chronic RT may improve IC in middle-aged and older individuals. However, the exercise intensity, training period, and task specificity for the CF should be further elucidated.

92 Board #6
May 27 9:30 AM - 11:30 AM
Systolic Blood Pressure And Heart Rate Recovery Are Related To Cognition In Healthy Older Adults
Brittany Intzand1, Tudor Vincenciu2, Kristell Pother1, Anil Nigam1, TT Minh Vu2, Karen Li1, Nicolas Berryman1, Clauudine Gautier1, Louis Bherer1. 1Concordia University, Montreal, QC, Canada. 2Université de Montréal, Montreal, QC, Canada.

SYNOPSIS: Attenuated heart rate recovery (HRR) and systolic blood pressure recovery (SBPR) after a maximal exercise test (VO2peak) are linked to cardiovascular risk factors (CVRF). The relationship between the presence of CVRF and reduced cognition is well established in older adults. Yet the explicit relationship between HRR or SBPR and cognition has yet to be studied in older adults, here we found that reduced HRR and SBPR were directly related to worse cognition. PURPOSE: To determine if a relationship exists between cognition and HRR or SBPR measured during a VO2peak test in older adults.

METHODS: Prior to enrollment in an intervention, a total of 68 participants (70:65yrs; 45 women) completed neuropsychological tests and a VO2peak incremental test on a cycle ergometer. After standard verifications at rest, heart rate and blood pressure were continuously monitored during the incremental test and a 3-minute recovery period. HRR was calculated as the first minute recovery heart rate subtracted from the maximal heart rate during the test, where lower numbers were interpreted as reduced recovery and increased likelihood of CVRF. SBPR was defined as the maximal reading during the test divided by the first- and third-minute recovery where a higher ratio indicates higher probability of CVRF. Correlations analyses were completed with sex, age and education as covariates.

RESULTS: VO2peak was inversely related to Stroop inhibition reaction time (r = -0.275, p = 0.048). HRR approached significance with total digit span score (r = 0.230; p = 0.090). SBPR was negatively associated with Stroop reaction time (r = -0.327, p = 0.042) and Stroop switching reaction time (r = -0.379; p = 0.017)

CONCLUSIONS: For the first time, we identified that there is a direct relationship between SBPR and cognitive outcomes. HRR and SBPR are early indicators of cardiovascular and endothelial dysfunction, thus, it could be that the relationship between cognition and CVRF are mediated by early vascular dysfunction that could be affecting upstream cerebral vascular health. This hypothesis could be confirmed in future work including larger samples of individuals as well as neuroimaging techniques.
Mental State (3MS) examination and the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). Physical function performance was assessed using the time to complete the 400-Meter Walk Test (minutes).

**RESULTS:** Average time to complete the 400-meter walk was 6.3±1.0 minutes, which was modestly associated with BMI (r=-0.312, p=0.088). The 3MS Total Score (94.7±3.7) was not significantly correlated with BMI (r=−.158; p=.397) or 400-Meter Walk Test performance (r=−.152; p=.415). Similarly, the RBANS Sum of Index Score (209.0±21.1) was not significantly correlated with BMI (r=−.297; p=.105) or 400-Meter Walk Test performance (r=−.164; p=.378). When examining this relationship by cognitive domain, a higher BMI was associated with a poorer RBANS Immediate Memory Index Score (r=-.412; p=.021). We also observed that worse performance on the 400-Meter Walk Test was associated with poorer RBANS Immediate Memory Index Score (r=−.314; p=.08).

Neither BMI nor 400-Meter Walk performance were significantly associated with RBANS Visuospatial/Constructional Index, Language Index, Attention Index, or Delayed Memory Index scores.

**CONCLUSION:** Findings reveal that RBANS Immediate Memory Index score was inversely associated with both BMI and physical function in sedentary older adults. This may suggest that both obesity and poor physical function negatively impact two-term memory performance in older adults. Future studies to investigate whether and how physical therapeutics may enhance short-term memory function in older adults are warranted.

Supported by UPMC Enterprises

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**Board #8** May 27 9:30 AM - 11:30 AM

**The Effect Of Acute Yoga And Circuit Training On Cognitive Function Of Sedentary Elderly**

Siou-He Chen, Chien-Hui Chan, Hsuan Wu, Ying-Hsuan Chang, Yuen Hei Man, Kuan-Chen Wu, Shihow-Chwen Tsai. **Institution of Sport Science, Taipei, Taiwan.** (Sponsor: Kun, Chia-Hua, FACSM)

Email: sctsa6@gmail.com

(No relevant relationships reported)

**Introduction:** Exercise is an effective strategy on improving cognitive function, but most reports emphasize the benefits of high-intensity exercise. **Purpose:** This study is to investigate whether two acute moderate-intensity exercises can improve cognitive function of the sedentary elderly. **Method:** Twenty-eight women without exercise habits were divided into two groups, each performed yoga (n=19; 62.25 ± 1.6 yrs old) or circuit training (n=9; 59.53 ± 1.96 yrs old). All participants completed 30 minutes of moderate-intensity exercise with moderate efforts, significant accelerated breathing and heart rate. The cognition function tests were performed before, immediately, 30 and 60 minutes after an intervention consisting of 40 min of either Yoga or circuit training exercise and a seated rest control. The cognitive parameters were compared by a mixed-model analysis for repeated measures. **Results:** The results indicated there were no difference in age between the two groups. Acute exercise improved cognitive function immediately after acute exercise, including got a significant higher total response score (F(3,75)=7.793, p<0.001), and complete Schulte table (as an indicator of attention, F(3,75)=4.239, p=0.008) and Stroop’s neutral test (F(3,75)=12.64, p<0.001) faster. There were no significant differences in other items such as responsive rate, memory span, and word, congruent, square, incongruent Stroop test after acute exercise. The benefits of exercise on total response score and Stroop’s neutral test can even be maintained up to 60 minutes after exercise. For the benefit of two different exercise, only the performance of Schulte table was significantly better in the circuit training group than the yoga group (F(1, 25)=4.554, p=0.043, Eta value=0.154). The scores of other cognitive tests did not differ between the two exercises. **Conclusion:** The two different exercises significantly improved cognitive function and can maintain up to 60 minutes after exercise. The circuit training exercise represented a better influence on attention than Yoga.

Supported by MOST Grant 107-2410-H-845-018-MY3.

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**Figure:** Effect of the three 7 h trial conditions on postprandial (A) glucose and (B) insulin concentrations in adults with medication-controlled T2D (n=23). Data are mean ± SEM. SIT: uninterrupted sitting; SRA3: sitting with 3-minute SRA breaks every 30 minutes; SRA6: sitting with 6-minute SRA breaks every 60 minutes.
EMERGING RESEARCH SUGGESTS IMPROVEMENT IN FATIGUE, SLEEPINESS, AND MUSCULAR RESPONSES TO RESTRICTED BREAKS DURING PROLONGED SITTING

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Purpose: To examine whether interrupting prolonged sitting with brief bouts of walking only or combined with simple resistance activity improve glucose levels in healthy, sedentary, young adults.

Methods: This study included 16 healthy, sedentary adults (9 women; 23.7±2.3 y; BMI 20.8±4.1 kg/m²; VO_{2 max} 39.1±5.3 ml kg^{-1} min^{-1}) who completed three 26-h laboratory conditions, including 22.5 h in a whole-room calorimeter, separated by 5-14 day washout period. The same procedures were performed in each of the three conditions except for the following 9-h activity period: uninterrupted sitting time (SIT); sitting with 8 min intermittent, brisk (60% VO_{2 max}) walking bouts (WALK; 7 bouts for a total of 56 min); or alternating 8 min brisk walks and simple resistance activities (RESIST; 3 bouts of walking and 4 bouts of resistance for a total of 56 min). Continuous glucose monitoring (CGM) was performed for 26 h. Standardized meals were consumed during each condition. The incremental area under the curve (IAUC) for glucose during the entire observation period and the three segments (activity, evening, and sleep periods) were compared between conditions after adjustment for standard covariates (e.g., age, sex, et al.) and additional adjustment for energy expenditure (EE). Results: Compared with WALK, SIT reduced glucose levels relative to a 24-h baseline by 1.47 mmol·L^{-1}·h^{-1} (95%CI: 0.28, 2.65; p = 0.02). Compared with SIT, RESIST reduced glucose levels relative to baseline by 2.94 mmol·L^{-1}·h^{-1} (95%CI: 1.65, 4.23; p < 0.001). When adjusting for EE, the only effect that remained was the comparison between SIT and RESIST during the activity period. During the evening period, WALK increased the CGM IAUC by 1.91 mmol·L^{-1}·h^{-1} [0.29-3.54] (p = 0.019) when compared to SIT, this effect was lost after adjustment for EE. Conclusions: Interrupting 9 h of prolonged sitting time with either WALK or RESIST reduced acute glucose responses in healthy, sedentary adults. This effect was more pronounced in RESIST than WALK and was only maintained during the 26 h period in RESIST.

Supported by Shanghai Science and Technology Committee (NO. 16080503300)

98

Purpose: To examine if interrupting prolonged sitting with simple resistance exercise helps to reduce daily fatigue, sleepiness, and muscular discomfort from using simple resistance exercises to interrupt prolonged sitting, yet it is unclear if these improvements are observed in college students.

Methods: Twenty-four college students (age 23.1 ± 4.3 years, BMI 27.4 ± 5.0 kg/m²) completed two 7-day assessments of subjective measures for discomfort, fatigue, and sleepiness while wearing an ActiGraph (PAL technologies) to track physical activity for steps, sedentary time, standing time, and sedentary time in 10, 30, and 60-minute bouts. The first week was used as control (CON) and consisted of normal daily activities while completing assessments of all outcomes in the morning (M), midday (MD), and evening (E). The experimental week (REX) followed a similar protocol, but added hourly resistance exercise breaks consisting of one bodyweight or resistance exercise for 2 sets of 15 repetitions per exercise. Results: Resistance exercise breaks induced almost significance in all variables (see table 1) to induce significant changes in CRP, adiponectin, and 8-hydroxydeoxyguanosine in any of the risk factors constituting metabolic syndrome. While within group changes showed no significant changes in any variables at POST.

Conclusions: It is suggested that levels of inflammation and oxidative stress are associated with changes in body fat, indicating that fat loss is effective in preventing and managing obesity-associated disorders. This study confirmed results of previous studies suggesting that longer period of exercise training with fat loss may be required to induce significant changes in CRP, adiponectin, and 8-hydroxydeoxyguanosine in the middle-aged obese adults.

Emerging research suggests improvement in fatigue, sleepiness, and muscular discomfort from using simple resistance exercises to interrupt prolonged sitting, yet it is unclear if these improvements are observed in college students.

Purpose: To examine if interrupting prolonged sitting with simple resistance exercise breaks to interrupt sedentary behavior in college students.

Methods: Twenty-four college students (age 23.1 ± 4.3 years, BMI 27.4 ± 5.0 kg/m²) completed two 7-day assessments of subjective measures for discomfort, fatigue, and sleepiness while wearing an ActiGraph (PAL technologies) to track physical activity for steps, sedentary time, standing time, and sedentary time in 10, 30, and 60-minute bouts. The first week was used as control (CON) and consisted of normal daily activities while completing assessments of all outcomes in the morning (M), midday (MD), and evening (E). The experimental week (REX) followed a similar protocol, but added hourly resistance exercise breaks consisting of one bodyweight or resistance exercise for 2 sets of 15 repetitions per exercise. Upon adjusting for EE, the only effect that remained was the comparison between SIT and RESIST during the activity period. During the evening period, WALK increased the CGM IAUC by 1.91 mmol·L^{-1}·h^{-1} [0.29-3.54] (p = 0.019) when compared to SIT, this effect was lost after adjustment for EE. Conclusions: Interrupting 9 h of prolonged sitting time with either WALK or RESIST reduced acute glucose responses in healthy, sedentary adults. This effect was more pronounced in RESIST than WALK and was only maintained during the 26 h period in RESIST.

Supported by Shanghai Science and Technology Committee (NO. 16080503300)

Purpose: To examine whether interrupting prolonged sitting with brief bouts of walking only or combined with simple resistance activity improve glucose levels in healthy, sedentary, young adults.

Methods: This study included 16 healthy, sedentary adults (9 women; 23.7±2.3 y; BMI 20.8±4.1 kg/m²; VO_{2 max} 39.1±5.3 ml kg^{-1} min^{-1}) who completed three 26-h laboratory conditions, including 22.5 h in a whole-room calorimeter, separated by 5-14 day washout period. The same procedures were performed in each of the three conditions except for the following 9-h activity period: uninterrupted sitting time (SIT); sitting with 8 min intermittent, brisk (60% VO_{2 max}) walking bouts (WALK; 7 bouts for a total of 56 min); or alternating 8 min brisk walks and simple resistance activities (RESIST; 3 bouts of walking and 4 bouts of resistance for a total of 56 min). Continuous glucose monitoring (CGM) was performed for 26 h. Standardized meals were consumed during each condition. The incremental area under the curve (IAUC) for glucose during the entire observation period and the three segments (activity, evening, and sleep periods) were compared between conditions after adjustment for standard covariates (e.g., age, sex, et al.) and additional adjustment for energy expenditure (EE). Results: Compared with WALK, SIT reduced glucose levels relative to a 24-h baseline by 1.47 mmol·L^{-1}·h^{-1} (95%CI: 0.28, 2.65; p = 0.02). Compared with SIT, RESIST reduced glucose levels relative to baseline by 2.94 mmol·L^{-1}·h^{-1} (95%CI: 1.65, 4.23; p < 0.001). When adjusting for EE, the only effect that remained was the comparison between SIT and RESIST during the activity period. During the evening period, WALK increased the CGM IAUC by 1.91 mmol·L^{-1}·h^{-1} [0.29-3.54] (p = 0.019) when compared to SIT, this effect was lost after adjustment for EE. Conclusions: Interrupting 9 h of prolonged sitting time with either WALK or RESIST reduced acute glucose responses in healthy, sedentary adults. This effect was more pronounced in RESIST than WALK and was only maintained during the 26 h period in RESIST.

Supported by Shanghai Science and Technology Committee (NO. 16080503300)
HIIT exercise with low volume seems to be a time-effective strategy for lowering risk factors contributing metabolic syndrome. Although results from this study show that both HITT and MIC reduce metabolic syndrome risk factors to a similar degree. Table 1. Metabolic syndrome risk factors, baseline to 1 year

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Emerging research demonstrates the link between physical activity and academic outcomes, however, Limited evidence exists on whether different modes of physical activity (PA) result in differences in cognitive and academic outcomes in real world settings. PURPOSE: The purpose of this study was to evaluate the effects of embedding a high intensity interval training (HITT) and muscular strength program in embedding a high intensity interval training (HITT) and muscular strength program in

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Conclusion HIIT exercise with low volume seems to be a time-effective strategy for lowering risk factors contributing metabolic syndrome. Although results from this study show that both HITT and MIC reduce metabolic syndrome risk factors to a similar degree. Table 1. Metabolic syndrome risk factors, baseline to 1 year

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Moderate-intensity continuous aerobic training (MICAT) and high-intensity interval training (HIIT) interventions improve insulin resistance (IR) and glycemic control in patients with metabolic syndrome (MS). Moreover, skeletal muscle mass negatively correlates with IR. However, there are contradictory results about the superiority of any of these interventions on the control of the glucose metabolism in MS. PURPOSE: to compare the efficacy of a HIIT-low volume protocol vs MICAT on the Homeostatic assessment model, glycated hemoglobin (HbA1c) and skeletal muscle mass, in adults with MS. METHODS: controlled, randomized, clinical trial using the minimization method, with two parallel groups for the purpose of showing superiority. Sixty patients with MS, of both genders, 40-60 years old, were included. A clinical evaluation, biochemical tests, an ergospirometry and a dual-energy X ray absorptiometry to determine total and regional skeletal muscle mass were carried out before and after a treadmill exercise program of 12 weeks, 3 sessions/week. Participants were assigned to an intervention with HIIT-low volume (n=29) in 22 min sessions that included six intervals at an intensity of 90% of VO2max in 36 min. RESULTS: patients had a mean age of 50.8±6.0 years, body mass index of 30.6±4.0 kg/m², body fat percentage of 38.7±7.0% and VO2max of 29.0±6.3 mL·kg⁻¹·min⁻¹; 70% were women. Compared to MICAT, HIIT-low volume was not superior in reducing Ln of IR (marginal mean difference: 0.083 [95% CI -0.192 to 0.257]; Cohen’s d: 0.249; p-value=0.346) or increasing Ln of total lean mass (kg) (0.040 [0.014―0.023]; Cohen’s d: 0.120; p=0.637) and Ln of thigh lean mass (g) (0.008 [0.029―0.038]; Cohen’s d: 0.154; p=0.599). After the intervention, the HIIT-low volume group, compared to the MICAT, had a higher HbA1c (5.81% vs 5.69%; 0.119 [0.005―0.233]; Cohen’s d: 0.554; p=0.040). When comparing before and after the intervention, both training groups decreased IR. CONCLUSION: HIIT-low volume, compared to MICAT, is not superior in reducing IR or increasing skeletal muscle mass in adults with MS. Colociones 111562638757; Interinstitutional 2016-13041; Doctoral scholarships 727-2015

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Board #8 May 27 9:30 AM - 11:30 AM Resistance Exercise And Cardiometabolic Risk In Prediabetes: A Systematic Review And Meta-analysis Raza Qadir1, Nicholas Sculthorp1, Taylor Todd2, Elise Brown1. 1Oakland University William Beaumont School of Medicine, Rochester, MI. 2University of the West of Scotland, Lanarkshire, United Kingdom. 3Oakland University, Rochester, MI. Email: razaqadir@oakland.edu (No relevant relationships reported)

Prediabetes is a highly prevalent precursor to type 2 diabetes, and is also associated with an increased risk of morbidity and mortality. Resistance exercise (RE) is an effective method of reducing cardiometabolic risk factors in persons with a diagnosis of type 2 diabetes, but its efficacy in individuals with prediabetes is unclear. Determining the cardiometabolic impact of RE in prediabetes is necessary for evidence-based exercise prescription for diabetes prevention. PURPOSE: TO undertake a systematic review and meta-analysis of randomized and non-randomized control trials examining the effect of RE on cardiometabolic risk factors in individuals with prediabetes. METHODS: PubMed, Cochrane, Web of Science, and Embase databases were searched for published studies of adults at risk for diabetes and who participated in a RE intervention. All studies included randomized or non-randomized control trials. The database search and data extraction were performed by two separate reviewers. A systematic review and meta-analysis were conducted to determine changes in adiposity, glycemic control, insulin resistance, blood lipids/liproteins, and blood pressure (BP) following the interventions using a random effects model to assess standardized mean differences (SMD) between RE and control. RESULTS: 10 studies comprising 404 participants were included in the analysis. For RE compared to controls, there were significant improvements in glycylated hemoglobin (SMD = -0.688; 95% confidence interval [CI] -1.178 to -0.198; p=0.006), fasting plasma glucose (SMD = -0.747; 95% CI -1.003 to -0.460; p=0.001), and total cholesterol (SMD = -0.723; 95% CI -1.177 to -0.27; p=0.002). No changes in waist circumference (SMD = -0.323; 95% CI -0.562 to 0.062; p=0.122), insulin resistance (SMD = -0.597, 95% CI -1.23 to 0.057; p=0.267), high-density lipoprotein (SMD = -0.287, 95% CI -0.748 to 0.174; p=0.223) or low-density lipoprotein (SMD = -0.398, 95% CI -1.027 to 0.231; p=0.215) cholesterol, triglycerides (SMD = -0.400, 95% CI -0.850 to 0.030; p=0.081), systolic BP (SMD = -0.16, 95% CI -0.491 to 0.158; p=0.315), or diastolic BP (SMD = -0.476, 95% CI -1.05 to 0.105; p=0.108) were found. CONCLUSION: RE appears to be an effective method of improving glucose control, but is less effective in improving blood lipids or blood pressure.

Board #6 May 27 9:30 AM - 11:30 AM High Intensity Interval Training And Muscular Strength On Academic And Behavioral Outcomes In Children Jessica Peacock. Merrimack College, North Andover, MA. (Sponsor: Kevin Finn, FACSM) Email: peacockj@merrimack.edu (No relevant relationships reported)

Abstracts were prepared by the authors and printed as submitted.
Baseline Cardiac Autonomic Predictors Of Blood Pressure Response To Standardized Endurance Training In Hypertensive Women

Marina Lívia Venturini Ferreira, Alex Carson, Silas Gabriel Oliveira Nunes, Rafael Rezende Ferreira, Claudia Regina Cavagneri, Mara Patricia Traina Chacon-Mikahil. UNICAMP, Campinas, Brazil.

Email: marina.lvferreira@gmail.com

(No relevant relationships reported)

Although international recommendations corroborate the anti-hypertensive effects of regular training (ET), interindividual responses are highly heterogeneous, differing between responders (RE) and non-responders (NR). Previous studies have shown the decrease in the activity of the autonomic nervous system (ANS) is involved in the ET-induced reduction of blood pressure (BP). However, it is not yet known whether this mechanism is related to the variability of BP response. PURPOSE: Assess baseline ANS variables with interindividual BP responses in hypertensive women undergoing ET.

METHODS: Forty-four women performed 12 weeks of ET on cycle ergometer (50 min.day⁻¹, 3 days.week⁻¹ at 60-70% heart rate reserve). Pre and post ET 20 min beat-to-beat BP waveforms were recorded by finger photoplethysmography and ANS was assessed by heart rate (HR) variability (HRV) recorded from HR monitor and analyzed to beat BP waveforms were recorded by finger photoplethysmography and ANS was assessed by heart rate (HR) variability (HRV) recorded from HR monitor and analyzed to beat.

RESULTS: Ten individuals were considered RE (A=15.6±7.6 mmHg) and 34 NR (A=4.3±7.9 mmHg). SBP changes were correlated with SDNN (r=0.395; p=0.008), RMRSSD (r=0.384; p=0.010), LF (r=0.318; p=0.036) and HF (r=-0.348; p=0.02). SDNN was able to predict 15% of variance in SBP changes (r²=0.39; p=0.008). Compared to RE, NR demonstrated greater SDNN (29±6.21±4.16; r=0.149, p=0.09), RMRSSD (32.7±27.3 vs. 17±4.8, p=0.013) and LF (59±1380 vs. 110±71, p=0.001) and HF (668±1340 vs. 154±164, p=0.012). For SDNN, a cut-off value of 18.7 discriminated RE and NR with good accuracy (AUC=0.81, sensitivity=80%, specificity=76%, p<0.01).

CONCLUSION: Baseline cardiac autonomic function can predict interindividual SBP responses to ET. Predictors cut-off values could be used to determine whether hypertension risk is likely to benefit from ET.

Cardiorespiratory fitness (CFR) is positively associated with greater brain volume in older adults; however, the mechanism is unknown. Improved structure and function of the large vessels supplying the brain due to habitual exercise may explain why CFR influences brain volume. PURPOSE: The purpose of this study was to determine whether this mechanism is related to the variability of BP response.

RESULTS: Young adults had a larger total brain volume (YA; 1,166±0.021 vs. OA; 1,104±0.02, p<0.05), higher VO₂max (YA; 40±1 ml/kg/min vs. OA; 32±2 ml/kg/min, p<0.05), and lower AIx (YA; 2.9±2.5 % vs. OA; 19.2±2.4 %, p<0.05) compared with older adults. VO₂max was negatively associated with AIx in young adults (p<0.05); however, VO₂max was negatively associated with AIx in older adults (r=−0.61, p<0.05) such that older adults with higher CFR demonstrated lower aortic hemodynamics. There were no associations between VO₂max, AIx, and total brain volume in young adults (p>0.05 for all). Conversely, both VO₂max (r=−0.51, p=0.05) and AIx (r=−0.64, p<0.05) were associated with total brain volume in older adults. When VO₂max and AIx were entered into the model using multiple linear regression, VO₂max was no longer a significant predictor of total brain volume in older adults (VO₂max; p=0.41, AIx; p=0.03). CONCLUSIONS: High CFR and low aortic hemodynamics are associated with larger total brain volumes in older adults. Using multiple linear regression, aortic hemodynamics are better predictors of total brain volume than CFR in older adults. Improved aortic hemodynamics may be a mechanism by which habitual exercise protects the brain from age-related volume decline. Supported by NIH grant HL118154.

Purpose: Acute mental stressors evoke cardiovascular reactivity that can influence the cerebral blood flow (CBF) responses during aerobic exercise. PURPOSE: To examine the relationships between cognition-related symptoms, cerebral vasculature’s ability to respond to changes in CO2 (vasoreactivity), and CBF responses during sub-maximal aerobic exercise in adolescents post-concussion.

RESULTS: Adolescents less than two weeks post-concussion completed the Post-Concussive Symptom Checklist (PSCS), cerebral vascular assessments, and a modified YMCA exercise protocol. CBF at rest was estimated from the slope (cm/s/mmHg) of the relationship between changes in increases in breath-by-breath end-tidal CO₂ and responses of CBF velocity during an air rebreathing task (i.e., increasing end-tidal CO₂). CBF velocity was measured...
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WeBWEDNESDAY, MAY 27, 2020

Board #5
May 27 9:30 AM - 11:30 AM
Potential Racial Disparity In Peripheral Vascular Function Regardless Of Menstrual Cycle Phase

Michelle D’Agata1, Alexandra E. Hirt1, Elissa K. Katulka1, Felicia R. Berube1, Megan M. Werner1, Sushant M. Ranadive1, Melissa AH Wittnan.1 1University of Kentucky, Lexington, KY. 2University of Maryland, College Park, MD. (No relevant relationships reported)

African American women (AAW) have the highest rates of cardiovascular disease (CVD) across the lifespan compared to women of other races. Vascular dysfunction is a non-traditional risk factor for CVD and is understudied in AAW. Previous studies have reported fluctuations in vascular function across the menstrual cycle (MC) with the changing levels of estrogen, but this relation has never been explored in the context of race. PURPOSE: To compare nitric oxide-mediated peripheral vascular function across 3 phases of the MC between AAW and CW using passive leg movement (PLM). METHODS: PLM was performed on premenopausal, healthy, female participants not using hormonal contraceptives; 7 AAW (24 ± 2 years, BMI: 20.5 ± 2.1 kg/m², BP: 113 ± 22/74 ± 9 mmHg) and 12 CW (23 ± 1 years, BMI: 23.4 ± 0.9 kg/m², BP: 113 ± 22/70 ± 2 mmHg). Phases of the MC were identified as early follicular (EF) (1-5 days post onset of menstruation; low estrogen), ovulation (OV) (within 1-3 days of luteinizing hormone surge determined by an ovulation test; high estrogen), and mid-luteal (ML) (8-10 days post ovulation; moderate estrogen). Blood velocity and diameter of the femoral artery were measured using Doppler ultrasound. A 2x3 repeated measures ANOVA was used to identify differences in vascular function between AAW and CW across 3 phases of the MC. RESULTS: The overall change in leg blood flow from baseline to peak (ml) was significantly lower among AAW compared to CW across the MC phases. EF (AAW: 195 ± 49, CW: 356 ± 64), OV (AAW: 156 ± 47, CW: 312 ± 81), ML (AAW: 244 ± 65, CW: 350 ± 30). The hyperemic response to PLM, calculated as area under the curve (ml), was significantly reduced in AAW compared to CW across the MC phases. EF (AAW: 45 ± 21, CW: 131 ± 40), OV (AAW: 49 ± 28, CW: 144 ± 40) and ML (AAW: 67 ± 22, CW: 130 ± 26). CONCLUSION: AAW are experiencing a attenuated peripheral vascular response to PLM compared to CW across the menstrual phases. These preliminary data suggest an overall race-derived disparity in peripheral vascular function regardless of MC phase in young premenopausal women.

Board #6
May 27 9:30 AM - 11:30 AM
Acute Effects Of Interrupting Prolonged Sitting On Vascular Function In Type 2 Diabetes

Frances Clare Taylor1, David W. Dunstan2, Ashleigh R. Homer1, Bronwyn A. Kingwell1, Paddy C. Dempsey1, Rachel E. Clime1, Neville Owen1, Robyn N. Larsen1, Michael J. Wheeler1, Melanie K. Townsend1, Nirav Mirzai1, Daniel J. Green1, Mary MacKillop Institute for Health Research, Australian Catholic University, Melbourne, Australia. 2Baker Heart and Diabetes Institute, Melbourne, Australia. 3CSL Ltd, Bio2, Melbourne, Australia. 4Institute of Metabolic Science, University of Cambridge, Cambridge, United Kingdom. 5School of Agriculture and Food, The University of Melbourne, Melbourne, Australia. 6School of Behavioural and Health Sciences, Australian Catholic University, Melbourne, Australia. 7School of Sports Science, Exercise and Health, University of Western Australia, Perth, Australia. Email: frances.taylor@baker.edu.au (No relevant relationships reported)

In overweight/obese adults, frequent interruptions to sitting time by brief activity bouts can mitigate the impairment of vascular function. However, it is unknown whether the benefits extend to those with type 2 diabetes (T2D), and whether there is an optimal frequency of activity break. PURPOSE: To examine the acute effects on vascular function in those with T2D, of interrupting sitting time with simple resistance activities (SRAs): 3min every 30min; or, 6min every 60min. METHODS: In a randomised crossover trial, 20 sedentary adults with T2D and overweight/obesity (35-70 yr; 11 males; 9 females) completed three 7-hour conditions (6-14 day washout between conditions): (1) uninterrupted sitting (SIT); (2) sitting with 3-min bouts of SRA every 30 min (SRA3); and, (3) sitting with 6-min bouts of SRA every 60 min (SRA6). Shear rate, blood flow and femoral artery flow-mediated dilation (FMD) were measured at 0h, 1h, 3.5h, 4.5h, 6h. Mixed models examined effects of condition and condition-by-time interactions, with adjustment for age, sex, BMI, baseline measurements and treatment order. Post-hoc analyses compared vascular measurements at individual timepoints and were re-run with adjustment for multiple comparisons (Šidák correction). RESULTS: Mean (±SD) resting shear rate across timepoints was significantly lower in the SIT condition (32.2 ± 23.3 s¹) relative to SRA3 (42.2 ± 27.9 s¹, PCondition < 0.0001) and SRA6 (44.6 ± 29.1 s¹, PCondition < 0.0001). Mean (±SD) resting blood flow, was significantly lower in the SIT condition (64.7 ± 45.2 ml/min), relative to SRA3 (86.1 ± 77.5 ml/min, PCondition < 0.0001) and SRA6 (85.0 ± 61.7 ml/min, PCondition < 0.0001). There were no condition differences in the temporal change in femoral artery FMD measurements across the 7h day (PCondition-by-time > 0.05 for all). However, FMD was significantly lower at the 6.5h timepoint in SIT compared with SRA3 (2.8 ± 3.5% vs 5.3 ± 2.7%, P < 0.0007). CONCLUSIONS: The results demonstrate that when the volume of activity is the same, one activity break per hour is just as effective as two activity breaks per hour for increasing lower-limb blood flow and shear rate. Interrupting sitting twice per hour was also beneficial for FMD at the final reading, however changes between sitting and activity breaks remained relatively unchanged at earlier timepoints.
Cardiovascular morbidity and mortality rates are highest among Black Americans, the mechanisms of which remain elusive. While it has been postulated that exaggerated autonomic reflexes or responsiveness could contribute to elevations in baseline or exercise blood pressure, increasing CVD risk, no studies have explored the movement-induced changes in hemodynamics. PURPOSE: Using passive leg movement (PLM), as model of the mechanoreflex (a component of the exercise pressor reflex) and an assessment of lower limb vascular function, the aim of this study was to compare the central and peripheral hemodynamic responses in young healthy Black (BA) and White Americans (WA). METHODS: Young (21±4 yr) healthy BA (n = 9) and WA (n = 10) males were instrumented with continuous central hemodynamic monitor (Finger Photoplethysmography), while peripheral hemodynamics were monitored using frequency domain multi-distance near infrared spectroscopy (NIRS) of the vastus lateralis, and ultrasound Doppler of the common femoral artery. After 1 minute of baseline, subjects underwent continuous PLM at 1 Hz for two minutes, while tissue oxygen saturation (StO2), leg blood flow (LBF), cardiac output (CO), heart rate (HR), stroke volume (SV), and mean arterial pressure (MAP) were recorded. RESULTS: Resting HR (61±3 v. 62±3 beats/min), SV (89±5 v. 92±5 ml/beat), CO (5.4±0.4 v. 4.4±0.5 L/min), and MAP (92±5 v. 86±3 mmHg) were not different between BA and WA, respectively (all, p>0.05). The peak PLM-induced changes in HR (6/2±11±3 beats/min, p = 0.06), SV (7.3±1.6 v. 11±4±1.9 ml/beat, p < 0.04), and CO (0.7±0.2 vs. 1.0±0.2 Ål/min, p = 0.09), while MAP (5.3±1.4 v. 6.0±0.8 mmHg, p = 0.05) was not different. The peak PLM-induced change in StO2, was significantly attenuated in BA (1.6±0.5 vs. 3.8±0.4 Ål%, p = 0.01). CONCLUSION: This research provides novel insights into potential racial differences in mechanoreflex sensitivity and lower limb vascular function. Black American men had an attenuated mechanoreflex response to PLM as compared to White American men; however, Black Americans also had a lower peripheral hemodynamic response, perhaps suggestive of lower limb vascular dysfunction, which might explain a propensity towards greater peripheral vascular disease rates in Black Americans.

METHODS: 16 breast cancer (BC) survivors completed 45 minutes of intermittent cycling at 60% of peak CPX wattage before (BASE) and after 16-weeks (FINAL) of exercise training. Eleven healthy sedentary women (Control) completed the same acute bout of exercise. Blood was taken at rest (PRE), immediately after (POST) and 1 hour after (1HR POST) exercise. Neutrophil phagocytosis and oxidative killing of E. coli, and expression of CD16, CXCR2 and TLR4 were assessed by flow cytometry (MFI ± SD).

RESULTS: Compared to Controls, at BASE PRE, BC survivors had lower phagocytosis of bacteria (4250±718 v 3991±1232; p=0.03), and elevated oxidative burst (4495±651 v 6254±1434; p=0.005). At BASE, BC survivors’ phagocytic response to acute exercise was impaired. BC survivors PRE to POST phagocytosis was unchanged (p=0.24) while Controls increased 15±20% (p=0.003). BC survivors PRE to 1HR POST phagocytosis increased by 10±17% (p=0.046) while Controls increased 14±14% (p=0.003). Following training, BC survivor PRE phagocytosis increased from BASE to FINAL by 10% (p=0.08), to similar levels as Controls (p=0.765). BC survivors FINAL PRE to POST phagocytosis increased by 10% (p=0.001) and PRE to 1HR POST by 11% (p=0.008). Oxidative killing of bacteria was unchanged by acute exercise or exercise training. At BASE, BC survivor expression of CD16 reduced during acute exercise, PRE to 1HR POST by 9% (p=0.04) which annulled following training.

CONCLUSIONS: Following cancer therapy, BC survivors have impaired neutrophil functions at rest and to a stressor, which are improved by 16-weeks of exercise training. The improved phagocytosis of bacteria in BC survivors may represent an intrinsic improvement in neutrophil functions consistent with reduced risk of infectious disease. Supported by Breast Cancer Research Foundation (New York, NY).
Purpose: Asthma is a chronic airway inflammatory disease affecting more than 300 million people around the world. Purinergic signaling via purinergic receptors (mainly P2X7, P2Y2 and P2Y6) are thought to play a key role in asthma pathogenesis and severity. High intensity aerobic exercise is known to trigger asthma attacks, while low to moderate intensity training reduces inflammation and improves asthma control. Therefore, this study investigated whether low intensity aerobic exercise reduces asthma phenotype by modulation of purinergic signaling.

Methods: Aerobic exercise (AE) was performed in a treadmill at low intensity, 5x/week, 1h/session, for 4 weeks, beginning 2 weeks after HD administration. HD (dermatophagoides pteronyssinus; 100mg/mouse) was administered 3x/week, for 6 weeks. Results: The results demonstrated that AE reduced adenosine triphosphate (ATP) accumulation (p<0.001), IL-1β, IL-4, IL-5, CXCL1/KC, IL-13, IL-12β, IL-23, IL-33 and TNF-α (p<0.001), while increased IL-1ra, IL-2, IL-10 and IL-12p40 in bronchoalveolar lavage (BAL). Total number of leukocytes, eosinophils, lymphocytes and neutrophils in BAL and the number of eosinophils, neutrophils and lymphocytes in the airway wall (p<0.01) were reduced by AE. Airway remodeling (collagen, elastin, smooth muscle and mucus) were reduced by AE (p<0.01). TGF-beta, INF-γ and VEGF levels was reduced by AE (p<0.01). Lung mechanics (Resistance, Elastance, GTIS, ITIS, RAW) and airway hyperresponsiveness (AHR) to methacholine was ameliorated by AE (p<0.01). IL-4, IL-5 and IL-13 production by re-stimulated mediastinal lymph nodes, splenocytes and bone marrow cells was also reduced by AE. The expression of P2X7, P2Y2 and P2Y6 by peribronchial leukocytes (p<0.01) and also by airway epithelial cells (p<0.01) were reduced by AE. Conclusions: Low intensity aerobic training reduces asthma phenotype by inhibiting purinergic signaling and lymphoid organ hyperactivation.

Purpose: Long-term exercise training reduces systemic inflammation in heart failure patients. However, due to the impaired immune system in these patients, an acute exercise challenge may trigger pro-inflammatory responses. We compared the acute response to a standardized cardiopulmonary exercise test (CPET) in patients with heart failure with reduced ejection fraction (HF/EF) to age and gender matched controls.

Methods: Patients with HF/EF (n=13; left ventricular ejection fraction [LVEF] < 40%) and controls (n=14; LVEF > 50%) participated in a CPET. Blood samples were taken before, immediately after and 2 hours after CPET. Flow cytometry was used to evaluate differences in cellular respiration of these subsets.

Results: T cells (CD8+ naïve T cells) with each bout of exercise plays a mechanistic role in the anti-tumor effects provided by regular exercise. We tested the hypothesis that blocking the β2-AR to augment NK-cells mobilized to blood with exercise was Δ524 cells/µL, with those who self-identified as either completing more than six hours of aerobic-type exercise (ACTIVE) or less than 90 minutes of any type of physical activity (INACTIVE) per week were recruited. Blood was collected and participants returned for a later visit to complete a treadmill maximal oxygen consumption (VO2max) test. Mitochondrial mass and MMP of CD4+ naïve (CD45RA+CCR7+) and CD8+ naïve (CD45RA-CCR7+) and effector memory (CD45RO+CCR7-) cells were assessed by geometric mean fluorescence intensity (gMFI) of Mitotrack Green FM and TMRE, respectively.

Results: Preliminary statistical analyses (n = 11 each group) revealed that ACTIVE had higher cardiorespiratory fitness than INACTIVE (60.0 ± 9.9 vs. 43.6 ± 8.2 mL/kg/min respectively; independent t-test; p = 0.0049). IL-1β, IL-4, IL-5, IL-12beta, IL-23, IL-33 and TNF alpha (p<0.001), while increased IL-1ra, IL-2, IL-10 and IL-12p40 in bronchoalveolar lavage (BAL). Total number of leukocytes, eosinophils, lymphocytes and neutrophils in BAL and the number of eosinophils, neutrophils and lymphocytes in the airway wall (p<0.01) were reduced by AE. Airway remodeling (collagen, elastin, smooth muscle and mucus) were reduced by AE (p<0.01). TGF-beta, INF-γ and VEGF levels was reduced by AE (p<0.01). Lung mechanics (Resistance, Elastance, GTIS, ITIS, RAW) and airway hyperresponsiveness (AHR) to methacholine was ameliorated by AE (p<0.01). IL-4, IL-5 and IL-13 production by re-stimulated mediastinal lymph nodes, splenocytes and bone marrow cells was also reduced by AE. The expression of P2X7, P2Y2 and P2Y6 by peribronchial leukocytes (p<0.01) and also by airway epithelial cells (p<0.01) were reduced by AE. Conclusions: Low intensity aerobic training reduces asthma phenotype by inhibiting purinergic signaling and lymphoid organ hyperactivation.

Purpose: Recent research has demonstrated that the release of catecholamines, myokines, and the mobilization and redistribution of effector lymphocytes (e.g. NK-cells) with each bout of exercise plays a mechanistic role in the anti-tumor effects provided by regular exercise. We tested the hypothesis that blocking the β2-AR in vivo would increase catecholamine signaling toward the β2-AR to augment NK-cell mobilization in response to a single exercise bout. Methods: Thirty healthy subjects (ages 22 - 43) completed a single 30-minute bout of steady state exercise on a cycle ergometer at +10 to +15% of their predetermined lactate threshold to determine the number of NK-cells mobilized to blood with exercise. Eighteen of these subjects then participated in a randomized double-blind controlled trial with a cross-over design, whereby a placebo, a non-preferential β1/β2-antagonist (80 mg nadolol), or a preferential β1-antagonist (10 mg bisoprolol) was ingested orally 3 hours before a 30-minute exercise bout performed on separate days. Blood samples were collected before and immediately after exercise for the enumeration of effector lymphocytes (NK-cells, γδ T-cells and CD8+ T-cells) by flow cytometry. Results: The median number of NK-cells mobilized to blood with exercise was AS52 cells/µL, with those subjects below the median demonstrating a smaller epinephrine response to exercise than those above the median (Δ0.05 ± 0.03 vs. 0±0.10 ± 0.08 mg/mL; p = 0.05). Larger numbers of NK-cells were mobilized with exercise in the bisoprolol trial (AS70 ± 352.2 cells/µL) compared to the placebo trial (A537.9 ± 198.1 cells/µL; p = 0.05). Bisoprolol did not augment the mobilization of γδ T-cells or CD8+ T-cells relative to...
High-fat diet (HFD) feeding disrupts the intestinal barrier integrity, inducing the translocation of bacteria into the portal circulation, leading to the whole-body cardioprotective β-blockers and also provide insights on how certain β-AR antagonists response to acute exercise. These findings may have implications for cancer patients on autophagy suggests that any potential negative effects of performing resistance exercise with low glycogen levels may result on mitigating disuse-induced muscle atrophy. This study was funded by the National Institutes of Health, Award number: R15 AR069913/ AR/NIAMS

PURPOSE: To investigate the sufficiency of increased mitochondrial content on mitigating disuse-induced muscle atrophy. METHODS: Mice overexpressing muscle PGC-1α (PGC-1α) and WT mice were bred at the University of Arkansas. At 10 wks of age, male and female mice (~8-10/group, ~70 mice total) underwent hindlimb unloading (HU) or normal cage activity (CON) for 7 days. Tissues were then collected, weighed and prepared for mRNA analysis of mediators of proteasomal degradation. Data for males and females were analyzed by 2X ANOVA with Tukey post-hoc. RESULTS: In both male and female mice, overexpression of PGC-1α was not sufficient to protect gastrocnemius, tibialis anterior, or soleus muscle atrophy (~17%, ~13%, ~27% lower muscle weights, respectively). In the gastrocnemius, Mudα-F1 mRNA content was ~2.5-fold greater in male and female WT-HU mice compared to WT-CON; however, both male and female PGC-1α mice had ~40% less Mudα-F1 content compared to WT-CON, regardless of intervention. Correspondingly, Atrogin1 mRNA content in the gastrocnemius was ~4-fold greater in male and female WT-HU mice compared to WT-CON; whereas both male and female PGC-1α mice had no differences in Atrogin1 content compared to WT-CON regardless of intervention. CONCLUSION: Although increased mitochondrial content appears to blunt the induction of the ubiquitin proteasomal degradation system during disuse atrophy, these blunted responses do not appear sufficient to mitigate disuse-induced muscle loss. This study was funded by the National Institutes of Health, Award number: R15 AR069913/ AR/NIAMS

A-24 Free Communication/Slide - Skeletal Muscle Regulation of Hypertrophy/Atrophy

May 27 10:00 AM - 10:15 AM  
Intake Of Essential Amino Acids Stimulates Mtorc1 Signaling And Inhibits Autophagy Following Glycogen-depleted Resistance Exercise

William Apró, Oscar Horwath, Jonas Granhag, Marcus Moberg, Eva Andersson, Björn Ekblom, Swedish School of Sport and Health Sciences, Stockholm, Sweden.  
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(No relevant relationships reported)

Autophagy is responsible for degrading and recycling cellular proteins under conditions of energetic stress and low nutrient availability. Activation of autophagy is mediated by AMPK which is activated by high-intensity exercise and low glycogen availability and performing resistance exercise with low glycogen levels may result in enhanced autophagy activation which in turn may have negative effects on muscle protein balance. Autophagy is inhibited by mTORC1 which is potently activated by essential amino acids (EAA). The opposing effects of AMPK and mTORC1 on autophagy suggests that any potential negative effects of performing resistance exercise with low glycogen availability may be rescued by EAA intake. PURPOSE: To study the effect of EAA intake on autophagy and mTORC1 signaling following resistance exercise with high and low glycogen availability.

METHODS: Using a unilateral study design in which one leg was glycogen loaded and the other leg was glycogen depleted, men and women underwent two experimental trials wherein they consumed either a placebo (PLA) or an EAA drink after resistance exercise. Unilateral differences in muscle glycogen content were achieved through glycogen loading and subsequent one-legged glycogen depletion exercising the evening prior to each experimental trial. Muscle biopsies were collected at baseline, post exercise and 1 and 3 h after drink intake in both legs in both trials.

RESULTS: Mean glycogen content was ~90% lower in the depleted leg compared to the loaded leg (228 vs 724 mmol/kg dry weight) across all time points in both trials. Phosphorylation of ULK1 at the AMPK-specific site S317 was elevated ~5-fold immediately post exercise in the depleted leg while remaining unchanged in the loaded leg with no differences between trials. In the PLA-trial, S317 phosphorylation remained elevated 60 min post drink ingestion, while in the EAA-trial at the same time point, it had returned to baseline values. Phosphorylation of S6K1 at the mTORC1-specific site T389 remained largely unchanged at all time-points in the PLA-trial while being increased by ~33-fold in both legs at 60 min in the EAA-trial.

CONCLUSIONS: Intake of EAA blunts the elevations in autophagy signaling induced by resistance exercise performed in a glycogen-depleted state while simultaneously stimulating the mTORC1 pathway.

BACKGROUND: Testosterone supplementation promotes whole-body lean mass accretion during severe energy deficit in non-obese, young men. The intramuscular mechanisms mediating this effect remain undefined.

PURPOSE: Determine the effect of supplement testosterone on androgen receptor (AR), anabolic, proteolytic, inflammatory, and myogenic pathways during energy deficit.

METHODS: Fifty men (mean ± SD, 25 ± 5 y, 25 ± 3 kg/m²) completed a 14-d weight maintenance (WM) phase, followed by a 28-d, 55% diet and exercise-induced energy deficit (ED) with 200 mg testosterone enanthate/week (TEST, n = 24) or placebo (PLA, n = 26). Muscle biopsies (vastus lateralis) from a subset (n = 10 per group) of participants exhibiting the greatest increase or decrease in leg lean mass (DEXA) and the other leg were assayed to assess phosphorylation status, total protein and gene expression following the first post-exercise biopsy.

RESULTS: Mean glycogen content was ~69% lower in the depleted leg compared to the loaded leg (228 vs 724 mmol/kg dry weight) across all time points in both trials. Phosphorylation of ULK1 at the AMPK-specific site S317 was elevated ~5-fold immediately post exercise in the depleted leg while remaining unchanged in the loaded leg with no differences between trials. In the PLA-trial, S317 phosphorylation remained elevated 60 min post drink ingestion, while in the EAA-trial at the same time point, it had returned to baseline values. Phosphorylation of S6K1 at the mTORC1-specific site T389 remained largely unchanged at all time-points in the PLA-trial while being increased by ~33-fold in both legs at 60 min in the EAA-trial.

CONCLUSIONS: Intake of EAA blunts the elevations in autophagy signaling induced by resistance exercise performed in a glycogen-depleted state while simultaneously stimulating the mTORC1 pathway.
Muscle loss is an important predictor of morbidity and mortality across a variety of diseases. Males and females appear to differ on clinical outcomes in relation to disuse-induced muscle atrophy, however reasons for these different responses have not been investigated.

**PURPOSE:** To investigate measures of muscle oxidative metabolism during the time-course of disuse-atrophy in male and female mice. **METHODS:** Disuse atrophy was induced using hindlimb unloading in 50 male and 50 female mice for 0 (CON), 1, 2, 3, or 7 days (n=10/group). Muscle sections of the tibialis anterior were stained for succinate dehydrogenase (SDH). Cross sectional area (CSA) by SDH staining was used to assess the effect of disuse on different muscle fiber phenotypes. mRNA content of Pparα was measured in the gastrocnemius, soleus, and extensor digitorum longus (EDL) muscles. Data were analyzed within each sex by one way ANOVA and trend analysis. A p<0.05 indicated statistical significance. **RESULTS:** CSA of SDH positive fibers progressively decreased in both male and female mice. CON animals (male and female) had SDH positive fiber CSA of ~400 µm² and 7 day unloaded animals had CSAs of ~300 µm². Both male and female mice had an SDH negative CSA of ~650 µm², with no significant differences in fiber CSA noted across groups. In the gastrocnemius muscle, Pparα content was 50-60% lower at 1 day of unloading in males and females and remained depressed in all experimental groups. Insole muscles of females, Pparα was ~60% lower at days 1, 2, and 3 compared to CON, but then recovered back to CON levels. Whereas in males, Pparα was ~60% lower with 1 day of unloading and remained depressed in 1, 2, 3, and 7 day groups. In females, there were no differences in Pparα content in EDL across all groups. In males, there was ~50-75% lower Pparα in EDL content that reached statistical significance at 2 days and remained depressed throughout intervention groups. **CONCLUSION:** Disuse results in muscle loss in males and females and appears to result in similar alterations to oxidative metabolism across multiple tissues. Future studies should investigate if improving oxidative metabolism is protective against disuse atrophy in males and females.

This study was funded by the National Institutes of Health, Award number: R15 AR069913/AR/Niams.

### A-25 Clinical Case Slide - Hip I

**Wednesday, May 27, 2020, 9:30 AM - 11:30 AM**

**Room: CC-2005**

**Chair:** Lauren Elson. Spaulding/Harvard University.

**Discussant:** Andrea Stracciolini, FACSM. Children’s Hospital Boston, Boston, MA.

**Discussant:** Keri L. Denay, FACSM. University of Michigan, Ann Arbor, MI.

**Email:** rajup@evms.edu

**Email:** no relevant relationships reported

**RESULTS:** There were no significant condition * time interactions for lean mCSA or LTM. However, there was a main effect of time for both lean mCSA (p<0.001) and LTM (p<0.001). Both HV and HI increased upper-leg LTM post-training (HV: pre = 8.96 ± 1.07 kg vs. post = 9.24 ± 1.14 kg; HI: pre = 8.95 ± 1.05 kg vs. post = 9.18 ± 1.06 kg). Similarly, both HV and HI increased lean mCSA post training (HV: pre = 185.8 ± 24.0 cm² vs. post = 191.8 ± 24.3 cm²; HI: pre = 185.7 ± 20.0 cm² vs. post = 195.1 ± 25.7). **CONCLUSION:** Six weeks of HV and HI training similarly increased upper-leg LTM and lean mCSA in previously trained college-aged males.

**HISTORY:** A 59-year-old beach volleyball player sustained a hip injury during a match. While playing, he landed on soft sand from a jump on his right leg. He felt a ‘jolt and pop’ in his right hip that radiated to his deep thigh, and felt his leg seemed ‘locked out of place.’ No past history of hip dysplasia, dislocation, hip surgery. He asked someone to pull on his leg to try and improve symptoms. After the incident, he was able to walk off on his own power, but noted discomfort upon weight bearing and walking.

**PHYSICAL EXAMINATION:** Examination revealed no focal tenderness, full ROM of the hip, but had discomfort with FABER maneuver. He was able to walk around at the clinic without assistance.

**DIFFERENTIAL DIAGNOSIS:** Hip dislocation, Acetabular labral tear, loose body, Coxa saltans, Occult fracture

**TEST AND RESULTS:** X-rays were obtained and suggested a posterior rim acetabular fracture; Same-day CT showed a comminuted intra-articular posterosuperior acetabular wall fracture with effusion, femoral head impaction, and irregularity of the central fovea suggested ligamentum teres femoris avulsion

**FINAL WORKING DIAGNOSIS:** Right posterior wall acetabulum fracture with femoral head impaction

**TREATMENT AND OUTCOMES:** 1. referred to Orthopedic Trauma; surgeon recommended evaluation under anesthesia (EUA) due to possibility of transient hip dislocation to evaluate for instability, which he declined. Recommended toe-touch weightbearing with crutches which he also declined as he felt able to ambulate. Hip dislocation precautions given.

2. At 1 month, he ended up using two canes to walk but was able to without significant symptoms. Advanced to weightbearing as tolerated.

3. At 3 months, felt better but still unable to play volleyball or run. X-rays showed interval healing in unchanged alignment

**CASE RAISES AWARENESS TO COUNSEL PATIENT ON RECURRENT DISLOCATION, OSTEONECROSIS, AND ARTHRITIS RISKS WITH THESE INJURIES, AND CONSIDER BONE DENSITY TESTING IF A LOW-ENERGY INJURY.
PHYSICAL EXAMINATION:
Mild valgus knee alignment. Guarded FADIR, not clearly positive. Tenderness to palpation, posterolateral trochanter/gluteal area.

DIFFERENTIAL DIAGNOSIS:
1. Labral tear
2. Snapping hip syndrome (tendon/muscle)
3. Femoroacetabular impingement (FAI) syndrome
4. Hip OA
5. Lumbar referred pain
6. Iliopsoas bursitis
7. Gluteal tendinopathy

TESTS AND RESULTS:
- Hip Xray (8/26/2016): WNL
- MSK Ultrasound: (6/23/2017):
- MSK Ultrasound (9/29/2017):
  - No snapping hip sx with log rolling, FABER, or FADIR. RF was observed rolling over the iliopsoas, without snapping. No labrum catching was noted.
- MRI pelvis w/o contrast: Findings consistent with Asymmetric incomplete fusion of the ischiopubic chondrosis with stress reaction.

TREATMENT AND OUTCOMES:
- Hip labral tear
- Ischiopubic synchondrosis with stress reaction

TESTS AND RESULTS:
- Pelvis and hip AP and Dunn radiographs: There is a healing fracture of the left inferior pubic ramus, with a faintly visible fracture line and surrounding periosteal reaction. MRI pelvis w/o contrast: Findings consistent with Asymmetric incomplete fusion of the ischiopubic chondrosis with stress reaction.

FINAL WORKING DIAGNOSIS:
Ischiopubic synchondrosis with stress reaction also known as Van Neck Disease.

OUTCOME:
1. Patient was made NBW on crutches for 2 weeks at her MR1 follow up appointment.
2. At 2 week follow up patient had decreased pain to palpation over left pubic bone. She was progressed to WBAT, PT, no ballet for 6-8 weeks and continue with the sports nutritionist.
3. At 3 week follow up, patient had no pain on physical examination. Patient was progressed to return to barre class for 10 minutes for one week. She could increase her time each week as instructed by her PT. Patient was not allowed to do speed work, jump or move her leg past 90 degrees in abduction, flexion or extension.
4. Patient will follow up in 6 weeks.
May 27 11:00 AM - 11:10 AM

Rare Case Of Avascular Necrosis In A Dodgeball Player

Steven C. Liu¹, Alpha Anders², Kenneth Vitale, FACSM²,
Eastern Virginia Medical School, Norfolk, VA. ¹UCSD School of Medicine, San Diego, CA. 
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(No relevant relationships reported)

History:
A 27-year-old male presented with left anteromedial hip/groin pain for 2 weeks. He competes in a dodgeball league and plays occasional racquetball as well. After a dodgeball game, he noted onset of hip and groin pain, which became progressively severe, and went to a local Emergency Department. He had x-rays and were told they were normal, however he had significant pain even with weightbearing at this point. No past history of hip dysplasia, dislocation, hip surgery.

Physical Examination:
Hip flexion was 110°, external rotation 20°, external rotation 60°, abduction 45°; significant pain with flexion, adduction, and internal rotation, and positive FABER. He was able to ambulate without assistance.

Differential Diagnosis:
- Labral tear
- Femoroacetabular impingement
- Femoral neck stress fracture
- Loose body
- Chondral defect
- Athletic pubalgia

Tests and results:
X-rays were obtained and suggested minimal left femoral head collapse, and did suggest mild right femoral head sclerosis; an MRI showed large areas of grade 2 avascular necrosis bilaterally. The left had a joint effusion, edema in addition to necrotic fatty signal in the femoral head compatible with early collapse.

Final/Working Diagnosis:
Bilateral hip avascular necrosis with early left collapse.

Treatment/Outcome:
- Internal Medicine and Rheumatology referral for serological work up.
- Referred to Orthopedic Surgeon; recommended toe-touch weightbearing, counseled on risk of progression. Alendronate was considered as with precollapse Ficat stages II-III.
- At 8 months, left hip pain was progressing, and noted onset of right hip pain. X-rays showed visible left AVN on the entire weightbearing surface with collapse and flattening of the superior articular surface; right hip now showed subtle sclerosis.
- His only pertinent history included a brief course of oral corticosteroids when he got his wisdom teeth removed, which he did not initially disclose. This case reports an unusual etiology of an avascular necrosis after taking a short-term dose of corticosteroids. Case raises awareness to counsel health providers about collaborating to provide patients with optimal care and avoid potential serious side effects.

May 27 11:10 AM - 11:30 AM

Bilateral Hip Pain - Soccer Player

Samantha Lucrezia, Danielle Hirsch, Patrick Mularoni.
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(No relevant relationships reported)

History:
A 16-year-old Asian male presented with 2 weeks of worsening groin pain. Pain began after a difficult soccer practice, without a specific inciting injury. Patient was evaluated by team’s athletic trainer and was referred to orthopedic surgery where x-rays were negative. One week later, patient presented to local pediatric emergency center with intermittent fevers, worsening pain, and inability to ambulate. He denied any recent travel outside the US or new exposures. Physical Examination: afebrile in no acute distress with tenderness to palpation over paraspinal muscles, costovertebral processes L3-L4 and quadriceps musculature. Patient walked with antalgic gait and found to have 2/5 strength hip flexion bilaterally with 5/5 strength in all other muscle groups. Cardiac, pulmonary and abdominal exam were unremarkable. There was no lymphadenopathy present on exam.

Differential Diagnosis:
1. Ankylosing Spondylitis
2. Iliopsoas Abscess
3. Epidural abscess
4. Osteomyelitis
5. Malignancy

Test and Results:
- ESR: elevated at 94 mm/hr, CRP: elevated at 4.57 mg/dl.
- CBC: mild normocytic anemia without leukocytosis or thrombocytopenia.
- CK, CMP, Uric Acid, LDH within normal limits

-MRI of lumbar spine and pelvic: signal enhancement within the bones of pubis with significance with surrounding soft tissue edema
-Bone biopsy: focally degenerated bone, mixed chronic inflammation, fibrosis with reactive changes. No microorganisms present on special stains
-Bone aerobic/anerobic cultures: negative
-QuantiFeron gold: POSITIVE, mycobacterium spatum PCR: POSITIVE
-Chest x-ray: negative

Final Working Diagnosis:
Tuberculous osteomyelitis of the pelvis

Treatment and Outcomes:
1. Treatment with ethambutol, isoniazid, pyrazinamide, and rifampin daily until cleared by infectious disease
2. Close follow up with Infectious disease clinic with monitoring labs every 2 weeks
3. Indomethacin PRN for pain
4. Range of motion and strengthening exercises for bilateral hip flexors with physical therapy
5. Regular follow up with local department of health

A 27-year-old male presented with left anteromedial hip/groin pain for 2 weeks. He competes in a dodgeball league and plays occasional racquetball as well. After a dodgeball game, he noted onset of hip and groin pain, which became progressively severe, and went to a local Emergency Department. He had x-rays and were told they were normal, however he had significant pain even with weightbearing at this point. No past history of hip dysplasia, dislocation, hip surgery.

Physical Examination:
Hip flexion was 110°, external rotation 20°, external rotation 60°, abduction 45°; significant pain with flexion, adduction, and internal rotation, and positive FABER. He was able to ambulate without assistance.

Differential Diagnosis:
- Labral tear
- Femoroacetabular impingement
- Femoral neck stress fracture
- Loose body
- Chondral defect
- Athletic pubalgia

Tests and results:
X-rays were obtained and suggested minimal left femoral head collapse, and did suggest mild right femoral head sclerosis; an MRI showed large areas of grade 2 avascular necrosis bilaterally. The left had a joint effusion, edema in addition to necrotic fatty signal in the femoral head compatible with early collapse.

Final/Working Diagnosis:
Bilateral hip avascular necrosis with early left collapse.

Treatment/Outcome:
- Internal Medicine and Rheumatology referral for serological work up.
- Referred to Orthopedic Surgeon; recommended toe-touch weightbearing, counseled on risk of progression. Alendronate was considered as with precollapse Ficat stages II-III.
- At 8 months, left hip pain was progressing, and noted onset of right hip pain. X-rays showed visible left AVN on the entire weightbearing surface with collapse and flattening of the superior articular surface; right hip now showed subtle sclerosis.
- His only pertinent history included a brief course of oral corticosteroids when he got his wisdom teeth removed, which he did not initially disclose. This case reports an unusual etiology of an avascular necrosis after taking a short-term dose of corticosteroids. Case raises awareness to counsel health providers about collaborating to provide patients with optimal care and avoid potential serious side effects.

Endnotes:

1. Treatment with ethambutol, isoniazid, pyrazinamide, and rifampin daily until cleared by infectious disease
2. Close follow up with Infectious disease clinic with monitoring labs every 2 weeks
3. Indomethacin PRN for pain
4. Range of motion and strengthening exercises for bilateral hip flexors with physical therapy
5. Regular follow up with local department of health

A 25-year-old male sustained a left knee hyperextension injury while being tackled by a friend in his backyard. He had immediate pain, swelling, and was unable to ambulate. X-Rays in the ED demonstrated an avulsion fracture of unknown origin. Patient was placed in a knee immobilizer and advised to follow up with orthopedics. Three days later, he presented to clinic with pain, swelling, significant instability, numbness and coolness in left foot, and inability to dorsiflex his left ankle.

Physical Exam:
Knee examination revealed significant ecchymosis of the posterior-lateral aspect of the knee and positive effusion. Coolness and decreased sensation to distal one third of left leg. He had a positive foot drop. Difficulty palpating dorsalis pedis pulse. Good capillary refill. Significant laxity to lateral collateral ligament in full extension (0 degrees). Positive Lachman’s as well as laxity with posterior drawer testing.

Differential Diagnosis:
1. Knee dislocation with peroneal neuropathy and possible popliteal artery injury 2. Multi-ligament left knee injury with peroneal neuropathy and possible popliteal artery injury

Tests and Results:
CT angiogram- No arterial injury
MRI - Edema and nonorganized hematoma involving gastrocnemius, soleus, popliteus, and tibialis anterior. Detached medial and lateral patellar retinaculum, medial and lateral meniscus tears. Partial tear of PCL, MCL strain, ruptured ACL and LCL.
Thrombus but intact peroneal nerve noted. Avulsion fracture of biceps femoris and tear of popliteus tendon. Medial femoral condyle osteochondral impaction fracture.

Final Working Diagnosis:
144 May 27 9:50 AM - 10:10 AM
114 Kilograms Overhead Too Much For This Knee
Erin S. Barnes, MD1, Joseph Medellin, MD, MPH, MBA2, Ryan Rompola, DAT, AT, ATC3. Temple University/MossRehab, Philadelphia, PA. 2Henry Ford Allegiance Health Sports Medicine, Jackson, MI. (Sponsor: Mark Lavallee MD, FACSM) Email: e.s.barnes89@gmail.com
(No relevant relationships reported)

HISTORY: History 61 year old male competing in the 102 kg category in the International Weightlifting Federation World Masters Championships, on his third attempt at clean and jerk (114 kg), was able to power clear the bar into the front rack position and subsequently performed a power jerk. As the bar was stabilized overhead, the patient’s right knee collapsed medially and he fell to the ground. Medical staff assessed the patient immediately on the platform.

PHYSICAL EXAM: Right knee exam: no obvious deformity with the leg in extension. Local edema quickly developed superior to patella, passive flexion and extension elicited pain, flexion with notable gaping between the superior pole of the patella and quadriceps muscle bulk. Patella was midline in femoral condyles, no tenderness along the medial or lateral joint lines. There was a palpable defect between the superior pole of the patella and quadriceps muscle bulk. Pulses: palpable DP pulses, good capillary refill Sensation: grossly intact to light touch in the right lower extremity.

DIFFERENTIAL DIAGNOSIS: Tibial-femoral dislocation Patellar dislocation Quadriceps tendon rupture Medial collateral ligament tear ACL tear

TESTS & RESULTS: No immediate imaging available in medical tent, ER CTA without vascular compromise and evidence of complete right quadriceps tendon rupture, which was later confirmed on pre-surgical MRI.

FINAL DIAGNOSIS: Complete right quadriceps tendon rupture TREATMENT & OUTCOMES: EMs was called and the patient’s knee was immobilized. Pulses were palpable throughout the duration of the exam. While in the ER there was concern for vascular injury therefore CTA was obtained. Once vascular injury was ruled out, patients’ knee was placed in a knee immobilizer and he was cleared to travel home. Patient underwent surgical repair one-week post-injury in his native state. He began physical therapy several days after surgery and rehab is ongoing. Return to sport estimated at 9-12 months post-injury.

145 May 27 10:10 AM - 10:30 AM
LEG BUMP- SOCCER
George Ross Malik, Samuel Chu. Shirley Ability Lab, Chicago, IL. (Sponsor: Dr. Joseph Ihm, FACSM) Email: g.malik@srarlab.org
(No relevant relationships reported)

HISTORY: A 12-year-old male with a past medical history of Celiac’s disease and growth deficiency on hormone supplementation presented to sports medicine clinic with a large, painless bump on the medial aspect of his left knee. He noticed it three months prior, but reported enlargement over the last few weeks. He described it as firm and large, painless bump on the medial aspect of his left knee. He noticed it three months prior. He denied any trauma or inciting event to the knee. He reported playing soccer 8 hours and squash 2 hours per week with both school and club teams. He did not mention fevers, chills, weight loss, erythema, ecchymosis, or edema.

PHYSICAL EXAMINATION: Examination revealed an approximately 1x2cm firm, non-mobile mass over the superomedial aspect of the left knee. No knee effusion was noted bilaterally. The left knee was non-tender to palpation along the medial and lateral joint lines as well as the patellar facets. There were no crepitus in the bilateral knees. The range of motion was minimally restricted in flexion on the left compared to the right. Full extension was intact without pain bilaterally. Sensation to light touch and motor strength was normal in the lower extremities. There was no varus or valgus laxity. McMurray’s and Lachman’s tests were negative bilaterally.


146 May 27 10:30 AM - 10:50 AM
Knee Injury Football
Michelle L. Walls. Michigan State University, East Lansing, MI. (Sponsor: Susan M. Ott, FACSM) Email: Alexander.spiewak@gmail.com
(No relevant relationships reported)

HISTORY: 14 year old male football athlete sustained an unwitnessed injury to his left knee at football practice. He was transported to the emergency room and subsequently to the orthopedic department. CO left knee pain and swelling with difficulty bearing weight.

PHYSICAL EXAMINATION: Moderate effusion. ROM 0-40 degrees, no joint line pain, stable to varus and valgus stress testing at 0 and 30 degrees of flexion. Positive lachman. Unable to do further testing due to pain and decreased ROM.

DIFFERENTIAL DIAGNOSIS: 1-ACL injury 2-locked knee due to bucket handle meniscus tear 3-fracture 4-patella dislocation/subluxation

TEST AND RESULTS: Plain radiographs : skeletal immaturity, displaced tibial spine fracture CT: same with the center of the physis closed MRI: Same no other intra-articular pathology and further definition of the size of the intra-articular fragment

FINAL WORKING DIAGNOSIS: tibial spine fracture

TREATMENT AND OUTCOMES: arthroscopically assisted fixation of fracture, non-weight bearing for 4 weeks in post operative brace ROM 0-30, Gradual return to full weight bearing and full ROM in post operative brace over the next 2 weeks. Placed in hinged knee sleeve and into ACL protocol physical therapy at 6 weeks PO. Negative lachmanachs achieved and maintained from immediately post op onward. Radiograph union of the fracture at 6 weeks PO. Anticipate return to basketball with brace at 3 months post op

147 May 27 10:50 AM - 11:10 AM
Knee Injury Football
Alexander A. Spiewak. Western Michigan University School of Medicine, Kalamazoo, MI. (Sponsor: Robert B Baker, FACSM) Email: Alexander.spiewak@gmail.com
(No relevant relationships reported)

HISTORY: A 17-year-old senior high school football quarterback sustained a right knee injury during the third quarter of a game. During the third quarter while the player was attempting to cut and change directions he planted hard on his right leg and attempted to push off. He subsequently fell to the ground screaming in pain. There was no contact with another player. Athletic trainers and the team physician ran onto the field to aid him. PHYSICAL EXAMINATION: Examination demonstrated a deformed right knee. The tibia was displaced laterally in relation to the femur. The patella was midline. His sensation was intact, no dorsalis pedis pulse was palpable. His range of motion was severely limited. Reduction of his true knee dislocation was performed on the field due to the lack of palpable DP pulse. His knee was easily reduced on the field and his dorsalis pedis pulse was then easily palpated. He was carried to the sideline. On sideline he had a grade II Lachmanachs with his exam being limited by pain. He was placed in a straight leg immobilizer and taken to the emergency department. DIFFERENTIAL DIAGNOSIS: 1. Knee dislocation 2. Patellar dislocation 3. Ligamentous injury

TEST AND RESULTS: CT Angiography lower extremity right Normal vascular structural integrity with normal pop. Artery-Moderate right knee effusion -No visualized fractures seen Knee complete 4 view right-Skeletally mature with physiologic valgus alignment -Lateral knee effusionMR right knee without contrast-Complete tear of ACL-Lateral femoral condyle cortical impaction fracture with deepened femoral notch-Large Joint effusion-Suspected longitudinal tear of the posterior horn of the lateral meniscus FINAL WORKING DIAGNOSIS: True knee dislocation with complete ACL tear and lateral meniscus tear as well as lateral femoral condyle impaction fracture

TREATMENT AND OUTCOMES: The patient was kept in hinged knee brace for 4 weeks to allow for capsular healing. Patient underwent right knee arthroscopic ACL reconstruction with bone-tendon-bone autograft and lateral meniscus repair. No periarticular corner injury was noted on

Abstracts were prepared by the authors and printed as submitted.
Bone Injury - Gymnastics

HISTORY: A 14-year old female level 10 USGA gymnast presented with right knee pain and swelling after hyperextending her knee during a landing while competing on vault. She did not feel or hear a pop but was unable to walk due to pain. The knee subsequently swelled and she sought medical treatment at a local facility. Radiographs were negative but she continued to have pain while walking with loss of motion. She had no previous knee injuries and did not complain of any paraesthesias. She otherwise was in good health with no history of illnesses or medical conditions

PHYSICAL EXAM: The patient was in no distress but could not weight bear on her leg. She had a 2+ effusion and her knee motion was limited from 20 to 125 degrees. She was neurologically intact for sensation and motor strength in the extremity. She was tender only on her proximal tibia near the patellar tendon attachment. Her patellar tendon and quadriceps mechanism was intact. She had no laxity to varus or valgus stress testing of the collateral ligaments with the knee extended or flexed 30 degrees. A McMurray’s test was too painful to perform. She had a negative Lachman’s and posterior drawer test. Her vascular examination (pulses, color, capillary refill, temperature) of the extremity were all normal.

DIFFERENTIAL DIAGNOSIS:
1. Patellar dislocation
2. Partial tear patellar tendon
3. Meniscal tear
4. Cartilage contusion
5. Occult fracture - tibial plateau

TESTS AND RESULTS:
Plain radiographs of the knee (sunrise, true AP and lateral): Normal MRI of the Knee: Normal ACL and PCL. Moderate knee effusion. Contusion of the lateral femoral condyle and the anterolateral tibial plateau. CT scan of the Knee: Cortical break in the lateral tibial plateau anteriorly

FINAL WORKING DIAGNOSIS:

TREATMENT AND OUTCOMES:
1. Non-operative treatment: crutches until free of symptom (3 weeks) then progressive weight bearing
2. Ibuprofen 800 mg up to three times per day prn for two weeks; cryotherapy daily
3. Conditioning only at gymnastics with no WB on extremity for 6 weeks followed by

4. Returned to gymnastics at 3 months?
denied any history of specific injury or inciting event. Further questioning revealed numbness of the 2nd and 3rd fingers on the right. Notably he did not have any neck or shoulder pain.

**Physical Examination:**
- Visual inspection revealed right sided pectoralis atrophy and winging of the inferior border of the scapula on the right. There was no tenderness to palpation in the cervical spine or shoulder girdle. There was full active cervical and shoulder range of motion without pain.
- Strength testing was normal and symmetric aside from weakness with forearm supination on the right compared to the left. Spurling test of the cervical spine was negative bilateral. Patient noted mild sensory deficits in the 2nd and 3rd digits on the volar aspect on the right. Normal radial and ulnar pulses bilateral.

**Differential Diagnosis:**
1. Pectoral nerve entrapment
2. Brachial plexopathy
3. Cervical radiculopathy

**Test and Results:**
- EMG/NCS: Electrodiagnostic evidence of multiple right cervical radiculopathy, mostly involving C5 and C6 roots. Incidental finding of mild right ulnar neuropathy.
- MRI C spine: Right-sided hypertrophic changes are seen about the Luschka joints at C3-C4, C5-C6 and C6-C7. Most prominent at C3-C6 where there is moderate to severe narrowing. No evidence of disc herniation, canal stenosis or cord effacement.

**Final Working Diagnosis:**
Cervical radiculopathy, primarily of the C6 nerve root. As the imaging findings did not fully correlate with physical exam findings and EMG findings, patient was referred to neurosurgery for consultation and second opinion which is currently pending.

**Treatment and Outcomes:**
- Provided neurosurgery recommends non-operative treatment patient will be referred to physical therapy to regain appropriate strength in hopes of returning to his prior workout routine.
- Physical therapy to regain appropriate strength in hopes of returning to his prior workout routine.
- Celecoxib offered minimal relief and he had no history of injury to the foot nor was he complaining of any pain in the knee or opposing foot. He underwent a 6-week course of physical therapy and home exercise program. He returned 5 weeks later with worsening weakness in the foot, to the extent of having foot drop in the foot. There was no significant history of injury to the back or knee, nor was he complaining of pain in either. He was referred to a neurologist, who performed a nerve conduction study, revealing a peroneal nerve entrapment, prompting referral for MRI of the right knee.
- Physical Examination: Initial exam revealed diffuse mild swelling around the ankle. His active dorsiflexion lacked 20 degrees when compared to the left and he reported pain with resisted eversion and dorsiflexion of the foot. His resisted dorsiflexion was 3/5 and eversion was 4/5.
- Follow up exam 5 weeks later demonstrated 1/5 strength with resisted dorsiflexion and 3/5 with eversion, but normal sensation and patellar and Achilles reflexes. Examination of the lumbar spine was negative. There was no atrophy.

**Differential Diagnosis:**
1. Peroneal nerve entrapment
2. Anterior tibial tendonitis
3. Peroneal tendon strain
4. Osteoarthritis
5. Radial nerve palsy secondary to periarticular ganglion

**Tests and Results:**
- MRI - periarticular ganglion extending into proximal calf
- Ultrasound - swelling around the anterior tibial tendon and hypochoic signal in the peroneal tendon.
- NCS - peroneal nerve entrapment
- MRI - periarticular ganglion extending into proximal calf

**Treatment:**
Medical weight loss program

**Final Working Diagnosis:**
Peroneal nerve palsy secondary to periarticular ganglion

**History:**
A 47-year-old RHD male presented to sports medicine clinic with 3-4 month history of left shoulder weakness. He first noticed the weakness while working out, specifically during overhead shoulder press. He denied any specific injury or trauma of his left shoulder. He reported intermittent pain extending from the posterior shoulder to his neck. Pain was described as dull. Pain was 2/10 at rest and 4/10 with overhead activity.

The patient noticed progressive muscle atrophy in his posterior shoulder region since the onset of symptoms. He denied any numbness or tingling of the left arm. Denied any recent illnesses. He denied prior treatment for this issue, including PT, injections, or surgeries.

**Physical Exam:**
- General: No acute distress. Left shoulder: No swelling or erythema. Notable atrophy of body of infraspinatus. Sensation intact to light touch. Normal range of motion in all directions. Strength 5/5 with shoulder abduction, forward flexion, and internal rotation.

**Differential Diagnoses:**
1. Rotator cuff tendinopathy
2. Ganglion cyst at spinoglenoid notch
3. Subacromial impingement syndrome
4. Cervical radiculopathy
5. Brachial plexopathy
6. Parsonage- Turner Syndrome

**Initial Test and results:**
- AP, Axillary, lateral x-ray views of left shoulder were normal. MRI left shoulder indicated supraspinatus and infraspinatus muscle edema without tendon tear without space-occupying lesion. EMG/NCS indicated focal conduction abnormality of the suprascapular nerve proximal to the level of the supraspinatus muscle and distal to the brachial plexus.

**Final Diagnosis:**
Suprascapular Nerve Entrapment

**Treatments and Outcomes:**
- Patient was referred to orthopaedic surgery and recommended shoulder arthroscopy for suprascapular nerve release. During the case the surgeon noted a small cyst at the spinoglenoid notch (not apparent on MRI imaging). 2 weeks post-op, the patient reported doing light daily activities with no pain or weakness. 4 weeks post-op patient was asymptomatic performing home exercises up to 5x/week. He returned to activities as tolerated with no restrictions.
spinal groove. Hypoechoic central fascicles (ie the motor axons); normal appearing peripheral fascicles (ie the sensory axons). Fascicle enlargement is consistent with a demyelinating process, not an axonal process.

**FINAL WORKING DIAGNOSIS:** Neuromyopathy AKA Parsonage-Turner Syndrome

**TREATMENT AND OUTCOMES:** He underwent physical therapy without improvement in symptoms. However, NCS/EMG revealed a demyelinating process that was consistent with spontaneous or autoimmune process such as neuropathic amyotrophy; ultrasound revealed mostly motor axonal involvement. He opted for conservative management, monitoring for spontaneous improvement. He did not seek further follow up.

**HISTORY:** A 63 yo M hockey player w/ PMxs of OA, HLD, kidney stones, & chronic pupillary anisocoria presented to the ED after 24 hours duration of LE weakness & pain. He underwent physical therapy without improvement. New ingestions, pain, visual disturbances, incontinence of bowel/bladder, or recent travel. He admitted to recent sick contacts in his family & a personal hx of preceding flu-like illness 2 weeks prior from which he recovered with no apparent sequelae.


**DIFFERENTIAL DIAGNOSIS:** 1. Acute inflammatory demyelinating polyradiculoneuropathy 2. Acute inflammatory myopathy 3. Mysaelenestigravis

**TEST AND RESULTS:**

- LABS: Hgb 18.9 gm/dl, Hct 51.5%. Total protein 9.2 gm/dl, CL: 625 units/L, DDimer: 0.70 mg/mL, IMAGING: CXR Neg, CT Head Neg, CT Chest/Abd/Pelvis Neg

**FINAL WORKING DIAGNOSIS:** Acute Inflammatory Demyelinating Polyradiculoneuropathy (Guillain-Barré Syndrome)

**TREATMENT AND OUTCOMES:** 1. Neurology assessed in the ED, w/ hx of neuropathy. 2. Continues to follow w/ Neuro, Sports Med, & PM&R for intermittent weakness. 3. Underwent prolonged course of PT for LE weakness for 1 year initially requiring assistive devices including walker/cane, slowly normalizing gait over time. 4. Completed PT, assessed by Sports Med for gradual return to sport 1 year initially requiring assistive devices including walker/cane, slowly normalizing gait over time. 5. Completed PT, assessed by Sports Med for gradual return to sport

**A-40 Free Communication/Poster - Recovery**

**Board #1**

**May 27 9:30 AM - 11:00 AM**

**EFFECTS OF CONTRAST WATER THERAPY ON THE RECOVERY OF HEART RATE VARIABILITY FOLLOWING ECCENTRIC EXERCISE**

Hsing Yu Kang, Wei Chin Tseng, Szu Kai Fu, Yen Min Teng, Jo Ming Chang, Cheng Hsiu Lai. University of Taipei, Taipei City, Taiwan.

**Purpose:** The aim of this study was to compare the effects of hot/cold immersion therapy and passive recovery following maximal eccentric exercise of the bilateral knee extensors on heart rate variability.

**Methods:** 14 health college males (18-22 yrs) were recruited and randomly assigned into the contrast water therapy (CWT) or passive recovery (CON) group (n=7 per group). Each participant performed 10 sets of 10 maximal isokinetic (30°/s) eccentric contractions (MaxECC) of each knee extensors. Contrast water therapy (8°C x 1 min and 45°C x 4 minutes, 3 reps), or the passive recovery interventions (15-min consecutive rest) were taken at 30 minutes post-MaxECC. Heart rate variability (HRV) parameters were collected by the portable heart rate monitor at 5 mins before, and 0-5, 10-15 and 25-30 mins after interventions.

**Results:** During the first 5 mins after interventions, mean HR (95.4 ± 11.1 bpm) and the normalized units of high frequency power (23.6 ± 10.3 μV/cm) of the CWT group showed significantly higher value than the CON group (81.5 ± 11.6 bpm, 18.5 ± 9.0 μV/cm; P<0.05), the mean R-R intervals (636.8 ± 78.8 ms), the standard deviation of normal R-R intervals (116.6 ± 6.6 ms) and the mean of the mean squared differences between adjacent R-R intervals (17.2 ± 7.7 ms) for CWT showed significantly lower than that of the CON (749.3 ± 104.5 ms, 46.1 ± 17.7 ms, 33.0 ± 12.8 ms; P<0.05). However, 10-15 and 25-30 mins after interventions, all HRV parameters between the two groups showed no significant difference (P>0.05).

**Conclusion:** These findings supported the hypothesis and suggested that one session of 15 mins CWT after eccentric exercise could be increased parasympathetic-activated activation in cardiac autonomic regulation, but the effect only lasting for 10 mins.

**Keywords:** autonomic nervous system, parasympathetic activation, normalization of high-frequency power

**Board #2**

**May 27 9:30 AM - 11:00 AM**

**The Effects Of Contrast With Compression Therapy On Muscle Recovery Post Exercise**

Shabnam Lateef, Ryan Oakley, Vinny Colantonio, Robert Lavelle, Anders LaFortune, Dlsa L. Lavallee, Justin J. McLinden, Jacob E. Earp. University of Rhode Island, Kingston, RI.

**Reported Relationships:** S. Lateef: Industry contracted research; Solid State Incorporated.

Intense eccentric exercise causes muscle damage that leads to a decrease in subsequent performance. Accelerating muscle recovery between bouts of exercise minimizes the risk of injury and is essential for optimal athletic competitive performance.

**Purpose:** The purpose of this study was to determine if the contrast with compression (CcwC) therapy proprietary device by Solid State Inc was able to improve muscle recovery post intense eccentric exercise. **METHODS:** Ten physically active men (age = 21.3 ± 2.1 years, height = 182 ± 8.5 cms; weight = 88 ± 19.5 kg; body fat = 17.2 ± 5.7%) completed two separate single-arm elbow flexor workouts on an isokinetic dynamometer. After one workout each participant received contrast with compression (CcwC) therapy immediately after, 24h and 48h after the workout. After the other workout the same person did not receive treatment(CON). Post-exercise recovery of selected characteristics were measured at 1h, 24h, 48h and 72h. Comparisons were made between the CcwC and CON groups using a Mixed Model ANOVA with repeated measures to identify time effects and an ANCOVA was used to identify interaction effects. A Bonferroni post-hoc test was used to test timepoint differences in between interventions in recovery post eccentric exercise. A p≤0.05 was used for all analysis.

**RESULTS:** CcwC therapy post exercise resulted in a significantly faster recovery rate of strength and power to baseline levels (p<0.00) as well as a greater recovery of overall relative strength (p<0.004). Treatment with CcwC significantly suppressed the post-exercise inflammatory response (p<0.05) and significantly reduced the secondary muscle damage response as measured by levels of Creatine Kinase post exercise. CcwC therapy also resulted in a significantly quicker recovery of the maximal elbow flexion range of motion (p<0.00) within the hour post exercise. Lastly, participants experienced significantly less soreness 48 hours and 72 hours post-exercise with CcwC therapy. **CONCLUSION:** Contrast with compression therapy significantly increases the recovery rate of muscle strength and power post eccentric exercise. CcwC is also effective at reducing exercise associated muscle damage, delayed onset muscle soreness and mitigates the loss of range of motion post intense exercise.

**Board #3**

**May 27 9:30 AM - 11:00 AM**

**An Examination Of The Effects Of Various Procedures To Improve Delayed Onset Muscle Soreness**

Michael Vela, Amanda Skaggss, Andrew Gutierrez, Caitlin Tagle, Kevin Canales, Mayra Limas, Gabriel Figueuora, Uliko Karabulut, Murat Karabulut, FACSM. University of Texas Rio Grande Valley, Brownsville, TX.

**Email:** michael.vela02@utrgv.edu

**Purpose:** To examine the acute effects of various recovery methods on delayed onset muscle soreness (DOMS). **METHODS:** Following intense DOMS-inducing exercise, nine males (age = 23.6 ± 2.4 years) were exposed to three treatment conditions (foam rolling (FR); body tempering (BT); blood flow restriction (BFR)) or control in a random order. Resting blood pressures were observed and recorded each laboratory visit. Subjects performed up with a 5-minute treadmill walk at a speed of 3.5 mph at 0% grade and performed three vertical jump (VJ) tests. The DOMS protocol consisted of 5 sets of leg extensions at 85%1RM until failure. Each repetition required a one-second of concentric contraction followed by a four-second of eccentric contraction. Soreness levels were objectively (Force Gage; FG) and subjectively...
Effects Of Different Non-pharmacological Methods On Recovery From Delayed Onset Muscle Soreness

Tabitha Abraham, Zulema Mendez, Roel Ruiz, Marcos Cruz, Robert Martine, Sael Elizondo, Concepcion Chapa, Ulku Karabulut, Murat Karabulut, FACSM, University of Texas Rio Grande Valley, Brownsville, TX.

Email: tabithabraham5@gmail.com

Purpose: To investigate the effects of diverse recovery methods on delayed onset muscle soreness (DOMS) and muscle performance. Methods: Ten healthy males (age = 24.1 ± 3.2 years; height = 173.3 ± 7.7 cm; weight = 81.5 ± 17.0 kg) participated in a crossover study with three randomized recovery treatment methods that were foam rolling (FR), TheraGun (TGUN), or vibration platform (VP). The first session started with a 5-min seated rest, followed by the recording of the subjects' resting systolic blood pressure (RSBP) and heart rate (HR) values. The subjects warmed up on a treadmill at 4.5 mph, 0% gradient, for 5-min. Three trials of vertical jump (VJ) test were performed and the best jump performance was recorded. Subjects continued to leg extension, which consisted of 1 warm-up set and then 4 sets at 80-85% of 1RM: 153.1 ± 20.1 kg; strength to weight ratio: 1.8 ± 0.2) participated in a randomized, crossover-controlled research study. In one testing block high intensity resistance exercise (6 x 10 back squats at 80% 1RM, 2 min rest) was followed by a one-hour flotation-REST session, while recovery in the remaining block consisted of a sensory stimulating control. Markers of neuroendocrine signaling (catecholamines, cortisol, testosterone), structural damage (myoglobin, creatine kinase), inflammation (IL-6, TNF-alpha) and psychological perception (soreness, mood, fatigue) were measured before exercise (PRE), immediately post exercise (IP), post 1-hour recovery (1R), twenty-four hours post exercise (+24) and forty-eight hours post exercise (+48). Mean differences were assessed using repeated measures ANOVA with pairwise post-hoc comparisons (p ≤ .05). Effect sizes (ES) were calculated to evaluate magnitude of significant treatment differences. Results: Flotation-REST significantly decreased soreness across the 48-hour recovery period (ES, IR: 0.68; +24: 0.47; +48: 0.28). Immediate improvements in positive affect (ES, IR: 0.74), negative affect (ES, IR: 1.03) and fatigue (ES, IR: 1.13) were accompanied by differences in neuroendocrine signaling. Norepinephrine was significantly reduced (ES, IR: 0.99) and testosterone significantly increased (ES, IR: 0.32) in flotation-REST compared to control. No treatment differences were displayed for structural damage or inflammation. Conclusion: The data suggest a positive impact of flotation-REST in the first 48 hours of recovery, particularly where psychological appraisal is involved.

<table>
<thead>
<tr>
<th>Task</th>
<th>Time (s)</th>
<th>Baseline</th>
<th>Foam Roll</th>
<th>Passive</th>
<th>p</th>
<th>n² (partial)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC Peak</td>
<td>13.7 ± 3.4</td>
<td>13.3 ± 3.4</td>
<td>13.5 ± 3.7</td>
<td>.293</td>
<td>.062</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>14.7 ± 4.1</td>
<td>13.8 ± 3.8</td>
<td>14.2 ± 4.4</td>
<td>.038</td>
<td>.625</td>
<td></td>
</tr>
<tr>
<td>CC Peak</td>
<td>10.8 ± 1.8</td>
<td>10.8 ± 1.6</td>
<td>11.1 ± 1.9</td>
<td>.118</td>
<td>.109</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>11.2 ± 2.1</td>
<td>11.1 ± 1.6</td>
<td>11.6 ± 2.1*</td>
<td>.047</td>
<td>.582</td>
<td></td>
</tr>
<tr>
<td>AC Peak</td>
<td>12.7 ± 3.7</td>
<td>12.8 ± 3.0</td>
<td>13.4 ± 3.6*</td>
<td>.011</td>
<td>.224</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>13.1 ± 3.7</td>
<td>13.3 ± 3.2</td>
<td>13.9 ± 3.6*</td>
<td>.003</td>
<td>.270</td>
<td></td>
</tr>
<tr>
<td>SR Peak</td>
<td>49.0 ± 7.5</td>
<td>50.3 ± 7.7</td>
<td>50.9 ± 8.4</td>
<td>.036</td>
<td>.162</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>50.1 ± 8.2</td>
<td>51.4 ± 7.5</td>
<td>52.3 ± 8.9*</td>
<td>.034</td>
<td>.164</td>
<td></td>
</tr>
</tbody>
</table>

Note: AC = simulated Ammunition can Carry; CC = Cover to Cover sprint; s = seconds; SC = Stair Climb; SR = Shuttle Run
*statistically slower than baseline, statistically slower than foam roll, a = < .05
Exercise-induced muscle damage (EIMD) occurs following strenuous and unaccustomed exercise. EIMD is associated with elevated creatine kinase (CK) blood concentrations, limitations in range of motion (ROM), and cellular swelling. EIMD may negatively affect training quality and performance thus methods to mitigate EIMD may be useful to resistance training populations. Self-myofascial release, in particular foam rolling (FR), has been utilized by competitive and recreational athletes to ameliorate the effects of EIMD. However, the effect of FR on EIMD has yet to be established. PURPOSE: The purpose of this study is to investigate the effect of FR on markers of EIMD after an acute bout of high volume resistance exercise. METHODS: Eight participants (five males and three females), between the ages of 18 and 35, completed two acute resistance exercise bouts (10 sets of 10 repetitions barbell back squat at 66% 1RM) separated by a minimum of seven days. Following one exercise bout, subjects performed FR targeting the iliacus and quadriceps, the vastus lateralis and rectus femoris, the tibialis anterior, and the gluteus maximus immediately post-exercise, immediately pre-exercise, and immediately post-exercise. RESULTS: There was a significant difference in serum CK from pre to 24 hours post (p = 0.04), as well as 24 and 48 hours post (p = 0.04). Hip ROM (p = 0.02) and knee ROM (p = 0.03) decreased and thigh circumference (p = 0.03) increased 48 hours post exercise. No significant differences between FR and CON were found for any measures. CONCLUSION: FR does not attenuate markers of muscle damage (i.e. serum CK, hip ROM, knee ROM, and thigh circumference) after an acute bout of high volume resistance training. This study suggests that despite its common practice, FR may not be an effective strategy for mitigating EIMD.

In response to the CO2-water (CO2:1000 ppm) immersion, the reduction of sympathetic nerve activity may imply the facilitation of muscle fatigue recovery. PURPOSE: In the present study, we investigated whether the whole body bath with CO2-water immersion may contribute to rapid recovery from exercise-induced muscle fatigue and its common practice, FR may not be an effective strategy for mitigating EIMD. However, the effect of FR on EIMD has yet to be established. PURPOSE: The purpose of this study is to investigate the effect of FR on markers of EIMD after an acute bout of high volume resistance exercise. METHODS: Eight participants (five males and three females), between the ages of 18 and 35, completed two acute resistance exercise bouts (10 sets of 10 repetitions barbell back squat at 66% 1RM) separated by a minimum of seven days. Following one exercise bout, subjects performed FR targeting the iliacus and quadriceps, the vastus lateralis and rectus femoris, the tibialis anterior, and the gluteus maximus immediately post-exercise, immediately pre-exercise, and immediately post-exercise. RESULTS: There was a significant difference in serum CK from pre to 24 hours post (p = 0.04), as well as 24 and 48 hours post (p = 0.04). Hip ROM (p = 0.02) and knee ROM (p = 0.03) decreased and thigh circumference (p = 0.03) increased 48 hours post exercise. No significant differences between FR and CON were found for any measures. CONCLUSION: FR does not attenuate markers of muscle damage (i.e. serum CK, hip ROM, knee ROM, and thigh circumference) after an acute bout of high volume resistance training. This study suggests that despite its common practice, FR may not be an effective strategy for mitigating EIMD.

Respiratory impedance has been studied as a possible countermeasure against fatigue during repeated bouts of high-intensity exercise. By creating resistance during inspiration, an impedance threshold device (ITD) decreases intrathoracic pressure and pulls more blood back to the heart, resulting in increased stroke volume and cardiac output. This increased blood flow may enhance exercise recovery by clearing metabolites and increasing tissue perfusion. PURPOSE: To examine the effects of breathing with an ITD during recovery between repeated bouts of high-intensity exercise. METHODS: Eleven participants (8 men, 3 women, 19-29 years-of-age) performed a total of 9, 20 s bouts of high-intensity exercise interspersed with 3 min of active recovery on an electronic bicycle ergometer. Participants were instructed to perform each exercise bout at an intensity that would elicit a rating of approximately 7 (very strong) on the Borg Category-Ratio scale of perceived exertion. The same exercise protocol was performed on different days, with and without the ITD during recovery. RESULTS: As expected, the exercise protocol significantly increased blood lactate (1.7 ± 0.2 mM pre-exercise vs. 11.5 ± 0.6 mM after bout 9, p < 0.001). Ratings of perceived exertion also increased across exercise bouts (4.9 ± 0.4 after bout 1, 7.5 ± 0.2 after bout 5, and 9.0 ± 0.2 after bout 9, p < 0.001). Participants rated their perceived recovery lower as the number of exercise bouts increased (p < 0.001). There were significant differences in peak and mean power output, as well as total work between exercise bouts, with the highest values recorded during the 9th bout (total work: 7434 ± 380 joules during bout 1, 2015 ± 266 Joules during bout 5, and 839 ± 303 Joules during bout 9, p < 0.01). Thus, perceptual pacing appears to decrease early bout, but give a near maximal effort during the last bout. However, results were not significantly different between the control and ITD conditions. CONCLUSION: Use of an ITD during recovery periods between repeated, high intensity exercise bouts that required pacing did not positively impact subsequent performance. Results may be different if individuals perform repeated, high-intensity exercise that requires a maximal or near maximal effort during each exercise bout rather than a pacing strategy.
It remains commonplace for athletes to utilize self-myofascial release techniques like foam rolling during muscular fatigue situations to acutely support or at least preserve subsequent performance capacities. However, currently, there is limited evidence to support this specific application of foam rolling. PURPOSE: The purpose of this investigation was to examine the effects of foam rolling vs. a sham ultrasound control treatment following fatiguing exercise on subsequent performance in trained female subjects.

METHODS: Twenty female subjects (age: 21.4 ± 1.1 y) participated in this crossover design study. Subjects were tested for reactive strength index (RSI), peak isometric mid-thigh pull (IMP) force, and fatigue perception followed by an exercise fatigue protocol. Then, subjects underwent either a foam rolling (FR) or sham ultrasound (CTL) treatment which was followed by repeat testing. A repeated measures ANOVA was used to examine the interaction of treatment (FR vs. CTL) x time (pre- vs. post-fatigue protocol) for each outcome measure. A dependent student’s T-Test was used to make comparisons between treatments pre- to post-fatigue protocol. Δ score for each outcome measure. RESULTS: There was a significant treatment x time interaction for fatigue perception (p=0.03) and RSI (p=0.03) but not peak IMP force. Both treatments resulted in a significant (p<0.05) increase in fatigue perception (FR: +3.2 ± 1.8 cm; CTL: +4.1 ± 2.1 cm) and decrease in RSI (FR: -8.9 ± 6.9%; CTL: -11.9 ± 7.5%) from pre- to post-fatigue protocol. Further analyses revealed that the increase in fatigue perception following FR was significantly less than CTL (p<0.03). Additionally, the decrease in RSI following FR was significantly less than CTL (p=0.02). The fatigue-induced decrease in peak IMP force did not differ between treatments. There was no significant correlation between the pre- to post-fatigue change in RSI and fatigue perception (p=0.10; r= -0.3).

CONCLUSIONS: In conclusion, this study corroborates a prior non-sham-controlled investigation in that foam rolling during neuromuscular fatigue situations may aid in the preservation of performance while reducing perception of fatigue.

SORENESS AND FATIGUE AS THE KEY PERCEPTUAL INDICATORS FOR PREVIOUS DAY WORKLOAD IN ATHLETES

Hanna Gardner, William Adams, Travis Anderson, Eleni Karras, Stacey Walton, Laurie Wideman, FACS.M. University of North Carolina at Greensboro, Greensboro, NC. (Sponsor: Laurie Wideman, FACS.M)

Email: hmgardne@uncg.edu

No relevant relationships reported

PURPOSE: As monitoring of athletes has become prominent throughout competitive sport, objective and subjective methods have proven valuable in informing of an athlete’s physical condition and preparedness. However, it remains unclear how objective load metrics are reflected in self-reported subjective indices. Thus, the purpose of this study was to examine the relationship between objective markers of workload and subjective assessments of soreness, fatigue, and stress the following day. METHODS: Twenty-six collegiate male soccer players (mean;SD; 20;1y; 75.83±5.90kg; 178.5±6.8cm) were GPS-enabled heart rate monitors during every training session and match within the 2017 season. Objective load variables (total distance covered (TD), number of sprints (SP), number of accelerations (AC), number of decelerations (DC), and training load (TL)) were collected each day. Subjective load (soreness, fatigue, and stress) were recorded on a 1-10 Likert scale the following morning. Mixed models tested the relation between subjective metrics and the objective metrics of the previous day’s training or match. RESULTS: Training load and deceleration numbers from the day before showed significant relevance to reported soreness and fatigue. Heavier training loads resulted in higher soreness and fatigue scores (TL P=0.001), just as lighter training loads resulted in lower soreness and fatigue scores. A similar positive correlation was found with the number of decelerations to reported soreness and fatigue (DC P=0.023). CONCLUSIONS: Lasting physiological impacts of the previous day’s training load and decelerations were reflected in player-reported soreness and fatigue the following morning. This information may be utilized by coaching staff to; 1) adjust training based on subjective metric scores and 2) inform tapering strategies to maximize performance in matches.
The sit and reach (SR) test is a common field test used to measure hamstring and low back flexibility. It is believed that hamstring and low back flexibility may prevent acute and chronic musculoskeletal injuries. Manufacturers of percussion massage devices have stated that such devices increase range of motion (ROM). PURPOSE: To determine the effects of percussion massage versus traditional static stretching on hamstring and low back flexibility. METHODS: 25 untrained college-aged adults (16 women and 9 men; 22.9±0.9 yr; 69.1±1.2 kg; 155.0±14.6 cm) participated in the study. Percussion massage and static stretching were performed on two separate days in random order with 48 hr between trials. At baseline on each day, participants performed the SR test. Participants then had vibration massage applied to the hamstrings and low back (1 min for each leg and low back in alternating fashion for 3 sets) or performed static stretching of each hamstring using a stretch strap and a low back stretch (1 min for each leg and low back in alternating fashion for 3 sets). Participants then performed the SR test again. The best of three SR test trials in each of the four testing conditions was used for analysis. RESULTS: Static stretching resulted in an improvement (p=0.03) of 7.2% (pre=13.1±4.4 cm; post=14.0±4.7 cm). Percussion massage did not affect (p=0.13) ROM (pre=13.4±4.4 cm; post=13.7±4.7 cm). CONCLUSIONS: Results indicate that percussion massage does not affect hamstring and low back flexibility. However, additional studies are needed to determine if longer applications of percussion vibration may improve ROM.

### 200 Board #16 May 27 9:30 AM - 11:00 AM

**The Efficacy Of Prolonged Cooling Using Phase Change Material For Enhancing Recovery Following A Marathon**

Susan Y. Kwiecien, Malachy P. McHugh, FACSM, Kirsty M. Hicks, Karen Keane, Glynn Howatson, FACSM. Lenox Hill Hospital, New York, NY. 2Northumbria University, Newcastle upon Tyne, United Kingdom. (Sponsor: Malachy P McHugh, FACSM)

Email: susan@nisomat.org

(No relevant relationships reported)

**PURPOSE:** Athletes often utilize cryotherapy interventions following exercise to mitigate muscle damage, inflammation and feelings of soreness. The literature has shown only small benefits from cryotherapy on accelerating recovery from exercise. The practical utility of modalities such as cold water immersion is questionable. Phase change material (PCM) packs can provide prolonged cooling while simultaneously allowing the wearer to continue with activities of daily living and thus, is a more practical alternative to other cryotherapy modalities. The aim of this study was to test the efficacy of a single prolonged cooling treatment using PCM following completion of a marathon on soreness, strength, muscle damage and inflammation on the days after running a marathon.

**METHODS:** Twenty-four participants (8 male, 16 female) completed a marathon and were randomized to receive the post-race intervention (3 h of 15°C PCM covering the quadriceps) or recover without an intervention (control). Soreness, knee extension strength, vertical jump height, creatine kinase (CK), and high sensitivity c-reactive protein (hsCRP) were recorded at baseline, 1, 2, and 3 days following the marathon. **RESULTS:** Soreness increased following the marathon (P < 0.0001) in both groups, but was lower in the PCM group (treatment effect P = 0.028) and resolved faster (treatment by time P < 0.044; D3 soreness: 1.1 ± 0.9 PCM vs 2.7 ± 1.6 control). Strength decreased following the marathon in both groups (P < 0.0001) with no difference between groups. Although not significant, by Day 3 strength recovered more in the PCM (98.6 ± 15.6%) vs. control group (90.4 ± 7.6%). PCM had a beneficial effect on jump height (treatment effect P = 0.037, treatment by time P = 0.031); over the 3 days post-race, jump height averaged 101 ± 10% of baseline in PCM treatment versus 89 ± 10% in the control condition (P = 0.037). CK and hsCRP increased over time (both P = 0.0001) peaking on D1, with no difference between groups. **CONCLUSIONS:** Prolonged post-marathon PCM cooling accelerated resolution of soreness and recovery of vertical jump performance, but had no effect on other indices of damage or inflammation. PCM cooling is a practical, wearable cryotherapy modality that can facilitate recovery following excessive exercise stress.
percussive and non-percussive massage do not affect performance time in a 1000m run nor do they alter the time course for blood lactate attenuation. Supported, in part by a grant from Theragum®.

A-41 Free Communication/Poster - Testing
Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

203
Board #19
May 27 9:30 AM - 11:00 AM
Test-retest Reliability And Performance Differences Between Traditional Upper Quarter Y-Balance Test And Two Modifications
Tal Amasay. Barry University, Miami Shores, FL.
Email: tamasay@barry.edu
(No relevant relationships reported)

The traditional Upper Quarter Y-Balance Test (TUQYBT) tests mobility and stability of the shoulder. The TUQYBT is performed in a push-up position, while the contralateral arm is pushing a reach indicator maximally in the medial, superolateral, and inferolateral directions. The TUQYBT has proven to be beneficial in analyzing shoulder function, specifically for athletic and active populations. It has not been proven to be suitable for the older adults and obese populations. Research shows that 67% of bodyweight is carried during the up position of push-up. During the TUQYBT this weight is shifted to one shoulder, which place a lot of stress on it. A decrease of 15% of the body load was found during a modified push-up (knees down) position. Moreover, load will further be reduced when performing a push-up in standing position on the wall.

PURPOSE: To determine test-retest reliability of two modified UQYBTs (modified push-up and standing positions) and to identify performance differences with respect to TUQYBT.

METHODS: Twenty-five students (nine men, 16 women; mean age 24.4±3.3 and 23.6±3.3 years), performed three variations of the UQYBT. Cronbach’s Alpha test-retest reliabilities were performed to analyze data consistency. Two separate one-way repeated measures ANOVAs were performed to determine the effect of the three starting UQYBT positions on the composite reach scores for each side, followed by post-hoc analyses. RESULTS: Findings revealed consistency for the two UQYBT modifications in all three reach directions, Cronbach’s Alpha values 0.87–0.99. Significant main effects were found on the right (F(2,72)=6.19, p=0.003) and left (F(2,72)=4.12, p=0.004) sides. Post-hoc analyses revealed that the standing UQYBT composite scores were significantly higher for both sides (right 73.1±7.5 cm, left 73.1±7.2 cm) than the modified push-up (right 68.5±7.5 cm, left 69.5±7.9 cm) and TUQYBT (right 65.2±9.0 cm, left 66.5±9.0 cm) scores (p<0.05). The modified UQYBT composite scores, for both sides, were significantly higher than TUQYBT scores (p<0.05). CONCLUSION: It appears that the modified UQYBT may be suitable for populations such as older adults and obese, who may have difficulty holding themselves up during the TUQYBT. Future research is needed to determine applicability in these populations.

204
Board #20
May 27 9:30 AM - 11:00 AM
Measuring Energy Expenditure Independent Of The Respiratory Quotient During Rest And Exercise
Seif A. Alshakah1, John R. Macaulay1, Paul Gerges1, Stella Crall1, Marshall D. McCue1, Derek C. Monroe1, University of California Irvine, Irvine, CA. Sable Systems International, Las Vegas, NV.
(No relevant relationships reported)

Widely used measures of energy expenditure (EE) are based on Weir’s (1949) equation that relies on oxygen utilization and carbon dioxide production to derive a respiratory quotient (RQ). However, Weir’s RQ-free equation, presented in the same article, was proven to be suitable for the older adults and obese populations. Research shows that 67% of bodyweight is carried during the up position of push-up. During the TUQYBT this weight is shifted to one shoulder, which place a lot of stress on it. A decrease of 15% of the body load was found during a modified push-up (knees down) position. Moreover, load will further be reduced when performing a push-up in standing position on the wall.

PURPOSE: To evaluate the reliability of the two modified UQYBTs (modified push-up and standing positions) and to identify performance differences with respect to TUQYBT.

METHODS: Twenty-five students (nine men, 16 women; mean age 24.4±3.3 and 23.6±3.3 years), performed three variations of the UQYBT. Cronbach’s Alpha test-retest reliabilities were performed to analyze data consistency. Two separate one-way repeated measures ANOVAs were performed to determine the effect of the three starting UQYBT positions on the composite reach scores for each side, followed by post-hoc analyses. RESULTS: Findings revealed consistency for the two UQYBT modifications in all three reach directions, Cronbach’s Alpha values 0.87–0.99. Significant main effects were found on the right (F(2,72)=6.19, p=0.003) and left (F(2,72)=4.12, p=0.004) sides. Post-hoc analyses revealed that the standing UQYBT composite scores were significantly higher for both sides (right 73.1±7.5 cm, left 73.1±7.2 cm) than the modified push-up (right 68.5±7.5 cm, left 69.5±7.9 cm) and TUQYBT (right 65.2±9.0 cm, left 66.5±9.0 cm) scores (p<0.05). The modified UQYBT composite scores, for both sides, were significantly higher than TUQYBT scores (p<0.05). CONCLUSION: It appears that the modified UQYBT may be suitable for populations such as older adults and obese, who may have difficulty holding themselves up during the TUQYBT. Future research is needed to determine applicability in these populations.

P. Nuccio, Shyretha D. Brown, Lindsay B. Baker, FACSM. Gatorade Sports Science Institute, Barrington, IL.

(No relevant relationships reported)

Research has been equivocal on whether or not sweat lactate ([Lac]) and glucose ([Gluc]) are related to serum [Lac] and [Gluc]. Purpose: To determine the relationship between sweat [Lac] and [Gluc] versus serum [Lac] and [Gluc] during cycling exercise in the heat for 90 min. Methods: Twelve moderately-trained recreational athletes (38 ± 6 y, 75.6 ± 14.5 kg, VO2 peak 45.1 ± 7.7 mL/kg/min) completed 90 min of cycling at 78 ± 5% HR max in the heat (31°C, 50% RH). Prior to exercise, the forehead was cleaned with alcohol and deionized water, then three absorbent patches (10 cm2 absorbent pad, 3M Tegaderm™ + Pad) were applied sequentially at (0, 30, and 60 min) and each patch was removed after 30 min increments of exercise along with a synchronous blood draw. The forehead was re-cleaned with deionized water between each patch removal/application. Sweat and serum [Lac] and [Gluc] were measured using ion chromatography. Descriptive statistics were conducted across all collection time points for sweat and serum [Lac] and [Gluc]. Pearson’s product-moment correlations were performed to assess the relationship between sweat and serum [Lac] and [Gluc] at the 90-min collection period. Due to limited sample volume the final n was 10 for each marker. Data are shown as mean ± SD. RESULTS: Forehead sweat [Lac] was 13.88 ± 3.29, 11.49 ± 3.13, and 11.91 ± 4.08 mM and serum [Lac] was 2.89 ± 1.33, 2.84 ± 1.64, 3.09 ± 1.13 mM, at 30, 60, and 90 min, respectively. Forehead sweat [Gluc] was 0.425 ± 0.417, 0.270 ± 0.239, and 0.357 ± 0.284 mg/dL and serum [Gluc] was 69 ± 3.29, 11.49 ± 3.13, and 11.91 ± 4.08 mM and serum [Lac] was 2.89 ± 1.33, 2.84 ± 1.64, 3.09 ± 1.13 mM, at 30, 60, and 90 min, respectively. There was a moderate, but non-significant, positive correlation between sweat and serum [Lac] and [Gluc]; r(8) = 0.485, p = 0.155 and a minimal, but non-significant, positive correlation between sweat and serum [Gluc]; r(8) = 0.156, p = 0.606. Conclusion: Sweat [Lac] and [Gluc] explain only 24% and 3% of the variation in serum [Lac] and [Gluc], respectively; suggesting other factors (aside from serum) impact sweat [Lac] and [Gluc]. Further research is warranted to understand the presence of lactate and glucose in the sweat and their applicability and relevance for use as biomarkers.

206
Board #22
May 27 9:30 AM - 11:00 AM
Elite Athletes Have Mildly Elevated Serum Bilirubin Concentrations
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(No relevant relationships reported)

Bilirubin is a potent endogenous antioxidant and immune system-modulating substance, which is implicated also in the cell signalization and in various metabolic pathways. Mild elevation of its systemic concentrations seems to provide substantial protection against numerous pathological conditions such as atherosclerotic and inflammatory diseases. Scarce reports in the literature suggest that serum bilirubin might have relevance also to the physical performance. PURPOSE: The aim of the current study was to assess serum bilirubin concentrations in the Czech elite athletes and to compare them with the Czech general population. METHODS: The study was performed in 145 consecutive healthy Czech elite athletes (M:F ratio=1.78) and in 2597 individuals (M:F ratio=0.91) of the Czech post-1990 cohort randomly selected from the Czech general population. Serum bilirubin concentrations as well as prevalence of benign hyperbilirubinemia (>17 umol/L, 1 mg/dL, a phenotypic sign of Gilbert’s syndrome) were evaluated. RESULTS: The medians of serum

Abstracts were prepared by the authors and printed as submitted.
biliubrin concentrations in the elite athletes were substantially higher compared to the general population (11.7 vs. 9.6 umol/L, p<0.001), and this substantial difference was observed in both men (13.0 vs. 11.3 umol/L, p=0.006) and women (10.29 vs. 8.3 umol/L, p=0.001). Compared to the general population, the prevalence of a phenotypic Gilbert’s syndrome (known also as benign hyperbilirubinemia) was significantly higher in both male (18.4% vs. 31.1%, p=0.004) and female athletes (7.4% vs. 17.3%, p<0.001). CONCLUSIONS: Elite athletes have significantly higher serum concentrations of bilirubin, the most potent endogenous antioxidant to substance. Simultaneously, also the prevalence of Gilbert’s syndrome is higher in elite athletes, suggesting that the presence of Gilbert’s syndrome may predispose to better physical performance. This study was supported by grant No. SVV 260156/2019 provided by Charles University.

Although a large body of research has investigated various hormonal and immunological responses to exercise, few studies have assessed the biological significance of those responses utilizing critical difference values (CDV) and biological variation (BV) in the context of monitoring biomarkers in professional athletes. Purpose: To assess salivary hormone changes over a professional American football season and determine if individual monitoring of these biomarkers is valuable. Methods: Professional American football players (n=24) were recruited to provide weekly saliva samples over the course of a seven week season. Saliva samples were collected between 0600 and 0800 hours following an overnight fast and a mouth rinse with distilled water. Eight samples (two baseline and six weekly samples) were collected per player and analyzed for salivary testosterone (T), cortisol (C), uric acid (UA), and immunoglobulin A concentration (sIgA). Player data were included for analysis if they provided samples at ≥70% of all collection time points (n=17). Data were analyzed using parametric statistics after confirmation of normality by Shapiro-Wilk and Reeds’ Criterion tests. The within-subject biological variation, CDV, and index of individuality (II) were calculated in accordance with the methods of Frasier and Harris. Lastly, relative percent change from baseline for each weekly collection was assessed using repeated measures one-way ANOVA. RESULTS: The CDV for salivary T, C, sIgA, and sIgA were 27.5%, 61.3%, 48.0%, and 59.2%; while BV was 10.8%, 26.1%, 20.5%, and 25%, respectively. It was calculated as 0.93, 0.52, 0.59, and 0.65 (arbitrary units) for T, C, sIgA, and sIgA, respectively. All hormones exhibited significant differences between players (p<0.001), however were not significantly different between weeks (P>0.05). Conclusion: These data suggest that individual players experience week-to-week variation in salivary hormone response over a professional American football season, however, significant variation in its ability to estimate performance. Furthermore, the relatively low II values may imply that these salivary biomarkers are useful in terms of monitoring meaningful individual changes across a season.

Blood lactate levels were recorded and graphed, and LT was derived by identifying the point immediately prior to where lactate levels had a greater than 1mmol/L jump from the previous stage that also placed the total lactate concentration above 4mmol/L. A 2-tailed, paired t-test, mean absolute percentage error (MAPE), single measures Intraclass Correlations (ICC), and Bland-Altman analysis with accompanying bias and Limits of Agreement were performed, calculated and plotted. Results: There was no difference between the HH estimated LT velocity compared to the lab-based methods (12.5 ± 2.0km/hr and 12.7 ± 1.3km/hr, respectively). There was a MAPE of 9.00% and an ICC of 0.652 with a 95% confidence interval of -0.222 to 0.869 (F(15,15) = 4.546, p = 0.004) when comparing the variables. Conclusion: Although there was no difference between HH estimated LT velocity compared to laboratory testing, the MAPE was above 5% and ICC slightly below 0.7 with a significant relationship. This data suggests that the HH does not produce a completely valid estimate of LT compared to lab-based tests; however, it still may be useful in situations where laboratory testing may not be available or practical.

**BACKGROUND:** Lactate levels are commonly used as an indirect measure to assess metabolic stress both in exercise (e.g., anaerobic threshold and exercise intensity) and clinical conditions like sepsis. The current method for measuring blood lactate does not meet the need in clinical settings. Multiple blood draws and long processing preclude timely decision-making in clinical practice. A minimally invasive, blood free, continuous lactate monitor can improve clinical decisions and patient care.

**PURPOSE:** To evaluate continuous lactate measurements of a novel enzymatic, Continuous Lactate Monitor (CLM), that was developed in our laboratory, during incremental cycling exercise challenges.

**METHODS:** Five healthy individuals 18-45 y/o (3 males, 2 females) participated in the study. Two CLM devices were inserted subcutaneously in the lower back flank an hour before the exercise challenge. Each exercise challenge consisted of a 12-minute warm up and up to 7, 4-min incremental workload bouts separated by rest intervals. Continuous lactate measurements obtained from CLM were compared with commercial lactate analyzer (Abbott iSTAT) measurements taken at 12 time points from venous blood, draws from the antecubital vein: before, during exercise, and up to 120 minutes post exercise. Area under the curve (AUC), and delay time were calculated to compare the CLM readings with blood lactate.

**RESULTS:** Average blood lactate increased from 1.02 to 16.21 mmol/L. Ratio of AUC derived from CLM to blood lactate was 1.09 (1.01-1.22). Average difference between CLM and blood lactate, with blood lactate as the independent variable between blood lactate measurement, was 1.4 mmol/L (0.878-2.37). At the lower levels of lactate (baseline), CLM sensitivity was lower. Average delay time between CLM readings and blood lactate was 6.16 minutes (3.70-11.21).

**CONCLUSIONS:** The newly developed CLM has shown to be a promising tool to continuously measure lactate in a minimally invasive fashion. Results indicate the CLM can provide needed trends in lactate over time. Such a device may be used in the future to improve treatment in clinical conditions such as sepsis, assess the response to endurance exercise in both clinical and athletic settings, and guide exercise prescriptions. Supported by PERC Systems Biology. *N.D. and J.W. equal contribution.

**PURPOSE:** Recent work by our lab (Gomez, et al., 2018) has shown that active virtual reality games (AVRGs) can elicit exercise intensities that meet American College of Sports Medicine (ACSM) recommended exercise guidelines for preventative health benefits. However, much of the work focusing on this topic has been limited to laboratory settings. The purpose of this study was to investigate differences in energy expenditure (VO2) and enjoyment of college-aged students while playing AVRGs in different settings (i.e., lab, gym, home). METHODS: A repeated measures design was used with 32 participants (16 males, 16 females, Age ~ 22 ± 2.6 years), all of whom completed two 45-minute AVRG sessions in the lab and gym. A subset of 4 participants completed an additional AVRG session at home. RESULTS: Significant differences
in VO$_2$ were observed among the three A VRGs (F (1, 28) = 9.128, p = 0.005; range = 13.53 - 23.04 mg/kg/min). However, there were no differences between settings in VO$_2$ or enjoyment (p > 0.05). CONCLUSIONS: Different A VRGs elicit exercise intensities, yet the setting in which they are played does not affect VO$_2$ or perceived enjoyment. These results suggest A VRGs can be studied reliably across multiple settings (lab, gym, and home) without having to consider environmental influences. As VR systems become more accessible and affordable, future research should continue investigating the effects of A VRGs during at-home play.

SuperJump® (SJ) is a fitness activity combining aerobic and anaerobic exercises performed on a mini trampoline. The exercise intensity can be modified by changing countermovement depth, jump height, and frequency. Although it has been hypothesized that practicing SJ may contribute to daily physical activity recommendations, no study has quantified intensity. PURPOSE: To investigate heart rate (HR) and perceived exertion responses of a SJ workout. METHODS: Seventeen (Males: n=9; Females: n=8) young adults (age: 25.8±2.7 years; height: 1.71±0.1 m; weight: 62.1±12.1 kg) volunteered for the study. The intensity of the activity was assessed by means of HR monitors during a SJ session (30-min). At the end of each bout of exercise, session ratings of perceived exertion (sRPE) on a CR10 scale were recorded. Percentages of age-predicted maximal HR (%HRmax) were utilized to quantify intensity. %HRmax data were categorically separated according to the American College of Sports Medicine (ACSM) classes of intensity (very light: <57%HRmax; light: 57-65%HRmax; moderate: 66-76%HRmax; vigorous: 77-95%HRmax; near maximal to maximal: >90%HRmax). Repeated measures ANOVA was used to evaluate differences (p<0.05) in relation to gender and exercise intensity. Post hoc analysis was applied using Bonferroni correction. RESULTS: No difference emerged for gender and sRPE data. Frequency of occurrence of %HRmax was significantly higher (p<0.005) for the moderate intensity (48.9±34.9%) with respect to very light (5.5±9.5%), light (16.5±24.4%) and vigorous (29.1±37.7%) intensities, while none of the subjects experienced near maximal to maximal values. According to sRPE values (3.1±1.2) subjects rated the SJ session as moderate. CONCLUSION: Findings indicate that SJ can be classified as moderate physical activity according to ACSM guidelines. Therefore, SJ may contribute to meet daily physical activity recommendations by representing an alternative form of low-intensity aerobic exercise. Further studies should investigate the long-term effects of SJ training on health-related physical fitness parameters.

Ventilatory changes during incremental exercise to maximum effort are represented as two inflection points: the ventilatory threshold (VT) and the respiratory compensation point (RCP). RCP is not frequently reported and detection methods have not been well validated. PURPOSE: To introduce an automated excess minute ventilation (ExVE) method to detect the RCP. METHODS: 171 peak cycle tests were performed by 96 healthy subjects (M/F) of varying body weight and training status. Expired air was collected for metabolic gas analysis (ParvoMedics TrueOne™). We compared RCPs from the proposed ExVE and the V-slope method (Davis, et al. 1985). Novel method: We extended the excess VCO$_2$ (ExCO$_2$) concept used to detect VT (Gaskill et al. 2001) and calculated ExVE as ([VE/VCO$_2$]-VE) to determine RCP. The V-slope method may not be capable of providing automatic solutions (Panteliehen et al. 2008). Thus we applied a parametric global method (Lavielle, 2005) to automatically find the first sustained rise in the ExCO$_2$ and ExVE curves. RESULTS: The detected RCP in the ExVE curve (Figure a) was located at the point of an increase in both the VE/ VCO$_2$ and VE/VO$_2$ and a decrease in end-tidal CO$_2$ (PetCO$_2$). (Figure b) (Jesús et al. 2016). There were extremely strong positive correlations in both RCP Time and RCP VO$_2$ between the ExVE and V-slope methods (0.934, 0.920). There was no significant difference between the ExVE and V-slope methods in both RCP variables (0.610 and 0.162) (Table). CONCLUSION: The ExVE method can determine the RCP. Our novel and automated protocol may increase the methodological consistency in both research and clinical practice.
The aim of this study was to investigate the difference between handball players with and without scapular dyskinesis regarding to functionality and endurance transfer power to scapular and upper part of body via posterior fascia chain. Additionally low back strength and functionality of upper extremity in scapular dyskinesis needs to future studies for handball players.

**Variables**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pearson Corr.</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Diff.</th>
<th>Std. Error Diff.</th>
<th>95% CI (lower)</th>
<th>95% CI (upper)</th>
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</thead>
<tbody>
<tr>
<td>RCP Time (sec)</td>
<td>0.934</td>
<td>-0.511</td>
<td>348</td>
<td>0.610</td>
<td>6.959</td>
<td>1.181</td>
<td>-33.137</td>
<td>19.471</td>
</tr>
<tr>
<td>RCP VO₂ (l/min)</td>
<td>0.920</td>
<td>-1.402</td>
<td>348</td>
<td>0.162</td>
<td>0.097</td>
<td>0.014</td>
<td>-0.228</td>
<td>0.038</td>
</tr>
</tbody>
</table>

**Result of Pearson correlation and independent two sample t-test**

**Conclusion:**

There were no statistically significant differences in SCUKEST and Davies tests between both groups (p = 0.05). There was statistically significant difference in favor of Group 2 according to Sorensen test between both groups (p = 0.026).

**Background/Purpose:**

While yoga is quickly becoming one of the most popular exercises, some significant yoga injuries were also reported. Lack of needed fitness for a specific yoga post is often the reason to get injured. Yet, no tool is available to assess participants’ fitness readiness for yoga practice. This study was to address this need by developing a Fitness Readiness for Yoga Poses Scale (FRYPS) and collected its psychometric evidence.

**Methods:**

A comprehensive literature search and consulting with a number of experts, 101 healthy college students (male = 27.72%, age = 20 ± 3 yr.) were recruited for the study. Specifically, their performance of 7 common yoga poses was evaluated, including mountain pose, pose back, bend forward, rising dog, downward dog, downward facing dog and flowing cobra, and their fitness were tested by 6 fitness tests, including sit-up, push-up, squat, squat-face, leg-lifting, and back-up, on the same day. The fitness scores were used to create a draft of FRYPS. The participants were then categorized into 3 groups based on their yoga performance (poor, fair, good). Using stepwise regression, FRYPS' scores as the independent variable, the yoga pose rating as the dependent variable, the relationship between FRYPS and yoga pose performance level was established. Additional analysis, such as receiver operator curve (ROC), were performed to help setting cutoffs for FRYPS.

**Results:**

The results of regression analysis indicated that a 7-level FRYPS can be used to evaluate the fitness readiness for yoga posture practice, including mountain standing, standing back bend, standing forward bend, rising dog, snake type strike and upper dog type.

**Conclusion:**

Consisting of six fitness tests (sit-ups, push-ups, squats, shoulder-flexibility tests, active knee-lifting and back-ups), a yoga fitness readiness scale called FRYPS was developed and its psychometric evidences were collected and confirmed.

**PURPOSE:**

Hamstring strain is a common injury among athletes. Asymmetries in muscle balance and activation are potential injury risk factors. Surface mechanomyography (sMMG) sensors are wearable devices that when applied across the physical muscle bulk displacement during a contraction is associated with greater muscle activation. The purpose of this study is to assess 1) the relationship of sMMG's correlation assessed relationships between measurement modalities.

**Methods:**

Hamstring strain is a common injury among athletes. Asymmetries in muscle balance and activation are potential injury risk factors. Surface mechanomyography (sMMG) sensors are wearable devices that when applied across the physical muscle bulk displacement during a contraction is associated with greater muscle activation. The purpose of this study is to assess 1) the relationship of sMMG's correlation assessed relationships between measurement modalities.

**RESULTS:**

Peak hamstrings muscle bulk displacement detected by sMMG (mean = 4.02 ± 1.04 mm) positively correlated with HHID maximum force generation (r = 0.88, p = 0.05). There was a significant difference in the timing duration of muscle contraction between EMG (mean = 4.443 ± 0.573 ms) and sMMG (mean = 4.469 ± 0.623 ms). p < 0.027.

**CONCLUSIONS:**

Results are consistent with physiologic expectations that increased physical muscle bulk during a contraction is associated with greater force. Similarity in time signatures with EMG support findings of successful sMMG
detection of hamstrings contraction (Figure 1). The sMMG sensor may be helpful for assessing hamstrings muscle performance of both force output and timing as part of neuromuscular control screening for injury prevention, rehabilitation monitoring, or return-to-sport readiness.

Figure 1. Example comparison of surface mechanomyography (sMMG) sensor output to hand-held dynamometry (HHD) and electromyography (EMG) during a resisted isometric hamstrings curl.

Raw sMMG hamstring muscle displacement (B) aligns with HHD force output (A) and processed EMG data (C) for muscle contraction duration. The timing activation threshold was set at 2 times above the standard deviation of a resting trial for each modality (Solonik et al., 2010).

Board #33
May 27 9:30 AM - 11:00 AM
Reliability Of A Submaximal Cycle Ergometer Verification Phase To Confirm VO\(_{2}\text{max}\)
Kirsten Thorhill, MS, Brandon Sawyer, PhD. Point Loma Nazarene University, San Diego, CA. (Sponsor: Robert Pettitt, FACSM)
Email: kthornhi@pointloma.edu
(No relevant relationships reported)

Purpose: To test the reliability of a submaximal cycle ergometer VO\(_{2}\text{max}\) test with a 90% power output verification phase (VP) test in active male and female participants.

Methods: 20 active (BMI = 22.7±2.9 kg/m\(^2\); age = 25.5±4.4) men (n = 10) and women (n = 10) completed 3 ramp VO\(_{2}\text{max}\) graded exercise tests (GXT) on a cycle ergometer followed by 10 minutes of active recovery, then performed a constant-load verification phase test at 90% of maximum power output achieved on the ramp VO\(_{2}\text{max}\) tests to verify attainment of a ‘true’ VO\(_{2}\text{max}\). Results: Maximum attained VO\(_{2}\) did not differ between the two verification phase tests (verification phase test 2: 3.01±0.69 L/min, verification phase test 3: 3.04±0.69 L/min; P=0.55). Likewise, VO\(_{2}\text{max}\) achieved on the verification phase was similar to the ramp VO\(_{2}\text{max}\) test (verification phase test 2: 3.01±0.69 L/min, verification phase test 3: 3.04±0.69 L/min; GXT 2: 3.03±0.71 L/min, GXT 3: 3.04±0.69 L/min; P > 0.05). ICCs and CVs for the group showed excellent consistency for VP VO\(_{2}\text{max}\) (ICC = 0.991; CV = 2.68 ±2.52%). ICC and CV for female participants VP VO\(_{2}\text{max}\) demonstrated excellent consistency (ICC = 0.987; CV = 2.5%). Male participants VP VO\(_{2}\text{max}\) displayed excellent consistency (ICC = 0.941; CV = 2.2%). Bland-Altman Plots showed no bias based on VO\(_{2}\text{max}\) value. A 90% submaximal verification phase test is a reliable test to confirm a ‘true’ VO\(_{2}\text{max}\).

Board #34
May 27 9:30 AM - 11:00 AM
The Winfight Test: Proposal Of A Punching Fatigue And Anaerobic Test For Combat Sports Athletes
Renata RT Castro\(^1\), André Marinho Fernandes\(^2\), \(^1\)Care Club, Rio de Janeiro, Brazil. \(^2\)CareClub, Rio de Janeiro, Brazil.
Email: castorr@gmail.com
(No relevant relationships reported)

Purpose: The principle of specificity states that training and testing should be relevant and appropriate to the sport in order to achieve better performance. The Wingate test measures anaerobic power and fatigue in a 30-seconds bout of all-out cycling. Despite the importance of anaerobic power analysis for performance in combat sports, there is no specific test for its evaluation in fighters. We propose the Winfight test, for analysis of fatigue and anaerobic capacity in professional combat sports athletes.

Methods: 10 professional combat sports athletes (6 males; age: 28±6 years) performed a 30-seconds bout of all-out exercise, punching a heavy bag, while wearing punch trackers (Hykso, USA). Velocity of each punch was recorded and plotted against time (Figure). Linear regression analysis was performed, and punch velocity x time slope was calculated. Peak (PeakVel) and minimal (MinVel) punch velocity were used to calculate velocity drop-off (VDO). Fatigue index (FI = VDO/time elapsed between peakV and minV) and %FI = VDO/100/PeakV/time elapsed between peakV and minV) were calculated. Data presented as mean ± standard error.

Results: Peak V (27.5±7.9 km/h) was achieved at 4±3 s. MinV (5.5±1.3 km/h) was achieved at 23±4 s. VDO was 22,08±7.5 km/h, a drop of 78.7±7.7%. When time was considered, FI = 1.2±0.4 km/h/s; %FI=4.4±1.2%/s. Punch velocity x time slope = -0.08±0.04. Conclusions: Due to the predominance of anaerobic metabolism, professional combat sports athletes cannot keep very high punching velocity for more than a few seconds. The Winfight test enabled the analysis of punching fatigue. This data can be used for training and tactics during fight camps. Studies are currently being done to evaluate Winfight test’s results reproducibility and correlation to performance.

Figure 1. Winfight test of a professional fighter
significant positive correlations between the WAT and NPT in the mean of peak power (MPP) (r = 0.727, p < 0.001) and mean of relative peak power (MRPP) (r = 0.388, p = 0.018), respectively. The MPP (796.18 ± 344.17 W) and MRPP (11.47 ± 2.60 W/kg) of the NPT were significantly higher than the MPP (705.67 ± 249.30 W) and MRPP (8.34 ± 2.55 W/kg) of WAT. There were positive correlations in MMP between NPT and VJ (r = 0.620, p = 0.001) between the WAT and VJ (r = 0.399, p = 0.015). Also, there were significant correlation (r≥0.25), p<0.04, d = 5.1 in MRPP between WAT and VJ, with a trend variance between the trials of 0.66. CONCLUSION: There were significant positive correlations between the WAT and NPT in MMP and MRPP. The NPT also showed greater correlation with field test (VJ). So, the NPT can be a good alternative measurement with lesser efforts for assessing anaerobic power and predict athletic performance in the field.

220 Board #36 May 27 9:30 AM - 11:00 AM Can Cognitive Training During Exercise Improve Performance On A Time To Exhaustion (TTE) Test? Nicholas J. Hanson, Rachel M. Dykstra, Michael G. Miller. Western Michigan University, Kalamazoo, MI. (No relevant relationships reported)

Mental fatigue can negatively affect our drive to continue exercise. A recent study showed that a training intervention combining exercise and a cognitive task was able to improve performance on a time to exhaustion (TTE) test, which is a challenging task where individuals are required to exercise at a set workload for as long as possible. PURPOSE: To determine if an 8-week cognitive training intervention can improve TTE performance by delaying mental fatigue. METHODS: Subjects were 28 recreationally active individuals, with a mean±SD age of 22.1±2.6 years. They were randomly assigned to one of two intervention groups: a control group (CON) that was asked to exercise normally at home, and a group that exercised in the laboratory either once (1X) or twice (2X) per week. Groups were designed to have nearly equal men and women. All subjects were asked to complete a graded exercise test (GET) to exhaustion and a TTE before and after an 8-week intervention. All tests were completed on a cycle ergometer. The GET consisted of cycling at a beginning workload of 70-85W and the workload increased every minute by 25-55W, depending on sex and training status. The TTE included a set workload corresponding to 75% VO2max. Training sessions included 1hr of cycling at 65% VO2max while continuously performing the AX-CPT task on a laptop computer. One-way ANOVAs were used to determine the effect of intervention group on change in TTE and VO2max values. RESULTS: CON had no change in VO2max (1.85 ± 3.4 ml·kg−1·min−1) and the experimental groups both had a small increase (1X: 2.8 ± 5.4, 2X: 2.5 ± 5.9 ml·kg−1·min−1); however, none of these were significant. There was not a difference between groups in VO2max change (p=0.313) or change in TTE (CON: 1.5 ± 9.0, 1X: 1.8 ± 15.8, 2X: 6.3±12.2 min; p=0.257). CONCLUSION: Although the 2X group saw an increase in TTE it was not significantly different from the other two groups. This method has promise, however, as four individuals in the 2X group improved TTE compared to only two subjects in 1X, and one subject in CON. Some individuals may be non-responders to this type of intervention; this would explain the large variability. Alternatively, the lack of significant findings may suggest that the intervention should be longer or include more sessions each week.

221 Board #37 May 27 9:30 AM - 11:00 AM Reliability Of Cycling Time Trials Performed At Maximal And Submaximal Intensities Andrew W. Subudhi, FACSM, Philip M. Batterson, Elizabeth D. Hubbell, Robert A. Jacobs, University of Colorado, Colorado Springs, CO. Email: asubudhi@uccs.edu (No relevant relationships reported)

Maximal time trial efforts provide reliable assessments of exercise performance, yet are invasive in nature and thus must be used judiciously. PURPOSE: To determine whether a time trial performed at a submaximal, non-exhaustive pace, akin to a “tempo” workout, could provide an equally reliable index of exercise performance. METHODS: Twenty-two volunteers (14 male, 8 female; age 29 ± 8 years) completed three submaximal (TTsub, n=14) or three maximal (TTmax, n=8) 250kW time trials on a cycle ergometer in a counterbalanced order of four weeks. Each trial was completed at the subject’s self-selected work rate to maintain Rating of Perceived Exertion (RPE) between 13 and 17 (Somewhat Hard to Very Hard) throughout the trial. TTsub was completed as fast as possible to simulate a race effort. Reliability across trials was assessed using the Intrasclass Correlation Coefficient (ICC) and the coefficient of variation (CV), calculated as the quotient of standard deviation and mean time to completion of each individual’s trials. Intraclass test-retest reliability in TTsub was assessed using the Intraclass Correlation Coefficient (ICC) and the coefficient of variation (CV). RESULTS: Time to complete 250kW at submaximal effort (RPE 15.2 ± 0.5 vs. 16.5 ± 0.7; P<0.001) was longer than for maximal effort (1621 ± 558 vs. 1463 ± 607s; P = 0.035). However, there were no differences in TTsub and TTmax reliability as assessed by ICC (0.92 vs. 0.97, P = 0.352) or CV of time to completion (7.3 ± 5.3 vs. 6.7 ± 4.0, P = 0.807). Conclusion: This study supports the concept that a tempo-style workout may be used as a reliable index of exercise performance. Future studies will be completed to evaluate the sensitivity of the non-exhaustive time trial to changes in aerobic capacity.

222 Board #38 May 27 9:30 AM - 11:00 AM Differences Between Pointe Shoe And Barefoot Jumping In A Professional Ballet Dancer: A Case Study Sarah K. Perry, Lorraine R. Brilla, FACSM. Western Washington University, Bellingham, WA. (Sponsor: Lorrie Brilla, FACSM) (No relevant relationships reported)

Ballet is an art form that requires highly trained athletes to perform specialized movements specific to their field. Some of the most unique aspects of ballet training that sets it apart from other athletics are the use of pointe shoes, the emphasis on bilateral training, and the full body aesthetic requirements of every movement. PURPOSE: To determine how wearing pointe shoes alters full body kinematics during ballet temps leves jumps on both the preferred stance leg and the non-preferred stance leg, to compare the left and right side to determine the effectiveness of bilateral ballet training, and to observe the contribution of upper extremity movement to jump execution. METHODS: One professional female ballet dancer (23 yrs) with 17 years of ballet training performed various jumps in two footwear conditions. She was instrumented with 10-camera motion capture system was used to collect three dimensional marker position data at 250 Hz. Sagittal plane upper and lower extremity angles were calculated and compared between conditions as well as between left and right sides.

RESULTS: During single leg jumps, ankle range of motion (ROM) was slightly larger en pointe (79.1° ± 1.31°) than barefoot (56.4° ± 0.68°) due to an increase in plantarflexion, regardless of preferred takeoff leg. Conversely, knee ROM was slightly smaller due to a decrease in flexion en pointe (45.8° ± 2.43°) than barefoot (56.1° ± 6.33°) for single leg jumps, regardless of preferred takeoff leg. A bilateral jump revealed no distinct differences between left and right sides. Upper extremity angles did not show clear trends between left and right sides or between footwear conditions, however, the ipsilateral shoulder (114.7° ± 6.69°) had slightly greater ROM than the contralateral shoulder (103.4° ± 8.49°) during single leg jumps. CONCLUSIONS: Wearing pointe shoes causes alterations to lower limb angles during single leg jumps, altering the demand on the dancer’s body during these movements. The increase in ipsilateral shoulder ROM implies ballet dancers utilize the upper extremity to accurately execute single leg jumps. The lack of obvious differences between left and right side joint angles indicates that bilateral ballet training is effective at the professional level.

223 Board #39 May 27 9:30 AM - 11:00 AM DECREASE IN PHYSICAL FITNESS IN SOUTH CHINA COLLEGE STUDENTS FROM 2015 TO 2018 Chunbo Qin1, Xi Jin2, Daixi Xie3, Yang Wen4, Mark Loftin, FACSM2, ‘Shenzhen University, Shenzhen, China. The University of Mississippi, University, MS. (Sponsor: Mark Loftin, FACSM) Email: 67696054@qq.com (No relevant relationships reported)

Physical fitness (PF) is important for human health and movement throughout the lifespan. PURPOSE: The aim of this study was to explore changes in physical fitness in college students from the first year of college to the third year of college. METHODS: 3606 Chinese college students aged from 16 to 23 years old (1810 males) were recruited from Shenzhen University in China. The subjects participated in PF tests in 2015 and 2018. Physical characteristics and PF tests included body weight (BW), body height (BH), body mass index (BMI), vital capacity, 50-meter running, long distance jumping, sitting body flexion, 800-meter running (only for females), 1000-meter running (only for males), sit-up (only for females) and pull-up (only for males). All students were tested by facilities TSNS200 (produced by Physical Fitness Science and Technology Company). Dependent T-tests were used to compare variables responses and a two-way ANCOVA was used to examine gender by time at post-test with pre-test scores serving as a covariate (p < 0.05). RESULTS: In females, significant differences were revealed in BW, BH, VC, 50-meter running, long distance jumping, sitting body flexion, and 1000-meter running. CONCLUSION: The results indicated that many PF performance tests decreased over the time frame noted. Moreover, it appears that limited performance was time was dedicated to PF. Therefore, we suggest that strategies should be enacted by the University or government to improve the condition of PF for college students in China.
A Comparison Of Step Tests To Predict Maximal Oxygen Consumption

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Introduction: Of the many methods to estimate maximal oxygen consumption (VO\textsubscript{2max}), step tests provide a quick estimation of VO\textsubscript{2max} with little or no equipment. Two recent studies have suggested that there is no difference between VO\textsubscript{2max} measurements from step tests (ST) and cycle ergometry. Such findings suggest that step tests could be used to replace cycle ergometry for VO\textsubscript{2max} testing. There is, however, minimal data on the accuracy and precision of VO\textsubscript{2max} from step tests. The purpose of this study was to determine how well step tests estimated VO\textsubscript{2max} for healthy college-aged males.

METHODS: Healthy college-aged males (n=16) and females (n=16) completed three 15s trials of the CKCUEST test with 45s rest between trials. DOM and NDOM GRF and hand kinematics were captured using Exergame and SMI motion analysis software, respectively. Oxygen consumption was collected using Parvo Medics TrueOne 2400. For both the medial-lateral (ML) and sagittal (S) directions, the peak moment and averaged moment were determined. Each step was scored as either a push-up or a pull-up. All trials were scored for push-up and pull-up scores. The push-up/pull-up (P/P) ratio was calculated for each participant.

RESULTS: No significant differences were found between the sexes for push-up/pull-up ratio. Both DOM and NDOM trials showed no significant differences between push-up and pull-up scores. The mean P/P ratio was 0.820 ± 0.195 and 0.817 ± 0.194 for DOM and NDOM, respectively. The mean P/P ratio was significantly (P<0.05) higher for DOM than NDOM.

CONCLUSIONS: The CKCUEST test is a valid and reliable tool to predict VO\textsubscript{2max} for healthy college-aged males and females. The CKCUEST test may be a useful tool for predicting VO\textsubscript{2max} in clinical and athletic settings.

A Biomechanical Analysis Of The Closed Kinetic Chain Upper Extremity Stability Test

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Purpose: The purpose of this study was to compare kinetic and ground reaction force (GRF) patterns between the dominant (DOM) and nondominant (NDOM) limbs.

Methods: Healthy college-aged males (n=16) and females (n=16) completed three 15s trials of the CKCUEST test with 45s rest between trials. DOM and NDOM GRF and hand kinematics were captured using Exergame and SMI motion analysis software, respectively. Oxygen consumption was collected using Parvo Medics TrueOne 2400. For both the medial-lateral (ML) and sagittal (S) directions, the peak moment and averaged moment were determined. Each step was scored as either a push-up or a pull-up. All trials were scored for push-up and pull-up scores. The push-up/pull-up (P/P) ratio was calculated for each participant.

Results: No significant differences were found between the sexes for push-up/pull-up ratio. Both DOM and NDOM trials showed no significant differences between push-up and pull-up scores. The mean P/P ratio was 0.820 ± 0.195 and 0.817 ± 0.194 for DOM and NDOM, respectively. The mean P/P ratio was significantly (P<0.05) higher for DOM than NDOM.

Conclusions: The CKCUEST test is a valid and reliable tool to predict VO\textsubscript{2max} for healthy college-aged males and females. The CKCUEST test may be a useful tool for predicting VO\textsubscript{2max} in clinical and athletic settings.
INTRODUCTION: Combine style assessments provide information regarding athlete’s strengths, weaknesses and ability. Values allow strength and conditioning professionals to assess training objectives and method of operation. PURPOSE: To evaluate longitudinal combine performance assessments in NCAA Division II football athletes. METHODS: One hundred fifty-four football athletes participated in combine style assessments over three years using six time points (16W1, 16SU, 17W1, 18W1, 18SU, 19SU). Tests included vertical jump via Vertec, broad jump via meter tape, electronically timed 40-yard dash, stopwatch or electronically timed pro-agility run, and maximal power clean, back squats and bench press. For data analysis, positions were condensed into categories of Bigs (offensive and defensive lineman) Skill (wide receivers, running backs, defensive backs) and Big Skill (quarterbacks, tight ends, linebackers). Descriptive statistics and comparative analysis, mixed methods regressions, were performed using SPSS (version 24.0) with significance set at \( p \leq 0.05 \). RESULTS: Athletes displayed significant increases in back squat (\( F=4.965, \ p<0.005 \)), power clean (\( F=3.164, \ p=0.008 \)), and bench press (\( F=4.329, \ p=0.001 \)) as they participated in subsequent assessments. Athletes displayed significant decreases related to subsequent assessment in broad jump (\( F=3.889, \ p=0.002 \)), vertical jump (\( F=3.146, \ p=0.039 \)) and pro-agility run (\( F=2.555, \ p=0.028 \)) but not left (\( F=2.797, \ p=0.017 \)). Squat (\( F=4.931, \ p=0.005 \)), power clean (\( F=2.806, \ p=0.017 \)), 40-yard dash (\( F=4.369, \ p=0.001 \)), pro-agility run (\( F=4.329, \ p=0.001 \)) performance improved with subsequent assessments and was significantly related to position category (Skill-Big Skill-Bigs). Bench press (\( F=4.827, \ p=0.005 \)) performance was significantly related to subsequent assessments and position category (Skill-Big Skill-Bigs). Broad jump (\( F=4.415, \ p=0.001 \)) and vertical jump (\( F=3.707, \ p=0.003 \)) performance were significantly related to subsequent assessments and position category (Skill-Big Skill-Bigs). CONCLUSION: Subsequent assessment had an impact on combine performance results. Further, position categories have differing attributes that will impact combine performance values.

Avid rock climbers and the research literature commonly agree that body mass (\( M_b \)) is the primary determinant of the energy cost of climbing. Given that gravitational resistance is the primary external force being worked against when climbing, it is presumed that the energy cost, as measured by steady-state oxygen uptake (\( VO_2 \)), should be proportional to both body mass (\( M_b \)) and the total mass of a climber and their gear (\( M_g \)) - i.e., \( VO_2 \sim M_b \cdot M_g \). In the absence of gravitational resistance when accounting for gender. PURPOSE: To begin understanding the relationship between mass and steady-state climbing energy expenditure. METHODS: Data from 524 men and 4 women (Mean/SD: 25.4 ± 4 yrs age; 22.7 ± 1.5 kg/m² BMI) from a previously published study (Heil IJEPS 2019) were used for these analyses. Each climber performed five mins of steady-state climbing at six combinations of “slow” and “fast” climbing speeds (4.6-9.1 m/min) across three treadmill grades: vertical (0°), overhang or negative incline (-5° to -10°), positive inclines (+5° to +10°). Steady-state \( VO_2 \) data collected with a portable indirect calorimetry system were analyzed using standard log-linear multiple regression analyses using treadmill speed and grade, a dummy-coded gender term, and either \( M_b \) or \( M_g \) as independent variables (\( n=0.05 \)). Derived mass exponents were then compared to the theoretical value of +1.0 using 95% CIs. RESULTS: When considering the gender term in the regression model, mass exponents for both \( M_b \) \( (b=0.95; \text{CI}: 1.28; 1.11-1.45) \) and \( M_g \) \( (b=1.32; \text{CI}: 1.14-1.49) \) were significantly larger than +1.0 (model \( p=0.001 \)), \( R^2 = 0.79 \). With the gender term, however, mass exponents for neither \( M_b \) \( (b=1.05; \text{CI}: 0.85-1.25) \) nor \( M_g \) \( (b=1.09; \text{CI}: 0.89-1.29) \) differed from +1.0 (model \( p=0.001 \)), \( R^2 = 0.82 \). CONCLUSIONS: The mass exponents for both \( M_b \) and \( M_g \) did not differ from the theoretical +1.0 value attributed to gravitational resistance when accounting for gender. The reason for the need to include the gender term, however, is not clear and may be an artifact of the imbalance between men \( (n=16) \) and women \( (n=4) \) in this study.
Camera-based girth measures paired with multi-spectrum bioelectrical impedance spectroscopy can aid in bodily measurements helpful for assessing composition. Fit3D is a relatively new technology for the determination of anthropometric circumferences. There are known relationships between abdominal obesity and cardiovascular parameters. PURPOSE: To evaluate relationships between anthropometric measurements calculated by the Fit3D and pre- and post-exercise blood pressure values. METHODS: 17 subjects (7 female, 10 male) underwent laboratory testing beginning with a body composition assessment by the Fit3D (Fit3D, Inc., USA). Subjects then had resting heart rate and blood pressure recorded, followed by a treadmill VO2 max assessment during which ventilatory threshold was identified using the V-slope method. This value was used to determine work rate in a subsequent 60-minute exercise session. Immediately after exercise, subjects were retested on the Fit3D and had post-exercise values of heart rate and blood pressure collected. Descriptive statistics characterized the study sample; simple linear regressions tested the relationships between anthropometric assessments and cardiovascular parameters. RESULTS: Subjects were 20.5 ± 1.7 years old, weighed 73.8 ± 15.4 kg, had a body fat of 24.2 ± 6.6%, resting heart rate (HR) of 78 ± 1.4 bpm, systolic blood pressure (SBP) of 122.8 ± 4.6 mmHg, and diastolic pressure of 74.6 ± 4.9 mmHg. The 3D-calculated “Body Shape Rating” was unrelated to HR at baseline (p=0.297) but a higher value predicted a lower post-exercise HR (β=0.691, p<0.003). Resting forearm circumference was unrelated to SBP (p=0.978) and DBP (p=0.539), but post-exercise forearm circumference predicted both SBP (β=1.336, p=0.031) and DBP (β=1.823, p=0.038). Calf circumference was unrelated to SBP, but demonstrated trends with DBP at rest (p=0.042, p=0.033) and post-exercise (β=-1.403, p=0.080). Upper arm and upper leg circumferences were unrelated. CONCLUSION: In a condensed age group, stressful exercise seemed to reveal otherwise-hidden correlations between peripheral anthropometric measurements and cardiovascular assessments.

INTRODUCTION: The Wingate Anaerobic Test (WAnT) is a popular test for measuring lower-body anaerobic capacity and related variables. However, it may be beneficial for athletes in activities where the whole body is utilized to perform anaeroic test that includes both upper and lower body power. Climbing machines may provide comparable anaerobic capacity test results to that of the WAnT. PURPOSE: To determine if a distance climbed 30-s maximal-effort test on a simulated climbing machine correlates with WAnT variables, specifically total work (anaerobic capacity). METHODS: 32 participants were recruited from the local university population and reported to the lab five times. Day 1 included reading and signing the IRB approved informed consent, recording of anthropometric data, and practicing the protocol on both the cycle ergometer (Monark 598E) and simulated climbing machine (Versachimber SM Sport). On days 2-5, participants performed the anaerobic test protocol on each machine twice using a random order. The WAnT protocol used a 7.5% body mass resistance with a 3-5-minute warm-up followed by 30-sec of maximal effort cycling. The climbing protocol included a 3-5-minute warm-up with no resistance followed by a 30-sec maximal effort climb with the lowest resistance possible on the machine. Each protocol was performed twice on two separate days. Intraclass correlation coefficient (ICC3,1) were calculated between two trials of the WAnT total work (J), between the two trials of the climber for distance climbed. Bivariate correlations were calculated for total work on the WAnT and distance on the climber.

RESULTS: Fifteen males (24.8±6.5yrs; 176.2±5.4cm; 77.0±13.5kg) and fifteen females (23.1±4.1yrs; 159.6±4.6cm; 69.2±13.8kg) completed the study. A high degree of test-retest reliability was found for WAnT variables (ICC = 0.99 [95% CI: 0.98-0.99]) and climbing distance (ICC = 0.99 [95% CI: 0.98-0.99]). WAnT total work and climbing distance were significantly correlated, r = 0.81, p < 0.001.

CONCLUSIONS: Simulated climbing machines may be a reliable method for performing anaerobic capacity testing. Athletes involved in activities involving both the upper and lower body may have a greater benefit using a simulated climbing machine over the traditional cycle ergometer.

PURPOSE: The maximum rate of lactate production (vLaMax) can be used to estimate the maximum anaerobic energy contribution, which can be used to optimize endurance training. The aim of this study was to examine the reliability of a 20-sec vLaMax estimate using either a variable or standardized alactic time interval (talac). METHODS: 16 trained male cyclists and triathletes (35.3 ± 8.9 yo, 1.80 ± 0.05 m, and 73.3 ± 11.2 kg, average 30-sec Wingate power of 9.0 ± 2.6 W.kg-1) were recruited. Subjects completed two familiarization trials on their own before completing two 20-sec maximal sprints on their own bikes which were attached to a Wahoo Kickr trainer. Each session began with a 10-min warm-up at 100 W before each sprint and were followed by 12-min passive rest. A lactate (HLa) sample was taken from the finger at the end of the sprint and then every 2-min after that until HLa dropped ≤ 1 mM. vLaMax was then calculated using (HLa post - pre)/(20-sec - alactic time), where talac was either time 0-sec to time where power drops 3.5%, or was set at 5-sec. RESULTS: Individual sprint sessions data were analyzed and no significant differences (p>0.05) nor were noted between session 1 and 2; all data were pooled and then vLaMax calculated using methods described above. Mean 20-sec sprint power was 9.8 ± 1.0 W.kg-1 (±10% of Wingate) and a total work of 14.5 ± 2.7. The vLaMax was calculated to be 4.0 ± 2.3-sec. There was no significant difference (p>0.05) between the calculated vLaMax, vLaMax 0.51 ± 0.18 M.L.-1.sec-1 and vLaMax 0.51 ± 0.15 M.L.-1.sec-1. Neither vLaMax value appears to be associated (r² < 0.10, p>0.05) with absolute performance. CONCLUSIONS: These results indicate that using a standard 5-sec produced similar results as calculating it using a 3.5% drop in power. While vLaMax may ultimately influence HLa testing curves (i.e., lactate threshold) and endurance performance, it does not appear to be associated with actual sprint power output.
PURPOSE: To develop a directional continuous jump motion test and conduct a comprehensive assessment and comparison of basketball players under the conventional measurement method (vertical jump, standing long jumps [forward, backward]) and the directional continuous jump measurement method (vertical, forward, backward). METHODS: Subjects included the following two groups: (a) general students (10 male students) and basketball students (10 male students). The conventional single jump (vertical jump, standing long jumps [forward, backward]) and the directional continuous jump (vertical, forward, backward) were measured using Kinect2. For the directional continuous jumps, subjects were instructed to perform the first vertical jump to the best of their ability and then to move to the next motion as quickly as possible after landing. Overall scores were calculated for jump height/distance using the conventional measurement method and the directional continuous jump measurement method. Then, the standard score (T-score) for the basketball group was calculated on the basis of the mean for the general male student group. The difference between the means of the standard score (T-score) on the conventional single measurements and on the directional continuous jumping measurement were tested. The level of significance was set at 5%. RESULTS: Significant differences were not found in the means of the overall standard scores (T-Scores) for conventional single measurements and directional continuous jump measurements. The individual results indicated that six subjects had an overall standard score (T-score) that was higher than the average (50) under the conventional measurement method, and eight subjects had higher than average scores under the directional continuous jump measurement method. It shows that even a player who scored below the mean for general students on the conventional measurement (single jumps) scored higher than the mean for all directions in the directional continuous jump measurement. CONCLUSION: When studying athletes, overall instantaneous force can be assessed and gauged efficiently using the directional continuous jump measurement method.

Heart rate index (HR\text{index}), expressed as an activity HR divided by resting HR (HR_{\text{rest}}), has been proposed to estimate oxygen uptake (VO_{2\text{max}}) of physical activity and aerobic capacity (VO_{2\text{max}}). Recently, a prediction equation (e.g., METs=6⋅HR\text{index}−5) that used HR\text{index} to predict VO_{2\text{max}} in MET was developed retrospectively from aggregate data of 60 published studies. However, it is unclear whether this predictive model is accurate when applied among individuals. PURPOSE: To examine the predictive validity of the HR\text{index} equation by comparing submaximal and maximal VO_{2\text{max}} predicted by the HR\text{index} equation (VO_{2\text{max}} = Pred) with that measured by indirect calorimetry (VO_{2\text{max}} = Meas). METHODS: 60 healthy adults (21±2 yrs.; 28 males and 32 females) participated in this study. Each subject underwent a VO_{2\text{max}} test and an experimental session on two separate days. The experimental session consisted of a 15-min resting period and three successive 10-min treadmill exercise bouts performed at 40%, 60%, and 80% of VO_{2\text{max}}. VO_{2\text{max}} and HR were recorded continuously during both the VO_{2\text{max}} test and the experimental session and these data were used to obtain VO_{2\text{max}} = Pred and VO_{2\text{max}} = Meas for each level of intensity and for VO_{2\text{max}}. Validation was carried out by Pearson product-moment correlation analyses, paired t-test, Bland-Altman plots, and by assessment of mean absolute errors. RESULTS: A significant (p<0.05) correlation coefficient was found between VO_{2\text{max}} = Pred and VO_{2\text{max}} = Meas at 40% (r=0.56, 60% (r=0.60) and 80% of VO_{2\text{max}} (r=0.55) and at VO_{2\text{max}} (r=0.51). VO_{2\text{max}} differed significantly (p<0.05) from VO_{2\text{max}} = Meas at 40% (5.7±1.4 vs. 4.9±1.0 METs), 60% (8.5±2.0 vs. 7.5±1.4 METs), and 80% of VO_{2\text{max}} (10.5±2.4 vs. 9.6±1.8 METs) and at VO_{2\text{max}} (11.8±2.7 vs. 12.6±2.3 METs). Prediction biases were 0.74±1.06, 0.82±0.83 METs, while mean absolute errors of prediction were 22.1%, 21.6%, 19.1% and 16.1% at 40%, 60%, and 80% of VO_{2\text{max}} and at VO_{2\text{max}}, respectively. Conclusion: It appears that the prediction equation involving HR\text{index} overestimates VO_{2\text{max}} at submaximal intensities and underestimates VO_{2\text{max}} in healthy adults. These results suggest that further investigation aimed to establish the accuracy of using HR\text{index} to predict VO_{2\text{max}} is warranted.
Heart rate plateau (HRplat) is an effective indicator for confirming VO2max attainment. However, it is unknown if this criterion holds for older populations. PURPOSE: Test the efficacy of HRplat for confirming VO2max in older individuals. METHODS: Twelve males and twelve females (60±8 years, N=24) completed individualized ramp and staged protocols to volitional fatigue on the cycle ergometer (CE) and treadmill (TM), respectively. Participants then performed verification protocols at 105% of their peak workload from each VO2max test. VO2max was confirmed using a plateau in VO2 (VO2plat = largest VO2 value, VO2plateau) at ≤150 ml/min, a VO2max verification criterion of a VO2 plateau ≥ 2% higher than the incremental phase, and a VO2max plateau ≥ 4 bpm higher than in one’s sample regardless of sex and modality. HRplat was more frequently met on CE as compared to TM. RESULTS: A VO2max plateau was met more frequently in older males than in females. VO2max and clear data processing procedures are needed. Table 1. VO2max attainment criteria for all tests across sex and modality (N=24).

![Table 1](image_url)

CONCLUSION: A verifiable criterion is for confirming VO2max in older males on both modalities and females on the CE. MRI may serve as a standard plateau criterion for VO2max attainment in older males and females. VO2max was the most robust method for establishing maximal effort. The verification criterion was met in older males on both modalities and females on the CE. MRI may serve as a standard plateau criterion for VO2max attainment in older males and females. VO2max was the most robust method for establishing maximal effort.

243 Board #59 May 27 9:30 AM - 11:00 AM Accuracy Of Age-predicted Maximal Heart Rate In The General Population

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Previous investigations in maximal aerobic capacity (VO2max) have attributed sex differences to anatomical and physiological parameters. PURPOSE: To determine the main factor affecting VO2max in a sample of physically active young adults. METHODS: Sixteen college-aged students (18-25 years, 8 males and 8 females) participated in a laboratory visit including body composition, hematocrit (HCT), and VO2max. Lean body mass (LBM) and fat mass (FM) were obtained from a body composition (DEXA) scan. Hematocrit (HCT) was determined using a micro finger blood sample and validated by measures of urine specific gravity (USG) to control for hydration status. A graded exercise test was performed on the cycle ergometer using 25 watt (W) per minute and 20 W per minute incremental protocols for men and women, respectively. VO2max, cardiac output max (Qmax) and stroke volume max (SVmax) were recorded using the COSMED Quark CPET metabolic cart. Cardiac output was determined using the Fick principle. Test measure means were grouped by sex and analyzed for significance using a one-way ANOVA. A Pearson’s R correlation was performed to determine the association between variables of HCT, LBM, SVmax, Qmax, absolute VO2max.

RESULTS: Males showed significantly greater measures of height (177.94 cm ± 5.74 cm vs. 166.6 ± 3.1 cm; p<0.01), LBM (63.70 kg ± 7.51 kg vs. 43.85 kg ± 19.0 kg; p<0.01), HCT (46.9% ± 3.5% vs. 42.2% ± 3.0%; p<0.05), absolute VO2max (3.377 L/min ± 0.64L/min vs. 2.439 L/min ± 0.309 L/min; p<0.05), Qmax (2.2 L/min ± 0.3 L/min vs. 1.84 L/min ± 0.18 L/min; p<0.01) and SVmax (110.1 mL ± 15.5 mL vs. 78.24 mL ± 7.47 mL; p<0.01) compared to females. Pearson’s R correlation analysis showed that absolute VO2max (L/min) was positively correlated with Qmax (R= 0.989), SVmax (R= 0.958) and LBM (R= 0.777).

CONCLUSION: Age-predicted maximal heart rate (APMHR) is an essential measure for health care professionals in determining cardiovascular response to exercise testing, exertion during exercise, and exercise prescription. Although multiple prediction equations have been validated for specific populations, the criterion validity of each for use in a general population requires testing. PURPOSE: To evaluate the agreement between measured max heart rate (HRmax) in a general population using APMHR equations in the general population. METHODS: HRmax from 99 graded treadmill exercise tests (GXT) at a standard performance clinic were attained (age: 38±12.4, BMI: 25.6±3.9, VO2max: 46.5±10.3). GXTs were terminated volitionally and were only included for analysis if RER exceeded 1.10. Five previously established equations were used to predict HRmax: Fox (220-age), Tanaka (208 – 0.7*age), Gellish (207–0.7*age), Gulati (206–0.88*age), and Aker (209–0.7*age). Bland-Altman plots were used to establish the level of agreement. Univariate ANOVA with pairwise comparisons was performed to assess if differences existed between measured and predicted HRmax.

RESULTS: Figure 1 depicts agreement between measured and predicted HRmax. A significant main effect was found for HRmax between measures (F=12.0994, p<.001). The Gulati equation was significantly different from GXT HRmax (p<.001). Analysis of Bland-Altman plots revealed minimal bias with similar levels of agreement in all prediction equations with the exception of Gulati (mean difference: 9.3). Slope of the plots show that prediction equations underestimate HRmax in individuals with lower measured HRmax and vice versa, with the exception of the Fox equation. CONCLUSION: All prediction equations aside from Gulati may be suitable to predict HRmax in a general population. The Fox equation may be superior as it is less likely to under or overestimate based on individual HRmax.

244 Board #60 May 27 9:30 AM - 11:00 AM A Validation Study Of A Treadmill Speed Incline Conversion Chart

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Previous investigations in maximal aerobic capacity (VO2max) have attributed sex differences to anatomical and physiological parameters. PURPOSE: To determine the accuracy of the Hillrunner.com treadmill speed incline conversion chart using ventilatory data, heart rate, subjective perceived effort, and blood lactate. METHODS: Two groups of experienced runners, divided based on their self-reported easy run pace, ran at 6 different speed/incline combinations for 3 minutes each. All stages were equivalent according to the Hillrunner.com chart, and 1 minute standing rest was given between stages. Group 1 (n=11) ran at inclines up to 4%, while Group 2 (n=22) ran at inclines up to 10%. Oxygen consumption (VO2),
respiratory exchange ratio (RER), heart rate (HR), blood lactate (BL), overall rate of perceived exertion (RPE), and leg RPE (LRPE) were measured for each stage. VO2 was compared against the VO2 predicted by the ACSM equation (ACSM VO2). Stage order was randomized, and repeated-measures ANOVA was used to detect differences between stages and inclines. RESULTS: Measures of exercise intensity did not change as incline rose from 0% to 4% in Group 1 (p<.05). Increases in VO2 (42.2±3.6 to 45.9±4.0 mL·kg⁻¹·min⁻¹; p<.05), HR (146±12 to 151±12 bpm; p<.05), BL (1.4±0.9 to 1.9±1.2 mM; p<.05), and LRPE (10±2 to 12±2 RPE; p<.05) were inconsistently achieved from 0% to 10% in Group 2. When compared with VO2, ACSM VO2 underestimated oxygen consumption at all inclines up to 8% (p<.05). ACSM VO2 was similar to VO2 at an incline of 10% in Group 2 (45.9±4.0 vs. 46.7±2.4 mL·kg⁻¹·min⁻¹; p<.05). Within subjects, pooled results showed moderate correlations between HR and BL at 0% and 2% (R=0.479, R=0.567, p<.01) with a notable difference at 4% (R=0.309, p<.05). Statistically significant correlations were also found between ACSM VO2 at BL at 6%, 8%, and 10% (R=0.601, R=0.560, R=0.600; p<.01) in the Group 2 participants. CONCLUSIONS: The HillRunner.com chart appears valid at relatively low inclines. However, at higher inclines, the decreases in speed may not prevent increases in exercise intensity as measured with VO2, HR, BL, and LRPE. The ACSM VO2 prediction equation underestimates oxygen consumption in a trained population at inclines up to 8%.

Confirmation of maximal oxygen consumption (VO2max) has relevance in both clinical and exercise settings. Though there are criteria in place to confirm VO2max has been attained, they are inconsistently achieved. For example, a plateau in VO2 with a corresponding increase in workload is often absent, and other criteria such as a respiratory exchange ratio (RER) ≥1.5 or heart rate (HR) within 10 beats per min (bpm) of age predicted maximum can result in an inaccurate estimate of VO2max. Due to these shortcomings, some researchers have suggested the use of a verification phase (VP) to confirm the attainment of VO2max. PURPOSE: Therefore, this study aimed to provide further evidence for the need to use a VP with VO2max testing protocols in populations of different fitness levels. METHODS: 49 participants (M: 27; F: 22; 21.9±2.6 y; 24±3.2 kg·m⁻²) had their VO2 and HR measured during three maximal graded treadmill tests with each test followed by a VP of differing intensity (85%, 95%, 105% final workload). Participants were divided into groups based on their VO2max using norms adapted from American College of Sports Medicine (ACSM) VO2max guidelines (poor, fair, good, excellent) resulting in 7, 19, 18, and 5 participants respectively. VO2max from the graded treadmill test was confirmed with the VP and/or an additional test if the highest VO2 value achieved was no more than 2 x typical error (1.9 to 3.7 mL·kg⁻¹·min⁻¹ across groups). RESULTS: Plateau was achieved on 43/47 tests (29%), RER was achieved on 10/47 tests (21%), HR within 10 bpm of age-predicted max was achieved on 83/147 tests (56%), and volitional fatigue was reached on 147/147 tests (100%). The highest VO2 value attained on the initial VO2 test was not different than either value attained following the VP at 95% or 105% of final VO2 test workload or a second repeat test on a separate day (P<.001). The 85% VP VO2 value was lower than the initial VO2max test value (P<.001). CONCLUSION: While traditional criteria to confirm the attainment of VO2max were inconsistently achieved, the use of a VP at (95% or 105%) or a subsequent repeat test on a separate day were able to confirm the VO2max value attained. Our data also suggests exercise studies employing only a single VO2max test should consider these inconsistencies across a range of fitness levels.
height and the deep squat (r = 0.416, F = (1, 22) = 4.611, p = 0.043) but not amongst the other lower extremity FMS tests (in-line lunge, hurdle step, active straight leg raise, p = 0.928, 0.78, 0.27, respectively). CONCLUSION: While there is no one perfect screening tool to assess athletic performance, individual tests within the FMS battery can be useful in identifying performance in NCAA Division III female athletes. The use of individual FMS testing can be an additional predictor for performance variables, particularly those involved with power motion such as the vertical jump.

249  Board #65  May 27 9:30 AM - 11:00 AM  ESTIMATION OF THE VENTILATORY THRESHOLD USING WIRELESS NEAR-INFRARED SPECTROSCOPY AND DISTANCE MAXIMUM ANALYSIS
David Lawson, Ericka Parsley, Noah Smith, Kendra Voth, Trent E. Cayout. University of Indianapolis, Indianapolis, IN. (No relevant relationships reported)

The ventilatory threshold (VT) separates moderate intensity (<VT) and heavy intensity (>VT) domains and can be determined using a pulmonary gas exchange system in a laboratory setting. Knowledge of an exercise workload (i.e., velocity during running) in which the VT occurs is useful when prescribing individualized cardiorespiratory exercise. If wireless near-infrared spectroscopy (NIRS) systems could estimate the VT, more environment specific testing results could be obtained.

PURPOSE: To investigate if the VT can be estimated via wireless NIRS responses from the medial gastrocnemius (G) or vastus lateralis (VL) during a running graded exercise test (GXT).

METHODS: 17 healthy, recreationally active adults (age = 21 ± 4 years, height = 1.69 ± 0.11 m, weight = 66.3 ± 16.8 kg) completed a GXT on a treadmill to volitional fatigue. Every three minutes the velocity was increased by 1 km/hr starting velocity = 5 km/hr) while the incline remained at 1%. Pulmonary gas exchange and NIRS (G, VL) data were continuously collected. The pulmonary gas exchange data was visually inspected (V-Slope, end-tidal pressures, and ventilatory equivalents) to identify the velocity at which the VT occurred (vVT). The last 15 seconds of NIRS data (G, VL) for each stage were averaged and the velocity at each NIRS threshold (vNIRS-G, vNIRS-VL) were determined by the distance maximum (Dmax) analysis. Concurrent validity of the NIRS thresholds (vNIRS-G, vNIRS-VL) were assessed against the VT (vVT) using Pearson correlation coefficients (r) and standard error of estimate (SEE). Statistical significance was established a priori at p < 0.05.

RESULTS: vNIRS-G was not significantly related to vVT (vNIRS-G = 8.6 ± 1.2 km/hr, vVT = 8.1 ± 1.1 km/hr, r = −0.08, p = 0.769) and had an SEE of 1.2 km/hr. vNIRS-VL also was not significantly related to vVT (vNIRS-VL = 9.1 ± 1.6 km/hr, r = 0.313, p = 0.221) and had an SEE of 1.1 km/hr. CONCLUSION: The present results demonstrate poor concurrent validity between the NIRS thresholds and the VT during running exercise. Based upon the present results, it is suggested that the NIRS threshold not be determined by Dmax analysis during running GXT.

250  Board #66  May 27 9:30 AM - 11:00 AM  Maximal Oxygen Consumption Differences Between A Treadmill And A Combined Arm And Leg Ergometer Protocol
Jeremy M. Frost, Jacob Kostuck, Corey A. Selland. Minnesota State University, Mankato, Mankato, MN. (Sponsor: Donna J. Terbizan, FACSM) Email: jeremy.frost@mnsu.edu (No relevant relationships reported)

There are different modes of exercise and equipment to measure maximal oxygen consumption (VO2max). The equipment used may elicit different values depending on the amount of muscle mass recruited, the participant’s activity history, and if the participant is sitting (bike) or weight-bearing (treadmill). Using a simultaneous arm and leg protocol may serve as an additional means of acquiring accurate estimates of cardiorespiratory capacity. Purpose: The purpose of this study is to compare the relative VO2max elicited from a common treadmill protocol (TM) to a simultaneous arm and leg ergometer protocol (AL).

METHODS: Participants completed two VO2max trials, separated by 7-14 days, with the order of the trials randomized. The TM trial was a maximal exercise test using a simultaneous arm and leg ergometer protocol. The AL trial participants used an arm and leg ergometer at the same time throughout the duration of the test. Resistance started at 50 watts on the electromagnetically-braked bike ergometer and increased by 30 watts for each two minute stage. The arm ergometer resistance started at 24.5 watts and increased 4.9 watts for each two minute stage. Cadence on the arm ergometer was set at 50 rpm while the leg rpm was self-selected.

RESULTS: Thirteen apparently healthy college-aged participants completed both TM and AL assessment trials (21 ± 1.68, female n = 9). There was a difference (p < 0.05) between TM and AL in VO2max (ml/kg/min) (45.0 ± 7.3 vs. 42.1 ± 6.7, respectively), RER (1.18 ± 0.08 vs. 1.13 ± 0.06 min, respectively), and completion time (10.9 ± 1.3 vs. 7.5 ± 2.2 min, respectively), with AL values at 6.1 ± 5.28 vs. TM value at 78.4 ± 100.7% of TM. Peak heart rate was not different between TM and AL (185.7 ± 8.3 vs. 188.3 ± 10.5 min, respectively). CONCLUSION: A standard treadmill protocol elicited a higher VO2max, RER, and completion time than a novel simultaneous arm and leg ergometer protocol. However, AL values were a high percentage of the TM values. Therefore, a simultaneous arm and leg protocol may serve as an additional option in the assessment of cardiorespiratory capacity.

251  Board #67  May 27 9:30 AM - 11:00 AM  Temporal Trends In Handgrip Strength For Adults
Trevor Dufner1, John S. Fitzgerald2, Justin J. Lang3, Grant Tomkinson1. University of North Dakota, Grand Forks, ND. 1Public Health Agency of Canada, Ottawa, ON, Canada. Email: trevor.j.dufner@und.edu (No relevant relationships reported)

PURPOSE: To estimate national and international temporal trends in handgrip strength for adults.

METHODS: Data were obtained from a systematic search of studies reporting temporal trends in handgrip strength for adults aged 20-89 years, and by examining national fitness datasets. Sample-weighted temporal trends were estimated using best-fitting regression models relating the year of testing to mean handgrip strength. International and national trends were estimated by a post-stratified population-weighting procedure.

RESULTS: Trends data from nine studies/datasets representing 2,550,360 adults from five high- and two upper-middle-income countries between 1967 and 2017, collectively showed a negligible decline in mean handgrip strength of −2.6% (95%CI: −2.8 to −2.4) or −0.08 standard deviations (95%CI: −0.09 to −0.07).

INTERNationally, trends were curvilinear over time, with the rate of change (per decade) in handgrip strength steady (from 1967 to 2000) or at 0.3% (95%CI: 0.0 to 0.6), before declining at −3.5% (95%CI: −3.3 to −3.7) from 2000 onwards. National trends ranged from a decline of −6.3% (95%CI: −7.2 to −5.4) per decade in England (50-89-year-olds from 2004 and 2013) to an improvement of 3.3% (95%CI: 2.8 to 3.8) per decade in Mexico (20-69-year-olds between 1978 and 2000).

CONCLUSIONS: Despite a negligible improvement from 1967 to 2000, handgrip strength has declined among adults over the past two decades, which is suggestive of a modern decline in overall strength capacity. Temporal handgrip strength data from low- and lower-middle-income countries are needed to better track trends in population health and fitness and to guide healthy public policy.

V02max is simply defined by the body’s ability to use oxygen during physical exercise and is widely used as an indicator of cardiorespiratory fitness. Lower V02max is associated with higher risk of morbidity and mortality as well as low physical performance while higher V02max levels predict good performance in aerobic sports. Direct measurement of V02max is still considered as the gold standard. However, it is costly, required sophisticated equipment, and less accessible. Therefore, several metabolic equations have been developed to estimate V02max using indirect calculation in sub-maximal tests. The most commonly used equations are those developed by the American College of Sport Medicine (ACSM) and the research group of Fitness Registry and the Importance of Exercise National Database (FRIEND).

PURPOSE: This study aims to evaluate the accuracy of these two equations to estimate V02max comparably to direct O2 consumption measurements.

METHODS: 30 healthy active men aged between 18-34 years old (BMI: 23.9±2.9 kg/m²) who are avid runners performed a maximal treadmill test with direct VO2 measurements (mO2/kg/min) using a metabolic cart (Vymus CPX). V02max estimation was calculated using ACSM and FRIEND running metabolic equations. Direct and indirect results were compared with repeated measures T-test. These preliminary results are part of a larger study which includes 180 men and women of all age group (18-34, 35-54, and ≥ 55y.o.).

RESULTS: Indirect V02max obtained from ACSM and FRIEND equations showed very large (d = 2.01) and moderate (d = 0.6) effect size, and were significantly different when compared to direct measurements (ACSM: 66.4±7.0; FRIEND: 56.5±5.9; Vymus: 53.0±6.3; p<0.001). The mean ACSM overestimation was 13.4 mO2/kg/min while FRIEND equation was only 3.5 mO2/kg/min.

CONCLUSION: The V02max calculated with ACSM and FRIEND equations for running showed overestimate values in our male sample. However, the average difference between direct and indirect measurement is smaller when using the FRIEND equation suggesting better accuracy. More research is needed to evaluate the accuracy in different populations and different fitness levels to optimize the V02max estimation formula.

Abstracts were prepared by the authors and printed as submitted.
VO₂max testing for research is often conducted in a highly controlled environment with only “encouragement” from testers to help ensure maximal effort is given. It has been hypothesized that music can have an ergogenic effect by either increasing the state of readiness to perform the exercise or create a state of disassociation from the task being performed to increase performance. For this reason, music is often discouraged during athletic testing. While there is a myriad of hypotheses and research on exercise with music, little research exists on the effect of music on optimal VO₂max testing conditions.

**Purpose:** This study seeks to determine the effects of self-selected music during a VO₂max test on measures of metabolic indices and perceived exertion.

**Methods:** Twenty-two women (19.95±0.79y and 65.41±9.96kg) volunteered to participate in this study. Individuals were asked to perform a modified Bruce protocol incremental treadmill test to exhaustion on two occasions separated by at least 24 hours, once with no music, and once listening to self-selected music. Time at volitional fatigue (TTE) was also recorded. During the test, expired gases were recorded to analyze maximal VO₂ and VO₂ at VT. RPE during each stage using the Borg scale and then averaged for each individual throughout the test. Following each test, participants were asked to rate their overall feeling of exertion on a visual analog scale (VAS). Paired samples t-tests were conducted to determine any differences between each condition.

**Results:** Paired samples t-tests showed no significant difference for TTE (x̅ = 684.18±86.07s; x̅ no music = 668±118.25s; p=0.12), VO₂max (x̅ = 44.45±5.82ml/kg/min; x̅ no music = 43.97±2.77ml/kg/min; p=0.36), or VT (x̅ = 27.29±6.52ml/kg/min; x̅ no music = 26.93±7.03ml/kg/min; p=0.32). However, paired samples t-tests revealed significant difference for RPE (x̅ = 13.1±1.58; x̅ no music = 14.1±1.48; p=0.05) and VAS (x̅ = 10.85±2.29cm; x̅ no music = 9.37±2.72cm; p=0.05).

**Conclusions:** The findings of this study supports previous research demonstrating a connection between music and a decrease in perceived exertion during exercise. However, the addition of self-selected music during a testing session did not have a significant effect on all physiological variables measured.

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**Board #70**

**Comparison Of Novel Hop Testing Method To Identify Decreased Performance And Asymmetries**

Andrew J. Hermann1, Garrett Bullock2, Bethany Huebner2, Kyle Mates2, Kyle Kiesel2, Jenna Gourlay2, Nathan Denning1, Phillip J. Plisky2, Alma College, Alma, MI.

**Purpose:** To examine the association between alternative and traditional hop testing in physically active adults.

**Methods:** Twenty physically active individuals (age 18 ± 32; 11 female, 9 male) participated. There were large associations between single leg single, double, and triple jump (r = 0.835–0.960, p<0.001). There were large associations between double leg single, double, and triple jump (r = 0.990–0.923, p<0.001). There were large associations between single leg single jump and double leg single jump (r = 0.939, p<0.001), single leg double jump and double leg single jump (r = 0.866, p<0.001), and single leg triple jump and double leg triple jump (r = 0.851, p<0.001). There were large associations between single leg single jump and 2-1-2 jump (r = 0.853, p<0.001), single leg double jump and 2-1-2 jump (r = 0.900, p<0.001) and single leg triple jump and 2-1-2 jump (r = 0.904, p<0.001). There were large associations between double leg single jump and 2-1-2 jump (r = 0.929, p<0.001), double leg double jump and 2-1-2 jump (r = 0.905, p<0.001), and double leg triple jump and 2-1-2 jump (r = 0.832, p<0.001).

**Conclusions:** There was a high positive correlation between all single leg jumps tested and the 2-1-2 jump as well as all double leg jumps and the 2-1-2 jump. These results indicate that utilization of double leg 2-1-2 jump may be a safer preparatory to examining performance before initiating single leg jumps. These results demonstrate that the 2-1-2 jump and double leg jumps may be utilized without the increased load of repetitive landing impact on a unilateral limb as seen in traditional hop testing.

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**Board #72**

**Comparison Of Peak Lactate Levels Between A Wingate Test And Dune Climb**

Jennifer A. Ostrowski, Thompson C. Paige, Marlene Wenta, Alma College, Alma, MI.

**Purpose:** The purpose of this study was to compare maximum blood lactate levels measured directly following a Wingate test vs. a sprint dune climb in healthy college subjects. METHODS: 11 participants (5 male, 6 female, mean age 20 years) that were enrolled in a cycling spring term course at Alma College voluntarily completed a sprint dune climb (approximately 70 feet uphill at 5% incline) and a Wingate test. Tests were performed 7 days apart to minimize effects of muscle fatigue. Blood lactate levels were measured immediately following cessation of exercise. RESULTS: There was no significant difference in maximum blood lactate level achieved between the two tests (w: 7.4±2.13 mg/dL; v: 6.35±4.19, p = 0.25). CONCLUSION: Peak blood lactate levels achieved following maximal anaerobic exercise does not appear to be altered by mode or environment (laboratory vs. field based) in this study.
A Comparison Of Female Only Predictive Equations Versus Measured Resting Metabolic Rate

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(No relevant relationships reported)

Established prediction equations, such as Dore, Garrow and Weber (GW), and Cunningham (CH) were developed to predict resting metabolic rate (RMR) in females. However, these female prediction equations should be reexamined to determine if an update is required. PURPOSE: To examine several well-known female only RMR prediction equations (RMRprediction) against measured (RMRmeas) values in healthy females. METHODS: Fourteen female participants (36.5 ± 16.2 yrs, 166.8±3.6 cm, and 62.7±33.2kg) participated in this study. Each participant followed standard pre-test guidelines and underwent a single RMR assessment using a metabolic cart calibrated before each test. Each participant laid motionless in a supine position under a ventilated canopy for 25-30 minutes. The most stable 5 minutes of resting data within ±5% of coefficient of variation was defined as the measured resting metabolic rate. A one-way repeated measures ANOVA was used to compare the RMRmeas against RMRprediction (Dore, GW, and CH). RESULTS: For significant differences, Cohen’s d effect sizes were reported. All results are expressed as ± SD with significance set at p ≤ 0.05. RESULTS: The GW (1408.3 ± 149.3 kcal/day) and CH (1497 ± 135.8 kcal/day) prediction equations did not differ from the RMRmeas (1485.4 ± 247.2 kcal/day) (p > 0.05). However, significant differences were observed for Dore (1104.5 ± 89.3 kcal/day, d = 2.71) prediction equation when compared to RMRmeas. Dore under-predicted 100% of cases under the LA and the Garrow had the highest variability over-predicting and under-predicting 50% and 21.4%, respectively. The Dore equation significantly underestimated RMR while the GW and CH over-estimated RMR. CONCLUSION: Our preliminary data shows that the use of the Dore prediction equation underestimated RMR by 380.9 kcal/day. This equation should be interpreted with caution. Although not statistically different from the RMRmeas, the GW equation had the largest variability of RMR estimates. Our data supports the continued use of the CH prediction equation, as no significant differences were observed compared to RMRmeas in a healthy population of females.

Board #73 May 27 9:30 AM - 11:00 AM

Vo2Max And Ventilatory Threshold Comparison Between Boxing And Arm-crank Exercise Tests


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(No relevant relationships reported)

The Bruce treadmill protocol is commonly utilized when assessing maximal oxygen consumption (VO2max). As the Bruce was developed originally for cardiac patients, and its initial stages are very slow coupled with a steep grade, it may not be an appropriate protocol for young or trained individuals with higher levels of cardiorespiratory fitness. Additionally, the steep grade used in the Bruce protocol elicits significant local muscular fatigue, which may cause participants to end the test prior to reaching their true VO2max. Secondly, the Astrand protocol also utilizes a steep grade and the speed of the first two stages is slowly increased, which may not elicit a significant cardiovascular response in healthy individuals. The apparent flaws of these two validated tests may present limitations that can induce measurement error and underestimation of VO2max in healthy or well-trained populations.

PURPOSE: The purpose of this study is to validate a novel VO2max protocol that may be better suited for healthy or well-trained populations. METHODS: Ten participants performed the Bruce, Astrand, and the novel protocol in a randomized and counterbalanced order with the following maximal values being recorded from each protocol: VO2max, minute ventilation (Ve), respiratory exchange ratio (RER), heart rate (HR), rating of perceived exertion (RPE), and time to exhaustion (TTE). RESULTS: Paired samples t-tests revealed no differences in VO2max when comparing the Novel versus both the Bruce protocols (p = 0.151 and p = 0.501). RESULTS: The Bland-Altman Analysis revealed that the Novel protocol exhibited a low degree of bias with tight limits of agreement when compared to the Bruce (mean bias ±95% LOA = −1.102 ± 4.357) and Astrand protocols (mean bias ±95% LOA = −0.440 ± 3.920). Additionally, the Novel protocol resulted in significantly lower TTE when compared to the Bruce (p < 0.001) and Astrand protocols (p < 0.001). CONCLUSION: The Novel protocol produces similar VO2max values to that of the Bruce and Astrand protocols with lower TTE, or test duration, making it a quicker and more effective protocol for this population.

Board #74 May 27 9:30 AM - 11:00 AM

Board #75 May 27 9:30 AM - 11:00 AM

Swim Or Run? Comparison Of Flume And Treadmill Maximal Aerobic Capacities In Trained Swimmers


(No relevant relationships reported)

PURPOSE: Treadmill testing and cycle ergometry are the most common modes of exercise testing for assessing maximal aerobic capacity (VO2max). Most sedentary subjects and trained runners have higher VO2max measurements during treadmill testing compared to cycle testing, suggesting mode of exercise affects VO2max. However, trained cyclists attain higher VO2max values on cycle ergometry than treadmill testing due to the specific adaptations of cycle training. Freestyle swimming is a dynamic exercise involving both upper and lower limbs. The purpose of this study was to determine if trained swimmers have higher VO2max values when swimming compared to running. METHODS: Eight trained swimmers (3 M, 5 F; 21.6 ± 2.9 years) performed VO2max testing on a treadmill and in a swim flume. For the flume test, subjects breathed through a 2-way non-rebreathing snorkel that collected their expired breath for analysis. For the treadmill test, subjects used a mouthpiece, nose clip, and 2-way non-rebreathing valve. For both modes of exercise, the subjects’ expired air was collected into a mixing chamber and analyzed by a metabolic cart. The subjects exercised at increasing intensities until volitional fatigue on both tests. Blood lactate was assessed before and after each test. VO2max measurements and heart rates (HR) were measured continuously and reported as 10-s averages. RESULTS: The subjects had higher VO2max values on the treadmill than in the swim flume (56.2 ± 7.8 vs. 50.6 ± 11.5 ml·kg⁻¹·min⁻¹, p = 0.034). At VO2max, minute ventilation, tidal volume, and respiratory frequency were all higher on the treadmill than in the flume. Respiratory exchange ratio and HR were significantly higher following the treadmill test and post-run lactate tended to be higher on the treadmill test (p = 0.055). However, oxygen pulse (VO2/HR), an index of cardiac stroke volume, did not differ between tests, as both VO2 and HR were lower while swimming. CONCLUSIONS: Results from the study suggest that running elicits a greater cardiovascular demand than swimming even in trained swimmers. This may be due to greater involvement of the larger leg musculature. Future studies should examine the other three competitive swimming strokes, as they are less efficient than the front crawl and more reliable on the lower body for propulsion.
People around the world are increasingly aware of their need to exercise regularly. Many of them are turning to simple, attractive solutions they see on television, but not all countries have equally strict regulations for assessment of product claims, and the criteria for scientific support appear to be lax for exercise equipment. It would be unfortunate for people to purchase useless equipment and give up exercise because of a lack of positive results. PURPOSE: to measure the acute physiological response to using a popular piece of equipment, commercially available in Costa Rica. METHODS: 1) VO₂ was tested at rest and using the equipment with a Jeager MasterScreen CPX metabolic cart (CareFusion Corporation, San Diego, CA). Energy expenditure was calculated simultaneously from heart rate (Polar FT7, Kempele, Finland), accelerometer (Actigraph wgt 3x-BT, Pensacola, FL) (ACC), and a pedometer (3DActive PDA-100, London, UK) (PED). 2) Twenty, apparently healthy students (15F, 12M) rested in a supine position for 10 min while measuring oxygen consumption. They proceeded to use the exercise machine according to manufacturer’s instructions in the highest setting, for 10 min (EXER). RESULTS: All data are Mean±SD. Subjects were 19.1±1.0 y.o., 1.647±0.073 m tall, and weighed 63.09±10.13 kg; resting VO₂ = 3.2±0.7 mL·kg⁻¹·min⁻¹. During EXER, calculated energy expenditure was highest with PED (63.3±7.6 kcal, gross), registering 2099.1±250.5 kcal·10 min. Exercise intensity was measured from VO₂ at 1.54±0.23 MECR, corresponding to 5.6±2.2 kcal·net (16.8±2.8 kcal·gross) 10-min energy expenditure. CONCLUSION: Not even the least accurate, most generous measurement using PED was close to the infomercial claim of 277 kcal in 10 min for a lean, small female runner. The actual net energy expenditure while using this equipment, as carefully measured in this study with indirect calorimetry, will result in an insignificant amount of body fat loss, even if used for a full hour every day. Users are advised to save their money and buy two or three good pairs of walking shoes instead. Funded by the University of Costa Rica, project VI-838-B6-766.

Components to determine orienteering performance consists of orienteering map reading ability and physical conditioning. Orienteers are typically trained in a well-designed course with pre-determined locations of start, controls and finish. The winner expends the least time. In addition, athletes always train themselves in varied outdoor settings or even on a treadmill. However, there had been no tool to assess orienteering map reading ability and physical conditioning respectively. PURPOSE: To develop a systematic approach to assess individual map-reading ability and physical conditioning with considering physiological characteristics. METHODS: Twelve orienteers (9 males and 4 females, training experience: 3.6 ± 1.7 yrs., BMI: 21.8 ± 1.8 kg/m²) were recruited to participate the study. Participants were asked to have 2 runs in the same test course wearing device of Garmin Forerunner® 935/HRM-Tri. The first run mimicked the real competition, which was followed by a second run after enough rest and reviewing the map in detail. Anaerobic threshold (AT: 10.0 ± 1.7 Watts) was measured from VO₂ at 1.54±0.23 MECR using a standardized protocol on treadmill. The map-reading ability is defined by the difference between the first run velocity and the second run velocity. Repeated measures of one-way ANOVA was used to examine the mean difference among the first run velocity, the second run velocity, AT and CV. Statistical significant difference is set at p < 0.05. RESULTS: The first run velocity was significantly lower than the second run velocity AT and CV (8.5 ± 1.2 km/h vs. 9.5 ± 1.5 km/h, 10.0 ± 2.0 km/h, 11.4 ± 2.0 km/h). However, the second run velocity did not differ from AT. The %HRmax of the first run was also significantly lower than that of the second run (85.7 ± 4.3% vs. 89.8 ± 2.6%). To further assess individual map-reading ability and physical conditioning, we constructed a four-quadrant analysis tool to interpret the current state and future training direction. Two of participants showed excellent map-reading ability and good physical conditioning, which matched their achievements in formal competition. CONCLUSION: A tool for assessing orienteer’s competence was developed. It may be helpful for a coach to prescribe individual training plan or select some talent athletes.

The Physical Power (CP) model provides a valuable insight into the physiological capacities of an individual to perform work by profiling both aerobic and anaerobic capacities. The 3 Minute All-Out Test for Critical Power (3MT) was developed as a time conscious method for obtaining CP as well as providing insights into the amount of work done above CP (WEP). Concerns about pacing during the test lead researchers to develop a protocol which blinding participants to time during the 3MT. Due to the role that knowledge of time plays in anticipation, pacing, and decision-making during exercise, this protocol may lead to inaccurate results obtained from the 3MT. PURPOSE: To investigate the effects of incorporating a race timer in the 3MT. METHODS: Twelve healthy active males (Age: 24.9 ± 2.2 years; Height: 180.4 ± 7.5 cm; Weight: 78.1 ± 6.6 kg; VO2peak 53.9 ± 6.1 ml.kg.min) completed one VO2peak test and one 3MT familiarization trial before completing one standard 3MT and one 3MT with the presence of a countdown race timer in a randomized and counterbalanced order. Paired t-tests were used to compare CP, WEP, VO2, Mean Power, Total Work, VO2peak, & HRmax between trials. CONCLUSION: These results suggest that the knowledge of time (elapsed or remaining) may have a significant impact on CP and WEP in the 3MT. This impact may be due in part to the role that knowledge of time plays in pacing and decision making, and fits within the framework of the Affordances Competition Hypothesis. These findings warrant further investigation in more experienced cyclists to better understand what role knowledge of time plays in the 3MT.
relationship between shuttle run and anaerobic fitness in this population. **PURPOSE:** To determine the accuracy of a shuttle run test (SRT) as a predictor of field hockey performance. **METHODS:** We enrolled 19 D1 field hockey players (18-22 years old) in an 11-week prospective study. Goalties and injured players were excluded from the study. A 6-week program prior to the study consisted of a 20m shuttle run during practice. Speed was gradually increased by 0.5 km/h at a time, each increase in running speed was coded as a change in level. A Polar Pro GPS/heart rate recorder (Polar Electro Inc. Vantaa, NV) recorded effort parameters during 43 practices. Data included time in heart rate (HR) zone 4 (%80-89%), time in HR zone 5 (%90-100%), percentage of HR max (%) total distance covered (m), distance (m/ min), maximum speed (km/h), number of sprints (acceleration >1.9 m/s²), and distance in speed zone 5 (>19.00 km/h) (m). Bivariate correlations and linear regressions tested relationships between SRT and on-field performance. **RESULTS:** SRT was significantly related to total distance covered (r=0.90, p<0.02), distance per minute (r=0.112, p=0.004), maximum speed (r=0.997, p=0.0013), distance in speed zone 5 (r=0.119, p=0.002), and number of sprints (r=0.188, p=0.001). No other relationships were detected. Better performance on the SRT corresponded to more (and more frequent) in-practice sprinting. **CONCLUSION:** Although the SRT may not provide a valid estimate of VO₂ max, it is a valid predictor for many components of on-field performance. It associates with total distance, distance per minute, maximum speed, distance in speed zone 5, and number of sprints in collegiate field hockey players.

**266 Board #82**
**Monday May 27 9:30 AM - 11:00 AM**
**Stroboscopic Vision-induced Sensory Reweighting During Postural Control**
Hwigeum Jeong, J. Ty Hopkins, FACSM, Seunguk Han, Hyunwook Lee. Brigham Young University, Provo, UT. **Sponsor:** Ty Hopkins, FACSM
Email: hwigeum@gmail.com

**PURPOSE:** The aim of this study was to explore the effects of stroboscopic glasses on postural control. **METHOD:** Study was conducted on 24 healthy people (M: 12, F:12, Height: 172.1±7.8, weight: 67.5±10.4) performed balance tests (jump landing balance and single leg balance) with 3 sets of 10 second, respectively. While the jump landing test has three conditions (eyes-open (EO), high and low strobe vision (HSV, and LSV) respectively), the single-leg balance has four conditions (EO, HSV, LSV, and eyes-closed (EC)). These two balance tests will be implemented on a firm surface and a foam surface. Main outcome measure were dynamic postural stability index (DPSI) and the center of pressure (COP) excursion with 2 directions (anterior-posterior (A/P) and medial-lateral (M/L)). For the surface conditions, student-t test was used. For DPSI and COP excursion, an analysis of variance with repeated measures was performed to determine difference in balance performance between these visual conditions. **RESULT:** In the jump landing balance, DPSI was greater on the foam than the firm (p = .0474). Likewise, in the single leg balance, COP excursion was greater in both A/P and M/L on the foam than the firm (p < .0001). For the vision conditions, in the jump landing balance, DPSI was greater in HSV and LSV than EO (p = .0100 and p = .0013, respectively). In the single leg balance, COP excursion was greater in EC, HSV, and LSV than EO (p < .0001). Additionally, COP excursion in EC was greater than HSV and LSV (p < .0002 and p = .0093, respectively). In the single leg balance, both HSV and LSV showed greater interaction with foam in both A/P and M/L than the firm (6% up to 22%). **CONCLUSION:** The effects of stroboscopic glasses on postural control were less than the effects of eyes-closure. The subjects seemed to rely more on visual inputs to stabilize posture in an unstable condition. The stroboscopic glasses, that can adjust visual inputs, may be used to measure the reliance of visual inputs in those who have reduced postural control in an unstable condition. The stroboscopic glasses, that can adjust visual inputs in those who have reduced postural control in an unstable condition. The stroboscopic glasses, that can adjust visual inputs in those who have reduced postural control in an unstable condition.

### Board #83
**May 27 9:30 AM - 11:00 AM**
**Anaerobic Power Measurement Tests In Athletes**
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**PURPOSE:** The aim of the present study is to verify if Countermovement Jump (CMJ) and Countermovement Jump with arm swing (CMJA) can be used as an alternative for anaerobic power measurement in athletes, due to the higher physical and psychological demand required by the Wingate test (WAnT). **METHODS:** Thirty-one individuals were selected, all males and physically active. All participants had reported any known cardiovascular, orthopedic or neuromuscular problems. A protocol familiarization session was held before each test in order to participants had the opportunity to learn about each protocol. WAnT was performed with 7.5% of the participants’ body mass. For all tests data were collected for analysis of Peak Power (PP), Average Power (AP) and Fatigue Index (FI). **RESULTS:** The results were as expected as the PP and AP indicators were higher in CMJA compared to CMJ. This was to be expected due to the increased power transfer rate through the use of the arms. The highest power measurements were found in the WAnT test, which was also expected. However, when analyzing FI, WAnT also has the highest index (6.33% in CMJA, and 17.08% in WAnT). Computing the AP (in watts) of the 3 tests, based on measurement of effect size (Hedge’s g), the following values were reached: 1.67 for WAnT, 1.17 for WAnT+CMJA, and 0.42 for CMJ+CMJA. So, can be said that there is large difference, in practical terms, in the first 2 cases, and moderate in the third case. **CONCLUSIONS:** This study showed that there are significant differences between the 3 anaerobic lower limb power assessments tested (WAnT, CMJ and CMJA). Therefore the WAnT test should not be replaced by the CMJ and CMJA tests when we are evaluating anaerobic power of the lower limbs, since the existence of significant differences between them, as showed in the effect size analysis (Hedge’s g). Remarks can be done in sports that have specific characteristics that recommend the adoption of one or another test, depending on the motor skill and other specific demands.

### Board #84
**May 27 9:30 AM - 11:00 AM**
**Establishing Prediction Equations For “the Big 3”: Bench Press, Squat, And Deadlift**
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**PURPOSE:** The purpose of this study was to use the 1RM bench press, squat, and deadlift for top ranked power lifters and Division I football athletes to establish prediction equations for “the big 3.” **METHODS:** Upon University IRB approval, one hundred seventy-four (88 power lifters; 86 Division I football athletes) experienced participants’ bench press, squat, and deadlift 1RM scores were collected via the International Powerlifting Federation website and the local university strength and conditioning coaches. Multiple regression was used to determine variability within each set of scores as well as to determine strong predictors. **RESULTS:** Multiple regression analysis demonstrated 86% of variance in 1RM DL is explained by BP and SQ [F (2, 169)=511.861; p<.0001] with SQ (β=.670) being the stronger predictor. Eighty-three percent of variance in 1RM SQ is explained by DL and BP [F (2,169)=45.904; p<.0001] with DL (β=.798) being the stronger predictor. And 71% of variance in 1RM BP is explained by DL and SQ [F (2,169)=201.718; p<.0001] with DL (β=.624) showing as the stronger predictor. **CONCLUSION:** When taken together, scores from two of the three lifts may predict the score of the third lift. This allows regression equations to be developed for each of the lifts. The following equations were predicted to predict scores for DL, SQ, and BP, respectively, and where DL = 1RM for DL, SQ = 1RM for SQ, and BP = 1RM for BP. DL = 40.511 + (.632)SQ + (.382)BP ; SQ = -18.829 + (.847)DL + (.179)BP ; BP = 7.855 + (.489)DL + (.171)SQ

Clinicians, coaches, and other fitness professionals may use these equations to estimate 1RM scores of power lifters and football athletes in instances where a new 1RM is being established, a return to play decision is being made, or any lift may not be completed for other reasons.
PURPOSE: The purpose of this study was to clarify the relationship between physical fitness and academic ability of Japanese children. METHODS: The participants were 2,417 elementary school 6th graders and middle school 2nd graders. The overall physical fitness assessment determined from physical fitness tests was used as the evaluation value: A: Excellent, B: Slightly excellent, C: Standard, D: Slightly inferior, E: Very inferior. For evaluation of academic ability we used the number of correct answers for basic and applied questions in national language and mathematics. For basic academic ability (language and math), applied academic ability (basic academic ability), and physical fitness, the total number of correct answers for all tests were calculated and analyzed.

RESULTS: As a result of the analysis, significant (p < 0.01) associations were found between all items of academic ability and the overall physical fitness assessments for elementary and middle school students. Significant χ² values were also found for all academic ability items in total number of correct answers by physical fitness evaluations. Residual analysis indicated that the rate of low correct answers was significantly lower, and the rate of high correct answers was significantly higher in children with higher levels of physical fitness. In other words, important evidence has emerged showing that children who have increased physical fitness owing to outdoor play and sports tend to have higher levels of academic ability.

CONCLUSIONS: Elementary school students tended to have higher academic ability as their overall physical strength was higher. This tendency appears as a remarkable difference in applied academic ability. On the other hand, in middle school students, the academic ability levels of groups A, B, and C were similar. However, the level of academic ability in groups D and E was remarkably low, and it seems that students in the low physical fitness group lacked a positive approach to study.

Independent mobility refers to the freedom of children to play or travel without adult supervision. Parents play an important role in influencing their children’s physical activity (PA). However, how parental granting mobility license may influence children’s after-school PA has seldom been investigated.

PURPOSE: To investigate the relationship between parental granting mobility license and objectively measured after-school PA among children in Hong Kong.

METHODS: One hundred twenty-seven children aged 8-12 years were recruited from three primary schools. Their parents responded to an 11-item scale to measure parental granting mobility license in four domains: travel to/from school, travel to other destinations, and active play categories (children walking and math). ActiGraph data for at least 3 days and their parents completed the questionnaire. On average, the after-school period lasted for 292.3 ± 100.7 minutes, of which 31.3% was accumulated in light-intensity PA (LPA) and 7.3% in moderate-to-vigorous PA (MVPA). After adjusting for gender, age and body mass index, the overall score of parental granting license was positively associated with after-school MVPA (B = 0.211, 95% confidence interval [CI]: 0.033 to 0.389). Two domains of the parental license, i.e., travel to sport-related destinations (B = 1.122, 95% CI: 0.322 to 2.901) and active play (B = 1.633, 95% CI: 0.473 to 2.792), showed significant associations with after-school MVPA. However, only active play remained significant in the stepwise multiple regression models. Neither the overall score nor the 4 domains of parental granting mobility license was associated with after-school LPA.

CONCLUSIONS: Higher level of parental granting mobility license, especially the freedom of children to play without adult’s supervision, was associated with more after-school MVPA in children.

Background: Exercise capacity is related to morbidity and mortality in the general population. Screen time is related to sedentary behavior and physical inactivity in children and adults. There is a paucity of data on screen time vs. exercise capacity using cardiopulmonary exercise test (CPET) in children and adolescents. Our aim was to evaluate and compare exercise capacity using CPET and screen time in healthy pediatric population. METHODS: Cross-sectional retrospective study assessing daily screen time (questionnaire and CPET (cycle ergometer)). Screen time was analyzed as “total screen time”, “mobile devices” (smartphones and tablets) and “sedentary devices” (computer and television). RESULTS: Seventy-two healthy non-obese children (mean age 13.6 ± 3.4 y/o, 47% Female, BMI%ile 50 ± 30.3) were evaluated. Peak oxygen uptake (peak VO₂) was preserved (mean peak VO₂: 98.8 ± 19.2%), but the correlation was found for peak VO₂ and “total screen time” (r=-0.32, p<0.007) and peak VO₂ and “mobile devices” (r=0.33, p=0.004) while no correlation was found for “sedentary devices”.

Conclusions: “Mobile devices” and “total screen time” were negatively correlated with exercise capacity in pediatric healthy population. Children and adolescents should be encouraged to decrease daily screen time and highlight mobile technology. Larger longitudinal studies are needed to better study the impact of screen time on morbidity in children.
PURPOSE: To assess feasibility and acceptability of AERIAL©, a 12-week heading training program developed by VICIS© in collaboration with the University of Washington (UW). METHODS: We conducted a longitudinal cohort study with n=21 youth (9 male, 12 female) from 2 premier level U12 soccer teams in the Seattle area. Coaches were trained regarding the AERIAL© program, instructing youth to perform the drills each week while correcting form. Drills focused on active core strength, spatial awareness, and head progression and took approximately 20 minutes per week. Data were collected at three time points (baseline, 6 weeks and 12 weeks) with a primary outcome of feasibility and acceptability, secondary outcome of heading confidence, and an exploratory outcome of heading safety behaviors (assessed via standardized video at the same three time points). RESULTS: Feasibility and acceptability were high for all stakeholders (mean±SD, total standard deviation): youth (4.6±0.5, SD 0.28), parents (4.5±2.5, SD 0.86), and coaches (3.8±3.5, SD 0.55). Heading confidence significantly improved in females in both games and practice from baseline to 6 weeks (Wilcoxon matched-pairs signed rank, p=0.0033 forames games and p=0.032 practice), and remained stable at 12 weeks. Males reported a high level of heading confidence at baseline and had no significant increases during the study. Video coding indicated a number of safety behaviors were present at baseline in nearly all athletes (eyes open, core and neck as one, contact with front of head, squared shoulders), while other safety behaviors increased during the training period, though not significant with this small sample size: 1) legs staggered 2) knees bent 3) arms up and 4) palms open. CONCLUSION: The AERIAL© program appears to be a feasible and acceptable means for introducing youth to heading and aerial maneuvers, and preliminary data suggests potential efficacy for improving safety and performance.

Two major health concerns with female adolescent athletes are psychosocial wellness and sports-related injuries. It is also known that these health concerns are much greater for minority students who attend high school in economically depressed cities. PURPOSE: To complete a pilot study on urban underrepresented minority and suburban female high school athletes, to determine the feasibility and utility of using Functional movement screening (FMS) to assess injury risk and Patient-Reported Outcomes Measurement Information System (PROMIS) to assess psychosocial health in this population during 10-weeks of athletic training. METHODS: In this feasibility pilot study, female student-athletes from an urban minority high school (n=10) and suburban high schools (n=10) were recruited into a 10-week athletic training study. The primary goals of this study were to: 1) recruit and retain the human subjects throughout the study period, 2) evaluate global health performance, and 3) assess injury risk. Self-reported data from the subjects were used to update injury status. For MSC, the dominant side throwing UE and ipsilateral hip were measured. ROM assessments included internal (IR), external rotation (ER), and total range of motion (TROM) of glenohumeral and hip joints. Strength included IR and ER of glenohumeral and hip joint, and hip abduction. Flexibility assessments included pectoralis minor length, and posterior shoulder tightness. Postural measurements included forward head posture and forward shoulder posture. Outcome measures included the QuickDASH with Sport Module, the Kerlan-Jobe Orthopaedic Clinic Shoulder and Elbow questionnaire (KJOC), and the Functional Arm Scale (FAS) for Throwers. A ROC curve analysis was performed to assess all aforementioned variables and outcome measures ability to predict injury. RESULTS: 27 participants experienced an injury from the mid-season to end-season. The QuickDASH Sport Module displayed fair accuracy to predict injury (Area under curve = 0.721). All other measurements had either poor accuracy or failed to predict injury altogether (Area under curve < 0.7). CONCLUSION: The QuickDash Sport Module may be used prior to the start of the season as a tool to identify those at a greater risk of injury with caution. Further research is needed to investigate predictors of injury among the softball adolescent population with increased sample size and considering differences among those who play year around, specialize in softball, or amongst different positions.

Exercise-induced bronchoconstriction (EIB) is a transient narrowing of the airway that can be attributed to heavy ventilation associated with sustained high intensity exercise greater than 8 min. High aerobic and ventilatory training demands can exacerbate the EIB response and lead to prevalence of EIB in endurance athletes like triathletes. The mixed relay triathlon, due to its high intensity and short duration format, will induce heavy ventilation that could lead to EIB. However, no research at present has determined the influence of a mixed relay on respiratory function and baseline spirometry measures which are vital for identifying athletes at higher risk for EIB.

PURPOSE: To determine severity and prevalence of EIB in healthy triathletes competing in a mixed relay and understand if baseline spirometry is predictive of the EIB response and race performance. METHODS: Seven males (17.7 ± 0.4 years, 183.7 ± 3.0 cm) and 5 females (17.6 ± 0.6 years, 171.1 ± 2.7 cm) competed in the Canadian Championships (300m swim, 6km bike, 1.6km run). Spirometry measures of Forced Expiratory Volume in 1 see (FEV1), Forced Vital Capacity (FVC), FEV1/FVC (%), Forced Expiratory Flow at 50% FVC (FEF50), FEV2-75% and Peak Expiratory Flow (PEF) was performed before warm up and 5 min post-race. Measures were calculated as % delta change (for EIB determination) and in raw units to determine pre-post differences in measures via paired sample t-tests. RESULTS: Mean race time was 22.4 ± 1.5 min including transitions (swim 4.5 ± 0.5 min, bike 10.4 ± 0.7 min, run 6.1 ± 0.6 min). No spirometry measure was significantly decreased post-race. One athlete had mild EIB (% decrease in FEV1 between 10 and 25%) and 2 athletes had a baseline FEV1/FVC ratio <0.7. Percent delta change in PEF and FEV2-75% were

Abstracts were prepared by the authors and printed as submitted.
correlated to finish time (r=0.78, r=0.83, p<0.05 respectively). CONCLUSION: An all-out 20 min ultra-short triathlon does not necessarily affect respiratory function in young healthy junior triathletes. It maybe that the decrease in PEF and FEF 25-75% affected finish time due to reduced airway function affecting exercise intensity. The low prevalence of EIB compared to older endurance athletes supports the late onset of EIB in endurance athletes (> 25 years) although the 2 athletes with <0.7 resting FEV1/FVC ratios show signs of underlying airway obstruction.

Dynamic warm-up protocols (DWP) consisting of moderate- and high-intensity exercise movements have been found to enhance strength and power performance in children; however, the effects of DWP on maximal treadmill exercise performance in children are unclear. Prior to pediatric exercise testing participants typically perform low-intensity treadmill walking (TW). PURPOSE: To compare the effects of a DWP with a TW warm-up protocol on maximal exercise performance in children. METHODS: 11 healthy children (10.8 ± 1.5 yrs) were tested for peak oxygen uptake (VO2 peak) on 2 nonconsecutive days following different 6 min warm-up protocols performed in random order. DWP consisted of 9 progressive body weight movements including dynamic stretches, lunges, hip bridges, and jumps whereas the TW protocol consisted of walking on a motor-driven treadmill at 2.2 mph and 0% grade. Comparisons between trials were made with a paired t-test. RESULTS: VO2 peak was significantly higher (p<0.04) following DWP than TW (56.9 ± 9.1 vs 52.7 ± 9.4 ml/kg/min) and a trend (p=0.08) towards greater maximal heart rate was noted following DWP vs TW (192.5 ± 7.5 vs 190.9 ± 7.1 bpm, respectively). No significant differences between DWP and TW trials were observed for maximal minute ventilation (70.7 ± 17.5 vs 64.0 ± 10.4 L/min, respectively), maximal respiratory exchange ratio (1.08 ± 0.05 vs 1.08 ± 0.07, respectively) and total exercise test time (640.9 ± 77.8 vs 638.0 ± 97.4 sec, respectively). No order effects between test day 1 and test day 2 were observed for any variable. CONCLUSIONS: These findings indicate that the design of the warm-up protocol can influence the cardio pulmonary responses to maximal treadmill exercise and that a DWP can result in a higher VO2 peak than a low intensity TW protocol in healthy children.

Table 1 The physical fitness differences between villages

<table>
<thead>
<tr>
<th>Variables</th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standing long jump (cm)</td>
<td>95.1±18.2</td>
<td>91.2±21.3</td>
</tr>
<tr>
<td>Tennis ball throwing (m)</td>
<td>6.2±2.2</td>
<td>6.4±2.4</td>
</tr>
<tr>
<td>Sit-and-reach (cm)</td>
<td>8.7±4.4</td>
<td>8.2±4.6</td>
</tr>
<tr>
<td>Turn back to run (s)</td>
<td>7.1±0.7</td>
<td>6.9±1.1</td>
</tr>
<tr>
<td>Walking on the balance beam (s)</td>
<td>7.7±5.6</td>
<td>8±4.4</td>
</tr>
<tr>
<td>Continuous foot jump (s)</td>
<td>6.9±2</td>
<td>6.0±1.4</td>
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</table>

CONCLUSIONS: The data suggests that there was no significant difficulty between villages and cities girls, but the country boys' physical fitness was better than cities girls'. All the students must improve physical fitness through increased PA, especial the girls.

Sprint speed is a common focus of adult strength and conditioning programming and research. However, the links between sprint speed and other tests of muscular-skeletal fitness (MSF) have not been extensively studied in youth. PURPOSE: To investigate the relationship between sprint speed and tests of jumping performance, muscular strength/endurance, agility, and anaerobic capacity in children and adolescents. METHODS: The analysis included 402 boys and 148 girls (ages 7 to 18 years) participating in a baseline MSF evaluation. Sprint speed was assessed via a 10-yard and 20-yard sprint. Agility and anaerobic capacity were assessed via the pro-agility and 200-yard shuttle run, respectively.Muscular strength and endurance were assessed by maximal number of chin-ups and jumping performance was assessed via the vertical jump, broad jump, and 5-hop jump tests. Pearson correlations were used to determine the associations between each fitness test relative to the 10- and 20-yard sprints, controlling for age and sex. RESULTS: Correlations were generally larger between 20-yard dash and other MSF tests than for the 10-yard dash. For example, the strongest correlation with both sprints was the pro-agility test, with r = 0.755 (p = 0.001) for the 20-yard sprint and r = 0.655 (p = 0.001) for the 10-yard sprint. Similar associations were found between the sprints and the 200-yard shuttle run, with correlations of r = 0.758 (p < 0.001) and r = 0.640 (p < 0.001) for the 20-yard and 10-yard dashes, respectively. While similar, the broad jump (r = -0.657 [p < 0.001]) had a slightly better correlation with the 20-yard sprint than either the vertical jump (r = -0.633 [p < 0.001]) or 5-hop test (r = -0.629 [p < 0.001]). The chin-up test had the smallest correlation with 20-yard sprint speed out of the MSF battery (r = -0.414 [p < 0.001]). CONCLUSIONS: Stronger relationships to the 10- and 20-yard sprints were found for the agility and anaerobic capacity tests compared to all MSF tests; however, all the MSF tests had greater associations to the 20-yard sprint overall. All three jumping tests were similarly associated with sprint speed. Future research is needed to determine if interventions targeting these MSF tests would lead to proportional alterations in the sprinting speed of youth.
### Scientific Fitness Literacy (SFL) and Its Relationship with Cardiovascular and Body Composition Characteristics

#### PURPOSE
To investigate the main factors affecting Chinese adolescents’ scientific fitness and provide countermeasures for Chinese adolescents’ health promotion.

#### METHODS
A total of 4663 healthy adolescents (age: 12.56 ± 5.81yrs, female: 54.5%) were investigated from 33 provinces. Divided into three groups according to age: juvenile (12-17yrs), pre-youth (18-28yrs), and late youth (29-40yrs); divided into three regions based on the administrative districts: Eastern Region (ER, 13 provinces), Central Region (CR, 8 provinces) and Western Region (WR, 12 provinces).

#### RESULTS
The results indicate that there are differences in SFL among different gender, age, education, region and exercise practice. Females (27.58±4.00) were higher than males (27.58±4.00); (2) Age differences (F(2,4660)=80.224, P=0.000<0.05): CR (28.63±3.84)>WR (28.15±3.76)>ER (27.82±3.63); (3) Differences of education level (F(2,4660)=63.10, P=0.000<0.05): Postgraduate (28.54±3.50)>University (28.41±3.76)>Middle school students (26.75±4.43); (4) Region differences (F(2,4660)=11.165, P=0.000<0.05): CR (28.63±3.84)>WR (28.15±3.76)>ER (27.82±3.63); (5) Differences of exercise patterns (F(9,4660)=203.194, P=0.000<0.05): regular exercise (30.99±3.96)>less regular exercise (28.70±3.51)>occasional exercise (27.92±3.42)>no exercise (25.94±4.00).

#### CONCLUSIONS
- Age, gender, education, region and exercise patterns are the main factors affecting the Chinese adolescents’ SFL. Female’s SFL is higher than males, pre-youth than juveniles, and CR and WR are higher than ER. The higher education levels, SFL can; the more regular the exercise, SFL can.

#### PURPOSE
To verify the association between type of exercise, physical activity level and body mass index (BMI) with cardiorespiratory fitness in Brazilian adolescents.

#### METHODS
Descriptive correlational study, conducted with 350 adolescents (16.26 ± 0.66 years old), from Curitiba, Brazil. Gender, age, type of exercise (sport practice, other type of exercise practice, or not engaged in any type of physical exercise) and physical activity level (at least 420 minutes a week) were evaluated through self-reported questionnaires. The BMI was calculated using kg/m² equation. The pacer physical test was applied to evaluate the cardiorespiratory fitness (VO₂max). Poisson regressions, with robust variance, adjusted for gender and age, were calculated to verify the variables associated with VO₂max adopting p<0.05.

#### RESULTS
Adolescents who practiced sports had a 2.04 times higher prevalence of having VO₂max in the healthy zone (PR: 2.04; 95% CI: 1.21-3.44) than those who did not exercise. The VO₂max of adolescents that practice another type of physical exercise did not differ from those not engaged in any type of physical exercise. Adolescents classified as sufficiently active had a 1.56 times higher prevalence of being in the healthy zone for VO₂max (PR: 1.56; 95% CI: 1.02-2.41) than those who were classified as insufficiently active. BMI showed no significant associations with VO₂max.

#### CONCLUSION
Adolescents practicing sports had better levels of cardiorespiratory fitness than those who practiced other types of physical exercise and those who did not exercise at all.

Additionally, adolescents who achieved adequate levels of physical activity had better levels of cardiorespiratory fitness.
Purpose: There is an increased interest in exploring the association between fitness components with cognitive development in youth in recent years. However, most of the studies so far have focused on healthy weight young people with little evidence with excessive fat accumulation population. To examine the association of health-related physical fitness with attention capacity in Latin-American children and adolescents to examine whether body fat is moderator of the association between them.

Study design: A cross-sectional study involving 201 children and adolescents with overweight and obesity (12.1 ± 2.1 years old; 34.3% girls) from Chile (The Active-Start study) and Colombia (HEPAFIT study). We assessed physical fitness components (muscular strength, speed-agility, and cardiorespiratory fitness) using the ALPHA and SUPRECOLE batteries. Attention capacity was measured by the d2 test. Linear regression and moderation analyses were conducted.

Results: Linear regression analysis adjusted for potential confounders (age, sex, body fat, peak height velocity, mother education and study [i.e., Active-Start or HEPAFIT]) revealed association between speed-agility (β=0.77; p<0.03) and cardiorespiratory fitness (β=4.5; p<0.001) with attention capacity. The Johnson-Neyman technique revealed a significant relationship between cardiorespiratory fitness and muscular strength and attention capacity when body fat was below, but not above, 34.8% (20% of sample) and 29.5% (48% of sample), respectively.

Conclusions: Cardiorespiratory fitness and speed-agility are associated with higher attention capacity in youth with overweight and obesity, but body fat seems to moderate these relationships. Randomized controlled trials in this population would help to better understand whether improvements in different components of physical fitness leads to better attention capacity by a reduction in their body fat.

OBJECTIVE: While school fitness environment is known to have a significant impact on children’s physical activity and fitness, no quick, easy, yet accurate tool is available to assess school fitness environment. The purpose of this study was to develop such a tool and validate it using a contracting-group method.

METHOD: After a comprehensive search on the literature, a check list of school fitness environment, including items in sports facilities, role of PE teachers, training methods by PE teachers, perceived values by principals and teachers and students’ reported PE participation etc., was developed. An evaluation team consisting of one researcher and two graduate students was formed and trained. The team then went to two schools, A and B, in Jiujiang city, China, to interview the principals, PE teachers, students in each school, went over the school sport facility, as well as tested a group of Grade 9 students’ aerobic fitness (1000-M run for boys and 800-M run for girls).

RESULTS: A total 219 students (106 boys, 113 girls) in School A and 235 students (110 boys, 125 girls) in School B were tested and their aerobic fitness level were evaluated using the 2018 high school entrance exam (HSEE) criterion. Comparing with their rating and some discussions, School A was rated having a better school fitness environment and students’ fitness performance (running time in seconds) and corresponding t-test comparison further supported the observation:

School A School B

<table>
<thead>
<tr>
<th>Boys (1000-M in s)</th>
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<tbody>
<tr>
<td>Total 234.0 ± 28.4</td>
<td>242.5 ± 30.8</td>
</tr>
<tr>
<td>HSEE Good &amp; Above 221.4 ± 14.5</td>
<td>227.1 ± 11.8</td>
</tr>
<tr>
<td>Girls (800-M in s)</td>
<td></td>
</tr>
<tr>
<td>Total 211.6 ± 22.6</td>
<td>231.0 ± 27.8</td>
</tr>
<tr>
<td>HSEE Good &amp; Above 211.3 ± 14.4</td>
<td>215.6 ± 13.1</td>
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</table>

CONCLUSIONS: With a combination of qualitative and quantitative methods, a simple school fitness environment tool was developed, and by comparing students’ aerobic fitness from two schools, its initial validity evidence was collected and confirmed.

The World Health Organization recommends that children accumulate at least 60 minutes of moderate-to-vigorous-intensity physical activity (MVPA) daily. However, knowledge about the association between physical activity (PA), physical fitness and body mass index (BMI) among elementary school children in the Arctic is limited.

PURPOSE: To examine the association between PA levels, physical fitness and BMI in elementary school children in Northern Norway.

METHODS: Elementary school children in 1st, 3rd, 5th and 7th grade were invited to wear an accelerometer (wGT3X-BT, ActiGraph, LLC, Pensacola, United States) for seven consecutive days (n=216). PA was categorized according to intensity, and dichotomized into reaching the PA recommendations or not. Physical fitness was measured by using Test of Physical Fitness (Fjortoft et al. 2011) consisting of a nine-item compound motor activity score that includes various combinations of endurance, strength, agility, balance, and motor coordination, which is calculated as total physical fitness based on z-scores. BMI (kilogram/height²) was used as body composition measure.

RESULTS: In total, 94 (43.2%) of 216 the children reached the recommendation of 60 min MVPA per day. There was a significant difference (p=0.001) in total physical fitness score between boys (3.01) and girls (-2.35). A positive association between physical fitness score and reaching the PA recommendations was observed in 3rd, 5th and 7th grade (p<.05). BMI was inversely associated with physical fitness in 5th and 7th grade (p<0.05) but not in 1st and 3rd grade. There was no significant association between those who achieved the PA recommendations and BMI.

CONCLUSION: Children in elementary school who reach the recommendations for PA seem to have a higher score on the physical fitness test, except for the first graders. BMI was not related to physical fitness or reaching PA recommendations except an inverse association between BMI and physical fitness in higher grades.

INTRODUCTION: The Talk Test (TT) is a well-accepted measure of exercise intensity and is a useful surrogate of ventilatory (VT) and respiratory compensation (RCT) thresholds in sedentary, fit, athletic, and cardiac populations. Recently, the TT has also been shown to reflect these same markers in children. PURPOSE: The present study was designed 1) to replicate TT results during incremental exercise in children, and 2) to evaluate the ability of the TT to predict when the subjects would be above (+TT) or below (-TT) VT intensity during interval exercise. METHODS: Healthy pre-pubertal children (5m, 5f) were studied using the TT and gas exchange during incremental exercise to determine the match between TT stages and VT. Another group of healthy pre-pubertal children (7m, 6f) were studied both during incremental and stochastic exercise, in order to determine how well TT responses during stochastic exercise predicted whether the children were above or below VT. RESULTS: During incremental exercise, there was good correspondence between the VO₂ in VT and the VO₂ at the last positive (LP) (r=0.79) and the equivalent (EQ) (r=0.75) stages of the TT, which match earlier findings from our laboratory (Giddings et al., 2018; LP TT, r=0.62 & EQ TT, r=0.75). During stochastic exercise, correct matching of predicted vs. observed +TT and predicted vs. observed -TT were present 73% of the time. Discordant results were present 27% of the time. These findings...
match earlier findings from our laboratory in adults relative to the matching of observed vs. predicted results. CONCLUSION: The TT behaves as a similar surrogate of VT in children, as it does in adults, during both incremental and stochastic exercise.

CONCLUSION Our results showed a beneficial change in RHR for females completing at least 6 months of the Hearts and Parks intervention program. However, we did not observe significant changes in HRR after the intervention. These preliminary results suggest the potential for this novel clinic-community intervention framework to have beneficial changes in some markers of CRF in children who have obesity.

This Asia-Fit study focused on the physical index of adolescents from Singapore (SGP), providing an overall indication of living habits that may affect obesity levels. PURPOSE: To compare physical activity (PA) levels and obesity rates among SGP adolescents.

METHODS: A total of 1648 adolescents from SGP (age: 13.49 ± 1.21 years, height: 159.76 ± 8.94 cm, weight (WT): 51.98 ± 13.41 kg; body mass index (BMI): 20.21 ± 4.22 kgm²; body fat percentage (BF%): 21.54 ± 10.21 %) participated in this study. A series of physical tests (15m youth Progressive Aerobic Cardiovascular Endurance Run (PACER) test, one-legged sit-and-reach (SRT), handgrip strength (HS) test, and 1-minute sit-up test (SUT)), a PA questionnaire and anthropometric measurements were collected from schools all over Singapore.

RESULTS: There were significant correlations between WT and BMI (WT: 51.98 ± 13.41 kg; BMI: 20.21 ± 4.22 kgm²; r = -0.90, p = 0.00), BMI and BF% (BMI: 20.21 ± 4.22 kgm²; BF%: 21.54 ± 10.21 %; r = 0.78, p = 0.00), vigorous exercise (VE) and moderate exercise (ME) (VE: 3.19 ± 2.07 days; ME: 3.06 ± 2.06 days; r = 0.46; p = 0.00). Negative significant correlation was found between VE and WT (3.19 ± 2.07 days; WT: 51.98 ± 13.41 kg; r = -0.06, p = 0.03). No significant correlation was observed between ME and BMI (3.06 ± 2.06 days; 20.21 ± 4.22 kgm²; r = -0.04, p = 0.13), VE and BF% (VE: 3.19 ± 2.07 days; BF%: 21.54 ± 10.21 %; r = -0.04, p = 0.09). 89.5% adolescents participated in ME (3.06 ± 2.06 days), 10.5% did not indicate participation. 70.7% adolescents participated in VE (3.19 ± 2.07 days), 12.1% did not indicate participation. 2.8% adolescents adhered to the American College of Sports Medicine (ACSM)‘s recommendation of 60 minutes of PA daily. A slightly higher percentage of adolescents sat for more than 8 hours daily (48.9%) than adolescents who sat for 1 to 8 hours daily (43.0%). 9.1% of adolescents did not report their sedentary duration.

CONCLUSIONS: Results indicate that Singapore adolescents are active and should continue regular PA as it effects BMI. Lifestyle changes of active behavior as opposed to prolong sitting is important as pre-pubertal obesity may predict adult obesity. Singapore adolescents need to adopt a healthy lifestyle that includes a well-balanced diet, with less sitting time and regular PA to reduce the risk of cardiovascular diseases in adulthood.

Introduction: A lower cardiometabolic risk in adulthood has been suggested when a better development of the cardiopulmonary and strength condition is reached at an early age. It is important to be able to assess the cardiometabolic risk against variables such as strength in the upper and lower limbs. PURPOSE: To explore the correlation between anthropometric and strength condition variables in upper and lower limbs in boys and girls assigned to sports training schools (soccer, volleyball, skating) in the municipality of Madrid (Colonia). METHOD: A total of 110 children and adolescents were evaluated using long jump test and handgrip strength (HS). The anthropometrics characteristics are, for boys and girls, respectively: weight (kg): 50.5 ± 12.9 and 49.2 ± 11.9, height (m): 158.3 ± 11.8 and 152.6 ± 9.2, age (years): 13.7 ± 13.8 and 12.9 ± 2.2. The Pearson’s correlation coefficient (r) was used to calculate the correlations regardless of gender and divided by boys and girls. The correlations studied were between the anthropometric variables (weight, height, body mass index (BMI), waist circumference and fat%), compared to long jump test (LJT), right HS (RHS) and left
HS (LHS). The results of r are indicated with a statistical level of significance of p < 0.001. Results: In the general analysis, r = 0.81 was obtained for height versus RHS and LHS and, for weight, r = 0.68 and 0.67 was found in RHS and LHS, respectively. When correcting by gender, the height in girls shows r = 0.7 and 0.65 in RHS and LHS; while, in children, it was 0.61, 0.85 and 0.89 for SL, RHS, and LHS, respectively. The weight in girls showed r = 0.6 for RHS and, in boys, 0.8 and 0.84 for RHS and LHS, in whom r = 0.6 and 0.63 for RHS and LHS were also found when compared with the BMI. No association was found with LT. Conclusion: The results indicated that the strength in the upper limbs (measured through the determination of handgrip strength) is a strong and moderate association in relation to height and weight respectively and regardless of gender. When comparing by gender, this relation is maintained in boys but the association in height went to a moderate level in girls. Thus, the results suggest that the development of strength measured through handgrip strength is closely related to the anthropometric characteristics of young athletes, especially height and weight.

293 Board #109 May 27 9:30 AM - 11:00 AM Accuracy Of Multi-frequency BIA In %Fat Change During Weight Loss Among Competitive Girl Runners
Eriko Uchiyama1, Norimitsu Kinoshita1, Kenta Okuyama2, 1Hosei University, Tokyo, Japan. 2Aichi University of Education, Nagoya, Japan.

Periodical measurement of %fat with accuracy is crucial for optimizing the health and performance in competitive runners who need strict weight control. Multi-frequency bioelectrical impedance analysis (MFBIA) is feasible for routine use but the evidence of the accuracy is limited to cross-sectional evaluation and no data is available for tracking of %fat change in competitive runners. PURPOSE: To investigate the accuracy of MFBIA for evaluating the decrease in %fat by weight loss among competitive girls runners. METHODS: The data of %fat were obtained from consecutive 25 freshmen long distance runners over 5 years in the same girl’s high school team and were retrospectively analyzed. The team regularly participated in the All-Japan high school Elks’ championship. MFBIA was performed at the preparatory season (PRE) and repeated after 5.6 ± 0.5 months at the competitive season (CMP) with dual energy X-ray absorptometry (DXA) as reference. Weight loss period was defined as that between PRE and CMP and changes in %fat (Δ%fat) was calculated by subtracting %fat in PRE from those in CMP. Bland-Altman analysis was used to evaluate the validity of MFBIA compared to DXA. Statistical significance of the mean difference between MFBIA and DXA was assessed by paired t-test. P < 0.05 was considered as statistically significant. Written informed consent was obtained from the runners and their parents. RESULTS: %fat by DXA vs. MFBIA at PRE and CMP were 19.7 ± 5.6 vs. 17.9 ± 5.4% and 12.7 ± 3.1 vs. 12.2 ± 2.6%, respectively. Thus, systemic error (the mean difference) of Δ%fat between MFBIA and DXA in the competitive runners, caution should be taken when using MFBIA for individual monitoring of %fat change during weight loss period. CONCLUSIONS: The %fat by DXA vs. MFBIA at PRE and CMP were 19.7 ± 5.6 vs. 17.9 ± 5.4% and 12.7 ± 3.1 vs. 12.2 ± 2.6%, respectively. Thus, systemic error (the mean difference) of Δ%fat between PRE and CMP and changes in %fat (Δ%fat) was calculated by subtracting %fat in PRE from those in CMP. Bland-Altman analysis was used to evaluate the validity of MFBIA compared to DXA. Statistical significance of the mean difference between MFBIA and DXA was assessed by paired t-test. P < 0.05 was considered as statistically significant. Written informed consent was obtained from the runners and their parents. RESULTS: %fat by DXA vs. MFBIA at PRE and CMP were 19.7 ± 5.6 vs. 17.9 ± 5.4% and 12.7 ± 3.1 vs. 12.2 ± 2.6%, respectively. Thus, systemic error (the mean difference) of Δ%fat between PRE and CMP was 2.5% for girls and 2.6% for boys. Thus, the results suggest that the handgrip strength measured through MFBIA for individual monitoring of %fat change during weight loss period. (No relevant relationships reported)

294 Board #110 May 27 9:30 AM - 11:00 AM Physical Qualities Discriminate Playing Level In Elite Youth Hockey Players
David Doan, Sebastien Lagrange, Pierre-Marc Ferland, Alain Steve Comtois. Université du Québec à Montréal, Montréal, QC, Canada.

PURPOSE: The purpose of this study was to compare physical test results between groups playing levels and positions in youth elite hockey players. METHODS: Subjects (n=49) came from 3 distinct levels: Bantam AAA Relève (the lowest, n=16), Bantam AAA Major (the second highest, n=17), and Midget Espoir (the highest, n=16). Physical characteristics and qualities were measured. The stationary broad jump was utilized to measure lower-body power. Jump distance was measured from toes to the closest landed heel. The best of two attempts was marked as the final score. The seated medicine ball throw was utilized to measure upper-body power. Throw distance was measured from the back of the wall to where the ball first made contact with the ground. The 20-minute shuttle run test was utilized to measure aerobic capacity. VO2max was estimated from the last level completed with the Leger-Lambert formula. Results are presented as mean ± standard deviation. A single factor (level or position) ANOVA and when significant a post-hoc analysis was also performed by using the least significant difference (LSD) for pairwise comparisons between groups tests results. Statistical significance was set at p<0.05. Analysis was conducted with IBM SPSS Statistics for Windows version 25. RESULTS: Hockey players of the two higher levels were significantly (p<0.05) taller (1.73 ± 0.08m and 1.74 ± 0.08m, respectively, vs. 1.63 ± 0.09m, heavier (66.68 ± 8.09m and 68.60 ± 10.96m, lower BMI = 20.68 ± 3.55 and 20.53 ± 3.27, respectively) and had greater aerobic capacity (3.87 ± 0.52 L/min and 3.84 ± 0.57 L/min respectively vs 2.96 ± 0.49 L/min) than the hockey players from the lower level. However, the higher level players, scored lower than the middle level at the seated meal ball throw (3.74 ± 0.49m vs. 6.0 ± 0.48m), even though the middle level players scored higher than the lower level (4.60 ± 0.49m vs. 3.49 ± 0.53m). Results also show that the goaltenders were significantly taller than the other hockey players (1.77 ± 0.10m vs. 1.72 ± 0.08m for defensmen and 1.67 ± 0.10m for forwards). CONCLUSION: The stationary broad jump, the seated medicine ball throw and the 20 minutes shuttle run are field tests that could be used in order to discriminate playing levels in youth elite hockey players. (No relevant relationships reported)

INTRODUCTION: Chinese communities have a tight knot culture with similar culture practices such as lifestyle choices which have a direct impact on health and fitness level. PURPOSE: To investigate the health components of adolescents in Shanghai and Taipei. METHOD: A total of 3207 adolescents were recruited for the study from Shanghai (N = 1588) and Taipei (N = 1619). All adolescents had their percentage body fat (%BF) taken by a bio-impedance analysis machine. The health status, muscle strength and flexibility were measured with a handgrip strength test (HGST), one-minute sit-up test (SUT) and a single-leg flexibility test (SLFT) respectively. The HGST was taken three times per arm in alternate turns. The best result of each side was taken and summed for analysis. Adolescents had to complete as many repetitions of sit-ups within one minute for the SUT. The SLFT was taken thrice on each side consecutively and the best score was used for analysis. Their cardiovascular fitness was measured by a 15m Youth Progressive Aerobic Cardiovascular Endurance Run (PACE-R) test. Adolescents were paired up for the PACE-R test, with one as the runner and another as the marker. Runners had to run back and forth 40m according to the frequency of the beep. Adolescents need to reach the 15m mark before the beep. Each unsuccessful attempt is indicated on the PACE-R test results slip. The test ceased upon the third unsuccessful run. RESULTS: Significant differences were identified between both countries for %BF (Shanghai: 22.22 ± 9.64 % vs. Taipei: 23.23 ± 9.74, p = 0.03), SUT (Shanghai: 51.97 ± 9.05 cm, Taipei: 51.15 ± 9.74 cm, p > 0.05) and SLFT (Shanghai: 33.30 ± 8.75 cm, Taipei: 32.73 ± 9.30 cm, p > 0.05). CONCLUSION: Shanghai’s adolescents had significantly higher scores than Taipei’s in all health components. Though both countries may have similar lifestyle choices, Shanghai’s adolescents may have higher energy expenditure with a healthier diet than Taiwan’s adolescents. Both countries’ adolescents should continue with regular physical activity to maintain their health.
WEDNESDAY, MAY 27, 2020

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### Board #113
**May 27 9:30 AM - 11:00 AM**

**Tethered Swimming Ineffective As Post Activation Potentiation Technique For 50-m Swimming Performance In Adolescent Swimmers**

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[No relevant relationships reported](#)

**Purpose:** The aim of the study was to investigate if tethered swimming (TS) performed 8 min before a 50-m freestyle swimming sprint could be an effective post-activation potentiation (PAP) method to improve performance. **METHODS:** Regional level male adolescent swimmers (age: 13.0±2.0 y; height: 161.1±12.4 cm; body mass: 52.5±9.5 kg) performed two trial conditions (1 experimental (TS), 1 control (CTR)) on different days. The control group performed a standardized 1200-m warm-up followed by 8 min of rest and a maximal 50 m freestyle swimming sprint. The experimental group performed the same protocol with an added TS component at the end of warm-up, which consisted of 3 x 10 s maximal effort of tethered swimming with 1 min rest in-between sprints. Performance (time-trial), selected biomechanical (stroke length), physiological (blood lactate concentrations, heart rate), psychophysiological (ratings of perceived exertion (RPE)) variables and Counter movement jump (CMJ) flight-time were collected.

**RESULTS:** Pre-performance tethered swimming had no effect on swimming time, RPE, stroke rate or CMJ flight time. Before the 50 m race, blood lactate concentrations were significantly higher in the TS than in control condition (p = 0.03, r2 = 0.62). One minute after the 50 m sprint, heart rate was significantly higher in the control condition compared to the TS (P = 0.046, r2 = 0.27).

**CONCLUSIONS:** The present study showed that 3 x 10 s tethered swimming performed 8 min prior to the event did not impact the 50 m sprint performance in young swimmers and may not be considered an effective PAP stimulus.

### Board #114
**May 27 9:30 AM - 11:00 AM**

**Wearable Sensors Differentiate Impacts And Intensity Between Games And Practices Among National Junior Ice-hockey Teams**

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(Sponsor: Mark Peterson, FACSM)

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[No relevant relationships reported](#)

**Purpose:** Use wearable sensors (WS) to compare player incurred impacts (PII) and absolute versus relative workload intensity between practices, games and teams to determine if developmental age affects these factors at the national team level. **Methods:** 90 total members of the U.S. National (NTDP) U17 (45 members) and U18 (45 members) teams consented to procedures approved by EMU Human Subjects Committee. Bioharness-3 (Zephyr, MD) WS recorded triaxial accelerations during practices (P) and games (G) of the two teams over two seasons. Impacts were identified using Impact Processor (Zephyr, MD). Impacts greater than 6 g (Z3, Z4, Z5 and above) were used as previously validated for PII. Triaxial accelerations were used to generate absolute intensity metrics 30 minute exponentially weighted Dynamic Accelerations (DYNAs) and session DYNAs. Relative intensity metrics Individual Hustle Score (IHS) and Intensity factor (IF) were based on session DYNAs relative to Dynamic functional threshold (DFT). Intensities and PII of two teams were compared between sessions and teams using MANOVA with Tukey post hoc (α = 0.05; SPSS 26.0, IBM, NY).

**RESULTS:** 7288 sessions (1400 G, 2802 P; U17 and 1039 G and 2047 P; U18) were compared. For all combined sessions, impacts were greater for U18 (6.4 ± 7.7) than U17 (5.4 ± 7 p < 0.05). Interestingly, impacts in G were not significantly different. Therefore, differences between teams were solely the result of higher impacts in P for U18 (5.8 ± 7.3 vs U17 (4.1 ± 6.3; p < 0.05). For workload intensity, overall, 30-min DYNAs and Session DYNAs were not different between teams for or for P, but both were higher in G for U17 (0.372 ± 0.0439 & 0.307 ± 0.0386, respectively) than U18 (0.360 ± 0.0579 & 0.292 ± 0.0524, respectively; p < 0.05). Although 30-min and Session DYNAs were not different for P, IHS and IF were higher for U17 (0.896 ± 0.1016 & 0.790 ± 0.0964, respectively) than U18 (0.890 ± 0.1116 & 0.767 ± 0.0981, respectively; p < 0.05).

**Conclusion:** Since PII are not different in G between U17 and U18, it appears developmental age does not affect PII in G. PII were higher in P for U18 than U17, but DYNAs were not different and relative intensities IHS and IF were higher, therefore, it doesn’t appear as though PII are related to developmental age in these two teams.

### Board #115
**May 27 9:30 AM - 11:00 AM**

**Vibration Platform Stretching Increases ROM Acutely, With No Long-term Effect In Junior Olympic Women’s Gymnasts**

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[No relevant relationships reported](#)

**Purpose:** To investigate the acute and chronic effects of vibration platform (VP) flexibility training on ROM at the hips in the middle split position. **METHODS:** Participants included 18 female gymnasts aged 7-16 years competing in JO level 6. Gymnasts were paired according to baseline data. ROM was measured using a calibrated inclinometer. **RESULTS:** HAST showed negligible to low correlations with %FM, %MM and %BM (r = 0.10 to 0.29). Since PII are not different in G between U17 and U18, it appears developmental age does not affect PII in G. PII were higher in P for U18 than U17, but DYNAs were not different and relative intensities IHS and IF were higher, therefore, it doesn’t appear as though PII are related to developmental age in these two teams.

When skiing both legs function independently and the stresses experienced by both legs is dependent upon the movement being performed (e.g. turning, jumping, landing, etc). It is well established that greater stress is placed upon the outside leg when turning and initiating tricks and that the magnitude of these forces changes based on the athlete’s momentum and the turn radius. Thus, ski athletes are at risk for developing bilateral asymmetries, which may put them at increased injury risk due to repetitive training on competition courses and non-symmetrical movement patterns. **PURPOSE:** To determine if a pattern of functional asymmetries are present in adolescent ski athletes from the same training mountain. **METHODS:** Competitive adolescent skiers (aged 14-18 years) were measured from Carrabassett Valley Academy in Kingfield, ME (n = 22) with a minimum of 2 years competing in their sport, performed a series of bilateral of tests to determine dominant and non-dominant lower body strength (5 isometric mid-thigh pull of a force platform) and power (vertical jump), rotational power (accelerometer measured median ball throw) and balance (V-balance test). Differences between legs were computed using a series of paired t-tests (p < 0.05). **RESULTS:** Athletes demonstrated greater rotational power moving towards their non-dominant (1115 ± 680 W) than dominant side (924 ± 605 W; p < 0.046). However, no differences were observed between dominant and non-dominant legs in lower-
Concussions are on the minds of many football players, parents and coaches; but attention has increased toward the potentially damaging effects of repetitive, subconcussive head impacts, particularly among youth football players. Advocates of the sport are looking for ways to improve player safety and reduce the potential risk of long-term brain abnormalities.

**PURPOSE:** To identify intrinsic and extrinsic characteristics of play associated with head impact exposure in youth football.

**METHODS:** Head impacts from one youth football team (7th & 8th grade) were measured during every practice and game between the 2018 & 2019 football seasons via a sideline head impact telemetry system and subsequently evaluated using video collected during each session. Each verified head impact was scored using a validated rubric consisting of up to 12 discrete characteristics of play (5 intrinsic, 7 extrinsic).

The mean, median and 95th percentile linear acceleration (LA) was calculated for each play characteristic.

**RESULTS:** Over two seasons, 1202 practice (median LA: 19.90 g) and 1571 game (median LA: 21.00 g) head impacts (2773 total) were examined. The “kickoff” (n = 95 impacts; 6% of all game impacts) had the highest 95th percentile LA (69.89 g) among all game play types (e.g., "run", "pass", "punt", etc.). Impacts that occurred “outside the hash marks” (61.75 g) and in the “redzone” (59.40 g) had the highest 95th percentile LA rankings among horizontal and vertical field positions, respectively. When players did not anticipate being hit (n = 53; 1.9% of all impacts), head impacts had a 95th percentile LA of 69.52 g. When the intended target was anterior or posterior-lateral (n = 164) directions. **CONCLUSIONS:** In the present study adolescent skiers demonstrated asymmetrical rotational power and non-significant trends asymmetrical lower-body strength but no other noteworthy differences in power or balance. In skiing, rotational power is necessary for rapid initiation of turns away from their dominant side. Training to correct this asymmetry may help athletes when turning towards their dominant side.

Girls have a greater decline in physical activity compared to boys as they go through adolescence. **PURPOSE:** The purpose of this study was to examine the impact of 45 minutes of daily PE on the fitness levels of African American middle school females.

**METHODS:** An analysis of variance (ANOVA) mixed effect linear model was used to evaluate the effectiveness of 45 minutes of daily physical education on the Progressive Aerobic Cardiovascular Endurance Run (PACER), push-ups, curl-ups and BMI among youth in grades 6th-8th attending Legacy Early College, a Title I school in the southeastern US. Gain scores (final post-test assessment in May 2019 - original pre-test assessment in September 2018) were calculated and analyzed for significance.

**CONCLUSIONS:** 45 minutes of daily physical education led to increases in PACER, push-ups, curl-ups and BMI among under-resourced middle school students. Supported by Campbell Young Leaders
For a large percentage of the children (LBIA = 37%, SBIA = 53%, HBIA = 67%), %BF values were outside the ± 3.5% minimally acceptable standard for accurate estimation.

**CONCLUSIONS:** The HBIA analyzer produced mean %BF similar to DXA supporting the potential use of this technology when group assessments in this population are of interest. However, due to the large intra-individual variability observed in this study, we do not recommend using the HBIA analyzer when precision of a specific child’s %BF is critical.

### A-43 Free Communication/Poster - Bone and Bone Mineral Density

**Wednesday, May 27, 2020, 9:30 AM - 12:00 PM**

**Room: CC-Exhibit Hall**

**Board #121 May 27 10:30 AM - 12:00 PM**

**Mechanical Stimulation Of Osteocyte-like Cells Changes Their Secretome - Implications For Regenerative Medicine**

Livía Santos, Aslihan Uğan-Kluske, Amanda K. Miles, Clare Coveney, David Boocock. Nottingham Trent University, Nottingham, United Kingdom.

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(No relevant relationships reported)

Osteocytes are secretory bone cells that regulate bone homeostasis and for this reason, are often coined as the “brain of the bone”. In vitro studies demonstrated that mechanically stimulated osteocytes release interleukins and growth factors that help coordinating bone formation and resorption, however, their secretome remains largely unknown.

**Purpose:** To investigate WNT signalling and the secretome of mouse and human osteocyte-like cells. Insights from this study could help to devise informed therapeutic exercise regimen e.g. aiming to preserve bone mass across ageing or accelerate bone fracture healing.

**Methods:** The murine MLO-Y4 (Kerafast) cell line was cultured according to Kerafast instructions. Human adipose stem cells (ATCC® PCS-500-011™) were expanded and differentiated into osteocyte-like cells (hOC) according to ATCC instructions. Cells were cultured in a computer-controlled bioreactor (Flexcell Int) for mechanical loading (3.4%, Hz, 5h). Static cultures were used as control. Relative expression of 84 key genes of the WNT signalling pathway (Sahiosciences) was quantified by RT-qPCR. Relative protein expression was estimated by western blotting. The secretome was analysed by quantitative mass spectrometry (TripleTOF 6600, SCIEX) using SWATH and IDA and processed using OneOmics (SCIXE) software.

**Results:** The relative gene expression remained unchanged in mechanically MLO-Y4 and hOC. Regarding protein quantification, active β-catenin and Cyclin D1 showed an up-regulation trend in mechanically stimulated MLO-Y4 but this was not statistically significant. A total of 917 proteins were identified in the MLO-Y4 secretome, ~12% present exclusively under mechanical active conditions. The secretome obtained under loading contained 14 cyclin-dependent kinases (CDKs) including CDK6, a critical regulator of osteoblasts and osteoclasts differentiation. A total of 329 proteins were identified in the supernatant of hOC, ~9% present exclusively under mechanical stimulation. Unlike MLO-Y4, no CDKs were identified in this cell type. The small ubiquitin-like modifier (SUMO) 2 and 3 were present in the secretomes of mechanically loaded MLO-Y4 and hOC.

**Conclusion:** Mechanically stimulated osteocyte-like cells secrete a specific set of proteins which could impact bone health and regeneration.

### 305 Board #123 May 27 10:30 AM - 12:00 PM

**Associations Between Measures Of Body Composition And Bone Mineral Density In Adults**

Meghan E. Garvey. University of Massachusetts Boston, Boston, MA. (Sponsor: Dr. Sarah M. Camhi, FACSM)

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(No relevant relationships reported)

PURPOSE: To provide a better understanding of the associations of bone mineral density (BMD) with lean mass (LM) and fat mass (FM) as these are currently not well understood.

**METHODS:** National Health and Nutrition Examination Survey (NHANES 2003-2004 & 2005-2006 cycles) participants (44.1 ±14.2 years old, 49.6% female) were included in this analysis if they underwent dual energy x-ray absorptiometry (total BMD g/cm², FM kg, and LM kg) and had complete data for age, sex, race, height (cm), physical activity (PA) (minutes per week), dietary calcium (mg/day), and smoking history. Hierarchical linear regression models were built to determine associations between BMD with FM and LM (Model 1), adjusting for demographics (Model 2: age, sex, race, and height) and behavioral factors (Model 3: PA, dietary calcium, and smoking history). Interaction terms (FM*sex, FM*age group, LM*age group, and LM*race) were included in Models 2 and 3. Due to significant interactions Model 3 was stratified further by sex and age. Adjusted $R^2$ were compared between models to determine fit.

**RESULTS:** The associations between LM and BMD remained unchanged between all models. There were robust negative linear associations between FM and BMD (β=-0.002, p<0.001) and positive linear associations between LM and BMD (β=0.006, p<0.001) in Model 1. When stratified by sex, the negative association in Model 3 between FM and BMD was found to have a larger amplitude in men when compared to women (β=-0.004, p=0.02; β=-0.002, p=0.03 respectively), whereas the associations between LM and BMD were consistent between sexes (β=0.006, p<0.001; β=0.006, p<0.002 respectively). When stratified by age, a larger negative beta between FM and BMD were found in 45+ as compared to 20-44 year age group (β=-0.007, p<0.001; β=-0.005, p<0.001 respectively) whereas a larger positive beta between LM and BMD were found in 45+ as compared to 20-44 year age group (β=0.007, p<0.001; β=0.005, p<0.001 respectively).

**DISCUSSION:** LM had consistent positive linear associations with BMD in all models and with stratification. The negative associations between FM and BMD varied between men and women, and between age groups. The exact mechanisms driving these differences with FM by sex and age require further investigation.

### 306 Board #122 May 27 10:30 AM - 12:00 PM

**Identifying Triad Risk Factors In Ultramarathon Runners**

Kira F. Skaggs1, Michael Fredericson, FACSM2, Emily K. Miller1, Megan Roche1, Tracy B. Hoeg2, Kristin Sainaini1, Emily Kraus1, ‘Stanford University, Palo Alto, CA. ‘University of California-Davis, Sacramento, CA.

(No relevant relationships reported)

Ultramarathon running has gained popularity in the past decade, necessitating a better understanding of the health benefits and risks of this sport. The Female Athlete Triad (Triad) and a similar condition reported in males are common in endurance athletes, but the prevalence of triad risk factors in ultramarathon runners is unknown.

**PURPOSE:** To identify the prevalence of Triad risk in ultramarathon runners.

**METHODS:** Runners who qualified to compete in a 100-mile endurance race were recruited pre-race to complete a survey assessing eating behaviors, menstrual history, training, and injury history; and dual-energy x-ray absorptiometry to assess bone mineral density (BMD). A cumulative Triad risk score was calculated using energy availability, body mass index (BMI), age of menarche and oligomenorrhea (for women), BMD, and history of bone stress injury.

**RESULTS:** 123 runners (40 female and 83 male) participants had a mean age, respectively, of 41.8 and 46.2 years. 57.3% of females and 26.5% of males received moderate cumulative risk scores; 5.0% of females and 4.8% of males were classified as high risk. 62.5% of females and 39.7% of males scored moderate or high risk for low energy availability, with 13% reporting a history of clinical eating disorder. Mean female and male BMI was, respectively 21.2 kg/m² (SD=2.1) and 22.9 kg/m² (SD=2.6). 15% of females and 0% of males scored moderate or high risk for low BMI, determined to be anything less than 18.5 kg/m². 15% of females and 28.9% of males had BMD Z-score<−1.0, and 6.0% of males had a Z-score<−2.0. 37.5% of females and 7.6% of males reported at least one prior bone stress injury.

**CONCLUSIONS:** Triad risk factors were common among ultramarathone runners, particularly in men.

**ACKNOWLEDGEMENTS:** Supported with grants from the Western States Endurance Run Foundation and the Napa Medical Research Foundation. Laboratory testing was done in partnership with InsideTracker.
exercise and their intervention period on bone metabolism (i.e., OPG/RANKL ratio) through meta-analysis and to examine the influence of moderating variables (e.g., age, gender, type of exercise, intervention duration) on bone metabolism. METHODS: The review was conducted according to the Preferred Reporting Items for Systematic Review and Meta-Analyses guidelines. The following databases were used to conduct the research: Academic Search Complete, MEDLINE, and SportDiscus. Keywords used were “exercise” AND “OPG” AND “RANKL” AND “bone”. The inclusion criteria for these articles were: 1) human subjects, 2) the blood collected before and after exercise; 3) the peer-reviewed journals published in English. Out of 161 articles, 10 were eligible to be included in this study. Comprehensive meta-analysis v.3 software was used to compute the effect size (cohens’ d) based on a random effect model and to conduct moderator analyses. RESULTS: The results indicate that there were moderate and positive effects of exercise training on bone metabolism (OPG/RANKL ratio) (ES= 572, 95% CI= 220, 925, p < 0.001). Moderator analysis results showed that exercise type (resistance, endurance, a combination of both) partially explained the heterogeneity of ESs (Q= 7.70, df= 2, p= 0.021). The endurance exercise has the highest ES across the groups (ES= 1.34, 95% CI= 0.67, 2.01). However, gender, age, and intervention duration did not influence on the size of the effect. CONCLUSION: The exercise training significantly improves a bone metabolism marker (OPG/RANKL ratio), and the endurance exercise seems to be more effective type of exercise.

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<th>Board #125</th>
<th>May 27 10:30 AM - 12:00 PM</th>
<th>BONE MINERAL DENSITY, BODY COMPOSITION AND BLOOD PRESSURE IN YOUNG AND MENOPAUSAL RUNNERS AND NON-RUNNERS</th>
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<td>Doris J. Morris, Inbar Naor-Maxwell, L. Jerome Brandon, FACSM. Georgia State University, Atlanta, GA. (Sponsor: L. Jerome Brandon, FACSM) Email: <a href="mailto:dmorris@gsu.edu">dmorris@gsu.edu</a></td>
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309 (No relevant relationships reported)

The onset of menopause brings with it various changes in bone mineral density (BMD) and body fat (BF) distribution. Physical activity has been identified as a protective factor from many diseases, especially those that result in physical limitations. Weight bearing activities are recommended for osteoporosis prevention. However, it is unclear how chronic running affects the BF% and BMD in healthy menopausal (MEN) women. PURPOSE: This cross-sectional study was designed to assess the effects of chronic running on BMD and BF% in MEN women. The BMD and BF% was compared in young (YNG) and MEN women with and without a running (RUN); NOR history. METHODS: We recruited 169 Women (57 YNG/NOR (34.1 ± 9.9 yrs.), 34 MEN/NOR (55.4 ± 10.4 yrs.), 51 YNG/RUN (40.0 ± 8.7 yrs.) and 27 MEN/RUN (56.9 ± 8.9 yrs.) and evaluated them for differences and relationships between BMD, blood pressure (BP) and BF%. RESULTS: Although the MEN women were older, the MEN women did not differ for weight, BMI or body fat%. but did differ for BMD (MEN 1.17 vs YNG 1.24). Weight and central adiposity as measured by waist circumference was related to BMD (p < 0.05) in both RUN and NOR. Consistent with expectation, both MEN/ RUN and MEN/NOR had lower BMD (p < 0.05) than the YNG/RUN and YNG/NOR. The MEN/RUN had a higher BP than the other groups and this may have contributed to their BMD response not being higher than the NOR. CONCLUSIONS: Although further study is needed to validate the findings in this study, these data indicate that a history of running does not result in a higher BMD in MEN women. This may have been partially due to the fact that body composition was not different between the groups and therefore the runners were not placing greater stress on the bones.

310 Board #126 May 27 10:30 AM - 12:00 PM Relationships Of Bone Mineral Density And Muscular Performance In College Students

Erick Ramirez, Alexandre Khartabil, Yadira Marin, Guillermo Escalante, Bryan Haddock, FACSM, Zhaojing Chen. California State University, San Bernardino, San Bernardino, CA. (Sponsor: Bryan Haddock, FACSM) Email: dnmorris@gsu.edu

The skeletal system is adapted to mechanical loading such as gravity and muscle contraction. The current gold standard to assess the skeletal health is to use the Dual Energy X-ray Absorptiometry (DXA) to measure bone mineral density (BMD), however, the DXA is costly and not portable. Muscular performance assessment, such as grip strength and jump power, are fairly simple and affordable measurements. PURPOSE: To investigate the relationships between BMD and muscular performance in healthy young adults. METHODS: Thirty healthy college-age individuals, ten males (25.7 ± 1.9 years; 171.9 ± 6.7 cm; 81.8 ± 11.4 kg) and twenty females (23.1 ± 1.9 years; 161.8 ± 6.1 cm; 64.9 ± 15.3 kg), volunteered for the study. Scans of total body, lumbar spine, dual femur and dual forearm were obtained by the DXA by a technician. Muscular performance was assessed by grip strength, single-leg vertical jump, knee extension and flexion. Pearson’s correlations were used to examine the relationships between BMD, muscular performance, and body composition.

RESULTS: Radii BMDs were significantly correlated with grip strength at their corresponding side (r = 0.684 on the right and r = 0.744 on the left, p < 0.001 for both). Total hip BMDs and femoral neck BMDs had strong correlations with hamstring peak torque (PT) and jump peak power (PP) at their corresponding side (p < 0.001 for all) but not quadricipet PT (Table 1). We also found strong correlations between all sites BMD and body composition variables: total mass, total bone free lean mass (BFLM), legs BFLM, and arms BFLM (p < 0.05). CONCLUSION: Our results suggest that muscular performance assessments of grip strength, vertical jump and knee extension are potential alternative tools to estimate bone mineral density in young adults. Further study in a large population and all ages are needed for future investigation.

Table 1. Selected Pearson’s Correlation Coefficients (n=30)
BACKGROUND: Handgrip strength is thought to be correlated to bone mineral density and muscle mass. PURPOSE: To determine the relationship between handgrip strength and body composition measures (bone mineral density and muscle mass) in large scale.

METHODS: We recruited 728 volunteers aged ≥20 y. Maximal handgrip strength and average handgrip strength were measured in 10-consecutive attempts with maximal efforts. Rest interval between each grip was 3 s. Bone density and muscle mass of all participants were measured using iDXA.

RESULTS: Our data show that average handgrip strength of 10 repeated tasks was highly linearly correlated with lean body mass (r=0.76; p<0.01) and moderately linearly correlated with bone mineral density (r=0.23; p<0.01). The maximum grip strength of 10 attempts deems low correlation with muscle mass (r=0.33; p<0.01) and bone mineral density (r=0.23; p<0.01).

CONCLUSIONS: Multiple grip tests seems to be superior in reflecting muscle mass and bone mineral density than single maximal value of handgrip strength.

Trabecular Bone Score and Bone Mineral Density in Older Adults
Matthew C. Scott1, James Stamples1, Brett Davis1, Heather Quiriat1, Eunhan Cho1, Bailey Theall1, Josh Granger1, Neil M. Johannsen1, Steve B. Heymsfield1, Frank Greenway1, Brian A. Irving, FACSM2, ‘Louisiana State University, Baton Rouge, LA. 2Pennington Biomedical Research Center, Baton Rouge, LA. (Sponsor: Brian A. Irving, FACSM)

METHODS: For the present analyses, we included pre-training data from 19 older adults (X(SD): 71±14.2y, 4 black, 6 males) participating in an ongoing exercise intervention (REALPA). Whole-body and lumbar spine scans were acquired using a Hologic Horizon®A DXA scanner to determine BMD. TBS 

RESULTS: A strong correlation between both whole-body BMD and lumbar spine BMD (r=0.815; p<0.0001) was observed; this was also true for lumbar spine BMD and lumbar spine TBS (r=0.834; p<0.0001). Sex differences were found (males vs. females) for Whole-body BMD (g/cm²; 1.156±0.12 vs. 0.972±0.10, p<0.001), lumbar spine BMD (1.150±0.20 vs. 0.920±0.15, p<0.05), and lumbar spine TBS (1.409±0.10 vs. 1.285±0.09, p<0.05). CONCLUSION: The sex differences for BMD and TBS are consistent with the literature, with males having higher BMD and TBS. Strong correlations between BMD and TBS suggest that TBS bone has construct validity. However, future studies are still warranted to determine whether TBS scoring provides clinically meaningful insight into fracture risk beyond traditional BMD. Furthermore, future research studies are warranted to determine whether exercise induced changes in TBS are sensitive markers for exercise induced bone remodeling, which would provide additional insight into the clinical utility of TBS.

Bone stress injury (BSI) is an overuse injury reported in up to 20% of female runners. Many runners sustain recurrent BSI. However, the role of impaired bone properties and other risk factors in those with recurrent BSI remain to be characterized. PURPOSE: To identify bone features that distinguish women with a history of multiple BSI. METHODS: We enrolled 41 female runners, ages 18-30, with a history of 1 lower extremity BSI (1 BSI; n=15), ≥ 3 lower extremity BSIs (multi BSI; n=12), or no BSI (n=14), for this cross-sectional study. We collected high-resolution peripheral quantitative CT (HR-pQCT) scans of the distal tibia, areal bone mineral density (aBMD) by dual-energy x-ray absorptiometry, bone material strength index (BMSI) using microindentation (Ostearth), and questionnaires.

RESULTS: There were no differences between groups in age, BMI, age of menarche, or aBMD. Multi BSI had higher Eating Disorder Examination Questionnaire (EDE-Q) scores and prevalence of amenorrhea than no BSI (p<0.05). Adjusting for height and weight, multi BSI had smaller total tibial bone area (p=0.049, Fig.), and a trend for greater total and trabecular volumetric BMD (p=0.07, p=0.09, respectively) compared to no BSI. 1 BSI had higher BMSI compared to no BSI and multi BSI (p=0.04), and lower cortical porosity compared to no BSI (p=0.048). Among the cohort, BMSI was significantly associated with cortical porosity (p=0.04), but not with cortical vBMD, cortical tissue mineral density, or aBMD. EDE-Q score was inversely associated with total bone area (p=0.02).

CONCLUSIONS: Our findings suggest runners with multi BSI have smaller bones and higher EDE-Q scores than no BSI. Total and trabecular vBMD appear to be higher.
There have been few longitudinal studies beyond one year examining bone mineral density (BMD) in collegiate distance runners. Weight-bearing activity such as running tends to be osteogenic, however runners often experience bone injuries and may have site-specific deficiencies compared to norms. **PURPOSE:** Examine the BMD of Division I cross country runners across a two-year time frame. **METHODS:** BMD of 19 collegiate cross-country runners (12 men & 7 women) were measured via dual energy x-ray absorptiometry at the beginning of the season for three consecutive years (v1, v2, v3). A repeated measures multivariate analysis of covariance (whole body lean energy x-ray absorptiometry at the beginning of the season for three consecutive years (v1, v2, v3)) was used to compare BMD values of men and women runners at four sites: AP spine (APBMD), femoral neck (FNBMD), whole body (WBBMD), and the non-dominant forearm (FABMD). **RESULTS:** Women had a significant decrease from v1 to v2 (1.240 ± 0.048 gm cm⁻² vs 1.194 ± 0.048 gm cm⁻², p=0.003) and v1 to v3 (1.240 ± 0.048 gm cm⁻² vs 1.195 ± 0.043 gm cm⁻², p=0.002) in WBBMD and men had a significant increase from v1 to v3 (0.441 ± 0.029 gm cm⁻² vs 0.450 ± 0.028 gm cm⁻², p=0.018) and v2 to v3 (0.425 ± 0.026 gm cm⁻² vs 0.450 ± 0.028 gm cm⁻², p=0.003) in FABMD. Men and women had similar BMD at all sites. Z-score analysis using <-1.0 as the cutoff for low BMD revealed that two women had a low z-score at the AP spine at all three points, one woman had a low z-score at the FN at all three time points, and low WB z-scores increased from one to three woman across the three visits. For the men at the AP spine, low z-scores decreased from three to one across the three visits, at FN no men had a low z-score, and there was only one male with a low z-score for WB (v3). For available data at the forearm, one woman and six men had low z-scores at v3. **CONCLUSIONS:** The AP spine in women may be a site of deficiency compared to norms. Males of this age may still be accruing bone at the AP spine and FA. Two years, with a significant increase in the FABMD, however, 50% of men had a low z-score at this site. Males of this age may still be accruing bone at the forearm. There have been few longitudinal studies beyond one year examining bone mineral density (BMD) in collegiate distance runners. Weight-bearing activity such as running tends to be osteogenic, however runners often experience bone injuries and may have site-specific deficiencies compared to norms. **PURPOSE:** Examine the BMD of Division I cross country runners across a two-year time frame. **METHODS:** BMD of 19 collegiate cross-country runners (12 men & 7 women) were measured via dual energy x-ray absorptiometry at the beginning of the season for three consecutive years (v1, v2, v3). A repeated measures multivariate analysis of covariance (whole body lean energy x-ray absorptiometry at the beginning of the season for three consecutive years (v1, v2, v3)) was used to compare BMD values of men and women runners at four sites: AP spine (APBMD), femoral neck (FNBMD), whole body (WBBMD), and the non-dominant forearm (FABMD). **RESULTS:** Women had a significant decrease from v1 to v2 (1.240 ± 0.048 gm cm⁻² vs 1.194 ± 0.048 gm cm⁻², p=0.003) and v1 to v3 (1.240 ± 0.048 gm cm⁻² vs 1.195 ± 0.043 gm cm⁻², p=0.002) in WBBMD and men had a significant increase from v1 to v3 (0.441 ± 0.029 gm cm⁻² vs 0.450 ± 0.028 gm cm⁻², p=0.018) and v2 to v3 (0.425 ± 0.026 gm cm⁻² vs 0.450 ± 0.028 gm cm⁻², p=0.003) in FABMD. Men and women had similar BMD at all sites. Z-score analysis using <-1.0 as the cutoff for low BMD revealed that two women had a low z-score at the AP spine at all three points, one woman had a low z-score at the FN at all three time points, and low WB z-scores increased from one to three woman across the three visits. For the men at the AP spine, low z-scores decreased from three to one across the three visits, at FN no men had a low z-score, and there was only one male with a low z-score for WB (v3). For available data at the forearm, one woman and six men had low z-scores at v3. **CONCLUSIONS:** The AP spine in women may be a site of deficiency compared to norms. Males of this age may still be accruing bone at the AP spine and FA.
High-impact training has shown to induce benefits in bone structure, mineralization, and strength. However, a dose-response relationship has not been established, and the acute response of biochemical bone turnover markers (BTM) after jumping has not been examined.

**METHODS:** To compare the acute BTM response and the associated ground reaction forces (GRF) induced by three different jumps for postmenopausal women.

**RESULTS:** In a randomized controlled cross-over study over three days, twenty-nine postmenopausal women (age (mean±SD): 60.0±1.6 years) were randomly assigned to 6x10 repetitions of three jumps: counter-movement jump (CMJ), drop jump (DJ), diagonal-drop jump (DDJ). A fourth day without jumping served as control (C).

Blood samples were collected before (PRE), after (POST), and 2-hours after (2Hr) exercise. Procollagen type-1 amino-terminal propeptide (P1NP), Osteocalcin (OC) and C-terminal telopeptide of type-1 collagen (CTX) were evaluated by a fully automated immunoassay system (SYSYS, ImmunoDiagnostic Systems Ltd., Bolton, England) by the method of Chemiluminescence. Peak sagittal (Fx), transversal (Fy), and vertical (Fz) GRF were measured by an AMTI (©Advanced Mechanical Technology Inc., Watertown, MA 02472-4800 USA) SGA6-4 force platform and the combined three-axis peak GRF was calculated. The BTM differences between PRE, POST, and 2Hr were tested with linear mixed models, and the differences in GRF between the jumps were tested with repeated ANOVA. Linear regression analyses were used to assess the correlation between ΔBTM and the associated GRF in each type of jump.

**RESULTS:** At POST, P1NP was increased (p<0.01) by 7.7±1.8% (CMJ), 9.4±1.3% (DJ), and 10.6±1.6% (DDJ), which were higher (p<0.05) than C. OC was increased (p<0.05) by 5.5±1.8% (DDJ), which was higher (p<0.05) than C. CTX was not significantly changed at POST. There were no significant differences in ΔBTM between the jumps at any time point. In CMJ, APINP POST correlated (p<0.05) with the combined three-axis peak GRF (r=0.71). CONCLUSION: The acute, jumping-induced increase in P1NP and OC without any rise in CTX indicates an osteogenic change in bone turnover in favor of bone mineralization, which based on the relationship between the combined three-axis peak GRF and the acute P1NP response after CMJ seems to be dose-dependent.

**CONCLUSIONS:** Adaptation to fast bowling, in terms of whole vertebra and site-specific bone mineral, substantially increases with age particularly on the ND side.

**Abstracts were prepared by the authors and printed as submitted.**
METHODS: Virgin female Sprague-Dawley rats (n=52; 4-mo-old) were singly housed and randomly assigned to placebo (PL) and LARC groups, via an implanted slow-release etonogestrel pellet (0.00ug/d vs. 0.30ug/d). A week later, animals were further randomized to weight bearing (WB) and HU groups (n=13/subgroup) for 6 weeks. Calcine injections were delivered 9 and 2 days prior to termination. Pre-post-HU, proximal tibia metaphysis (PTM) and the tibia mid-diaphysis (TD) were scanned with in vivo peripheral quantitative computed tomography. At termination tibiae were stored for mechanical testing and dynamic/static histomorphometry. Univariate and repeated measures 2-way ANOVA were used.

RESULTS: Despite increasing their food intake during HU (p<0.01), HU animals lost weight and weighed less than WB animals starting on HU week 2 (p<0.01). Irrespective of pellet type, HU resulted in a loss of total and cancellous volumetric BMD (vBMD) at the PTM (p<0.01), reduced cortical thickness at the PTM and TD (p<0.01), and reduced endosteal and periosteal mineralization (MS/HS, MAR, and BFR; p<0.02) at the TD compared to WB animals. Irrespective of loading group, at the PTM LARC animals lost cancellous vBMD (p<0.05), but had an increase in osteoid (organic bone matrix; p<0.04) compared to PL animals. PTM HV/TV and Tb.Th were greater in PL-WB animals compared to PL-HU animals only (p<0.04). Similarly, ultimate force was greater in PL-WB animals compared to PL-HU animals only (p<0.02).

Conclusions: On balance, LARC implantation did not blunt nor worsen the bone response to unloading. LARC appear to be a viable option for premenopausal female astronauts selected for long-duration missions. This work is supported by the Translational Research Institute for Space Health and funded under the NASA Human Research Program.

PURPOSE: To examine differences in total BMD and BMD at the femoral neck and mid-shaft between female power lifters (PL), Olympic lifters (OL), soccer players (SP), and recreationally active individuals (RA).

METHODS: Thirty-seven females participated in this study: 10 PL, 8 OL, 8 SP, and 11 RA (mean age = 24.5 ± 7.9 years). Total BMD, BMD at lumbar vertebrae L1-L4, and BMD at the femoral neck of the dominant leg were measured along with body composition (total fat mass, lean mass, and percent body fat) with dual-energy x-ray absorptiometry. Body composition components were compared across groups with a one-way ANOVA. BMD measures were compared across groups with an ANCOVA with weight, height, and body mass index as covariates. Tukey’s tests were used for post-hoc analysis. Significance was accepted at P < 0.05.

RESULTS: All three athletic groups had greater total BMD than RA (1.071 ± 0.066 g/cm²). OL (1.306 ± 0.08 g/cm²) had greater total BMD than PL (1.071 ± 0.07 g/cm²), but it was not different than SP. At the femoral neck, OL (1.127 ± 0.09 g/cm²) and SP (1.212 ± 0.10 g/cm²) [but not PL (1.075 ± 0.16 g/cm²)] had greater BMD than RA (0.971 ± 0.09 g/cm²). BMD at the femoral neck was greater in SP than in PL, with no difference between OL and PL. At lumbar spine sites L2 - L4, there was no difference across the three athletic groups. OL and PL had a greater BMD than RA at L2-4, whereas SP had greater BMD than RA only at L4. There was no difference across all groups at L1.

CONCLUSION: Olympic lifting includes both high- and odd- impact movements in addition to high-force loading. Olympic lifters showed similar BMD at the femoral neck as soccer players and similar BMD in the lumbar spine as power lifters. Thus, Olympic lifting may have greater BMD effects in the two key regions that are susceptible to injury compared to sports that do not combine power and odd-impact training.

POWER Lift is dependent on bone mineral density (BMD), and easily measurable with Dual energy x-ray absorptiometry (DXA) scans. DXA scans were originally used to determine total body and regional bone mineral content and areal density measures. Advances in DXA scanning technology and accompanying software allows provides total body and regional soft tissue analyses, the ability to analyze uniquely created regions of interest, and anatomical measures including structural angles and segmental length.

PURPOSE: To determine the intraoperator and interoperator reliability of leg length measurements using total body DXA scans. METHODS: Total body DXA scans from 53 young children were acquired. Right and left leg lengths were determined twice (consecutively) by two investigators (Invest 1 and Invest 2). Leg lengths were determined as the vertical distance from the most proximal point of the head of the femur to the proximal aspect of the medial malleolus of theibia following view enlargements of the legs on the DXA analyses computer screen. Group mean differences, explained variance, and calculation of the 95% confidence intervals were determined and results are expressed as mean ± SE, and significance p<0.05.

RESULTS: Intraoperator reliability for Invest 1 right leg length (66.48 ± 0.10 cm) and left leg length (66.49 ± 0.10 cm)愉快 (r² = 0.999) and left leg (66.66 ± 0.10 cm; r² = 0.999) and left leg (66.47 ± 0.10 cm; r² = 0.999) resulted in no significant group mean differences, and significant explained variance. Subsequently, the group mean of the right and the left leg lengths were used for both Invest 1 and Invest 2 to determine the interoperator reliability. Similarly, no significant group mean differences and significant explained variance were found for the right leg length (66.49 ± 0.10 cm versus 66.26 ± 0.10 cm; r² = 0.998) and the left leg (66.62 ± 0.10 versus 66.65 ± 0.10 cm; r² = 0.973). Bland Altman plotting resulted in mean differences of 0.23 cm and 0.17 cm; with the 95% confidence intervals ranging from 2.55 to 0.08 cm and 2.60 to -2.26 cm for the right and left legs, respectively. CONCLUSION: Leg lengths measured from total body DXA scans provide highly reliable measures and may provide greater accuracy than traditional measures using anthropometric tapes due to the elimination of soft tissue.
Purpose: Bone mineral density (BMD) is used as an indirect indicator of risk of osteoporosis and bone fracture. Both swimming and running have been found to have a positive effect on bone mineral density. A comparison of the effects of swimming and running on bone mineral density in humans has not yet been performed. The purpose of this study was to compare the effects of running and swimming on bone mineral density in young individuals versus mature individuals and to compare intrinsic variables of body weight, height, gender, years swimming or running, distance ran or swam per week, and hours of physical activity per week.

Methods: This was a quantitative, correlational study that sought to determine whether statistically significant differences in bone mineral density exist between swimmers and runners across the lifespan. Heel bone mineral density of each participant was assessed using the GE Achilles Ultrasonometer.

Summary of Results: This study included 54 total participants with 12 runners under age 30, 18 runners over age 30, 11 swimmers under age 30, and 13 swimmers over age 30. No statistically significant differences in bone mineral density existed between swimmers and runners in the young adult or mature adult groups (P = 0.618). Athlete weight was the only factor that had statistically significant differences in bone mineral density. The results do not indicate that the mode of activity (swimming/running) correlates with significantly different findings in BMD.

Conclusion: No correlation between mode of activity and bone mineral density can be established at this time. The degree of activity cannot be determined due to the study’s correlational nature. The results demonstrate that swimming and running have similar effects on bone density. Athlete weight had statistically significant differences in bone mineral density. This indicates that the overall body weight plays a larger role in the formation/maintenance of bone mineral density than activity selection did in this study.

The role of diet in bone health has been widely researched. Numerous studies have concluded that dietary calcium is important for the development of healthy bone but the relationship between cholesterol and saturated fat, which may hint at the role of animal protein in bone health, has drawn less attention among researchers.

Purpose: The purpose of this study was to determine the association between dietary cholesterol and saturated fat intake, and bone mineral density (BMD) among women based on calcium intake levels. Methods: A total of 41 women (38.90 ± 7.92 years) were included in this study. Anthropometric data were collected and BMD (g/cm²) was measured at the hips, femoral, neck, and lumbar spine with a Hologic dual energy x-ray absorptiometry machine. Dietary intake was assessed using a 3-day food diary. Participants were divided into two calcium intake groups based on average daily calcium intake: a calcium sufficient group (calcium intake ≥ 75% of the recommended intake) and a calcium deficient group (calcium intake < 75% of the recommended intake). Results: Among the calcium sufficient group, a significant positive correlation (p < 0.05) was found between lumbar spine BMD and dietary cholesterol intake (r = 0.41, p = 0.020) and dietary cholesterol intake (r = 0.41, p = 0.020). A significant positive correlation (p < 0.05) was found between femoral neck BMD and saturated fat intake (r = 0.37, p = 0.038) but this association disappeared after controlling for protein intake. No significant correlations were found between the calcium deficient group. Among the calcium sufficient group, regression analysis indicated that dietary cholesterol was a significant predictor of lumbar spine BMD only (F(1,30) = 6.02, MSE = 0.03, p = 0.020, Adj. R² = 0.14). Conclusions: Among a group of calcium deficient women, it appears that other nutrients are not associated with BMD. For women who are receiving an adequate amount of calcium, cholesterol and saturated fat intake are both associated with higher BMD. Of particular interest was the positive correlation between dietary cholesterol and lumbar spine BMD even after controlling for protein intake which might indicate the importance of animal sources of protein for bone health. Future research should examine the role of animal protein compared to non-animal protein on BMD.
PURPOSE: The purpose of this cross-sectional study was to examine the relationships among percent body fat (%BF), areal bone mineral density (aBMD) and non-dominant handgrip strength in healthy college-aged students. METHODS: Healthy college-aged women (n=73, 20.4±1.3 years; 163.5±7.1 cm; 64.7±11.3 kg) and men (n=59, 21.1±1.4 years; 177.4±5.7 cm; 77.7±10.6 kg) between the ages of 18 and 25 years were recruited from the University of Massachusetts Lowell. Body composition (%BF) and aBMD of the non-dominant side of femur (FN: femoral neck, TH: total hip) and lumbar spine (L1-L4) were measured by dual energy X-ray absorptiometry. Isometric handgrip test was measured by JAMAR Dynamometer, and the average of three trials of the non-dominant side was used for data analysis. The total bone-specific physical activity (tBPAQ, average of past and current BPAQ) score was used to obtain a comprehensive account of lifetime physical activity related to bone health. RESULTS: Partial correlation tests showed significantly negative relationships between %BF and aBMD of the non-dominant FN (r_{SR}=-.387, p=.002), TH (r_{SR}=-.458, p=.0001), and lumbar spine (r_{SR}=-.446, p=.0001) in young women, while controlling for tBPAQ and BMI. Similarly, FN (r_{SR}=-.453, p=.001), TH (r_{SR}=-.425, p=.001), and lumbar spine (r_{SR}=-.291, p=.034) were found in young men. In addition, higher %BF had a negative impact on isotonic hand grip strength in both women (r_{SR}=-.446, p=.0001) and men (r_{SR}=-.410, p=.002), respectively. CONCLUSIONS: Our data suggests that regardless of BMI and physical activity, %BF can adversely affect musculoskeletal health in young adults. These results have important implications for prevention of future loss of aBMD in young adults, individuals who may be overweight or obese, and individuals undergoing weight loss.

Tobacco use is common and is associated with less favorable bone properties in older adults at risk for osteoporosis. Baseline bone properties are related to stress fracture risk in military populations. Whether a history of tobacco use is associated with less favorable bone microarchitectural properties in military recruits is unknown. PURPOSE: To examine the influence of prior tobacco use on bone microarchitecture using data from a large prospective field study (789 men and women from a larger planned cohort of 4000 U.S. Army recruits). METHODS: We collected high-resolution peripheral quantitative computed tomography images of the ultradistal tibia at the 4% site during the first week of basic combat training (BCT) from 556 male and 233 female recruits. Also, self-reported history of tobacco use was assessed via questionnaire. Generalized linear models stratified by sex were used to evaluate the relationship between a history of tobacco use and baseline bone microarchitecture. Models were further stratified by tobacco type. All models were adjusted for prior physical activity, recruit and parents' level of education, race/ethnicity, age, and body mass index (BMI). RESULTS: 21.29% of recruits reported prior tobacco use. Tobacco users were more likely to be male (25.5%, p<0.0001) and white (26.8%, p=0.0007). There were no differences in tobacco use by socioeconomic status, prior physical activity, or BMI. At the ultradistal tibia, tobacco use in female recruits was associated with lower indices of cortical thickness and cortical area, with decrements ranging from -2.53% to -10.46% depending on the method of tobacco consumption (all p<0.05). In male recruits, use of tobacco pipe was associated with a 17.39% lower cortical thickness (p=0.026). There were no significant differences reported in trabecular bone parameters associated with prior tobacco use in male or female recruits. CONCLUSIONS: These data show that tobacco use, particularly female recruits, with a history of tobacco use may enter BCT with some less favorable microarchitectural properties, potentially placing them at greater risk for stress fracture, although this remains to be determined.

The signaling pathway responsible for muscle hypertrophy following testosterone replacement therapy (TRT) and resistance training (RT) has not been elucidated after spinal cord injury (SCI). Furthermore, it is unclear whether evoking muscle hypertrophy improves mitochondrial citrate synthase activity (CS) and Complex III (CIII) activities after SCI. PURPOSE: To examine the effects of TRT+RT compared to TRT only on protein expression of markers associated with muscle hypertrophy, substrate utilization and mitochondrial biogenesis in men with SCI. METHODS: Twenty-two men with motor complete SCI were randomized to 16 weeks of TRT+RT or TRT only. Evoked progressive RT using neuromuscular electrical stimulation (2 lb. increments) was administered twice weekly. TRT patches (2-6 mg/day) were applied at bedtime. Muscle biopsies were captured before and after 16 weeks from the right vastus lateralis. Protein expression of markers associated with muscle hypertrophy were evaluated [FAK, total and phosphorylated Akt, total and phosphorylated mTOR] and substrate utilization and mitochondrial biogenesis [GLUT4, PGC1α, total and phosphorylated AMPK]. Mitochondrial CS and CIII activity were also measured. RESULTS: TRT+RT demonstrated a 27.5% increase (P=0.01) in average fiber CSA compared to a -9% decrease following TRT only. Circulating IGFBP-3 increased (P=0.001) in both TRT+RT (1764±665 to 2548.5±853 ng/ml) and TRT (1918.5±587 to 2778±967 ng/ml). GLUT4 was elevated in the TRT+RT group compared to the TRT only (P=0.005). Total Akt (P=0.06) and phosphorylated Akt/Sec389 (P=0.049) were also elevated in the TRT+RT group. Mitochondrial CS (34% P=0.006) increased in the TRT+RT group. CONCLUSION: Sixteen weeks of TRT+RT resulted in hypertrophy of myofibers that was associated with increased protein expression and markers of activation of Akt. This was further associated with elevations in GLUT4 protein expression and markers of mitochondrial function in persons with SCI.

Spinal cord injury (SCI) adversely affects testosterone levels and bone quality. Resistance training (RT) and testosterone replacement therapy (TRT) have been shown to improve muscle quality in SCI. Such improvements to muscle quality may also result in improved bone quality. PURPOSE: To examine if combining open kinetic chain RT and TRT (TRT+RT) can be beneficial to trabecular bone quality following SCI. METHODS: Nine subjects with SCI were randomized into a TRT+RT group for a 16-week intervention. Each subject also underwent magnetic resonance imaging (MRI) prior to (BL) and following the intervention (PI). MRI microarchitecture techniques were used to evaluate trabecular bone quality, measured as plate width (PW; μm), trabecular bone thickness (TBTh; μm), trabecular bone spacing (TBSp; μm), and network area (NA; 1/mm) for the right proximal tibia (ProxT) and distal femur (DistF). Mixed models with random effects were used to calculate differences between BL and PI (MD ± SE) and were then transformed to effect sizes similar to Cohen’s d (95% CI [effect size]). RESULTS: Following the intervention, ProxT PW (MD: 30.56 ± 22.52, d: 0.48, -0.21 to 1.17 [medium]), TBTh (MD: 0.02 ± 0.01; d: 0.70, 0.01 to 1.39 [medium]), and NA (MD: 0.04 ± 0.02; d: 0.05, -0.05 to 1.33 [medium]) all increased from BL measures. In contrast, TRST (MD: -0.25 ± 0.17; d: -0.52, -1.22 to 0.17 [medium]) decreased from BL. The DisF similarly presented with increases in both PI compared to BL for PW (MD: 11.7 ± 42.70, d: 0.10, -0.60 to 0.79 [negligible]), TBTh (MD: 0.01 ± 0.01; d: 0.29, -0.41 to 0.98 [negligible]), and NA (MD: 0.03 ± 0.03; d: 0.39, -0.30 to 1.08 [small]), as well as decreases in TBSp.
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Board #150
May 27 10:30 AM - 12:00 PM
Hypermobility Characterization In Participants With Down Syndrome Attending An Instructor Led Controlled Adaptive Exercise Setting
Bradley D. Clark, Amy L. D. Valadez, Daniela A. Rubín, FACSM, Cal State University, Fullerton, Fullerton, CA. (Sponsor: Daniela Rubín, FACSM)
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Introduction/Background: Joint hypermobility (JHM) and hypotonia are features shown in people with Down Syndrome (DS). Adaptive Exercise Programs adapt not only to the physical but also to behavioral and intellectual challenges. This study characterized JHM and related measures in a sample of adults with DS attending an adaptive exercise program.

Methods: Thirteen adults with DS (11 males and 2 females, 28.5 ± 3.2 y, height: 158.6 ± 8.4 cm, body mass: 78.22 ± 15.03 kg) participated. Participants attended adaptive exercise programming twice a week for ≥ 9 months. Tests included range of motion (AROM) measured three times (median score reported), JHM was determined through the 9-point Bighton scale, upper body (hand-grip dynamometer) and lower body (30-second sit-to-stand) strength.

Results: Means ± SD for AROM included: shoulder extension = 21.3 ± 8.9°, shoulder flexion = 179.0 ± 9.7°, shoulder abduction = 174.9 ± 8.8°, shoulder medial rotation = 59.2 ± 13.2°, shoulder lateral rotation = 86.1 ± 11.6°, hip extension = 143.4 ± 5.8°, hip flexion = 94.0 ± 13.6°, hip abduction = 27.8 ± 8.4°, hip adduction = 17.1 ± 4.5°, hip medial rotation = 31.5 ± 6.3°, hip lateral rotation = 31.9 ± 5.6°, ankle dorsiflexion = 16.6 ± 8.2°, ankle plantarflexion = 44.9 ± 8.2°, subtalar eversion = 19.2 ± 6.0°, subtalar inversion = 25.9 ± 6.0°, and hip lateral rotation = 27.9 ± 5.6°. Participants presented with: no JHM 38.4% (n=5) and persistent hypotonia. Despite the sizable incidence of JHM, JHM was more prominent in lower body (30-second sit-to-stand) strength.

Conclusion: There were not significant correlations between JHM and muscle strength (r=-0.338, p=0.259) or physical function (r=-0.085, p=0.220).

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Board #151
May 27 10:30 AM - 12:00 PM
Lean Mass Changes After 10-week Resistance Training Intervention In Adults With Down Syndrome
Emily M. Post, Madison L. Kackley, Lydia K. Caldwell, Matthew K. Beeler, Carl M. Maresh, FACSM, Brian C. Focht, FACSM, Jeff S. Volek, William J. Kraemer, FACSM, The Ohio State University, Columbus, OH. (Sponsor: William Kraemer, FACSM)
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Purpose: To examine changes in body composition (i.e. lean mass) after a 10-week resistance training intervention in individuals with Down syndrome.

Methods: Data was collected on willing 18 - 40-year-old moderately active men and women with Down syndrome (age 24.4 ± 6.3 years, height 149 ± 11.2 cm, weight 72.0 ± 24.5 kg). Twelve participants completed 24 resistance training sessions (duration 45 - 60 minutes per session). Dual x-ray absorptiometry (DXA) was used to assess body composition both pre- and post-intervention (i.e. body fat, lean tissue mass, fat tissue, bone density). A nonlinear periodized resistance exercise program was implemented; made of light, moderate, and heavy resistances. The participants began the first two weeks of the intervention with exercises using 12-15 RM Zone repetitions and moderate 8-10 RM Zone progression from 1-3 sets over the two-week period of time. After that flexible period, using light, moderate, and heavy (4-6 RM zone) for 3 sets were rotated with toleration of the work out noted each training session. The resistance training intervention utilized a body part bodybuilding training program 3 days per week (chest, back, upper body, lower body). The exercises consisted of body weight exercises, machine based, resistance bands, and free weight exercises. Each program was individualized per participant regarding specific exercises based off of movement kinematics, understanding, skill, and strength levels. Participants were kept in a light to moderate intensity heart rate range via heart rate chest monitoring strips.

Results: There were no significant difference between pre- and post-intervention for body mass (p=0.23), body fat (p=0.85), or bone mineral density (p=0.078). However, there was a significant increase between pre- and post-intervention in lean mass (p=0.033).

Conclusion: A 10-week moderate resistance training intervention is a great enough stimulus to significantly increase lean muscle tissue in adults with Down syndrome.

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Board #152
May 27 10:30 AM - 12:00 PM
Alterations In Musculoskeletal Function And Body Composition In Children With Autism Spectrum Disorder
Monica C. Orosa, Stephanie V. Rosales, Kautialanpi P. Kekuawela, Areum K. Jensen. San Jose State University, San Jose, CA.

Purpose: To determine whether differential body composition may affect muscular strength and function in children with ASD

Methods: Total of 40 adults, TDC and children with ASD participated in the study. Muscular strength (i.e., torque, work, and power) during knee extension and flexion was measured at 90, 150, and 210°/sec in the lower extremity using Humac Norm Isokinetic Dynamometer. Maximal isometric muscular strength was measured using a handgrip dynamometer. Body mass index (BMI), waist-to-hip ratio, and whole-body scan from Dual Energy X-Ray Absorptiometry were used to identify the body fat mass.

Results: Compared to controls, TDC and ASD had lower BMI (20.1±0.7 TDC, 22.3±4.4 ASD vs. 27.2±2.3 Adults, kg/m²). All groups had similar percent body fat (26.4±2.3 Adults, 29.8±1.83 TDC, 32.9±3.84 ASD, %) and percent lean body mass (69.5±2.2 Adults, 66.8±1.7 TDC, 64.4±3.6 ASD, %). However, compared to TDC, ASD children had significantly lower bone mass percentage (2.7±0.3 ASD vs. 3.2±0.2 TDC, %). Waist-to-hip ratio was significantly higher for ASD (0.91±0.04 ASD vs. 0.85±0.01 TDC).

Conclusion: The maximal and leg strength were significantly lower in ASD compared to TDC normalized for their body weight (30.2±5.2 ASD vs. 42.8±2.5 TDC, kg). There is a significant inverse relationship with muscular strength and regional percent fat in the forearm.

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Board #153
May 27 10:30 AM - 12:00 PM
Acute Effects Of Photobiomodulation Therapy On Muscle Force Recovery In Persons With Multiple Sclerosis
Mitra Rouhani1, Miguel Tolentino2, Erik Queoff3, Chris Cho4, Jeri-Anne Lyons5, Alexander V. Ng, FACSM. 1. Marquette University, Milwaukee, WI. 2.University of Wisconsin-Milwaukee, Milwaukee, WI.
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Purpose: To investigate PBMT on muscle force recovery after a fatiguing contraction in PwMS. A secondary aim was to determine if self-reported symptom outcomes influenced the response to PBMT.

Methods: Randomized double-blinded repeated-measures design. Ambulatory male and females (n=17, 14 females) with relapsing-remitting MS were evaluated pre- and post-PBMT in 4 visits over 4 weeks. The muscle function measurements consisted of 3 maximal voluntary contractions (MVCs) of Tibialis Anterior (TA) muscle.

Abstracts were prepared by the authors and printed as submitted.
followed by 2 min. of intermittent isometric contraction at 45% MVC. PBMT was then administered to the TA muscle belly at 1 of 4 energies: 40J, 80J, 120J or placebo (active device: 3 pulsed wavelengths at the same time including 640nm, 875nm, and 905nm, placebo device: single pulsed wavelength at 640 nm). After PBMT, recovery MVC’s were obtained. Baseline psychosocial measurements comprising depression (CES-D), fatigue (MFIS) and QOL (PROMIS) were obtained during visit 1. McNemar’s test was used to test for each light dose compared to placebo and Spearman’s correlations were compared with Fisher’s r to a transformation.

RESULTS: All subjects were able to recover strength to within 12% of their initial strength during the 120J visit. However, 6/17 subjects did not recover to the same degree after the placebo. This difference in force recovery between high (120J) dose and placebo was significant with p=0.03. Muscle recovery correlations with depression and QOL differed between 120J vs. Placebo (0.35 vs. -0.44, p=0.03 and -0.09 vs. 0.67, p<0.03, respectively).

CONCLUSIONS: PBMT at 120J may improve muscle force recovery in PwMS. Those reporting greater depression, or lower QOL may benefit most from PBMT. Supported by a pilot grant from the National MS Society.
The alignment of the muscle fibers has a significant effect on the strength and function. A number of studies have suggested that the properties of muscle architecture are related to muscle strength in many pathological conditions. However, there is no study describing the relationship between muscle strength and muscle architecture in multiple sclerosis (MS) patients.

**PURPOSE** To determine the muscle architecture (pennation angle, muscle fiber length and muscle thickness) of the lower extremity muscles in MS patients and to compare with healthy peers.

**METHODS** Fifteen patients with MS and 10 age and sex matched 10 matches healthy volunteers included in the study. Muscle thickness and pennation angle of the rectus femoris (RF), biceps femoris (BF), tibialis anterior (TA), gastrosoleus (GS) and gastrocnemius (GC) muscles were assessed by B-mode ultrasonography. The fascicle length was calculated with pennation angle and muscle thickness values. Muscle strength was assessed with using digital hand-held dynamometer.

**RESULTS** Pennation angles of RF, BF, TA were lower in MS patients (respectively, p<0.002, p=0.023, p=0.002). There was no difference in fiber length of all muscles Only in rectus femoris, thickness was lower then control group (p=0.015). Moreover, there was a positive correlation between rectus femoris muscle thickness and knee extensor muscle strength (p=0.014, r=0.744).

**CONCLUSIONS** We found that the muscle architecture was affected in MS patients. Determining the muscle architecture alterations in patients with MS may provide building novel and efficient loading models in related muscles.

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**Muscle glycogen content (MGC) has the potential to impact exercise performance and has implications for timing of exercise testing & prescription. Previously difficult to assess, MGC can now be estimated non-invasively using ultrasound imaging.**

**PURPOSE** The aim of this study was to compare changes in muscle glycogen scores across the menstrual cycle using ultrasound imaging. METHODS: Twenty-eight subjects (10 male; 18 female) ages 18-30 (24.0 ± 2.78) participated in this study. Subjects were divided into Control (CON; 10 male), Non-Contraceptive (NC; 8 Female), and Oral-Contraceptive (OC; 10 Female) groups. Measurements at 22, 56, & 73% of the thigh were taken on the vastus medialis, vastus lateralis, & rectus femoris of the dominant leg using ultrasound. Subjects were measured at the follicular, ovulatory & luteal phases of the menstrual cycle. Using ImageJ, muscle pixelation values were determined by capturing a 25 x 8 mm section of the muscle directly below the superficial aponeurosis. The mean of three images from each site were then taken and adjusted for gain setting to calculate a total leg MGC score. A higher pixelation value corresponds to a lower MGC score and vice versa. A repeated-measures ANOVA (group X time) with post-hoc comparisons was performed to assess differences across groups and visits. RESULTS: No significant differences in MGC were observed between visits or groups (all p>0.05). The CON (0.96 ± 0.21, 0.82 ± 0.10, 0.86 ± 0.23) and the OC (1.05 ± 0.17, 0.94 ± 0.17, 1.01 ± 0.18) groups showed a tendency to increase MGC during the ovulatory visit but for the NC group (0.97 ± 0.15, 1.05 ± 0.27, 0.91 ± 0.15) to decrease (Figure 1). CONCLUSIONS: While there were no significant effects found, there was a trend for the MGC of the CON and the OC groups to increase during the ovulatory visit but for the NC to decrease. Further research is needed to fully understand the implications of these changes during the menstrual cycle and how it relates to exercise performance.
RESULTS: Our panoramic measures showed excellent intertester reliability for length, area and thickness measurements (ICC = 0.981, 0.982, 0.985, respectively). In addition, the SEM for length, area and thickness were SEM = 0.178, 0.078, 0.046, respectively.

CONCLUSIONS: Our method of assessing TrA morphology showed excellent reliability in the three dimensions measured and had low error rates that were equal to or better than those associated with other muscles previously measured. Panoramic imaging seems to be a reliable technique that could be used to visualize the whole TrA muscle in one image. Comparison to MRI images would further help establish its validity.

Measurements of CSA using US in selected leg muscles were comparable to or better than those associated with other muscles previously measured. Panoramic US measures using the Pearson product correlation.

RESULTS: Seven male athletes sustained HSI (mean age = 19.1 ± 0.8 yrs). PSFR (1/mm) was lower (p = 0.003) in the injured limb (0.81 ± 0.22) compared to the uninjured limb (0.95 ± 0.18). Mmax% was also lower (p = 0.023) in the injured limb (1.44 ± 0.41) compared to the uninjured limb (2.03 ± 0.56). Both measures indicated decreased tissue organization in the injured limb, characterized by disruption of the reflected fascicular banded pattern. CONCLUSION: SF analysis successfully detected differences between injured and uninjured muscle tissue. Although differences in SF parameters between limbs cannot differentiate whether alterations are due to mechanical disruption of fascicles or presence of edema, this method may have promise in identifying structural changes following HSI and in monitoring changes throughout recovery.

Supported by NBA & GE Healthcare Orthopedics and Sports Medicine Collaboration and NIH Grant U54TR002373 and U54TR002375.
It has been suggested that changes in echo-intensity (EI) measured through ultrasound can detect the presence of muscle swelling. However, the time course of changes in EI has never been examined relative to a non-exercise control condition following naïve exercise. PURPOSE: To determine changes in tendon mechanical characteristics (MT), ST, and ISOR as assessed by myotonometry and the isometric strength (ISOR) immediately post exercise. METHODS: 27 resistance trained individuals visited the laboratory 4 times. During visit 1, paper work and maximum strength were measured. During visit 2 (2-7 days later) participant’s MT and ISO were measured in both arms before performing 4 sets of biceps curls in a randomized arm. Additional measures were taken immediately after exercise, as well as 24 and 48 hours after exercise.

MT images were saved for EI measurement. Results are displayed as means (SD). RESULTS: For MT there was an interaction (p < 0.001). MT increased from pre [2.88 (0.64) cm] to post [3.27 (0.67) cm] exercise and remained elevated above baseline 24 [3.09 (0.86) cm] and 48 [3.29 (0.86) cm] hours post. There were no changes for MT in the control group from pre [2.88 (0.64) cm] to post [2.88 (0.64) cm] exercise, or 24 or 48 hours post. For EI there was an interaction (p = 0.012). In the experimental group EI increased from pre [22.9 (9.6) AU] to post [25.9 (12.3) AU] exercise and was depressed below baseline 24 hours post [20.4 (9.9) AU]. For the control condition, EI was different between pre [2.83 (0.32) AU] and post [2.57 (0.32) AU] 24 hours post. In addition, EI were lower 24 [23.3 (11.4) AU] and 48 hours post exercise compared to immediately post exercise [27.4 (13.0) AU]. For ISO, there was an interaction (p < 0.001). In the experimental condition ISO decreased from pre [40.6 (14.7) Nm] to post exercise [24.8 (9.4) Nm] and remained depressed 24 [32.2 (11.3) Nm] and 48 hours [33.9 (11.4) Nm] post exercise. CONCLUSIONS: Naïve exposure to resistance exercise produced a swelling response, which was elevated 48 hours post exercise. This swelling was accompanied with a prolonged decrease in ISO, which is likely indicative of muscle damage. Despite an increase in MT, EI was only elevated immediately post exercise. In addition, EI changed in the control condition despite no changes in MT.

Lateral abdominal muscles play a significant role in trunk control and rotation during baseball batting. Repetitive and unidirectional baseball batting could lead to asymmetric hypertrophy of lateral abdominal muscles. This adaptive change may subsequently impose abnormal loads on the spine and predispose baseball players to sports injury. No study has examined whether adolescent baseball players present lateral abdominal muscle asymmetry and its relationship with risk of sports injury.

PURPOSE: This study aimed to compare the thickness of lateral abdominal muscles on both sides of the trunk, and to investigate whether asymmetry of lateral abdominal muscle thickness was correlated with risk of sports injury in high school baseball players.

METHODS: Fifteen position players from a high school baseball team (right-handed batting and throwing; aged 16.0 ± 1.1 years, height 172.6 ± 5.0 cm, weight 73.3 ± 10.8 kg) completed the Functional Movement Screen (FMS) testing. B-mode ultrasound images were recorded from the external abdominal oblique (EO), internal abdominal oblique (IO), and transverse abdominis (TA) at the end of expiration in the crook-lying position. The absolute thickness of each lateral abdominal muscle for both sides was determined and compared using paired t-tests. The relationship between the asymmetry ratio (difference between two sides expressed as a percent of the dominant side) and FMS composite score was analyzed using the Spearman correlation coefficient.

RESULTS: The EO thickness was significantly greater in the dominant side than in the non-dominant side (6.85 ± 1.13 vs. 5.05 ± 1.46 mm, p < 0.001), and the TA thickness was significantly greater in the non-dominant side than in the dominant side (4.21 ± 0.85 vs. 3.49 ± 0.60 mm, p = 0.003). Only the asymmetry ratio of TA was significantly correlated with the FMS composite score (r = 0.54, p = 0.040). CONCLUSIONS: High school baseball players showed side-to-side thickness asymmetry in the EO and TA. The significant correlation between the TA asymmetry ratio and FMS composite score suggests an increased risk of sports injury. High school baseball teams should consider integrating TA training into players’ routine training program.

Supported by the Ministry of Science and Technology of Taiwan (MOST 108-2410-H-006-098).

Resistance exercise using concentric and eccentric muscle contraction (i.e., dumbbell curl exercise) decreased significantly bioelectrical impedance analysis (BIA) (Atsuta et al. 2019). However, the influence of muscle contraction type on exercise-induced BIA change remains unclear.

PURPOSE: The purpose of the present study was to examine time course changes in muscle swelling evaluated by BIA following concentric-muscle contraction.

METHODS: Nine male subjects (20.0 ± 0.8 yrs, 175.4 ± 2.4 cm, 65.2 ± 6.3 kg) performed isokinetic (60 deg/s) concentric knee extension (6 repetitions × 10 sets, 60 s rest period between sets). Before and during 24 h of post-exercise, time course changes in BIA (locally evaluated BIA for vastus lateralis muscle), maximal voluntary contraction (MVC) of knee extension exercise, muscle thickness (evaluated by ultrasound) for vastus lateralis muscle and thigh circumference were evaluated. Blood samples were also drawn to investigate blood lactate, serum creatine kinase (CK) and myoglobin levels.

RESULTS: Blood lactate and CK levels were significantly increased after exercise (P < 0.05). Moreover, the MVC was significantly decreased immediately after exercise.
A-46 Free Communication/Poster - Injury, Injury Prevention, Recovery, and Rehabilitation
Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

353 Board #169 May 27 10:30 AM - 12:00 PM
A Time-Efficient NIRS Protocol For Cross- And Within-limb Comparisons Of Muscle Oxidative Capacity
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(No relevant relationships reported)

The non-invasive determination of muscle mitochondrial oxidative capacity via Near Infrared Spectroscopy (NIRS) typically involves voluntary contraction of a single limb and requires as many as 22 brief ischemic occlusions per measurement. This limits the number of oxidative capacity measurements that can be completed in a given test session and also makes cross-limb muscle comparisons challenging. PURPOSE: To establish the efficacy of a recently developed protocol that utilizes fewer (i.e. 6) ischemic occlusions combined with surface electrical stimulation (E-stim) in both limbs simultaneously.
RESULTS: The test employs 2 upper thigh cuffs and 2 NIRS sensors placed directly over the vastus lateralis (VL) muscles (supine position) or the semi-tendinosis (ST) muscles (prone position). Metabolic rate is temporarily increased via E-stim pads placed above and below each NIRS sensor. A standard 6Hz frequency is employed using a pre-modulation setting, with the intensity (mV) sensors placed directly over the vastus lateralis (VL) muscles (supine position) or limbs simultaneously.
CONCLUSIONS: E-stim protocol is time efficient and has the potential to facilitate within- and cross-limb comparisons of muscle mitochondrial capacity.

354 Board #170 May 27 10:30 AM - 12:00 PM
Characterization Of Muscle Inflammation Susceptibility: A Potential Prognostic Factor For Optimal Post-surgical Rehabilitation
Devin Drummer1, Kaleen Lavin1, Jeremy McAdam1, Regina Seay1, Derek Wiggins1, Inmaculada Aban1, Gabriel Turliotos2, Scott Schutzler1, Jasvinder Singh2, Herrick Siegel1, Elie Ghanem1, Jin Zhang1, Arny Ferrando3, Madhavi Kadakia3, Lowry Barnes1, S. Louis Bridges, Jr.1, Marcos Bamman1, FACSM1. 1University of Alabama at Birmingham, Birmingham, AL. 2University of Arkansas for Medical Sciences, Little Rock, AR. 3Boothon School of Medicine, Wright State University, Dayton, OH. (Sponsor: Dr. Marcos Bamman, FACSM) Email: drummerd@uab.edu
(No relevant relationships reported)

Background: Many individuals with end-stage osteoarthritis undergo elective total hip/knee arthroplasty (THA/TKA) to alleviate pain and improve mobility and quality of life. However, ~35% suffer long-term mobility impairment following surgery. Previously, we have shown this may be in part due to muscle inflammation susceptibility (MusIS+), an overt pro-inflammatory state localized to skeletal muscle surrounding the diseased joint, found in some but not all THA/TKA patients. Purpose: We are interrogating the hypotheses that a) MusIS+ status will result in a differential perioperative myogram profile that may partially explain low functional outcomes, and b) resistance training rehabilitation will more effectively overcome MusIS+ status than usual care for effective recovery post-surgery. Methods: Muscle samples were leveraged from our ongoing two-site, randomized, controlled trial (N=84). Participants were dichotomized to MusIS+ status (+) based on surgical (SX) muscle gene expression of Fn14 which drives pro-inflammatory signaling via NFKB. MusIS+ samples were probed for pro-inflammatory gene and protein expression targets, and indices of skeletal muscle function. Preliminary perioperative comparisons were made using two-tailed T-tests; alpha P≤0.05. Results: 84 participants (29M/55F; 62±8yrs; BMI 30.7±5.4kg/m2) undergoing THA/TKA were assessed. Thus far, 37 have been clustered as MusIS+ (n=14, ~4-fold greater Fn14 mRNA) or MusIS- (n=23). SX thigh muscle mass (TMM), quadriceps power and torque were lower (P<0.05) than the contralateral limb (CTR). Additionally, skeletal muscle fibrosis and type II cross-sectional area were greater in the SX leg and MusIS+ respectively (P<0.05). Tumor necrosis factor-α receptor and IL-6 trended higher in MusIS+ (P>0.05). Phosphorylated 4e-RPS6 was lower in the SX leg and 4E-BPI was significantly lower in MusIS+ (P<0.05). Conclusions: Preliminary results suggest patients undergoing TKA/THA exhibit more inflammation on the SX limb, accompanied by lower TMM, torque and power. MusIS+ leads to greater inflammation and blunted anabolic signaling, highlighting the profound impact of muscle inflammation and emphasizing the potential value in perioperative MusIS assessment to inform optimal post-surgical care. Grant: R01HD094124

355 Board #171 May 27 10:30 AM - 12:00 PM
Myostatin Mediates Quadriceps Muscle Atrophy And Fibrosis Rapidly After ACL Transection In Novel Murine Model
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(No relevant relationships reported)

Anterior cruciate ligament (ACL) injury results in quadriceps muscle atrophy and strength loss that may never fully recover. Underlying mechanisms driving these maladaptations have not been thoroughly investigated. PURPOSE: Develop an animal model recapitulating observed clinical phenotype after ACL injury to identify the early molecular and morphological signature within quadriceps muscle and clarify the rapidity with which therapies should be administered. METHODS: Surgical ACL transection (ACL-T) was performed unilaterally on mice (n=5) followed by 5-Ethyl-2'-deoxyuridine (EdU) injection 7d after ACL-T. Quadriceps muscle was harvested from injured and uninjured limbs. Immunoblotting measured myostatin signaling, and immunohistochemical techniques assessed morphology. In vivo knee extensor peak torque was measured on a separate group of mice (n=3) before and 7d after ACL-T. RESULTS: Myostatin and p-SMAD3 expression increased 7d after ACL-T by 131% (1.6 ± 0.2 vs 0.7 ± 0.1 AU, p=0.02) and 174% (1.1 ± 0.1 vs 0.4 ± 0.1 AU, p<0.01). Fibroblast density increased (4e-RPS6/ fiber: 45%, p=0.08; Te64/mm²: 106%, p=0.04), as did fibroblast proliferation (215%, p=0.02). Extracellular matrix (ECM) content increased 53% (p=0.03), along with a 31% decrease in fiber cross sectional area (CSA) (1394 ± 91 vs 2011 ± 134 µm², p<0.01). Knee extensor peak torque decreased 21% (p=0.04). Myostatin signaling was correlated with fiber CSA and fibrotic indices 7d after ACL-T (Table 1). CONCLUSIONS: Myostatin signaling is starkly and rapidly upregulated 7d after ACL-T in mice, promoting robust decrements in muscle size, quality, and function. Our findings suggest that myostatin-mediated muscle dysfunction represents a modifiable therapeutic target. Pharmacological myostatin inhibition immediately after ACL injury, preceding surgical and loading interventions, may mitigate quadriceps maladaptations and partially preserve strength. Support: R01 AR072061, T32AG000270

Table 1. Elevated myostatin signaling mediates ECM accumulation and myofiber atrophy in quadriceps muscle 7 days after ACL transection. (Values are mean ± SD and P<0.05)

<table>
<thead>
<tr>
<th>SJ</th>
<th>Value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myostatin</td>
<td>R value</td>
<td>P value</td>
</tr>
<tr>
<td>0.7246</td>
<td>0.0011</td>
<td></td>
</tr>
<tr>
<td>p-SMAD3</td>
<td>R value</td>
<td>P value</td>
</tr>
<tr>
<td>0.4141</td>
<td>0.0084</td>
<td></td>
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<tr>
<td>0.7291</td>
<td>0.0054</td>
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<tr>
<td>0.5681</td>
<td>0.0299</td>
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R-Blasto density (gCM²/kg) | 0.7246 | 0.0011 |
| R-Blasto density (gCM²/mm²) | 0.4141 | 0.0084 |
| R-Blasto proliferation (EdU + Te64) | 0.7291 | 0.0054 |
| ECM content | 0.5681 | 0.0299 |
| myofiber CSA | -0.8349 | 0.0065 |
Robotic locomotor training has been shown to be effective for significantly improving body composition and making some moderate, but not significant, changes in bone mineral density in individuals with spinal cord injury (Karalis et al., 2017). The effect of the training on other important mechanical properties of bone is unknown.

PURPOSE: To determine the effects of 8 weeks of robotic locomotor training on mechanical properties of rat bones. METHODS: Twelve female Sprague-Dawley rats received spinal cord transections at 5 days old. At 3 weeks old, half of them were randomly assigned to a Training group and half to a Control group. The Training group received 5 minutes of robotic gait training with 90% body support for 5 days a week for 8 weeks. The Control group received no exercise. At the conclusion of the 8 weeks, the animals were euthanized and the right femurs were harvested for testing. Anthropometric measures and 3-point bending tests using an Instron material testing system (Norwood, MA) were performed. Independent t-tests were used to determine differences between the two groups (p < 0.05). RESULTS: There was no difference in body mass between the two groups prior to group assignments, but after 6 weeks of training the Control group had greater mass (p < 0.035) and at the end of training this difference continued (mass = 210.3 ± 36.0 g vs. 166.7 ± 14.5 g; p < 0.012). The Control group’s femur mass was significantly larger (p = 0.041), but when considered as a percentage of body mass, the Training group’s femur mass was larger (p = 0.014). Peak load and rupture loads were not different between the two groups, but when normalized for body mass the Training group had higher load values than the Control group (59.0±2.7% and 53.3±12.1% for the Training and 52.4±2.0% and 41.6±8.7% for Control; p = 0.001 and p = 0.035, respectively). The deflection at rupture was greater for the Control group (0.75 ± 0.09 mm vs. 0.59 ± 0.14 mm; p = 0.025), as was the energy absorbed (57.0 ± 6.1 mJ vs. 39.6 ± 12.1 mJ; p = 0.009). There were some differences in midshaft diameters, but the cross-sectional areas were not different between the two groups. CONCLUSION: Rats who experienced training had stronger and more massive femurs than those who experienced no training. This work was supported by NS 0850516.

Effect Of Gastrocnemius Post-exercise Needling Treatment On Achilles Tendon Tendinopathy Prevention
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PURPOSE: Long-term post-exercise high intensity gastrocnemius tension can induce the Achilles tendon tendinopathy. The gastrocnemius post-exercise needling treatment may decrease gastrocnemius tension. METHODS: 32 male 12 weeks old SD rats divided into 4 groups: the needling group (NED group), exercise group (EX group), exercise and needling group (EXNED group) and control group (CON group). The animal treadmill protocol was 60% average VO2max intensity (16.5m/min) eccentric running at -11° condition lasting 911 condition lasting 90 minutes for 24 days. The EXNED and NED groups accepted needling treatment with 0.25mm diameter needle which penetrate 5mm on gastrocnemius for 5 minutes after exercise each day. Gastrocnemius and Achilles tendon were harvested at the 26th day in EX group was significantly higher than other groups (733.58±306.82 VS 291.92±156.19, 153.74±114.96, 192.67±112.36, OD/mm, P<0.05); IGF-1 expression and cell apoptosis ratio was lower in EX group was significantly higher than other three groups (4.00±0.33 VS 3.25±0.22, 0.19±0.01, 0.15±0.01; P=0.005); KGF-1 was no significance difference between groups in EX and NED group (357.26±210.54, 798.79±122.06 VS 958.59±176.41, 1133.60±251.63, 60.18±8.7; OD/mm, P=0.05). Collagen I in EX and EXNED group were significantly lower than CON and NED group (378.58±306.82 VS 291.92±156.19, 153.74±114.96, 192.67±112.36, OD/mm, P=0.05); IGF-1 was no significance difference either. CONCLUSION: The results were statistically significant before and after treatment in terms of VAS (p<0.001) and AKPS (p<0.001), Physical Functioning(p<0.001), Role-Physical<0.001), Bodily Pain<0.05, General Health<0.05 and Social Functioning<0.05. However, no significant differences were observed in Role-emotional(p=0.19), Vitality(p<0.15) and Mental Health(p=0.32). No significant between-group differences were found in all this scale (p>0.05).

Effects Of Hip-knee Muscle Strengthening Combined With Whole-body Vibration Training On Patellofemoral Pain Syndrome
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Email: lilyhxz@163.com

PURPOSE: This study aimed to investigate the effect of whole-body vibration (WBV) training combined with hip-knee muscle strengthening training on adult patellofemoral pain syndrome (PFPS).

METHODS: Thirty-six adults with PFPS were included in this study and randomly assigned to either a combined training group (Group 1) that received WBV training plus hip-knee muscle strengthening training (n=18) or a control group (Group 2) that performed hip-knee muscle strengthening training only (n=18). Group 1 performed 18 sessions to strengthen knee extensors, hip abductor and lateral rotator muscles for 40 minutes per session (20 minutes WBV training plus 20 minutes hip-knee strengthening training) three times a week for six weeks. Group 2 performed the same number of sessions (2-20 minutes hip-knee strengthening training only per session) to strengthen the muscles of the hip and knee. All patients were evaluated using a Visual Analog Scale (VAS), Anterior Knee Pain Scale (AKPS), and Short Form-36 (SF-36) before and after treatment. RESULTS: The results were statistically significant before and after treatment in terms of VAS (p<0.001) and AKPS (p<0.001), Physical Functioning(p<0.001), Role-Physical<0.001), Bodily Pain<0.05, General Health<0.05 and Social Functioning<0.05. However, no significant differences were observed in Role-emotional(p=0.19), Vitality(p<0.15) and Mental Health(p=0.32). No significant between-group differences were found in all this scale (p>0.05).

CONCLUSIONS: The WBV training plus hip-knee strengthening training and hip-knee strengthening training can both effectively improve pain, knee function and quality of life on adult patients with PFPS. However, whether the WBV training is more effective than hip-knee strengthening training need to be further research.
Joint hypermobility is largely understood as a dysfunction of collagen fibers within the connective tissues of ligaments and tendons, allowing for a range of motion which is markedly increased over validated normal values. Generalized Joint Hypermobility (GJH) is defined using a Beighton score ≥ 5.6. Additionally, previous studies have used microscopic imaging to determine these relationships, and there has yet to be a published study looking into the correlation between the sonographically determined length and width of ligaments, and GJH in a college-aged population in North America.

### METHODS

To determine the relationship between the length and width of the anterior bundle of the Ulnar Collateral Ligament (UCL) of the elbow and GJH.

- **RESULTS:**
  - Overall, 48 of 330 patients (14.6%) reported generalized joint hypermobility (GJH) based on the Beighton score ≥ 5.6. Fifty-three participants reported hypermobility in at least one elbow; there was no difference in prevalence of hypermobility between elbows: (Right: r = .483, p < .001; Left: r = .465, p < .001). Hypermobility in one elbow was strongly correlated with hypermobility in both elbows (r = .828, p < .001).
  - We found moderate correlations between UCL thickness and joint gaping for left and right elbows (r = .422, p < .001), r = .324, p < .001).
  - We found no difference in UCL thickness or joint width between participants with hypermobile elbows and those without (e.g., right elbow joint width under valgus stress: Normal = 231799, Hypermobile = 228415; (r25) = .301, p = .763). Left elbow joint width under valgus stress was weakly correlated (r = .167, p = .006) with GJH overall but not specifically with left elbow hypermobility.

### CONCLUSION

There was no relationship between Beighton score and UCL anterior bundle thickness or joint width under gravity induced valgus stress. There was no statistically significant difference in UCL thickness or joint width in participants with elbow hypermobility and those without.

### Effect Of Forearm Flexors/extensors Strength Training On Functional Capacity After Open Carpal Tunnel Release

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### RESULTS:

- **RESULTS:**
  - Significant main effect was found for groups or time (p<0.05) in HGS (IG: 31.1±8.2 kg, CG: 27.2±4.6 kg), HPS (IG: 8.0±4.6 kg, CG: 8.5±4.2 kg) and TPDT (IG: 2.0±0.2, CG: 2.5±0.3) at 12 weeks compared to pre-surgery values: HGS (IG: 27.6±12.9 kg, CG: 27.7±12.5 kg), HPS (IG: 7.1±4.8 kg, CG: 8.6±4.4 kg) and TPDT (IG: 2.3±0.4, CG: 3.3±0.4). In BCTQ, no differences were found between groups (p>0.05), however a significant main effect for time (p<0.05) was revealed at 12 weeks (IG: 1.8±0.68, CG: 1.5±0.4) compared to pre-surgery (IG: 3.8±0.76, CG: 3.4±0.5). **CONCLUSION:** Our findings suggest that the addition of the selected muscle strength training program to usual care after OCTR does not appear to add significant benefits to the functional recovery of those patients. Further research utilizing a larger number of patients and other strength training protocols is needed to reveal the potential role of wrist muscle strength training in functional capacity of patients with CTS after OCTR.
the supraspinatus was 47% (partial = 26 and full = 5), infraspinatus was 36% (partial = 21), subscapularis was 40% (partial = 23), and biceps was 12% (partial = 4 and full = 2). The incidence of rotator-cuff and biceps tendon tears was significantly associated with both age (r = 0.545, p < 0.001) and the duration of wheelchair use (r = 0.406, p = 0.008). The results from a logistic regression model with age and the duration of wheelchair use as predictors indicated that for each 1-year increase in age (when holding the duration of wheelchair use constant) the predicted odds of any rotator-cuff or biceps tear increased by 13% (p = 0.02). CONCLUSION: Similar to previous studies, this study found high prevalence of shoulder muscle tendon tears in MWC users. This is notably higher than what has been reported for the able-bodied population. Since duration of wheelchair use and age correlate positively with tendon tears, early intervention should be studied to determine if the decline of tendon health can be slowed in this population. Further longitudinal investigation with a larger population of MWC users with SCI is underway to further elucidate the evolution of shoulder pathology due to MWC use.

Supported by NIH Grants R01 HD84423-01 and NCATS UL1 TR002377.
clinical diagnoses of the respective injuries of the athletes participating in this study. Peripheral venous blood samples for DNA extraction and genotyping for known SNPs (SNP arrays) from all study subjects were collected. The comparison of allelic frequencies of these SNPs was made between cases and controls. For statistical analysis, we used the software PLINK. To estimate the magnitude of the effectiveness OR was used to estimate the magnitude of the effectiveness, and p-values for the significance of ORs were calculated using the z2 - test. The p value of 10-5 was set as a threshold for genome-wide statistical significance. To display significant SNPs, the Manhattan plot was used.

RESULTS: Association analysis revealed 2 genes that could be important as risk factors for investigated injuries, the PAPP2 (chr 1: rs1158045, OR 13.8, p-value= 1.64·10-4) and the GNG12 (chr 1: rs28435277 OR 13.8, p-value= 1.64·10-4) with the p-value remaining at the level of “suggestive significance” (p< 10-3).

CONCLUSIONS: Our study results identified suggestive significance in allelic differences of PAPP2 and GNG12 between case and control groups. It is important to continue with further research of genetic risk profile to understand the biological processes associated with injury risk.

367 Board #183 May 27 10:30 AM - 12:00 PM Loading To Optimize Patellar Tendon Repair After Injury Danielle Steffen, Keith Baar, FACSM. University of California, Davis, Davis, CA. Email: dnsstefen@ucdavis.edu (No relevant relationships reported)

PURPOSE: Tendonopathy is one of the most common musculoskeletal issues in jumping sports. In sports like basketball and volleyball, tendonopathy rates reach greater than 45%. Interventions to prevent or treat tendonopathies would improve an athlete’s quality of life and team performance. The goal of any intervention to treat tendonopathy is to increase the content of directionally oriented collagen, decrease pain, and increase the tensile strength of the tendon. This study is designed to determine the molecular changes that promote tendon repair.

METHODS: Patellar tendon injury was induced in male Wistar Rats with a 2mm biopsy punch. Rats then recovered with normal cage activity for 15 days to allow a mature scar to form. Following scar formation, groups received either an isometric load (4 x 30 second contraction, 2 min rest) or an equivalent time under tension using dynamic loads (360 contractions lasting 33ms each). The injured region of the tendon was collected 18 hrs after loading and immediately frozen. RNA was isolated from the tendon for RT-qPCR determination of genes involved in tendon (collagen I, III, lysyl oxidase, and scleraxis) and fibrocartilage (collagen II, aggrecan, tenasin C, and Sox9) formation.

RESULTS: Tendon scar formation was confirmed by visual inspection. The injured region showed increased vascularity and greater volume. Our preliminary findings: Tendon scar formation was confirmed by visual inspection. The injured region showed increased vascularity and greater volume. Our preliminary findings: Tendon scar formation was confirmed by visual inspection. The injured region showed increased vascularity and greater volume. Our preliminary findings: Tendon scar formation was confirmed by visual inspection. The injured region showed increased vascularity and greater volume. Our preliminary findings: Tendon scar formation was confirmed by visual inspection. The injured region showed increased vascularity and greater volume. Our preliminary findings: Tendon scar formation was confirmed by visual inspection. The injured region showed increased vascularity and greater volume. Our preliminary findings: Tendon scar formation was confirmed by visual inspection. The injured region showed increased vascularity and greater volume. Our preliminary findings: Tendon scar formation was confirmed by visual inspection. The injured region showed increased vascularity and greater volume. Our preliminary findings:

CONCLUSIONS: This pilot study confirms that following injury there is an increase in cell mass (greater RNA) in the scar. Further work on the expression of tendon and cartilage genes within the scar will help with the development of a loading program to repair patellar tendinopathy.

368 Board #184 May 27 10:30 AM - 12:00 PM Early Physiological Changes To The Vastus Lateralis After Non-invasive Anterior Cruciate Ligament Injury Emily R. Hunt1, Steven M. Davei2, Douglas W. Van Pelt1, Christian Lattermann2, Esther E. Dupont-Versteegden3, Timothy A. Butterfield, FACSM4, Lindsey K. Lepley5. 1University of Kentucky, Lexington, KY. 2University of Connecticut, Storrs, CT. 3Children’s National Health and Women’s Hospital, Harvard Medical School, Cambridge, MA. 4University of Michigan, Ann Arbor, MI. 5(Sponsor: Timothy A. Butterfield, FACSM) (No relevant relationships reported)

Insufficient recovery of quadriceps muscle strength is commonly reported after anterior cruciate ligament (ACL) injury. Although weakness is secondary to a complex manifestation of intrinsic and extrinsic factors, the goal of any treatment to address tendonopathy is to increase the content of directionally oriented collagen, decrease pain, and increase the tensile strength of the tendon. This study is designed to determine the molecular changes that promote tendon repair.

PURPOSE: To investigate the role of atrophic pathways after non-invasive ACL rupture. Methods Male Long-Evans rats were randomly assigned to 8 groups (n=8 per group): 1) control group and 7 ACL injury groups (6, 12, 24, 48-hours, and 1, 2, 4-weeks). The right hindlimbs of ACL injury rats were exposed to a single impulse, longitudinal tibial compression, to induce a non-invasive ACL rupture, followed by normal cage activity. After which rats were euthanized as per assigned group. Right and left vastus lateralis muscles (VL) were harvested, weighed and flash frozen in liquid nitrogen. The VL were immunoreacted for dystrophin to quantify fiber cross-sectional area (CSA), and RNA was isolated to measure the abundance of MuRF-1, MAFbx (markers of protein degradation) and 45s (marker of translational capacity). rRNA expression was determined using RT-PCR. One-way ANOVAs with Bonferroni post-hoc were used to determine differences between groups, and paired t-tests were used to detect VL differences between limbs (P < 0.05). Results: ACL injury resulted in a decrease in muscle wet weight (P=0.003) and a trend toward reduced CSA (p=0.008) at 1-week post-injury, compared to control, 2- and 4-week time points. CSA of the ACL injured limb VL was smaller than the VL of the contralateral limb at 1-week only (p= 0.01). MAFbx abundance was significantly increased at 48-hours post-ACL injury (P=0.0001), with no differences for 45s rRNA, total RNA concentration or MuRF-1. Conclusions: Results indicate that ACL injury induces atrophy which is transient and not related to a decrease in ribosome biogenesis but likely due to increased protein degradation. Future studies should focus on a comprehensive analysis of atrophic pathways after ACL injury, to establish key therapeutic windows for targeting therapy-resistant quadriceps weakness after ACL injury. Supported by K01AR071503.

369 Board #185 May 27 10:30 AM - 12:00 PM Epidemiology Of Acromioclavicular Joint Injuries At A Colorado Ski Resort Naomi Kelley, Laura Pierpoint, Morteza Khodaei, FACSM. University of Colorado School of Medicine, Aurora, CO. (No relevant relationships reported)

Purpose: Acromioclavicular joint (ACJ) injuries are amongst the most common injuries in winter sports. The purpose of this study was to determine trends with respect to injury mechanism, environmental factors, associated injuries, and demographics amongst patients treated for acute ACJ injuries at the Winter Park Ski Resort clinic in Colorado. Methods: This was a retrospective descriptive analysis, specifically using an injured patient cohort from the Winter Park Ski Resort clinic. The timeframe used was from 2012 to 2017. All patients diagnosed with an ACJ injury who saw the ski clinic at the mountain’s base were included in the patient cohort. Chart review was performed to confirm diagnosis and obtain case details. Results: A total of 341 acromioclavicular joint injuries (6.7% of total visits) were encountered during the study period. The majority of ACJ injuries were grade I (41.3%) and mainly occurred in men (86.5%). The majority (96.8%) of the cases were primary ACJ injuries on the right shoulder (56.9%). The average age of patients with ACJ injuries was 30.0 years (range 10-72). More than half (62.2%) of ACJ injuries occurred due to snowboarding injuries and the remaining due to skiing injuries (37.8%). The most common mechanism of injury (93.5%) was fall to snow while snowboarding. Women were more likely to have a grade 1 ACJ injury than men (80.4% vs 35.4%, P < 0.001). Women with ACJ injuries were also more likely to suffer the injury due to skiing than snowboarding (71.7% vs 28.3%; P < 0.001), compared to men who were more likely to suffer the injury due to snowboarding than skiing (67.5% vs 32.5%, P < 0.001). Conclusions: Most of the ACJ injuries were Class I and occurred mostly in men. Snowboarders were more likely to have an ACJ injury than skiers.

370 Board #186 May 27 10:30 AM - 12:00 PM Increased ATFL Thickness Associates To Decreased Physical Activity Levels After Acute Lateral Ankle Sprain Tricia J. Hubbard-Turner, FACSM1, Michael J. Turner, FACSM2, Kyeongtak Song3, Chris Burcal3, ErikWikstrom1. 1University of North Carolina @ Charlotte, Charlotte, NC. 2University of North Carolina @ Chapel Hill, Chapel Hill, NC. 3University of Nebraska @ Omaha, Omaha, NE. Email: thubbar1@uncc.edu (No relevant relationships reported)

Purpose: Lateral ankle sprains remain one of the most common orthopedic injuries. Most concerning are the number of patients that develop long term ankle instability and have decreased activity levels. Despite these problems there are limited long-term studies examining changes after an acute lateral ankle sprain (LAS). Methods: Purpose: To examine the post-injury thickness of the anterior talofibular ligament (ATFL) and if that thickness relates to physical activity levels one year after an ankle sprain. Twenty college students (8 males and 12 females, age=21.2 ± 2.4 yrs, mass=80.9±21.6kg, ht=173.3±10.6cm) with an acute LAS and 20 healthy matched controls (8 males and 12 females, age=21.9 ± 2.8yrs, mass=79.1±20.2kg, ht=172.5±9.8cm) participated in this study. ATFL thickness was measured with a LOGIQ Book diagnostic ultrasound. The examiner oriented the probe to visualize the cross sectional view of the lateral malleolus, lateral talar articular surface, and the neck of the talus. Once those landmarks and the ATFL were located, images were saved. Thickness of the ATFL was measured at the midpoint of the ligament between the attachments on the lateral malleolus and talus. Two blinded examiners measured the thickness of the ATFL (mm) at 3 days post LAS and 1 year post LAS, and physical activity levels as measured by the IPAQ and NASA physical activity scales. Results: There was a significant relationship between post-injury ATFL thickness and both the IPAQ and
NASA physical activity scales. As ligament thickness increased, “average time spent performing vigorous physical activity” significantly decreased (p<0.04, r=-0.86) and “average time spent performing moderate physical activity” (p<0.02, r=-0.84) also decreased one year after injury. As ligament thickness increased in subjects with a LAS, time spent walking (p=0.01, r=-0.92), days per week where vigorous activity (p=0.02, r=-0.81) or moderate activity (p=0.04 r=-0.85) was pursued one year after their strain significantly decreased. Conclusions: The changes in AFFL morphology may lead to the decreased physical activity levels by contributing to ligamentous laxity and/ or perceptions of instability. Future research needs to focus on early interventions to ensure proper ligament healing occurs to restore joint function.

Women have a ~4-fold greater risk of anterior cruciate ligament (ACL) rupture compared to men. ACL injury is associated with greater estrogen levels. Estrogen increases knee laxity, in part by blocking lysyl oxidase activity, thus decreasing collagen crosslinking and ligament stiffness. Methyl sulfonyl methane (MSM) supplementation is suggested to counter this effect.

PURPOSE: To determine whether MSM supplementation alters knee laxity over the menstrual cycle.

METHODS: Healthy women (ages 18-30) were followed over a 5-month period. Knee laxity measured using a GRNR knee arthrometer (Prothria, Worchester, MA) at menstruation and ovulation during baseline (month 1&2) and intervention phases (month 3 & 4). In the 1st cycle, all participants were randomly assigned to daily ingestion of 3g of MSM or placebo (PLA; rice flower). Saliva samples were taken before all laxity measurements to determine estradiol levels (Salimetrics, Carlsbad, CA). Two-way ANOVA (supplementation and time) was used to determine differences with alpha set at p<0.05. At time of submission data remains blinded.

RESULTS: Baseline knee laxity was the same in both groups at all time points (p=0.20, Group A =9, Group B =11 due to dropout). Compared to baseline, the average knee laxity during the intervention period in Group A was significantly lower at ovulation compared to Group B (p=0.036). Upon analysis of estradiol levels and subsequent unblinding, the interaction between estrogen levels, laxity, supplement and time will be determined.

CONCLUSION: Knee laxity decreased at ovulation in Group A. MSM may show efficacy in decreasing knee laxity at ovulation in females and help to reduce ACL injury.

Rheumatoid arthritis (RA) is a systemic inflammatory disease characterized by exercise intolerance and increased risk for cardiometabolic disease. High intensity interval training (HIIT) improves both inflammation and cardiorespiratory fitness (CRF) in RA, however the mechanisms underpinning these therapeutic benefits are unclear.

PURPOSE: To identify baseline skeletal muscle pathways linking HIIT with improvements in RA inflammatory disease activity and CRF.

METHODS: Participants with RA (n=13; mean age=63.9±7.2) underwent RA disease activity assessments (DAS), cardiopulmonary exercise testing, ultrasound, and biopsy assessments pre- and post-10 weeks of supervised HIIT. Cardiopulmonary exercise testing measured CRF as RVO2 peak (mL/kg/min). Skeletal muscle RNA was isolated from vastus lateralis biopsies. Illumina Human HT-12v4 Expression BeadChips and Ingenuity Pathway Analysis were used for quantitative whole genome RNA analyses. Differential Skeparan correlations (p<0.05) were assessed between the gene expression with ΔDAS and ΔCRF (post - pre).

RESULTS: HIIT improved RA DAS (-23.8%; p<0.001) and CRF (+18.2%; p<0.001). ΔDAS was strongly correlated with baseline muscle expression of 46 genes (0.80<r<0.80; p<0.001); including genes encoding proteins involved in substrate energy metabolism (n=9; LIAS, NDUFV3, GLDC, AGL, BCKDHB, PD2K, LDHB, ACS52, PANK2) and inflammatory pathways (n=4; FCR56, TNFRSF19, CMTM4, NK7G). In contrast, CRF was strongly correlated with baseline expression of 16 genes; only 1 (NDFUB4) involved in cellular metabolism and 0 in inflammation. Novel network analysis revealed muscle upregulation of NF-kB and MAPK/JNK pathways associated with greater improvements in DAS.

CONCLUSIONS: HIIT-mediated improvements in RA disease activity associate strongly with baseline alterations in skeletal muscle metabolic pathways. Thus, exercise training may improve RA inflammation via coordinated regulation of muscle and immune cell energy metabolism.
CONCLUSIONS: SEP of injured gastrocnemius muscle was lower than uninjured one in professional rugby players. However, muscle stiffness did not differ.

375 Board #191 May 27 10:30 AM - 12:00 PM Oculomotor Function In Adolescent Athletes Following Concussion
Bianca Edison1, Nicole Mueske1, Tracy Zadow1, Gene Yu2, Adriana Conrad-Forrest1, Tishya Wren1. 1Children's Hospital Los Angeles, Los Angeles, CA. 2University of Southern California, Los Angeles, CA.

376 Board #192 May 27 10:30 AM - 12:00 PM Abstract Withdrawn

377 Board #193 May 27 9:30 AM - 11:00 AM Visual Input Affects Force Steadiness And Accuracy Among Chronic Ankle Instability Patients, Ankle Sprain Copers, And Healthy Controls
HYUNWOOK LEE1, Seunguk Han1, S. Jun Son2, Hyunsoo Kim3, Ty Hopkins, FACSM. 1 Brigham Young University, Provo, UT. 2Cha University, Seongnam, Korea, Republic of. 3West Chester University, West Chester, PA. (Sponsor: J Ty Hopkins, FACSM)

Email: hyunwook.lee31@gmail.com

378 Board #194 May 27 9:30 AM - 11:00 AM Effect Of Kinesio Taping On Postural Control In Individuals With Chronic Ankle Instability
Lin Wang, Lulu Yin. Shanghai University of Sport, Shanghai, China. (Sponsor: Stanley Sai-chuen HUI, FACSM)

Email: wanglin.sus@gmail.com

379 Board #195 May 27 9:30 AM - 11:00 AM Balance Training with Stroboscopic Vision is Superior to Balance Training Alone for Chronic Ankle Instability
Kyung-Min Kim1, Fidel Hita-Contreras2, Antonio Martinez-Amat2, Soon-Mi Choi3, Agustín AIbar Almazán2, Mariola Estudillo-Martínez2, David Cruz-Diaz1. 1University of Miami, Miami, FL. 2University of Jaén, Jaén, Spain. 3Midwestern State University, Wichita Falls, TX.

Email: kmk154@miamio.edu

No relevant relationships reported

No relevant relationships reported

No relevant relationships reported

No relevant relationships reported

No relevant relationships reported

A maximal voluntary isometric contraction (MVIC) of eversion, inversion, and hip abduction. Two days after MVIC tests, subjects participated 2 practices, followed by 3 testing trials of 10% and 20% of their MVIC for 15 seconds for submaximal force steadiness and accuracy measures with and without the stroboscopic glasses. The central 10-sec (20-80% of the total time) of three testing trials was analyzed. Main outcome measures were force steadiness, which was one standard deviation (SD), and force accuracy was a root mean square across the 10-sec data. Force steadiness and accuracy were analyzed by 3 (groups) x 2 (visual conditions) ANOVAs. RESULTS: The CAI and coper subjects exhibited greater errors than controls in 20% eversion MVIC in force steadiness (p<.001) and p=.01, respectively). CAI subjects demonstrated less steadiness in 20% eversion and hip abduction under strobe vision (SC) compared with eyes open (EO) (p=.02, both). Additionally, CAI subjects showed less accuracy than copers and controls in 20% eversion MVIC (p<.0001 and p=.0001, respectively). CAI subjects demonstrated less accuracy in 20% eversion under SC compared with EO (p=.002).

CONCLUSIONS: Individuals with a history of a lateral ankle sprain (LAS) showed reduced force steadiness than healthy controls. Only CAI patients relied more on visual input during force steadiness and accuracy tasks. A LAS injury (coper) reduced the ability to control fine force, but recurrence of LAs (CAI) altered reliance on visual input.

Chronic ankle instability (CAI), which is characterized by deficient postural control, may be improved through Kinesio Taping (KT) intervention. However, the effect of KT on postural control in individuals with CAI is controversial.

PURPOSE: This study aimed to investigate the acute effect of KT on postural control through computerized dynamic posturography (CDP) and perceived sensation in individuals with CAI.

METHODS: A total of 35 male adults with CAI participated in the study. Each participant received four random ankle taping, including KT, athletic taping (AT), sham taping (ST), and no taping (NT). Subsequently, a series of postural stability measurements was performed using CDP. The tests included sensory organization test (SOT), unilateral stance (US) test, limit of stability (LOS) test, motor control test, and adaptation test (ADT). In addition, perception stability and comfort were measured through visual analogue scaling. One-way repeated measures analysis of variance was conducted to determine difference on postural control among KT, AT, ST, and NT.

RESULTS: No significant difference was observed for parameters in SOT, US test, and LOS test among four taping. In the motor control test, the amplitude scaling scores of KT were 25.87% lower than NT (p<.001) in forward-small slip and 21.58% lower than ST (p<.001) in backward-large slip. In ADT, sway energy scores were 7.59% greater in ST than this in AT (p<.028). For perception stability, KT was performed better than ST (p<.001) and NT (p<.001), and AT was performed better than ST (p<.001) and NT (p>.001). For perception comfort, KT was performed better than AT (p<.001) and NT (p<.031).

CONCLUSIONS: KT and AT could not facilitate postural control for CAI individuals during static and voluntary measurements. However, they could provide effective support to cope with sudden perturbation. In addition, KT improved perception stability and comfort, whereas AT improved perception stability but provided the least comfort.
Chronic ankle instability (CAI) patients have consistently displayed postural control deficits. Previous research postulated that CAI patients rely more on the utilization of visual feedback than controls to compensate for the proprioceptive deficits after lateral ankle sprains. However, little is known about how reduced visual feedback would alter dynamic postural control in CAI patients relative to controls and copers. PURPOSE: To identify the effect of visual feedback disruption via stroboscopic glasses on dynamic postural control among groups of CAI, coper, and control. METHODS: 20 CAI (10M, 10F, 23.6±3.9 yr, 174.7±11.8 cm, 76.3±17.5 kg), 20 coper (10M, 10F, 22.2±1.4 yr, 176.4±10.2 cm, 69.3±10.9 kg), and 20 control (10M, 10F, 22.6±2.7 yr, 174.4±7.2 cm, 80.0±24.4 kg) subjects were categorized according to the Foot and Ankle Ability Measure (FAAM) and Modified Ankle Instability Index (MAII) questionnaires. Each subject performed three trials of a single-leg-hop stabilization test with eyes open (EO) and stroboscopic vision (SV). Force data (200 Hz) were collected using an in-ground force plate to calculate the dynamic postural stability index (DPSI) and directional stability indices (medial/lateral, anterior/posterior, vertical). Two-way repeated ANOVAs (group x condition) were used to examine the differences between the Foot and Ankle Ability Measure (FAAM) and MAII questionnaires. The Fear Avoidance Beliefs Questionnaire (FABQ) was administered. Participants completed 3 SEBT trials per condition, starting with No VE followed by VE to eliminate the effect of heightened motivation with a randomized order. Analysis of Variance (ANOVA) examined group differences and whether VE affected performance for Anterior (ANT), Posteromedial (PM), and Posterolateral (PL) reach distances. FABQ was compared between the CAI and Healthy groups using a t-test; all alpha levels were <0.05 a priori. RESULTS: With No VE, a significant group-by-condition interaction was observed in both the ANT (CAI: 66.90 ± 5.50 vs Healthy: 70.65 ± 4.52) and PM (CAI: 77.60 ± 7.70 vs Healthy: 81.89 ± 8.25) reach directions, which diminished with VE: ANT (CAI: 70.43 ± 4.52 vs Healthy: 71.77 ± 5.10) and PM (CAI: 85.41 ± 7.19 vs Healthy: 86.45 ± 8.71), showing that the two groups behaved similarly with VE. There was no statistically significant interaction (p=0.48) for the PL reach direction without VE (CAI: 73.60 ± 7.84 vs Healthy: 75.16 ± 11.72) or with VE (CAI: 81.18 ± 9.79 vs Healthy: 80.06 ± 11.93). The CAI group had significantly higher FABQ scores (10.53 ± 9.45) than the healthy group (0.41 ± 1.70) (p=0.001). CONCLUSIONS: The CAI group had lower performance on the SEBT without VE, but with VE, the scores were comparable to healthy controls. Clinicians and researchers should acknowledge the impact that motivation and psychological stresses have on functional performance in patients with pathologies such as CAI.

Board #196
May 27 9:30 AM - 11:00 AM
Effect of Stroboscopic Vision on Postural Control in Individuals With and Without Chronic Ankle Instability
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Board #197
May 27 9:30 AM - 11:00 AM
Activities Of Hip Muscles In Response To Perturbed Walking In Individual With Chronic Ankle Instability
Chiao-I Lin, Mina Khajooei, Alexandra Nair, Mika Heikkila, Hannes Kaplick, Engel Tilman, Frank Mayer. University of Potsdam, Potsdam, Germany.
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Board #198
May 27 9:30 AM - 11:00 AM
Verbal Encouragement Improves Star Excursion Balance Test Performance In Patients With Chronic Ankle Instability
Susan Saliba, Abbas Haider Jaffri. University of Virginia, Charlottesville, VA. (Sponsor: Jay Hertel, FACSM)
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Board #199
May 27 9:30 AM - 11:00 AM
Comparison Of Gender Differences In Ankle And Knee Proprioception
Xiaoyue Hu, Lin Wang. Shanghai University of Sport, Shanghai, China.
Email: moonhxyx@163.com

Absorbs were prepared by the authors and printed as submitted.
proprioception between male and female in follicular cycle. METHODS: Twenty-four healthy college student (male: n=12, age: 23.8±1.8 years; height: 1.73±0.07m; weight: 59.8±3.12kg; female: n=12, age: 21.75±1.77 years; height: 1.64±0.64m weight: 56.25±6.77kg) were included in the study. Knee and ankle proprioception were measured by an electric-driven movable frame which was moved by an electric motor rotated the foot on an axis at a rate of 0.4°/s. The test results were averaged from five movement in each direction such as knee flexion and extension; plantarflexion, and dorsiflexion in ankle joint. The independent t-test was used to compare differences between proprioception of ankle and knee joint in males and follicular females. The significance level was p < 0.05. RESULTS: There were no significant differences between proprioception of plantarflexion (male: 0.78±0.26°; female: 0.65±0.27°, p=0.215) and dorsiflexion (male: 0.64±0.18°; female: 0.62±0.33°, p=0.872) between males and follicular females. No significant differences were found on knee flexion (male: 0.54±0.21°; female: 0.54±0.32°, p=1.000) and extension (male: 0.55±0.23°; female: 0.43±0.17°, p=0.132) in male and follicular female. CONCLUSIONS: There were no significant gender differences on ankle and knee proprioception. Therefore, proprioception may not be the cause of the decline in posture control of female.

Elevation training masks are commonly used in strength and conditioning to simulate working in a hypoxic environment through resisted inspiration (RI). It is further suggested that RI improves the ability of the athlete’s muscle to utilize available oxygen carried by hemoglobin. Though some data exists regarding gross training effects and elevation training mask during exercise. PURPOSE: to determine the effects of an elevation training mask on ankle joint kinetics during a treadmill walking task. METHODS: Seven healthy young adults performed two 10-minute treadmill walking tasks at 1.6 m/s in each of two conditions: normal walking (CON) and with RI. Three-dimensional kinematics and ground reaction forces (GRFs) were simultaneously recorded using a 6-camera motion capture system (250 Hz) and instrumented treadmill (1500 Hz). Peak ankle plantarflexor moments and powers were determined from the second (M2) and tenth (M10) minutes of the treadmill walking task. Two repeated measures ANOVAs were used to determine the effects of time and condition on peak plantarflexor moments and powers. RESULTS: No time by condition interactions were observed for plantarflexor moments (p = 0.26) or powers (p = 0.18). The RI condition was associated with greater plantarflexor moments (p = 0.04) and powers (p = 0.01) than the CON condition. No effects of time were observed for plantarflexor moments (p = 0.84) or powers (p = 0.63). CONCLUSIONS: These findings demonstrate that ankle joint kinetics are greater when performing a treadmill walking task when wearing an elevation training mask. Given the constant mechanical demand, these data suggest that a multi-joint task was used to wear an elevation training mask. Subsequent research may seek to address changes in joint contributions to the walking task when wearing an elevation training mask.

### Table 1. Mean ankle joint moments and powers during stance phase propotion in the second (M2) and tenth (M10) of the CON and RI conditions.

<table>
<thead>
<tr>
<th>Condition</th>
<th>M2</th>
<th>M10</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>CON</td>
<td>-1.24 (0.32)</td>
<td>-1.25 (0.34)</td>
<td>2.11 (0.45)</td>
</tr>
<tr>
<td>RI</td>
<td>-1.25 (0.55)</td>
<td>-1.31 (0.53)</td>
<td>2.76 (0.54)</td>
</tr>
</tbody>
</table>

### Response

Ankle range of motion (ROM) is believed to be one of the contributing factors in balance deficits. Multiple studies have investigated balance in reference to vision, strength, vestibular function, proprioception, and sensation. However, most of these studies have utilized geriatric, athletic, or injured populations focusing on static balance measures. PURPOSE: Although there are multiple factors that play a role in balance, the purpose of this study was to assess the influence of ankle flexibility on dynamic single leg balance in fit and unfit males. METHODS: Twenty-five male subjects (age = 22 ± 2 years; ht = 179 ± 7 cm; wt = 85.6 ± 15 kg) were recruited for this study. Ankle flexibility (which includes dorsiflexion, plantarflexion, eversion, and inversion) was measured in degrees for both legs with a goniometer. Subjects then completed four trials, of which the first two trials were familiarization, of the single leg balance test for each leg. The dependent variable was the ratio between participants with the highest (n=5) and lowest (n=5) bilateral CAIT scores in this study was to explore the contribution of perception of unilateral and bilateral CAI on dynamic balance test. METHODS: Subjects were males and females 18-35 years old (n=25, age = 23.8 ± 1.8 yr). All subjects completed the Cumberland Ankle Instability Tool (CAIT) to measure perceived ankle instability (lower CAIT scores are associated with greater perceived instability). Dynamic balance was assessed using 3 repetitions in each direction (anterior, posterior-medial, and posterior-lateral) of the Y-Balance Test (YBT). Asymmetries in CAIT scores and reach distances were calculated by subtracting right leg values from left leg values. Further comparisons were analyzed between groups of bilaterally highest (>80%) and lowest (<20%) combined CAIT scores. RESULTS: There was a significant positive moderate correlation between CAIT asymmetries and asymmetries in the anterior reach (r=0.520, p=0.001) and between dorsiflexion of the left ankle and anterior posterior SI (r=0.899). Significant differences were found between participants with the highest (n=5) and lowest (n=5) bilateral CAIT scores in right posteriormedial reach (101.00 ± 9.91 vs 86.80 ± 5.89, p<0.02), right posterolateral reach (96.40 ± 7.70 vs 76.80 ± 4.87, p<0.001), and right composite score (89.96 ± 5.93 vs 78.44 ± 3.85, p<0.007). CONCLUSION: Subjects reporting increased perceived ankle instability demonstrated decreased YBT performance on the side of perceived instability. Decreased reach distances may be attributable to neuromuscular consequences of ankle injury, changes in movement strategy associated with apprehension, or both. In fact, the larger the perceived asymmetries the greater the performance deficits. These findings may help clinicians contextualize sensorimotor assessment results in patients with a history of ankle sprain.

### Response

Ankle sprains are common injuries which can progress to chronic ankle instability (CAI) and balance impairments. While objective data guide treatment for individuals with CAI, the patient’s subjective experience is often overlooked and not counted in the adoption of plan of care. Individual perception of ankle instability is an important factor and has the potential to influence presentation of sensorimotor impairments either through neureomotor or fear-avoidance mechanisms. The purpose of this study was to explore the contribution of perception of unilateral and bilateral CAI on dynamic balance test.

**Board #2002**

**May 27 9:30 AM - 11:00 AM**

**The Relationship Between Perception Of Ankle Instability And Dynamic Balance In Individuals With A History Of Ankle Sprains**

Melanie Hudson, Kimberly Migliarese, Thomas Wagner, Kristen Jaggers, Adrian Arrow, Stephen Glass, Brent Harper, Radford University, Roanoke, VA. (Sponsor: Trent Hargens, FACSM)

(NO relevant relationships reported)

**Board #202**

**May 27 9:30 AM - 11:00 AM**

**Static Platform Model Evaluation For Study Of Sudden Ankle Movement.**

Leandro Santos, Júlia Greve, Angelíca Angioleta, Raúl Bolliger, César Augusto. Universidade de São Paulo, São Paulo - SP, Brazil.

Email: leandro.dias@usp.br

(NO relevant relationships reported)

**Board #203**

**May 27 9:30 AM - 11:00 AM**

**Static Platform Model Evaluation For Study Of Sudden Ankle Movement.**

Leandro Santos, Júlia Greve, Angelíca Angioleta, Raúl Bolliger, César Augusto. Universidade de São Paulo, São Paulo - SP, Brazil.

Email: leandro.dias@usp.br

(NO relevant relationships reported)
Acute ankle sprain leads in 40% of all cases to chronic ankle instability (CAI). Perturbed walking.

Purpose: To assess if there is a difference of knee muscle activities between the involved and uninvolved leg in participants with CAI during the uninvolved leg. The latter might potentially indicate a risk of ankle sprain or future at the knee muscles are limited to the involved (unstable) ankle or are also present at

Previous investigations identified increased muscle activities while landing in CAI compared to

CAI is related to a variety of motor adaptations at the lower extremities. Previous inter-individual variability of muscular activities at the involved leg might indicate a rather stereotypical response pattern. It remains to be investigated, whether muscular control at the knee is not affected by CAI, or whether both sides adapted in a similar style to the chronic condition at the ankle.

Test based on presence or absence of normal distribution (Bonferroni adjusted α level p<0.0125). Results: No statistical difference was found between involved and uninvolved leg for RF (Pre200: 4±2% and 11±22%, respectively, p=0.878; Post100: 10±5and 18±11%, p=0.878; Pert200: 6±3% and 13±24%, p=0.721) as well as for BF (Pre200: 12±7% and 11±6, p=0.576; Post100: 10±7% and 9±1%, p=0.732; Pert200: 7±4 and 7±7%, p=0.386). Discussion: No side differences in muscle activity could be revealed for assessed feedforward and feedback responses (perturbed and unperturbed) in unilateral CAI. Reduced inter-individual variability of muscular activities at the involved leg might indicate a rather stereotypical response pattern. It remains to be investigated, whether muscular control at the knee is not affected by CAI, or whether both sides adapted in a similar style to the chronic condition at the ankle.

A-48 Free Communication/Poster - Biomechanics of Clinical Tests

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

Identifying increases in injury-relevant biomechanics when athletes are distracted by a secondary task may be important for assessing performance and injury risk in athletic environments. It is unknown if this dual task cost (DTC) measured during detailed motion capture testing is associated with DTC on simple clinical tests. Such a relationship may prove useful for improving clinically feasible return-to-play assessments.

Purpose: Investigate whether dual-task ability spans clinical and laboratory methods of assessment. Methods: Twenty-three female soccer players (21 ± 3 yrs, 1.7 ± 0.1m, 64 ± 10 kg) completed an agility drill requiring two 90° turns and one 180° turn. This was completed in isolation (baseline) and under three dual-task conditions: counting backwards by seven (S7), dribbling a soccer ball (BH), and combined ball dribbling and counting tasks (BHST). Agility drill DTC (dDTC) was calculated as the percent change in completion time between dual-task and baseline conditions. A jump-land-jump task from a 30 cm box was also completed while 3D kinematics and kinetics were recorded. Dual task jump conditions included working memory (WM), working memory + visual attention task (WMV), and unanticipated working memory + visual attention task (UWMV) tasks. Biomechanical DTC (bDTC) was calculated as the percent change in peak knee valgus moment (pkVM) between dual-task jump landings and a single-task jump landing. Spearman’s rho correlations were run between all combinations of aDTC and bDTC (Figure 1). Results: Increases in dDTC for the S7 condition were associated with increases in bDTC for the WMV (p=0.49, p=0.02) and the WM (p=0.43, p=0.04) conditions. No other relationships reached significance (i.e., p>0.05). Conclusion: Dual-task ability spanned clinical and laboratory assessments when the secondary task was an anticipated cognitive task. Further research is needed to establish the clinical utility of these relationships.
PURPOSE: The Star-Excursion Balance Test (SEBT) is commonly used to assess dynamic balance. While the maximum reach distance (MRD) of the posteroomedial (PM) direction of the SEBT is lower in individuals with ankle and knee dysfunction, we do not know whether MRD relates to feedforward and feedback movement control strategies. The purpose of this study was to assess the relationships between MRD of the SEBT and muscle activation levels, reflex responses to unexpected perturbations, and kinematics during a single-leg squatting (SLS) task.

METHODS: 20 healthy participants performed the SLS task and two, 9-condition SLS tasks on a custom-built device, once with a flexing and once with an upright trunk. SLS conditions varied by speed and resistance with one random perturbation induced per condition. Sagittal motion was captured via Vicon. EMG were recorded from the quadriceps (Q), hamstrings (H), Gluteus Medius (GMed), and Soleus (Sol). EMG and kinematics during feedforward (FF) (-50-0 ms) and feedback (short-latency reflex (SLR) 0-50ms, long-latency reflex (LLR) 50-200ms) motor control were compared to MRD. Pearson Correlations were calculated for SLS EMG and kinematics (hip, knee, and ankle) to MRD. Step-Wise Regression to predict MRD was performed using significantly correlated SLS variables.

RESULTS: Significant correlations between SLS EMG and MRD: FF H (Flexing: p=0.014, R= -0.540; Upright: p= 0.015, R= -0.537), SLR H (Flexing: p=0.044, R= 0.434; Upright: p=0.017, R= -0.528), SLR QH Ratio (Flexing: p=0.020, R= 0.516), LLR H (Flexing: p=0.007, R= -0.581; Upright: p=0.013, R= -0.557), and LLR Q Ratio (Flexing: p=0.042, R= 0.458). Significant correlations between SLS kinematics and MRD: SLR Hip flexion (Flexing: p=0.018, R= -0.522) and LLR Hip flexion (Flexing: p=0.021, R= -0.512). Step-wise regression results: LLR H Flexing explained 33.8% of the variance in the MRD (p=0.007, R= -0.581).

CONCLUSIONS: Greater Hamstrings activation during feedforward and feedback control (SLR, LLR) and greater hip flexion during feedback control of a perturbed single-leg squatting task were associated with poorer dynamic balance during the PM-SEBT.

The Overhead Squat (OHS) and Single-Leg Squat (SLS) are two clinical tests commonly used by sports medicine practitioners to identify high-risk biomechanical movement patterns. Traditional scoring of these tests requires subjective judgement whereas new technology has allowed for automatic scoring and additional objective data. To date, few studies have examined sex differences in OHS and SLS performance and none measured the male-female motor control differences in a marker-less motion capture system. PURPOSE: To determine if biomechanical differences exist between male and female collegiate athletes during performance of an OHS and SLS. METHODS: 75 female (18±1.0y; 166±9.6 cm; 64±10.0kg) and 58 male (18±1.2y; 184±1.7 cm; 86.9±15.2kg) collegiate athletes completed OHS and SLS testing as part of their pre-participation exam. SLS’s sports included football (n=24), baseball (n=19), lacrosse (n=10), and soccer (n=11). Male athletes displayed greater peak knee valgus angles (M: 11.5°±10.9°, F: 6.3°±9.2°; P<0.01) and peak knee varus angles (M: 25.7°±9.6°, F: 19.8°±8.2°; P<0.01). For the non-dominant limb, males displayed greater peak knee valgus angles (F: -28.7°±5.8°, M: -26.5°±6.3°; P<0.05) whereas new technology has allowed for automatic scoring and additional objective data. To date, few studies have examined sex differences in OHS and SLS performance and none measured the male-female motor control differences in a marker-less motion capture system. PURPOSE: To determine if biomechanical differences exist between male and female collegiate athletes during performance of an OHS and SLS. Male athletes displayed different movement strategies during performance of an OHS and SLS. Injury prevention programs may need to target sex-specific biomechanical patterns to improve movement capacity.

Y balance test kit™ (YBT) is commonly used for the clinical assessment of dynamic balance. YBT is an instrumented version of the Star Excursion Balance test (SEBT) that has Anterior (A), Posteroomedial (PM), and Postolerolateral (PL) directions of the SEBT. Reach distance and kinematic difference on the YBT have been reported to differ across gender.

PURPOSE: To compare muscle activity of the lower extremity muscles between males and females on the YBT and on stable and unstable surfaces.

METHODS: Surface EMG was collected on 10 male and 10 female healthy adults for gluteus maximus, gluteus medius (GMed), medial hamstrings, biceps femoris, vastus medialis, rectus femoris, vastus lateralis, anterior tibialis (AT), and medial gastrocnemius (MG) on the stance leg while performing YBT during stable and unstable conditions. During stable condition, the participant stood on the YBT kit to perform the test. Same activity was also performed on the unstable surface that was introduced using Theraband™ stability trainer which was placed on top of the foot during the test. An instrumented Y balance test kit™ was used to assess differences in EMG between males and females for each direction and each muscle during YBT for stable and unstable conditions separately with a cut off 0.05. EMG were reported as the percentage of the maximal voluntary isometric contraction (%MVIC).

RESULTS: Females showed significantly higher EMG than males for GMed (31±16 vs 15±8 %MVIC; P<0.01), AT (61±14 vs 42±14 %MVIC; P<0.01), and MG (60±29 vs 35±20 %MVIC; P<0.01) in PL direction on the stable surface. Similarly, on unstable surface females showed significantly higher EMG than males for TA in A (52±9 vs 35±8 %MVIC; P<0.01), PM (55±17 vs 37±14 %MVIC; P<0.02), and PL (76±18 vs 43±10 %MVIC; P<0.01) directions and for MG in A (61±22 vs 36±19 %MVIC; P<0.01) and PL (74±34 vs 42±22 %MVIC; P=0.02) directions of the YBT.

CONCLUSIONS: Females produced higher muscle activity than males mostly for the ankle muscles irrespective of the surface. Higher muscle recruitment could be an indication of reduced muscle strength in females. This difference in the muscle activation among the genders maybe one of the factors for increased susceptibility of female athletes to injuries.

The Y-Balance Test (YBT) is a movement screen which assesses dynamic stability and neuromuscular control of the lower extremity. Several studies have analyzed kinematic and kinetic predictors of YBT performance, but kinetic factors determining YBT performance are not well understood. PURPOSE: To determine relationships between sagittal, frontal, and transverse plane joint kinetics and YBT performance. METHODS: 31 healthy individuals (15M, 16F; age 23.1 ±7.3; height 172.3 ± 9.1 cm, mass 59.05 ± 9.8 kg) participated in this study. Whole body kinematics were recorded using a motion capture system while dominant limb YBT trials were performed on a single force plate. Joint moments were calculated using inverse dynamics. Maximum reach distances normalized to leg length in the anterior (A), posterior-medial (PM), and posterior-lateral (PL) directions were calculated. Joint moment values at maximum reach in each direction were determined. All joint kinetic variables which were correlated with max reach distances at the p < 0.01 level were entered into a stepwise linear regression. RESULTS: In the A direction, a model containing knee extensor moment explained 21% of the variance in reach distance (p = .01). In the PM direction, a model containing hip extensor and knee rotator moments explained 67% of the variance in reach distance (p = .001). In the PL direction, a model containing hip extensor moments explained 34% of the variance in reach distance (p<.001). CONCLUSIONS: Females produced higher muscle activity than males mostly for the ankle muscles irrespective of the surface. Higher muscle recruitment could be an indication of reduced muscle strength in females. This difference in the muscle activation among the genders maybe one of the factors for increased susceptibility of female athletes to injuries.
Previous injury to the lower extremity may increase an athlete’s risk for future injury. Functional screening is one way to determine if an athlete is at a higher risk of future injury. By assessing athletes’ performance on these tests, there is potential for medical providers to implement intervention strategies to decrease risk of future injury. PURPOSE: To determine the association between previous history of injury and two lesser known lower extremity functional tests, the single-leg hip bridge (SLHB) and the single-leg walk-sit (SLWS). METHODS: Sixty-eight recreationally active (participation in exercise or sports for at least 3 days per week for 30 minutes) individuals completed this cross-sectional study. Each participant completed continuous repetitions of a SLHB until failure and repeated on the contralateral leg, as well as a SLWS test, bilaterally, where they were required to hold a single-leg walk/sit position until failure. Simple linear regression models were conducted to assess the association between previous injury and the SLHB score and SLWS time. A Poisson regression model was used to assess the association with previous injury for the right and left leg scores on the SLHB. RESULTS: Seventy participants were screened for this study. Of the 70, 2 were excluded, leaving 68 total participants (21 men, 22.4 ± 5.7 years old, 181.96 ± 67.8 cm, and 76.66 ± 10.60 kg; 47 women, 23.3 ± 1.7 years old, 166.30 ± 9.06 cm, and 66.22 ± 9.99 kg). Twenty-five (37%) participants self-reported a previous injury. There was a statistically significant association between a previous injury and the SLHB for the right leg (Relative Risk (RR) = 0.93; 95% Confidence Interval (CI): 0.76-0.93), but not statistically significant association between previous injury and SLHB for the left leg (RR = 0.98; 95% CI: 0.86-1.05). There was no statistically significant association between the SLWS time on either the right (mean difference = 5.57 seconds; 95% CI: -14.17-3.04) or left (mean difference = 5.68 seconds; 95% CI: -13.37-2.02) with previous injury. CONCLUSION: These findings indicate that previous injury to the lower extremity may not affect SLWS time. The SLHB count could be affected depending on the side the injury was on, but additional research is warranted.
dominant woman during the first trimester. Valid measurements were defined as having ≥ 600 minutes of wear time [by the algorithm of Choi et al. (MSSE, 2012)] on 4 days, including 1 weekend day. Women-specific two regression algorithms [Hibbing et al. (MSSE, 2018)] were used to estimate daily minutes of moderate to vigorous intensity PA (MVPA), light PA (LPA), and sedentary behavior (SB). Minutes per day of MVPA, LPA, and SB were then combined into weighted (i.e., weekend day vs. weekday) averages. Plasma glucose values from a random, 50-1-hour glucose challenge test (GCT) performed at 24-28 weeks gestation were obtained from the Kaiser Permanente Northern California electronic health records. Associations of MVPA, LPA and SB (i.e., log transformed) with glucose were estimated by linear regression and adjusted for age, race-ethnicity, BMI category, and GLOW trial randomization (i.e., intervention vs. usual care). RESULTS: The cohort had a median 38 (IQR= 37–39) minutes per day of MVPA, 248 (41) minutes per day of LPA, and 389 (97) minutes per day of SB. The median plasma glucose value on the GCT was 112 mg/dl (35). None of the PA variables were statistically significantly associated with plasma glucose (ρ > 0.5 for MVPA, LPA, and SB). CONCLUSION: Objectively measured PA, assessed over 7 days during the first trimester of pregnancy, does not appear to impact glucose tolerance at 24-28 weeks gestation in women with overweight/obesity.

The amount of time spent in sedentary behaviors is higher in pregnant populations compared to non-pregnant populations. Time spent in sedentary behaviors has also been shown to increase across trimesters. PURPOSE: To describe patterns of sedentary behavior in a sample of pregnant women in their third trimester.

METHODS: Participants were enrolled in a behavioral physical activity and dietary intervention. Participants wore an accelerometer on their right hip for all waking hours for seven consecutive days during the third trimester (~35 weeks gestation). Participants had to wear the monitor for a minimum of 10 hours/day, on at least 8 of the 3 days to be included analyses. Sedentary time was defined as any <100 counts/minute. Sedentary behaviors were quantified (mean±SD, or %) as total volume (% of day), % of morning (6am-12pm), afternoon (12pm-6pm), and evening (6pm-12am); % of weekday and weekend; number and length of bouts; and total number and length of breaks from sedentary behavior. RESULTS: Participants (n=29) were on average 29.0±4.4 years of age and had a pre-pregnancy BMI of 26.6±7.2 kg/m². A majority of participants were White (75.0%), married (86.2%) and had a college degree (58.6%). Women spent 63.8% of waking hours sedentary (549.5±153.5 minutes), engaging in 77.2±17.7 total bouts per day, with each lasting on average, 7.7±2.4 minutes. Time spent in sedentary behaviors was similar across (1) time of day: 62.8% of morning, 62.5% of afternoon, and 63.2% of evening and (2) type of day: 64.2% weekdays and 62.9% weekends (for seven consecutive days during T2 (18-22 weeks gestation) and T3 (34-36 weeks gestation), using a wrist-worn accelerometer. A two-step bootstrapped hierarchical regression model examined the influence of four predictor variables (age, Body Mass Index (BMI), and total PA volume (light, moderate and vigorous) in 2T and 3T on HR and SV.

RESULTS: The median plasma glucose value on the GCT was 112 mg/dl (35). None of the PA variables were statistically significantly associated with plasma glucose (ρ > 0.5 for MVPA, LPA, and SB). CONCLUSION: Objectively measured PA, assessed over 7 days during the first trimester of pregnancy, does not appear to impact glucose tolerance at 24-28 weeks gestation in women with overweight/obesity.

The prevalence of gestational diabetes mellitus (GDM) has rapidly risen during the past decade, and it is considered that GDM contributes to the increasing risk of adverse perinatal outcomes. Physical activity has been reported to be beneficial in improving pregnancy outcomes in pregnant women with GDM, however, there is a lack of evidence-based recommended amounts of physical activity specific for preventing GDM among Chinese pregnant women.

PURPOSE: The study aims to explore the "optimal physical activity cut-off value" for preventing GDM among pregnant women in Beijing, preparing to provide scientific basis for future research of personalized exercise prescription.

METHODS: A total of 321 pregnant women who took regular prenatal examination in outpatient clinic were finally chosen into the study, including 59 patients with GDM and 262 controls. General information and clinical data of each participant was collected through electronic medical record system, physical activity data was investigated using the short form of International Physical Activity Questionnaires (IPAQ), and physical activity level was calculated bases on the standard methods. Differences in means for continuous variables were compared using t-test, and differences in proportions were tested by chi-square test. ROC curve analysis was conducted to screen the "optimal physical activity cut-off value." RESULTS: Compared with control group, average age (31.62 ± 2.95 vs 29.90 ± 3.34 yrs, p=0.03, n=36, P=0.05) the proportion of participants with low education level (25.42% vs 8.78%, p=0.05) and overweight or obese before pregnancy (38.90% vs 24.05%, p=0.03) in GDM group were significantly higher. The area under the ROC curve is 0.820 (0.77-0.86) (P=0.05), and the "optimal physical activity cut-off value" is 834 MET*min/pregnancy.

CONCLUSIONS: Older age, lower education level and overweight or obese before pregnancy contributes to the risk of GDM. It is recommended that physical activity level of more than 834 MET*min week, accordingly walking no less than 36 minutes per day is beneficial to reduce the risk of GDM.

After pregnancy and delivery, dysfunctions, such as alterations in pelvic floor function (PFF), core stability (CS), and aerobic capacity (AC), are common in postpartum women. PURPOSE: To observe the differences in PFF, CS, and AC in postpartum women before and after an 8-week functional training program.

METHODS: Sixteen postpartum women (age: 32±3.0 years, ≤ 1 year post-delivery) completed an 8-week functional training intervention (60 minutes each time, 4 times per week). The functional training including pelvic floor muscle bio-feedback training,
RESULTS: There were significant differences in pre- and post-intervention values of all variables in these postpartum women following 8-week functional training. Specifically, the PFFBT composite score improved by 33.8% (p<0.01), the YBT scores for the directions of AL, PL, PMR, PLL and PLR were improved by 13.4%, 13.2%, 7.1% 13.5%, and 8.5%, respectively (all p<0.01), the AMET scores for abdomen E, F, LFL and LFR were improved by 56.6%, 30%, 26.5% and 30.1%, respectively (all p<0.01), and the ST score was improved by 19.9% (p<0.05).

CONCLUSIONS: An 8-week functional training program, improved PFF, AC and CS in postpartum women. Future randomized, controlled studies are needed to confirm these findings.

403 Board #219 May 27 10:30 AM - 12:00 PM Impact Of Postpartum Exercise On Maternal Health And Infant Physical Activity And Sleep Behaviours

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(No relevant relationships reported)

Physical activity (PA) has many implications for health, including effects on weight loss, body mass index (BMI), and sleep behaviours. The literature has established a relationship between mother-child physical activity, however, the impact of this interaction is unknown during the postpartum period. PURPOSE: To determine if a structured postpartum resistance training intervention with strollers and babies (60 minutes/session, twice/week for 10 weeks) improves maternal health outcomes and if infant physical activity (IPA) levels and infant sleep behaviours (ISB) are impacted.

METHODS: Forty-six women voluntarily enrolled in the Active Mom, Active Baby Intervention. Measures were taken at baseline (t1), 5-weeks (t2; mid-intervention), and 10-weeks (t3; post-intervention). At each time point, maternal weight (kg) was used to calculate BMI (kg/m²), and maternal physical activity (MPA) levels were measured using the self-reported International Physical Activity Questionnaire-long form (IPAQ-L). Infants were assessed using the Rothbard Infant Behaviour Questionnaire-Revised (IBQ-R) for PA and sleep behaviours. A nonparametric test was used to determine if there was a significant change in maternal weight, BMI, and PA levels (light, moderate, and vigorous-intensity PA). Differences in PA and ISB were made using a one-way ANOVA with repeated-measures. A post hoc comparison was completed using the Bonferroni test after the three time points.

RESULTS: Maternal age of participants (n=46) was 32.0±3.5 years at 16.6±7.5 weeks postpartum. The results showed a significant (p<0.001) decrease in maternal weight (-1.4±0.04kg) and BMI (-0.5±0.005kg/m²) across the intervention. There was no significant difference in light- or moderate-PA in the mother, however, vigorous-intensity PA increased from t1 (214.2±313.3MET-mins/week) to t2 (837.3±516.7MET-mins/week; p<0.001) and was maintained until t3 (736.0±582.6MET-mins/week; p<0.001). There was a significant increase in scores for IPA from t1 (3.89±0.85) to t2 (4.47±0.83; p<0.001) to t3 (4.80±0.93; p<0.001). No change in infant sleep behaviour was found between time points. CONCLUSION: A postpartum exercise intervention with babies can increase physical activity in both mother and infant, resulting in maternal weight loss.
A-50 Free Communication/Poster - Protein Metabolism

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

406 Board #222 May 27 9:30 AM - 11:00 AM
Effects Of Exercise Training On Circulating Branched-chain Amino Acid And Ketone Levels In Diabetics
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Purpose: Elevated levels of circulating branched-chain amino acid (BCAA) and ketone bodies are recognized as biomarkers for cardiovascular disease (CVD) and other pathological conditions in type-2 diabetes mellitus (T2DM). Aerobic exercise interventions have previously shown decreases in levels of these markers, suggesting improved metabolic status and reduced risk of CVD. However, the efficacy of resistance training and concurrent programs in reducing BCAA and ketone body levels has not been well researched.

Methods: The current study was performed as a secondary analysis of the HART-D trial, a 9-month randomized, controlled exercise-training trial of 262 participants with T2DM. Participants were randomized to one of four groups; non-exercise control, aerobic training (AT), resistance training (RT), or a combined aerobic-resistance training (ATRT). The effects of the 9-month intervention on BCAAs (leucine, valine, and isoleucine) and ketone bodies (β-hydroxy-butyrate, BHB; acetoacetate, AcAc; and acetone) were examined across groups using general linear models adjusting for age, race, sex, and baseline BMI. We performed per-protocol analyses limited to all control participants (n=33) and only the exercise group participants who met the criteria of ≥7 adherence to their exercise prescription for 6 months (AT, n=62; RT, n=55; ATRR, n=64).

Results: AcAc (r=1.76 ± 6.4, p=0.006), acetone (r=1.6 ± 3.6, p=0.003), and total ketone body (r=1.4 ± 2.0, p=0.001) concentrations (shown as mean ± SE in μmol/L) decreased in the RT group compared to the control group. Acetone also decreased in ATRT compared to the control group (r=10.2 ± 3.5 μmol/L, p=0.004).

Conclusions: Our results suggest that RT and ATRT programs could improve ketone body metabolism in those with T2DM.
CONCLUSION: Despite greater increases in extracellular EAA concentrations for high versus standard EAA intakes and the mechanical stimulus exerted by exercise, the stimulatory effect of varying doses of free-form EAA on MPS are equivalent during moderate energy deficit.

Supported by USAMRDC; authors’ views not official U.S. Army or DoD policy.
Leucine-enriched essential amino acids (LEAA) can acutely enhance post-exercise muscle protein synthesis and may facilitate muscle damage recovery, although the relationship between these outcomes during the prolonged post-exercise recovery period is unclear. PURPOSE: We aimed to determine the effect of LEAA on ‘free-living’ rates of myofibrillar protein synthesis (MyoPS) and its relationship to markers of muscle damage after an unaccustomed bout of resistance exercise (RE) in recreationally-active men. METHODS: Twenty healthy males (24.1 ± 4.3 yrs) consuming a controlled diet (1.2g/kg/day of protein) were randomized to consume 4.0g of LEAA (containing 1.0g leucine) or isocaloric placebo (PLA) thrice daily for 4 days following an acute bout of lower-body RE (5x12 repetitions at 75% maximum of leg press and knee extension). MyoPS at rest and overnight was measured by D2O (150ml, 70% APE) with body water enrichment as the precursor. RESULTS: LEAA increased ~72% after 2% (P < 0.001) with no differences between groups (P > 0.05). By 48h, SUM decreased ~21% and SOR increased (all P < 0.01) with both variables generally returning to baseline by 96h. Compared to PLA, LEAA consumption significantly attenuated the decrease in SUM (P < 0.05) and had small-to-moderate effects on decreasing SOR. HSP25 increased ~16% post-RE (P < 0.005) with no difference between groups (P > 0.05). Consistent with a trend toward increased Z-band streaming in PLA (P = 0.07), HSP70 expression increased ~32% more (P < 0.05) during recovery in PLA as compared to LEAA. LEAA correlated with SOR (r = -0.84, P < 0.05) whereas there were no correlations between MyoPS and any other outcomes (P > 0.05). CONCLUSION: Daily consumption of LEAA mitigates muscle strength loss and may moderately alleviate muscle damage recovery from an unaccustomed bout of resistance exercise in recreationally-active men, but this does not appear to be related to the extent of myofibrillar protein synthesis.

Supported by Ajinomoto Co. Inc.
CONCLUSIONS: Whey protein isolate may decrease CAR on post-exercise days, in recreationally active women, indicating a possible reduction in central fatigue associated with strenuous exercise, but may not alter the ability to perform short-duration sprint cycling.

417 Board #233 May 27 9:30 AM - 11:00 AM
The Influence Of A Whey Protein Preload Prior To Carbohydrate Consumption On Cycling Performance
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INTRODUCTION: The consumption of carbohydrates during a bout of endurance exercise has been shown to promote a glycogen sparing effect and lead to an improvement in exercise performance. The consumption of whey protein prior to a prolonged bout of endurance exercise may augment insulin secretion and further spare muscle glycogen.

PURPOSE: To examine if a whey protein solution consumed as a preload prior to a glucose bolus influenced performance and metabolic responses during a cycling performance trial.

METHODS: Ten recreationally trained cyclists and triathletes completed two experimental trials. Each participant was required to perform two separate cycling performance tests, which consisted of cycling for 30 min at 90% lactate threshold, followed by a 30 min time trial. Participants consumed a whey protein isolate preload (0.7 g/kg/BLM) or a placebo 20 min prior to the consumption of a glucose beverage (0.9 g/kg/BLM). The glucose beverage was consumed 10 min prior to the cycling performance test. During both trials, plasma glucose, c-peptide, insulin, glucagon, and NEFA concentrations were measured.

RESULTS: There were no significant differences in overall time trial performance (WP 16.8 ± 0.34 km; PL 17 ± 0.4 km; p = .346). WP stimulated a significant increase in plasma insulin concentrations at time point 0 (WP = 222.88 ± 45.1 pg/ml; PL = 85.95 ± 45.1 pg/ml; p = .047) compared to the placebo trial. Despite an increase in plasma insulin, there were no significant timepoint differences for plasma glucose. WP stimulated a significant increase in plasma glucon concentrations for timepoint -10, 0, 15, 30, 45, and 60 when compared to the PL trial (all p values < .05).

CONCLUSION: Although there were significant alterations in plasma insulin concentration due to the consumption of the whey protein isolate preload, this did not influence overall cycling performance or substrate utilization.

Funding Source: National Strength and Conditioning Association – GNC Sport Nutrition Grant

418 Board #234 May 27 9:30 AM - 11:00 AM
The Effects Of A Relative Dose Of Pre-sleep Protein On Recovery Following Evening Resistance Exercise
Juliana V. Costa, Takudzwa A. Madzima. Elon University, Elon, NC. (Sponsor: Paul C. Miller, FACSVM)

Pre-sleep consumption of protein has been shown to enhance recovery of muscle function after evening exercise. Previous studies have primarily compared casein protein (CP) to carbohydrate (CHO), however, less data exists examining the effects of a blend of CP and whey protein (WP, (CP+WP)) or a dose relative to an individual’s lean body mass (BLM). PURPOSE: To assess the acute effects of pre-sleep consumption of isocaloric CP, CP+WP, or CHO at a dose relative to BLM on recovery following an evening lower-body resistance exercise (RE) bout.

METHODS: Fifteen active males (age: 21±1yrs, body fat:14.2±2.7%) participated in this randomized, double-blind, crossover study. One-repetition maximums were performed on the leg press and extension machines to determine RE intensity. Participants performed an evening (1600-1900) lower-body RE bout and were provided with 0.4g/kg/BLM WP supplement post RE. A single dose of 0.6g/kg/BLM of CP, 0.4g/kg/BLM CP and 0.2g/kg/BLM WP was consumed 30 minutes prior to sleep and each trial was separated by 72 hours. Measurements of perceived recovery (visual analogue scales (VAS) for recovery, soreness and fatigue), appetite (VAS for hunger, satiety and desire to eat), as well as pressure-pain threshold (dolorimeter) and average power (Biodes29) of the right thigh muscles were assessed the following morning. ANOVAs were used for analyses and significance was accepted at p = 0.05.

RESULTS: There was no significant difference in perceived morning recovery, soreness and fatigue between pre-sleep supplements. There was a significant difference in pressure-pain threshold at the rectus femoris (p=0.001), vastus medialis (p=0.001) and vastus lateralis (p=0.001). Both CP (98.0±17.3N), and CP-WP (98.2±21.7N) had a greater pressure-pain threshold (i.e. less soreness) than the PLA (80.6±21.7N) at the rectus femoris. Average power was similar between supplements. Hunger was significantly greater after CP than CP-WP (52.2±17.2 vs. 39.9±15.9 mm; p = 0.048). There was no difference for satiety and desire to eat. CONCLUSIONS: Pre-sleep consumption of CP and CP-WP at a dose relative to BLM may enhance overnight recovery to a greater extent than CHO as a result of less muscle soreness the following morning after an acute evening RE bout.
Skeletal Muscle Regulatory Markers Responses Following Whole And Egg White Ingestion In Resistance Trained Men

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(No relevant relationships reported)

CONCLUSIONS:

Protein ingestion is recommended to maximize muscular adaptations post resistance training (RT). Eggs are a rich food source commonly consumed post-workout to meet protein requirements. Although removing egg yolk is often promoted for the improvement of body composition (BC), whole-egg (WE) consumption has been shown to cause a greater stimulation of post-exercise muscle protein synthesis than egg-white (EW). However, changes in BC and skeletal muscle regulatory markers to chronic RT coupled with WE or EW consumption have not been evaluated.

PURPOSE: To compare the effects of WE vs. EW ingestion after 12 wks of RT on BC and skeletal muscle regulatory markers in non-diabetics. METHODS: Thirty RT men [age (24 ± 2 yrs), volunteers] were randomized to either a WE (72 + 3 g protein) or EW (56 + 2 g protein) group after a 4 wks warm-up period. Blood samples were obtained prior to, immediately after strength training, and 60 minutes post-shake, and post-run. Symptoms were rated on a 10 point scale and included six upper abdominal problems, seven lower abdominal problems, and five systemic problems. RESULTS: Symptoms experienced during the LP shake included belching (2), stomach cramps (2), intestinal cramps (3), flatulence (1), urge to defecate (1), stitch (1), dizziness (1), muscle cramp (1), urge to urinate (2), and fullness (1). Severity was consistently low with only urge to urinate rated as a 4. Symptoms experienced during the HP shake included belching (1), belching (1), bloating (1), stomach cramps (2), intestinal cramps (1), flatulence (1), stitch (1), and fullness (1). Severity was consistently low with a maximum of 3. There was no significant difference in the severity of symptoms experienced between the two trials and no difference in the number of symptoms. CONCLUSIONS: A pilot trial indicates no difference in exercise-induced GI symptoms with a HP or LP shake pre-run and suggests intakes up to 0.4g/kg body weight can be well tolerated. Supported by a Mount Royal UniversityInnovation Grant.
It is known that different patterns of protein ingestion might influence the muscle protein synthesis rate in different magnitudes. However, it is questionable whether this could be translated into differential muscle growth, when the total amount of protein ingested throughout the day is equal and optimal to induce muscle hypertrophy.

**CONCLUSIONS**

Between groups for any of the variables.

**RESULTS**

- Both groups showed an increase in the CSA of RF (P3X: 9.97±1.58 to 10.76±0.56cm², P5X: 8.53±0.61 to 9.64±0.59cm², p=0.016), VL (P3X: 30.19±1.54 to 33.60±1.42cm², P5X: 31.95±1.62 to 34.13±1.57cm², p=0.005), and in the sum of the CSA of both muscles (P3X: 40.16±1.70 to 44.36±1.72cm², P5X: 40.48±1.79 to 43.77±1.81cm², p=0.002).
- However, there was no statistically significant difference between groups for any of the variables.

**CONCLUSIONS**

- The ingestion of the total amount of protein, recommended for induction of muscle hypertrophy, in three or five meals a day had no influence in rectus femoris and vastus lateralis muscles growth.

**Purpose**

- Protein recommendations pre-running have yet to be established and will need to consider performance responses as well as the potential for exercise-induced gastrointestinal symptoms. The purpose of this study was to examine the impact of a high protein (HP) shake consisting of 0.4 g/kg body weight (BW) protein vs. a low protein shake (LP) 0.15 g/kg BW protein pre-run on glucose, gut fullness, and perceived exertion.

**METHODS**

- Five (n=2) endurance trained runners were administered a HP or LP shake one hour prior to a 10 km run in a randomized cross-over design. CARBOH and water intakes remained consistent across trials. Blood glucose was measured at fasting, 30, and 60 minutes post-shake and post-run using a glucose meter. Perceived exertion was measured using Borg’s scale. Exercise induced gastrointestinal symptoms were measured at fasting and 30 minutes post-run using a 10-point questionnaire. Gut fullness was measured using a visual analogue scale at fasting, 15, 30, 60 minutes post-shake and post-run.

**Results**

- Blood glucose peaked at 30 minutes post-shake and there was no difference between the HP and LP shakes. There was a significant interaction between time and shake (p=0.044), however no main effect of time or shake. There was a significant interaction between the two interventions. Gut fullness changed over time (p=0.005), however, was not affected by the composition of the shake. There was no difference in the number of exercise-induced gastrointestinal symptoms experienced on the HP and LP shakes.

**Conclusion**

- The results from this pilot study suggest that the inclusion protein in the pre-run meal is feasible and provides support for a fully powered trial. Supported by Mount Royal University Innovation Grant

**Purpose**

- To examine whether consuming the recommended amount of protein, for hypotrophy, in 3 or 5 meals results in different muscle growth on trained men submitted to 8 weeks of resistance training.

**METHODS**

- All volunteers had a diet program prescribed by a registered dietitian. Men in the P3X group, were instructed to ingest the recommended amount of protein (1.6-2.2g/kg), mainly, in three meals; while, men in the P5X were instructed to ingest the total amount of protein in five meals. While dieting, both groups were submitted to an equal program of lower limbs resistance training, for 8 weeks, twice a week. Each session comprised 5 sets of unilateral horizontal leg press and 3 sets of unilateral knee extension, with a range of 8-12RM and 2 minutes of interval between sets. Before, and after, the intervention, the cross-sectional area (CSA) of muscles rectus femoris (RF) and vastus lateralis (VL) were measured by ultrasonography and then, data were analyzed. The normality and homogeneity of data were tested with Shapiro-wilk’s and Levene’s tests, respectively, and then a repeated measures GLM analysis was run to test the effects of intervention (P3X vs P5X) vs time (baseline vs 8 weeks) on muscle CSA.

**RESULTS**

- The effects of protein intake pattern at each meal on anabolic response such as muscle thickness changes and muscle protein synthesis were not examined. Skewed protein intake pattern and inadequate protein intake at all three meals is more effective than skewed protein intake at dinner for RT-induced muscle hypertrophy.

**CONCLUSIONS**

- Protein-enriched meal at breakfast to achieve adequate protein intake at all three meals is more effective for muscle accretion compared to typical protein intake pattern, skewed protein intake towards dinner. Skewed protein intake pattern and inadequate protein intake at breakfast was reported to be a negative factor for muscle regulation, and no study has examined the effects of protein intake pattern at each meal on anabolic response such as muscle hypertrophy.

**CONCLUSIONS**

- The results from this pilot study suggest that the inclusion protein in the pre-run meal is feasible and provides support for a fully powered trial. Supported by Mount Royal University Innovation Grant

**Purpose**

- Nutrient availability is known to influence the exercise response. However, there is a paucity of information regarding the role of post-exercise protein ingestion in modulating intramuscular adaptation to treadmill-based endurance exercise training.

**METHODS**

- In a randomized parallel group design, 15 individuals (VO2max 55 ± 6 ml·kg·1·min-1) completed six weeks of treadmill running (4 sessions per week), progressively increasing in both duration (30-60 min) and intensity (60-75 % VO2max). Participants were randomly assigned to a group receiving a supplement containing carbohydrate (CHO; 1.6 g sucrose·kg·1; n = 7) or carbohydrate-protein (CHO-P; 0.8 g sucrose·kg·1 and 0.8 g whey protein hydrolysate·kg·1; n=8) ingested immediately post-exercise and then 1 h later. To determine mRNA expression of several mitochondrial,mitogenic signaling, protein synthesis and lipid-carbohydrate metabolism genes, muscle biopsy samples were collected at baseline and follow-up, with 48 h of lifestyle standardization to exclude any acute effects on transcriptional changes. **RESULTS:** An up-regulation in mammalian target of rapamycin (mTOR) gene expression was shown in CHO-P.
Dietary protein and/or carbohydrate consumption augments postexercise recovery by facilitating the rebuilding of damaged contractile tissues and restoring energy reserves, particularly in a postabsorptive state. It is unclear how altering postexercise nutrient timing when in a postprandial state affects the shift towards fat utilization and changes in net protein retention after a resistance training bout. PURPOSE: To examine the effects of immediate versus delayed postexercise nutrient intake on substrate oxidation and protein retention during recovery. METHODS: In a single-blinded, crossover design, resistance trained males (n=19; 23±2 y, 80±10 kg) were randomized to receive a mixed meal immediately after exercise (IMM), or 2 h later (IMM+2H). Protein and carbohydrate concentration were the same in IMM and IMM+2H (proposed intake was 100 g total protein and 50 g carbohydrate per day). The dominant leg of each subject was used, and participants performed a standardized resistance protocol (10 sets of 6 repetitions) on the day of each trial. Handgrip dynamometry and quadriceps muscle thickness were measured before and after each trial. Carbohydrate and protein intake was calculated from dietary records and validated by breath tests using [13C]phenylalanine to model the metabolic fate of dietary AA. RESULTS: Nitrogen balance in IMM was 1.7±0.2 g/day and 2.0±0.2 g/day in IMM+2H (p=0.01). Carbohydrate enrichment was 0.13±0.02 g/min in IMM and 0.18±0.02 g/min in IMM+2H (p=0.001). Carbohydrate oxidized in IMM was significantly higher than IMM+2H (2.0±0.2 g/min vs 1.2±0.2 g/min, p=0.001). Carbohydrate oxidation was +2H at 60 minutes after exercise (0.21±0.13 g/min vs. 0.11±0.12 g/min, respectively; p<0.001). Carbohydrate oxidation was higher in IMM+2H than IMM at minute 90 (p=0.05, ES=0.60), minute 120 (p=0.05, ES=0.40), and minute 150 (p=0.05, ES=0.50). There were no significant differences in salivary cortisol among groups (all p values >0.05). CONCLUSION: In the postprandial state, +2H promoted higher fat utilization than IMM, whereas IMM promoted greater carbohydrate oxidation earlier in the recovery period. Both interventions resulted in similar net protein retention. Thus, postponing postexercise nutrient intake when in a postprandial state may be implicated in body composition improvements.

Low physical activity (e.g. reduced daily steps) reduces the ability of dietary amino acids (AA) to support muscle protein synthesis, leading to eventual muscle loss. Interrupting prolonged sitting with short bouts of intermittent exercise can improve carbohydrate and lipid metabolism, however its ability to sensitize skeletal muscle to dietary AA has yet to be investigated. PURPOSE: To determine the ability of interrupting prolonged sitting with practical ‘activity snacks’ to enhance the postprandial incorporation of dietary AA into myofibrillar protein. METHODS: As a subset of a larger study, twelve participants (7 males and 5 females; ~23y; ~40.0±9.8 kg/m2; ~25.1±5.0 kg/m2; ~4676 steps/d) completed three 7.5 h trials in a randomized order consisting of prolonged sitting (SIT), sitting with intermittent walking (WLK; 2 min at 3.1mph every 30 min) or sitting with intermittent squatting (SQT; 15 ‘chair stands with calf raise’ every 30 min). Mixed-macronutrient meals (~55:30:15% carbohydrate:fat:protein) were provided at 20% (breakfast) and 30% (lunch) of daily energy requirements to be consistent with Western feeding patterns. Meals were enriched to 15% with ring-[13C]phenylalanine or ring-[13C]phenylalanine to model the metabolic fate of dietary AA. Muscle biopsies taken at the end of each trial as well as at the beighe--dug of trial 2 were used to determine change in AA enrichment (LMS/MS) in the myofibrillar protein fraction (AMyo). RESULTS: AMyo was 0.032±0.004MPE in SIT and tended to be greater with SQT (0.038±0.003; P=0.10) and WLK (0.047±0.006; P=0.06) according to a priori comparisons (paired one-tail T-test). Relative to SIT, effect sizes were large for WLK (ES=0.88; 95% CI -0.30 - 2.07) and moderate for SQT (ES=-0.55; 95% CI -0.60 - 1.71). CONCLUSION: Interrupting prolonged periods of sitting with intermittent bouts of body weight-dependent activity has the potential to improve the utilization of dietary AA for de novo muscle protein synthesis in young healthy adults. Our results add to the evidence that reducing sedentary time through ‘activity snacks’ may help maintain muscle mass and quality. Future research should determine whether at risk populations (e.g. aging, obese) may obtain a greater benefit from this simple lifestyle modification. Supported in part by an ACSM Research Endowment Grant.

Abstract: The multiplicity of resting metabolic rate (RMR) prediction equations indicates that many variables affect RMR, making it difficult to adopt a single equation for all individuals who wish to lose, gain or maintain weight. PURPOSE: To improve the accuracy of RMR prediction equations for obese individuals and to construct a new formula to evaluate RMR after weight loss (WL). METHODS: This study examined the RMR gap in 21 men (M) and 18 women (W), 25-60 yrs, with 27± IME= 40 kg/m2 and 10-20% WL after at least three months in a structured weight reduction program with a customized diet and professionally tailored exercise prescription. At entry and at follow-up visits participants’ RMR, weight, height, fat-free mass (FFM), fat mass (FM), were measured with reliable instruments to ascertain the RMR change relative to FFM and FM. Pre and post RMR measurements were compared to calculated RMR using existing Harris and Benedict (HB), Ravussin and Bogrados (RB) and Johansen et al. (J). T-test, ANOVA and χ2 test comparisons were analyzed using SPSS 19.0, significance level P<0.05. To improve accuracy new prediction equations were constructed through stepwise linear regression based on before (RMRb) and after (RMRa) RMR measurements: M: RMRa=132.82+28.37(W)-250.59(H)+9.46(FFM)-2.871(A)-25.932(FM) M: RMRb=1862.68-7.779(W)+716.679(H)+18.099(FFM)+1.964(A)+14.972(FM) M: RMRb=553.971+1.6601(W)+1033.839(H)-13.734(FFM)-10.950(A)-19.668(FM) W: RMRa=-552.850+7.288(W)+340.730(H)+8.932(FFM)-5.064(A)-5.015(FM). RESULTS: In M and W there was a significant difference in WL (M: 104±13 vs. 87±11; W: 88±10 vs.75±8; P<0.01), BMI (M: 33.3±28.3; W: 32±4 vs. 27.3; P<0.01) and FM in kg (M: 37.7±26.9; W: 40.9±27.8; P=0.01); M only in FFM (65.9±63.9 vs. 61±9; P=0.02) whereas in RMR (1802±176 vs. 1684±176, P=0.04). Calculated RMR before and after WL using the J equation was closest to measured RMR in M and W before and in W after WL (M: -337±223; W: -57±256, vs -69±128); but only accurate was W before WL (P=0.351). RMR calculations with the new equations were more accurate and closest to measured RMR before and after WL in M (-0.05±154 vs. 0.03±197) but only after WL in W (P=0.301). CONCLUSION: The study illuminates the need to adopt different equations for assessment of individuals’ RMR before and after weight loss.
A-51 Free Communication/Poster - Behavioral Aspects, Correlates and Predictors of Exercise

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

Board #248 May 27 10:30 AM - 12:00 PM
Do Genetic Variations Predict Physical Activity Response To Lifestyle Intervention Among Obese Adults With Diabetes?
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PURPOSE: Those who are prone to high physical activity (PA) in natural environments may respond better to a PA promotion intervention than those who are prone to low PA. A genome-wide association study (GWAS) and a candidate gene study identified 4 single nucleotide polymorphisms (SNPs) related to PA: rs978656 near C18orf2 and cardiorespiratory fitness (CRF) measures at baseline, year 1, and year 4 (n=2675). Of the 3649 participants who were successfully genotyped for all the 4 SNPs, we used linear mixed effects models to regress PA phenotypes in response to a lifestyle intervention.

METHODS: This is a secondary analysis of Look AHEAD, a multi-center randomized controlled trial among participants who are overweight/obese and have type 2 diabetes (ages 45-76). Look AHEAD is designed to test the health benefits of an intensive lifestyle intervention (ILI), combining caloric restriction and PA promotion for weight loss, as compared to diabetes support and education alone. We examined the moderating effects of the 4 SNPs individually and in a weighted genetic score (GS). We hypothesized that the main effect of the intervention on CRF was significant (p=0.04) among A allele carriers (less-PA-prone) at year 1; however, this finding did not persist following that the main effect of the intervention on CRF was significant (p=0.04) only among A allele carriers (less-PA-prone) at year 1; however, this finding did not persist following

RESULTS: None of the individual SNPs or the GS were associated with baseline PA.

CONCLUSIONS: The ILI may have a more salient effect on CRF among A allele carriers of rs978656. Future intervention studies on the genetic basis of PA change are recommended to include more GWAS-identified SNPs.

Board #250 May 27 10:30 AM - 12:00 PM
Heart Rate Variability Mediates Fatigue And Motivation Throughout A High-intensity Exercise Program.
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PURPOSE: High-intensity exercise programs are often promoted as a time-efficient public health intervention to combat chronic disease. Increased physical effort, and subsequent fatigue, can be barriers to long-term maintenance of these exercise programs. The purpose of the present study was to determine if heart rate variability (HRV) mediates state traits related to exercise program adherence. We hypothesized that exercise-induced, temporary shifts in resting HRV would significantly affect daily fatigue and motivation. METHODS: Fifty-five healthy men and women (ages 19-35 years) used a commercially-available smartphone application to monitor daily HRV status throughout a six-week high-intensity exercise intervention. Participants were randomly assigned to either control (CON) (n = 29, 24.1 ± 4.1 years, 41.4% male) or treatment (TREAT) (n = 26, 23.7 ± 4.5 years, 53.8% male) groups. Within CON, exercise intensity was prescribed as while intensity within TREAT was modulated in response to observed shifts in daily HRV. Participants reported treatment and global physical fatigue during each exercise session. RESULTS: Prevalence of temporary shifts in resting HRV were 37.6 and 38.7% for the CON and TREAT conditions, respectively. Within CON, shifts in HRV resulted in less motivation (mean diff. = -4.00%, 95% CI = -7.56, -0.44; p = .030) during HRV shifts. Within TREAT, shifts in HRV resulted in no change in motivation (mean diff. = .028, 95% CI = -4.79, 4.86; p = 1.00) and more physical fatigue (mean diff. = 4.79, 95% CI = 1.85, 7.74; p = .018). Spectral domain metrics (i.e., LF/HF ratio) were significantly lower (mean diff. = -.14, 95% CI = .27, .01; F = 4.715, p = .030) during HRV shifts. Within TREAT, shifts in HRV resulted in no change in motivation (mean diff. = .258%, 95% CI = -6.54, 1.38; F = 1.63, p = .202) with reduced physical fatigue (mean diff. = .548%, 95% CI = -5.96, 6.22, F = 10.40, p = .001). Within TREAT, LF/HF ratio was higher (mean diff. = .13, 95% CI = 0.23, 0.24; F = 5.59, p = .018) during HRV shifts. CONCLUSIONS: These data establish a link between expected shifts in heart rate variability throughout high-intensity exercise programs with motivation to participate and physical fatigue. Additionally, modulation of training volume, in response to these shifts, can optimize adherence-related behavioral responses during high-intensity programs.

Board #249 May 27 10:30 AM - 12:00 PM
Motives And Barriers To Initiation And Exercise Adherence In A Fitness Club Setting.
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PURPOSE: Worldwide, about 183 million adults are fitness club members and there is a need of more understanding why some individuals adhere to exercise, and others drop-out. The main aim of the present study was to examine proportions reporting regular exercise, non-regular exercise and drop-out, as well as identify motives and barriers to exercise throughout the first year of fitness club membership. In addition, we wanted to compare motives between those who reported regular exercise at three, six, and 12 months, with those who did not (irregular exercise or drop-out).

METHODS: New fitness club members (< four weeks membership) were followed for one year. At onset (n = 250), and after three (n = 224), six (n = 213) and 12 (n = 187) months, participants completed an electronic questionnaire (including background variables, exercise involvement, motives and barriers to exercise), and 184 answered at all time-points. According to exercise involvement, participants were categorized into: Regular exercise ≥ two sessions/week, and non-regular exercise: ≤ one session/week, exercise relapse or drop-out. Cochran’s Q test, independent t-tests or chi-square were used as appropriate.

RESULTS: Of 184 participants, 37.0% reported regular exercise throughout the follow-up. At three, six and 12 months; 23.0%, 28.3% and 34.8% reported exercise drop-out. At all follow-up, positive health (79.1% to 85.5%), increase in mobility (59.4% to 70.7%), and strength endurance (58.3% to 66.3%) were reported as most important exercise motives. Among exercise drop-out, priority (60.9% to 71.7%) was perceived as most important barrier throughout one-year follow-up. Other barriers were reported by <20.0%. The intrinsic motives enjoyment and challenge were perceived as more important among regular exercisers compared with non-regular exercisers (p = .005) throughout the first year of fitness club membership.

CONCLUSIONS: A total of 63.0% reported non-regular exercise throughout the first year of fitness club membership. Extrinsic motives and internal barrier were perceived as most important. Regular exercisers rated the intrinsic motives enjoyment and challenge higher than non-regular exercisers.

Board #251 May 27 10:30 AM - 12:00 PM
AUTONOMY AND VARIATION IN HIGH-INTENSITY INTERVAL TRAINING: IMPACTS ON POST-EXERCISE ENJOYMENT, SELF-EFFICACY, AND INTENTION
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PURPOSE: Benefits associated with high-intensity interval training (HIIT) are established and research demonstrates that HIIT is well-tolerated in a variety of populations, protocols, and modalities. However, relatively little is known about the impact of variation and self-selection of work intervals on post-exercise perceptions. PURPOSE: The purpose of this study was to determine the impact of autonomy and variation on exercise enjoyment and both self-efficacy for and intention to repeat HIIT exercise.

METHODS: Twenty-one physically active participants (12 male, 9 female; mean BMI = 27 ± 5; mean age = 28 ± 6) completed three, 20-minute HIIT trials after

Abstracts were prepared by the authors and printed as submitted.
completion of maximal testing. All experimental trials included a total of 10 minutes of work and 10 minutes of recovery. Work and recovery were conducted at 90% and 10% of peak work, respectively. Trials included: a standard interval bout with repeating 60-sec work and recovery segments (Traditional), an interval bout with a mix of predetermined 30-, 60-, 90-, & 120-second segments (Varied), and a bout with a self-selected number of 30-, 60-, 90-, & 120-second segments (Autonomous).

In-task affective valence and enjoyment were measured four times during work and recovery. Differences between trials were analyzed using dependent t-tests. RESULTS: Difference scores were deemed to be enjoyable exercise sessions (scores ranging from 95-100 on the 18-126 scale). Self-efficacy for completing HIIT (measured on a 0-100 scale) was greater for the Autonomous trial compared to the Varied trial (77% vs. 70%; P < 0.05) and intention to exercise (measured on a 1-7 scale) was not different across trials, but there was a trend towards Autonomous HIIT producing stronger intentions than Varied HIIT (4.3 vs. 3.7; P < 0.10). CONCLUSIONS: Findings indicate that each trial of HIIT was enjoyable and produced relatively positive ratings for exercise self-efficacy and intention.

These findings suggest that provision of autonomy during HIIT exercise sessions can produce more desirable psychological responses for self-efficacy and possibly exercise intention.

**436 Board #252**
May 27 10:30 AM - 12:00 PM

**Perceived And Actual Motor Competence And Physical Activity In Children With And Without Asthma**

Indica Sur, Katherine Q. Scott-Andrews, Lexie R. Beemer, Tiwaloluwa A. Ajibewa, Leah E. Robinson, FACSAM, Toby C. Lewis, Rebecca E. Hasson, FACSAM. University of Michigan, Ann Arbor; MI. (Sponsor: Rebecca Hasson, FACSAM)

(No relevant relationships reported)

Motor competence (MC) and perceived motor competence (PMC) are important determinants of physical activity participation and may contribute to the lower physical activity levels and fitness previously observed in children with asthma.

**PURPOSE:** The purpose of this study was to compare MC, PMC, and moderate-to-vigorous physical activity (MVPA) levels in children and adolescents with and without asthma, and to determine whether motor skills predict lower MVPA in children with asthma compared to their healthy peers.

**METHODS:** Eleven children with persistent asthma (age=11.1±0.7 years; 54.5% female; BMI percentile=53.4±9.8) and 20 children without asthma (age=11.1±0.6 years; 54.5% female; BMI percentile=60.3±6.2) participating in the Exercises for a Healthy Asthma Lifestyle and Enjoyment (ExHALE) study have been analyzed to date. Asthma diagnosis was verified by the child’s physician. MC was measured using the Movement Assessment Battery for Children-2. PMC was measured using the Athletic Competence domain from the Self-Perceptions Profile for Children. MVPA was assessed via accelerometer.

**RESULTS:** Children with asthma reported lower PMC than children without asthma (2.5±0.1 vs. 2.9±0.1; p=0.04) with no significant differences in MC between groups (7.0±0.9 vs. 7.6±0.5; p=0.55). Children with asthma engaged in fewer minutes of MVPA per day compared to their healthy peers (22.7±7.5 vs. 44.±12.23; p=0.06), however, in preliminary analyses, this difference was not statistically significant. MC and PMC were not significant predictors of MVPA (MC: β=0.95; 70.70; PMC: β=−14.6±9.3; p=0.05), and there were no differences by asthma status (p>0.05).

**CONCLUSIONS:** Children with asthma reported lower self-perceptions of motor competence and engaged in fewer minutes of health-enhancing physical activity compared to their healthy peers. Motor skills, however, were not significant predictors of physical activity engagement. Additional research is needed to better understand the factors contributing to lower physical activity levels and fitness previously observed in children with asthma. As the ExHALE study proceeds, we will be able to reexamine these relationships further and examine asthma characteristics that may influence these relationships.

**437 Board #253**
May 27 10:30 AM - 12:00 PM

**Aerobic Exercise Enhances Behavior Features In Model Of Parkinson’S Disease Mice Via Pink1/parkin Pathway**

Jianshe Wei, Baozhu Fan, Rifat Jabeen, Chunlei Guo, Bright Anyomi, Solomon Agegnehu, Mengjie Han, Yuling Zhang, Jianshe Wei, Baozhu Fan, Riffat Jabeen, Chunlei Guo, Bright Anyomi, Yuling Zhang, Ke Wang, Hui Zhang, Juan Cen. Institute for Brain Sciences Research, Henan University, Kaifeng, China.

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(No relevant relationships reported)

Oxidative stress in the brain of Parkinson’s patients leads to impaired mitochondrial function, while exercise can improve mitochondrial function, but the mechanism is unclear. There are two mechanisms of mitochondrial function: autophagy and transport function.

**PURPOSE:** To detect the expression of mitochondrial autophagy protein PINK1/Parkin in MPTP-induced Parkinson’s (PD) mice by treadmill exercise, and to explore the effect of aerobic exercise on mitochondrial function.

**METHODS:** 32 C57BL/6J male mice were divided into 4 groups: Saline group (S), Saline: Exercise group (SE), MPTP group (M), and MPTP + Exercise group (ME). M and ME mice were injected with MPTP to construct a PD model. SE and ME mice were subjected to 8 weeks treadmill training. Behavioral tests were performed after exercise; immunofluorescence and histochemistry, and Western Blot to detect molecular indicators.

**RESULTS:** (1) The time of passing the balance beam, M group was longer than the S group (P<0.01) and the ME group was shorter than the M group (P<0.05) (Fig1A); In the forced swimming test (Fig1B)and the open field experiment (Fig1C&D) the mouse fast moving time, M group was shorter than the S group (P<0.05), while the ME group was longer than the M group (P<0.05). (2) The expression of a-Syn was up-regulated in the M group (P<0.01), but in the ME group was decreased after exercise (P<0.05) (Fig2). (3) The expression of Tyrrosine hydroxylase (TH)(Fig3), TOM-40(Fig4) in group M was lower than that in group S (P<0.05), while ME group was higher than that M group (P<0.05). (4) The protein of Parkin and PINK1 were increased after exercise (P<0.05) (Fig5).

**CONCLUSION:** Exercise can enhance the mitochondrial autophagy ability, improve the mitochondrial transport function, promotes behavior features in PD mice.

**Key words:** aerobic exercise; mitochondrion; autophagy; Parkinson’s disease

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Health benefits are a frequent exercise motive, despite mental and fitness improvements occurring sooner. Key cross-sectional participation motives in high intensity functional training (HIIT) have included mental (e.g., enjoyment), social (e.g., affiliation), and fitness (e.g., nimbleness) factors, which vary by age and are related to self-efficacy (SE). However, no research has examined relationships between changes in these variables after HIIT participation. **PURPOSE:** To investigate how perceived changes in health and motivation related to SE changes by age. **METHODS:** Data were from an observational study evaluating participation and SE at a university HIIT gym. Participants (n = 35; 52% female, 97% white, 26.5 ± 26.6 months HIIT experience) were emailed two online surveys (2-6 months apart) including demographics, general health status, exercise motivation, and 12 SE mental, social, and fitness factors.

Data were from an ongoing program evaluation study at a university HIIT gym. **RESULTS:** Participants (n = 35; 52% female, 97% white, 26.5 ± 26.6 months HIIT experience) were emailed two online surveys (2-6 months apart) including demographics, general health status, exercise motivation, and 12 SE mental, social, and fitness factors including HIIT adherence. Participant age ranged from 20-76 years; three age cohorts (C) were used for analysis: C1 (20-34 years, n = 10), C2 (35-64 years, n = 13), and C3 (65+ years, n = 10). Difference scores were compared using bi-variate correlations. **RESULTS:** No C1 participants reported changes in health; a slight decrease in motivation (-0.4 ± 1.0) was not correlated with changes in any SE factors. For C2 participants, the slight increase in motivation (0.4 ± 1.5) was correlated with SE for adherence (r = 0.65, p = .04) and a slight decrease in motivation (-0.4 ± 1.0) was not correlated with changes in any SE factors. For C3 participants, a slight decrease in health (-0.2 ± 0.4), improved health was correlated with SE for adherence (r = 0.78, p = .008) and a slight motivation increase (0.4 ± 1.5) was correlated with SE for adherence (r = 0.65, p = .04).
and agility (r = 0.78, p < .006). CONCLUSIONS: Perceived health improvements for participants ages 35+ increased SE for adherence, as well as mental factors for middle-age participants, while increased motivation was only related to increased SE for adherence among older adults. Age differences must be considered for HITT program design and delivery, and future research might examine these relationships in comparison to other fitness programs.

439 Board #255 May 27 10:30 AM - 12:00 PM
Physical Activity, Sedentary Behavior, And Social Media Use In College Students
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There is currently a gap in the literature regarding the relationship between physical activity (PA), sedentary behavior, and social media use. It is unclear if hours per day of social media use is associated with activity patterns of college students. Additionally, it is unclear if type of social media accounts followed influence activity patterns.

Purpose: To examine the relationship between PA, sedentary behavior, and social media use in college students. Methods: College students completed a one-time online questionnaire. PA and sedentary behavior were assessed using the International Physical Activity Questionnaire-Short Form. Social media use was assessed with the International Social Media Use Questionnaire. Results: Two-hundred ninety-two students provided informed consent and were eligible to participate in the study. Activity patterns were self-reported [median (25th, 75th percentile)]. Participants reported 120 (80, 240) min/wk of moderate intensity PA, 240 (120, 360) min/wk of vigorous intensity PA, and 250 (165, 360) min/wk of sedentary behavior. Only 30.8% of the sample engaged in a minimum of 150 of moderate intensity activity each week, and 61.4% in the recommended minimum of 75 minutes of vigorous intensity PA. Furthermore, 31.6% of participants did not report any engagement in moderate intensity PA, 27.9% did not report any engagement in vigorous intensity PA. In this sample, 97.9% of students reported using social media daily, with 41.38% and 43.1% reporting 1-2 hours and 3-4 hours of social media use each day, respectively. Social media use was not associated with moderate or vigorous intensity physical activity (p=0.05); however, hours per day of social media use was associated with sedentary behavior (r= 0.156, p=0.09). Additionally, following health/fitness social media accounts was significantly associated with BMI (r = -0.129, p=0.029), sedentary behavior (r = 0.128, p=0.031), and reaching the vigorous intensity PA guidelines minimum recommendation (r = -0.194, p=0.001). Conclusion: While there is an increased interest in utilizing social media as an intervention strategy to promote behavior change, results from this study indicate that social media may have a undesirable relationship with vigorous intensity PA and sedentary behavior. Future studies should examine the longitudinal influence of social media on PA and use objective PA monitoring.

440 Board #256 May 27 10:30 AM - 12:00 PM
Influence Of Resistance-exercise Training On Total Physical Activity In Gulf War Veterans With Chronic Pain
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Nearly 30% of US military Veterans of the Persian Gulf War are currently suffering from debilitating multisymptom illnesses. A primary complaint among these individuals is chronic widespread musculoskeletal pain (CMP). Previous lab has observed lower levels of total physical activity (PA) in civilian CMP patients compared to their healthy peers. In general, CMP patients with lower levels of PA are at risk for greater disability. While exercise-training interventions may have demonstrated benefits for fitness and health related outcomes, their influence on total PA, particularly in CMP patients, is an open question.

Purpose: To quantify the influence of a 16-week resistance exercise training (RET) trial on self-reported and actigraphy measures of total PA in Gulf War Veterans (GV) with CMP. Methods: Fifty-five GV with CMP were randomly assigned to 16 weeks of RET (n=28) or a wait-list control (n=27). The RET consisted of twice weekly sessions with a personal trainer, initiated at a low intensity (25-35% 1 RM) with progression as tolerated. At baseline, 6 weeks, 11 weeks, and 17 weeks, all participants completed the International Physical Activity Questionnaire (IPAQ) and were a waist-mounted actigraphy monitor (ACTI) for 7 days during waking hours. Total PA was defined for the IPAQ as the summative total score (MET-min/week) and for the ACTI as total counts per day relative to wear time (counts/d/min). Analyses were limited to GV with valid measures at baseline and at least one additional time point. Data were log transformed and extreme outliers (> 3 SD) were excluded. Separate linear mixed models with group and time point as fixed effects were fit for the IPAQ and ACTI measures, using baseline values as a covariate to control for initial differences.

Results: GV assigned to RET completed 88% of training sessions and exhibited strength increases of >20% for 7 of 8 lifts. Estimates for the fixed effects and their interaction were not significant for either measure (IPAQ: F1,76 = 0.17, p = 0.68; ACTI: F1,76 = 0.09, p = 0.76). CONCLUSION: Although 16 weeks of RET were well attended and resulted in improvements in fitness for GV with CMP, total PA level, outside of the exercise sessions, did not appear to be impacted. Supported by US Department of Veterans Affairs grant #I01CX000383

441 Board #257 May 27 10:30 AM - 12:00 PM
Acute Effects Of Intermittent Physical Activity On Psychological Stress And Insecurity In Children And Adolescents With And Without Asthma

Interruption of physical activity (PA) may be a novel strategy to promote PA in children and adolescents with asthma, potentially averting the physiologic changes associated with exercise-induced bronchial constriction that occurs during exercise. Yet, the psychological impact and acceptability of intermittent PA have not been rigorously evaluated in this clinical population. Purpose: To examine acute changes in psychological stress and insecurity in children and adolescents with and without asthma while performing five exercise conditions in a laboratory setting. Methods: Thirty-nine children and adolescents between the ages of 8-15 years (35% with asthma; 52% female; mean age: 11.1±0.4 years; BMI%ile: 57.8±5.2) were recruited from Southeast Michigan to participate in the exercises for a Healthy Asthma Lifestyle and Enjoyment (ExHALE) study. Participants completed 5 exercise conditions in the following order: 1) 6-minute walk test, ii) 5-minute resistance circuit, iii) 5-minute activity video, iv) 5-minute gamified obstacle course, and v) the YMCA Three-Minute Step Test. Heart rate (HR) and rating of perceived exertion (RPE) were measured to objectively and subjectively assess exercise intensity using HR monitoring and the children’s OMNI Perceived Exertion Scale, respectively. Psychological stress and insecurity were self-reported using a Visual Analog Scale pre- and post-activity. Results: Mean HR was significantly different across all conditions (p<0.01), with the highest HRs observed during the obstacle course and the lowest HRs during the activity video (gamified obstacle course: 167±2.4 bpm; step test: 146±0.3±5 bpm; walk test: 122±4.1 bpm; resistance circuit: 131±8.2 bpm; activity video: 105±7.5 bpm). There were no differences in HR by asthma status (p=0.05). RPE followed the same trend as HR but there were no significant differences in RPE (p=0.05), psychological stress or insecurity across conditions or by asthma status (p=0.05). Conclusions: Intermittent PA of varying intensity and duration did not increase psychological stress or insecurity in children and adolescents with and without asthma. These findings provide preliminary evidence in support of using intermittent PA to promote PA participation among children and adolescents with asthma.

442 Board #258 May 27 10:30 AM - 12:00 PM
Psychological Responses To Intermittent Physical Activity In Children With And Without Asthma
Katherine Q. Scott-Andrews, Lexie R. Beemer, Tiwaloulua A. Ajibewa, Indica Sur, Leah E. Robinson, FACSM, Toby Lewis, Rebecca E. Hasson, FACSM. University of Michigan, Ann Arbor, MI. (Sponsor: Rebecca Hasson, FACSM)

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BACKGROUND: Knowing how children feel during physical activity and what type of activities they enjoy can provide insight regarding their motivation to participate in future activity. These factors may be especially important for children with asthma who experience many barriers to maintaining an active lifestyle. PURPOSE: To compare psychological responses (physical activity enjoyment and mood) during intermittent activities of varying intensity across conditions in children with and without asthma. METHODS: Thirty-one children (asthma: n=11, 45% male, mean age: 11.1±0.7 years; BMI%ile: 53.4±9.8; non-asthma: n=20, 50% male; mean age: 11.1±0.6 years; BMI%ile: 60.3±6.2) participated in the Exercises for a Healthy Asthma Lifestyle and Enjoyment (ExHALE) Study. Participants completed 5 conditions in the following order: 1) Six-minute moderate-intensity walk test, 2) 5-minute moderate-intensity resistance circuit, 3) 5-minute moderate-intensity activity video, 4) 5-minute high-intensity gamified obstacle course, and 5) the YMCA Three-Minute high-intensity step test. Enjoyment was assessed via the Physical Activity Enjoyment Scale following

Abstracts were prepared by the authors and printed as submitted.
443 Board #259 May 27 10:30 AM - 12:00 PM Alcohol, Tobacco And Marijuana Use In A Population Of Ultramarathon Runners Ankit Shah1, Umar Khan2, Rebecca Torguson3, Kecia Alexander4, Casey Fisher2, Matthew Sedgley, FACSM1, Aaron Baggish1, Andrew Lincoln1. 1MedStar Union Memorial Hospital, Baltimore, MD. 2Georgetown University School of Medicine, Washington, DC. 3MedStar Cardiovascular Research Network, Baltimore, MD. 4MedStar Sports Medicine, Baltimore, MD. 5Massachusetts General Hospital, Boston, MA. 6MedStar Health Research Institute, Baltimore, MD. (Sponsor: Matthew Sedgley, FACSM) Email: ankit.b.shah@medstar.net (No relevant relationships reported)

Purpose: It is well accepted that routine low to moderate intensity physical activity leads to decreased cardiovascular (CV) morbidity and mortality. However, recent observational studies suggest that athletes who exercise at the highest doses (frequency x duration x intensity) may exhibit a reverse J-shaped dose-response with respect to mortality and development of CV disease. Our objective was to determine the prevalence of alcohol and marijuana use in ultra-marathon runners and whether these behaviors were associated with CV risk factors.

Methods: This was a pilot survey involving 180 John F. Kennedy 50 Mile ultramarathon race participants held in Hagerstown, MD. Predefined CV risk factors included current or prior history of smoking, diabetes, hypertension, dyslipidemia, and obesity (BMI >30). Health behaviors included use of alcohol and marijuana.

Results: Of the 868 registered runners, 292 (34%) completed the survey. 106 (36.3%) runners had at least one CV risk factor and 15 (5.2%) had known CV disease. Overall, 1.4% of runners reported being a current smoker, 25.3% were prior smokers, 31.3% lived with a smoker, 2.8% consumed alcohol during ultra events, 45.7% consumed alcohol after ultra events, 13.8% were told they drink too much, and 12.4% regularly used marijuana. Runners with at least one CV risk factor were more likely to have consumed alcohol during ultra events (p=0.025) and were told they drink too much (p=0.02). There were no differences by asthma status on enjoyment across activity conditions (all p>0.05).

Conclusions: Participants reported lower mood during the higher intensity tempo-paced activity, but similar levels of enjoyment for all activities. These findings suggest intermittent activity of varying intensities and durations is an enjoyable form of exercise for both children with and without asthma.

444 Board #260 May 27 10:30 AM - 12:00 PM Perceived Barriers And Motivators For Physical Activity In Women With Perinatal Depression Sylvia E. Badon, Esti Iurrralde, Nerissa Nance, Lyndsay A. Avalos. Kaiser Permanente Northern California, Oakland, CA. Email: sylvia.e.badon@kp.org (No relevant relationships reported)

Physical activity (PA) may help reduce severity of depressive symptoms in women with perinatal depression (depression during pregnancy or postpartum). However, less than one third of pregnant and postpartum women meet national PA recommendations, and PA is likely even lower in women with perinatal depression. Barriers and motivations for PA among women with perinatal depression are not well understood.

PURPOSE: The aim of this study was to identify barriers and motivators for PA among women with perinatal depression. METHODS: Pregnant and postpartum women with perinatal depression were identified using Kaiser Permanente Northern California’s universal perinatal depression screening program. We conducted 8 focus groups totaling 35 women with prenatal (n=15) or postpartum depression (n=20). Focus groups were analyzed using an inductive approach. RESULTS: Pregnant women were, on average, 27 weeks gestation (range: 11-37) with mild to moderately severe depressive symptoms (Patient Health Questionnaire (PHQ)-8 mean: 10; range: 4-19). Postpartum women were, on average, 12.5 months postpartum (range: 8.5-16.5) with no to moderately severe depressive symptoms (PHQ-8 mean: 7; range: 0-16). Perceived barriers to PA included: identifying pregnant and postpartum women included low energy and mood, limited time due to other priorities, feeling discouraged when comparing to pre-pregnancy self, and limited geographic accessibility and high cost of group exercise classes. Unique barriers identified by pregnant women were physical discomfort and fear of judgement from others. Postpartum women identified lack of childcare as an additional barrier. Motivators for PA included: providing support and postpartum women included self-care (“me time”), improved mood after PA, making progress toward goals, being strong and fit to keep up with their children, and having a social support system. CONCLUSIONS: Interventions to increase PA in pregnant and postpartum women with perinatal depression should include components addressing motivation, time, geographic accessibility, and cost barriers. Interventions can also increase PA by promoting potential mood benefits, fostering a sense of accomplishment, and leveraging social support as motivators in pregnant and postpartum women with perinatal depression.

445 Board #261 May 27 10:30 AM - 12:00 PM Exercise Interests, Identity, And Motivations Across Levels Of Activity And Exercise Preferences: What Moves You? Katrina Taylor, Emily R. Dunston. Eastern Washington University, Cheney, WA. Email: ktnaylor53@ewu.edu (No relevant relationships reported)

Despite numerous benefits of engaging in adequate moderate-to-vigorous physical activity (MVPA), nearly half of US adults do not meet activity guidelines. Exercise motivations have been positively associated with MVPA; however, little research has investigated exercise interests and identity across levels of MVPA and exercise mode preferences. PURPOSE: To determine differences in exercise identity, interests, and motivations across levels of MVPA and exercise mode preferences. METHODS: US adults (n=170; age 34.1±13.9 y) completed a survey consisting of the Exercise Identity Scale, Behavioral Regulation in Exercise Questionnaire, and Exercise Interest Scale. Demographic information, MVPA and exercise preferences were also reported. Data were analyzed using one-way ANOVA to determine differences across quartiles of MVPA and exercise mode preferences. RESULTS: Exercise identity was significantly lower in Q1 (35.3±12.6) than Q3 (48.8±10.5, p<0.001) and Q4 (53.2±10.7, p<0.001). Exercise interests were different across quartiles with Q1 reporting lower scores in the challenge (p<0.001) and creativity (p<0.05) subscales. Intrinsic motivations (p>0.05) were different across quartiles of MVPA with higher motivations with increased MVPA. Exercise interests differed across exercise preference, specifically in the outdoor (p<0.001), competition (p<0.001), social (p=0.04), and challenge (p<0.02) subscales. People who prefer outdoor exercise had significantly higher outdoor interest scores (14.1±1.9) compared to those who prefer group (11.3±3.0), individual (11.4±2.9), or sport activities (11.8±2.7). People who preferred sports had higher competition interest (11.1±2.9) than group (8.1±3.0), individual (8.6±2.9), or outdoor activities (8.4±3.4; p<0.005 for all). There were no differences in exercise motivation or identity across exercise mode preferences (p>0.05).

CONCLUSIONS: Our findings suggest exercise identity, interests, and intrinsic motivations may play an important role in MVPA engagement. Further, exploratory role in MVPA engagement. Further, exploratory research could be determined using the Exercise Interest Scale. Future research should investigate the association between exercise interests, identity and motivations and long-term adherence to MVPA in previously inactive individuals.

446 Board #262 May 27 10:30 AM - 12:00 PM The Effects Of Frequency Framing On Fitness Center Commitment Contracts Jessica Ramirez-Magana, Zachary Zenko. California State University Bakersfield, Bakersfield, CA. (No relevant relationships reported)

Research from the field of behavioral economics indicates that different frames of similar or equal situations can impact decision making. Rather than only focusing on maximizing utility, decision-makers are influenced by other, nonrational factors, such as the way choices are presented. PURPOSE: The purpose of this study was to analyze if the framing effect applied to the context of fitness center commitment contracts. METHODS: 145 adults (mean age [SD]: 31 [11] years; 88 men, 56 women) in the United States completed an online survey in which they were randomized to one of two frames. In the Twice/Week group, participants were asked to consider a commitment contract in which attending a fitness center twice per week for one year would result in a 50% membership reimbursement. Participants in the 104Year group were asked to consider a commitment contract in which attending the fitness center 104 times in one year would result in a 50% membership reimbursement. Both commitment contracts were identical in terms of total commitment and total number of required fitness center visits (i.e., 104 times per year, or twice per week for 52 weeks [2*52 = 104]) but framed to emphasize either short-term intervals (weekly) or long-
Despite the abundance of literature examining the effects of mental toughness (MT) on increased athletic performance, challenge appraisal, and motivation within the context of sport, there is a paucity of literature examining mental toughness within the context of physical activity (PA). Furthermore, studies that have examined mental toughness within the context of PA only included athletes in their samples.

**Purpose:** To examine MT and PA among college students enrolled in a mid-Western university. **Methods:** Participants (N = 273) completed online questionnaires regarding age, sex, race, athlete status, MT, and PA. The Mental Toughness Questionnaire (MTQ48) was used to measure MT while the International Physical Activity Questionnaire—Short Form (IPAQ-SF) was used to measure PA. Pearson's Product-Moment Correlations were used to assess correlations between MT and PA. Independent samples t-tests were used to determine whether MT and PA varied according to sex (male vs. female), race (White vs. non-White), or athlete status (athlete vs. non-athlete). **Results:** There were no significant differences between overall MT, total PA, VPA, MPA, and meeting PA guidelines. Of the six subscales of MT, only challenge showed significant correlations with overall PA, r(273) = .133, p < .05. Scores on the challenge subscale of MT were higher for athletes compared to non-athletes (3.68±0.37 vs 3.55±0.43, p < .05). Furthermore, overall PA was higher for athletes compared to non-athletes (688.65±734.82 vs 324.80±511.70, p < .05). **Conclusion:** Mental toughness was not correlated with PA among college students. However, differences in MT and PA according to sex, race, and athlete status should be examined further.
**Board #267 May 27 10:30 AM - 12:00 PM**

**The Desire To Move And Rest: Trait Or State? CRAVE Scale Validation Across 2 Years**

Miguel Blaucht, Matthew Stults-Kolehmainen, Nia Fogelman, Carol E. Garber, FACSM, John B. Bartholomew, FACSM, Rajita Sinha. Teachers College, Columbia University, New York, NY. Yale New Haven Hospital, New Haven, CT. Yale University, New Haven, CT. University of Texas at Austin, Austin, TX. (Sponsor: Carol Ewing Garber, FACSM)

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(No relevant relationships reported)

**Purpose**

The CRAVE (Cravings for Rest and Volitional Energy Expenditure) Scale measures the intrinsic desire or want for movement and sedentary behaviors, as assessed “right now”. The purpose of the current study was to test the reliability of the CRAVE Scale:

a) at 6-month intervals over 24-months and b) over 2 time points within the same test day.

**Methods**

The CRAVE Scale was administered to 127 subjects (57% non-Caucasian, 47% female) at 0, 6, 12, 18 and 24 months and at two time points (Point 1; Point 2) within the same lab session. CRAVE description: 13-items (7-REST & 6-Move), 1-10 Likert scale. A Linear Mixed Effects (LME) Model was used for the analyses of test-retest reliability of the CRAVE across months and within each day. In addition, an LME was used to test gender and race/ethnic interactions with CRAVE.

**Results**

The CRAVE Scale showed greater reliability within each day (Table 1) than across months.

Within-day Move scores correlation: r’s = .74-.95. Within-day Rest scores correlation: r’s = .73-.89. Move Score correlations across 0-24 months: r = .49 for point 1 and r = .40 for point 2 (p-values < .05). Rest Score correlations across 0-24 months: r = .37 for measurements at both points (p-values < .05). Therefore, CRAVE scores taken within the same day were more closely associated than scores across 0-24 months. Race/ethnicity, but not gender, had a significant interaction with the CRAVE. Specifically, Asian individuals wanted to move more than Caucasians and African-Americans at 0-months, 6-months and 18-months and Hispanic individuals at 0-months only (p-values < .05).

**Table 1.** Means, standard deviations and correlations for Move and Rest Scores within the same test day (session points 1 and 2).

<table>
<thead>
<tr>
<th>Time (months)</th>
<th>Move (Point 1)</th>
<th>Move (Point 2)</th>
<th>Move Scores (r)</th>
<th>Rest (Point 1)</th>
<th>Rest (Point 2)</th>
<th>Rest Scores (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>32.7 ± 15.2</td>
<td>35.9 ± 12.8</td>
<td>0.95</td>
<td>25.1 ± 13.9</td>
<td>20.9 ± 11.9</td>
<td>0.89</td>
</tr>
<tr>
<td>6</td>
<td>28.4 ± 12.9</td>
<td>26.7 ± 14.5</td>
<td>0.74</td>
<td>24.3 ± 14.2</td>
<td>24.3 ± 16.7</td>
<td>0.73</td>
</tr>
<tr>
<td>12</td>
<td>30.6 ± 13.7</td>
<td>28.8 ± 13.6</td>
<td>0.79</td>
<td>24.4 ± 14.6</td>
<td>23.9 ± 15.8</td>
<td>0.82</td>
</tr>
<tr>
<td>18</td>
<td>29.0 ± 13.0</td>
<td>29.4 ± 15.9</td>
<td>0.86</td>
<td>28.0 ± 15.9</td>
<td>24.5 ± 15.2</td>
<td>0.76</td>
</tr>
<tr>
<td>24</td>
<td>29.9 ± 11.6</td>
<td>28.0 ± 11.7</td>
<td>0.82</td>
<td>26.4 ± 16.0</td>
<td>25.4 ± 16.3</td>
<td>0.84</td>
</tr>
</tbody>
</table>

**Conclusion**

These findings suggest that the desire (or want) to either move or rest has state-like properties. Individuals’ desire to move/rest is does not vary by gender but may by race/ethnicity.

Research support: NIH/NIDDK Grant number: R01-DK099039

**Board #268 May 27 10:30 AM - 12:00 PM**

**Understanding College Students’ Motivation In Virtual Reality-Based Exercise: An Expectancy-Value Approach**

Joonyoung Lee, Tao Zhang, Ana West, Leigh A. Karch, Jordan Reynolds. University of North Texas, Denton, TX.

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(No relevant relationships reported)

**Purpose**

To investigate college students’ motivation in VR-based exercise and exercise intention from the expectancy-value model perspective (Eccles et al., 1983), which includes expectancy-related beliefs and three task-values (i.e., attainment value, intrinsic value, and utility value).

**METHODS:** Participants were 72 college students (Mage = 20.72, SD = 1.66; Male = 54.2%) from a public university in the U.S. Among them, 94.4% of the participants reported “never” or “rarely” played VR-based exercise before. They played the VirZoom Arcade (stationary bike game) requiring moderate-to-vigorous pedaling and leaning their body to the left and right for at least 5 minutes. After attending the VR-based exercise session, participants completed VR-based expectancy-value questionnaires adopted from previous studies, which was developed for measuring students’ motivation and intention for future participation in VR-based exercise.

**RESULTS:** The correlation analysis indicated the positive associations among the study variables. A multiple regression analysis revealed a statistically significant effect, F(3,68) = 30.162, p < .001, R² = 57.1%. The utility value (β = .409), attainment value (β = .296), and intrinsic value (β = .269) were three significant predictors of students’ intention for future participation in VR-based exercise, but the expectancy-related belief was not a significant predictor of students’ intention for future participation in VR-based exercise.

**CONCLUSIONS:** The findings indicated that VR-based exercise is useful, important, and interesting that can enhance college students’ intention to participate in VR-based exercise in the future. VR technology could be considered as an efficient motivational tool to promote exercise, but further research is needed to examine the effects of VR-based exercise on college students’ health outcomes using an experimental research design.
Behavioral theories may inform the development of lifestyle interventions to address low participation in physical activity (PA) and high volumes of screen time (ST). Self-determination theory (SDT) has been shown to explain intrapersonal factors influencing behavior such as self-efficacy for PA or ST and self-regulation of motivation (e.g. intrinsic vs extrinsic). However, less is known about the value of extending SDT into a dyadic context. Actor-partner (i.e. parent-adolescent) interdependence models (APIMs) allow for testing of these dyadic relationships.

**PURPOSE:** The purpose of the cross-sectional Family Life, Activity, Sun, Health, and Eating (FLASHFE) Study was to evaluate health risk behaviors (including PA and ST) in parent-adolescent dyads. METHODS: Parent-adolescent dyads provided responses to online surveys assessing PA and ST behaviors in the context of environmental and family interactions. We examined the influence of SDT-based constructs (observed for self-efficacy and a latent construct for motivation) on PA and ST in 1,228 dyads who provided complete data. Structural equations were used to estimate APIMs in STATA 15.1. **RESULTS:** Models specified a priori provided a reasonable fit to the data; however, fit statistics (CFI=0.90, RMSEA=0.09; SRMR=0.06) suggested that estimates from parent-adolescent models were less robust than those from parent- or adolescent-only models (PA & ST). For both PA and ST, adolescent self-efficacy was a stronger predictor of adolescent motivation than parent self-efficacy for parent motivation (β =-0.40 vs. 0.25, p <.001). Parent’s and adolescent’s motivation did predict each other’s motivation (p<.001) and their own behaviors but not the PA and ST of their dyad partners. **CONCLUSIONS:** Although SDT explains intrapersonal effects, it may not extend adequately to a dyadic setting. Motivational self-regulation of parents and adolescents are related; however, longitudinal studies conducted to evaluate whether changes in SDT variables are associated with change in parent-adolescent PA and ST patterns over time are needed.

**Self-perception Differences Between Crossfitters And Other Recreational Exercise Participants**

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(No relevant relationships reported)

Improved mental health is an important benefit of physical activity participation. However, understanding the benefits that might occur based on different modes of recreational exercise is not often examined. **PURPOSE:** To compare physical activity levels and self-perceptions of CrossFit participants and participants of other exercise modes. METHODS: 163 female participants with various exercise habits took an online survey that consisted of questions about subject demographics and the CRAVE within 24 hours of starting and again within two minutes of finishing a maximal treadmill test. Changes were assessed with paired t-tests. Correlations were calculated to assess relationships between the CRAVE and mental energy (ME), physical fatigue (PF), physical energy (PE), and physical fatigue (PF).

**Results**

Desire to move significantly decreased (39.9 ± 9.6 vs. 29.5 ± 10.7, p<.001) while desire to rest significantly increased (17.8 ± 12.3 vs. 29.1 ± 18.1, p<.001) from pre- to post-treadmill test. Desire to move pre- was significantly associated with desire to move post- (r =0.63, p<.002). Baseline desire to rest was significantly associated with desire to rest post- (r =-0.48, p<.002) and with the post-test change in desire to move (r =-0.53, p<.014). Change in desire to move was inversely associated with change in desire to rest (r =-0.73, p<.002).

Baseline desire to move significantly was associated with the post PE (r =0.45, p<.001). Change in desire to move had a negative association with change in PF (r =-0.52, p<.019), but not with change in PE (r =0.31, ME (r =-0.10) or MF (r =-0.17). Change in desire to rest had an inverse correlation with change in PE (r =-0.64, p<.003) and a positive correlation with change in PF (r =0.53, p<.016). It was not correlated with change in either ME (r =0.06) or MF (r =-0.20).

**Conclusion**

Desires to move and rest change with an exercise stimulus, with desire to move decreasing and rest increasing. Furthermore, these findings suggest that people who move and rest are moderately associated with feelings of physical energy/fatigue but not mental energy/fatigue.

**The Desire To Move And Rest: Validation Of The Crave Scale Using A Treadmill Test**

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(No relevant relationships reported)

**Purpose**

The CRAVE (Cravings for Rest and Volitional Energy Expenditure) Scale measures the intrinsic desire (or want) for movement and sedentary behaviors, as measured “right now”. The purpose of this study was a) to evaluate changes in and the construct validity of the CRAVE Scale before and after maximal exercise and b) assess relationships between these desires and with perceptions of energy and fatigue.

**Methods**

The CRAVE Scale is made up of 7-Rest & 6-Move questions (1-10 Likert scale). Fatigue and energy were measured with visual analogue scales. The CRAVE was administered to 21 undergraduate students in physical activity classes (ages 19-24 years; 57% non-Caucasian; 58% female). Participants were given the CRAVE within a minute of starting and again within two minutes of finishing a maximal treadmill test. Changes were assessed with paired t-tests. Correlations were calculated to assess relationships between the CRAVE and mental energy (ME), mental fatigue (MF), physical energy (PE), and physical fatigue (PF).

**Results**

Desire to move significantly decreased (39.9 ± 9.6 vs. 29.5 ± 10.7, p<.001) while desire to rest significantly increased (17.8 ± 12.3 vs. 29.1 ± 18.1, p<.001) from pre- to post-treadmill test. Desire to move pre- was significantly associated with desire to move post- (r =0.63, p<.002). Baseline desire to rest was significantly associated with desire to rest post- (r =-0.48, p<.002) and with the post-test change in desire to move (r =-0.53, p<.014). Change in desire to move was inversely associated with change in desire to rest (r =-0.73, p<.002).

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**Conclusion**

Desires to move and rest change with an exercise stimulus, with desire to move decreasing and rest increasing. Furthermore, these findings suggest that people who move and rest are moderately associated with feelings of physical energy/fatigue but not mental energy/fatigue.

**High intensity functional training (HIIT) is a mode of exercise where participants exercise at their perceived high-intensity and perform both aerobic and resistance exercises with emphasis on multi-joint movements modifiable and scalable to all ability levels. This may benefit older adults who are recommended to participate in concurrent exercise training to improve functional capacity. Low-self efficacy (SE) (i.e., belief in ability to accomplish a task) is a barrier to exercise for many older adults. **Purpose:** To investigate how one’s SE for participation in HIIT is related to enjoyment, motivation, and SE for performing various exercise tasks in older adults. High values in self-efficacy for participation in HIIT was expected to positively correlate with self-efficacy values for performing various exercise tasks. **Methods:** Data were drawn from an ongoing program evaluation study including a cohort of 11 sport and exercise-related tasks. (No relevant relationships reported)

**Conclusion**

High intensity functional training (HIIT) is a mode of exercise where participants exercise at their perceived high-intensity and perform both aerobic and resistance exercises with emphasis on multi-joint movements modifiable and scalable to all ability levels. This may benefit older adults who are recommended to participate in concurrent exercise training to improve functional capacity. Low-self efficacy (SE) (i.e., belief in ability to accomplish a task) is a barrier to exercise for many older adults. **Purpose:** To investigate how one’s SE for participation in HIIT is related to enjoyment, motivation, and SE for performing various exercise tasks in older adults. High values in self-efficacy for participation in HIIT was expected to positively correlate with self-efficacy values for performing various exercise tasks. **Methods:** Data were drawn from an ongoing program evaluation study including a cohort of 11 sport and exercise-related tasks. **Results:** SE to continue HIIT was significantly correlated to general exercise motivation (r =-.85, p = .000), "I can recognize my strengths and weaknesses in different situations" (r =-.80, p = .002), "I enjoy doing..."
exercise’ (r = 0.65, p = 0.017), and ‘I can do physical exercises that require resistance’ (r = 0.59, p = 0.036). Discussion: SE for continued HIFT participation was positively related to exercise enjoyment and motivation as well as SE for self-awareness and resistance exercises, which can influence group class design. Older adults who have these attributes will have the confidence and knowledge to gauge their intensity appropriately and participate in exercises that may push their functional limits. Future research should analyze if continued HIFT adherence positively influences SE and functional capacity.

There were 1.09 million international college students in the U.S. as of 2018 (Institute of International Education). Previous studies showed that many international students experienced academic stress, as well as language and cultural stress. (Yan & FitzPatrick, 2015). Further, previous studies also indicated that the U.S. college culture can facilitate participation in physical activity for international students (Yan & Cardinal, 2013). It is unclear whether these different types of stresses and time in the U.S. would be associated with their participation in moderate-to-vigorous physical activity (MVPA). PURPOSE: The present study aimed to examine whether academic, cultural, and language stresses, as well as time in the U.S. would predict MVPA among international college students. METHODS: Participants were 249 international college students (48.2% female; Mage = 27.48, SD = 6.12) enrolled in a public research university in Southern U.S. MVPA was measured by the International Physical Activity Questionnaire (Craig et al., 2003). Previously validated scales were used to measure students’ perceived academic stress (e.g., “I worry about my academic performance”), cultural stress (e.g., “It’s hard for me to develop opposite-sex relationships here”), and language stress (e.g., “My English embarrasses me when I talk to people”). Time in the U.S. was measured by asking how many months they had been in the U.S. Finally, gender and BMI were also measured. RESULTS: The independent t test showed that males participated significantly more MVPA than females (Male: M = 293.71 METs; Female: M = 241.79 METs); t(245) = 3.09, p<.01. The multiple regression model with gender and BMI controlled was statistically significant, F(6,242) = 3.37, p<.01, R² = 7.7%, Cultural stress significantly predicted MVPA (β = -.21, p<.01), with higher cultural stress was associated with lower MVPA. Language stress, academic stress, and time in the U.S. did not predict MVPA. CONCLUSION: The results indicated that cultural stress was related to MVPA among international college students. However, it is unclear whether experiencing more cultural stress discourages MVPA or participating MVPA helps international students manage their cultural stress. To answer this question, qualitative studies and interventional studies are needed in the future.

A single-bout of aerobic exercise produces a short-term ‘boost’ to executive function. For example, recent work by our group has shown that the high-level executive function of ‘switching’ between different tasks is improved following a 20-min single-bout of moderate-intensity aerobic exercise. Notably, previous work examined immediate exercise-related task-switching benefits and it is therefore unknown how long the benefit to executive function persists. PURPOSE: Here, we employed an AABBB task-switching paradigm involving stimulus-driven (SD) saccades (i.e., saccade at target onset) and their executive mediated minimally delayed (MD) counterparts (i.e., saccade at target offset). MD saccades require active response suppression of a SD saccade and are mediated via an extensive frontoparietal network. Further, a SD saccade completed following a MD saccade results in an increase in reaction time (RT), whereas the converse switch does not (i.e., the unidirectional switch-cost) - a result attributed to a task-set inertia within executive networks. METHODS: SD and MD saccades were completed prior to and immediately, 30-min and 60-min after a 20-min single-bout of aerobic exercise (via cycle ergometer) at a moderate intensity (80% of HRmax). RESULTS: The pre-exercise ocularmotor assessment revealed a reliable unidirectional switch-cost (22 ms, SD=18) (p<.001) and the magnitude of this cost decreased at the immediate (9 ms, SD=12) and 30-min (11 ms, SD=15) post-exercise assessments (p<.01). At the 60-min assessment, a switch-cost (20 ms, SD=22) on par to the pre-exercise assessment was observed. CONCLUSION: Accordingly, a single-bout of aerobic exercise provides a boost to the executive function of task-switching that persists between 30- and 60-min post-exercise.

Stresses On Physical Activity Among International College Students
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No relevant relationships reported

PURPOSE: The purpose of this study was to examine the sociocultural factors explaining PA among middle-aged and older women, with specific focus on subjective social status (SSS) and perceived neighborhood characteristics. METHODS: The survey data were collected from a total of 588 women (mean ages: 56.79). The International Physical Activity Questionnaire was used to assess PA levels in leisure-time (LTPA). Individuals were categorized into the three PA groups (i.e., no-LTPA and low-/upper-LTPA groups based on 50th percentile of LTPA levels). Perceived neighborhood characteristics were measured using the Neighborhood scale consisting of 31 items with the Likert scale across seven environmental dimensions (e.g., walkability, safety, social cohesion). SSS was assessed using a 10-rung ladder ranking with higher rungs indicating higher SSS in their neighborhood. A multinomial logistic regression model was established to examine the associations of perceived neighborhood characteristics and SSS with LTPA, after controlling for study covariates including demographic characteristics (i.e., age, race, marital status), objective social status (i.e., education, household income), and health conditions (i.e., body mass index, number of chronic diseases). RESULTS: Overall, neighborhood walkability was the environmental characteristic significantly associated with greater odds of being low- (OR = 1.43; 95% CI = 1.10, 1.86) and upper-LTPA (OR = 1.76; 95% CI = 1.34, 2.31), when compared to no-LTPA. Additionally, women with higher SSS demonstrated greater odds of being low- (OR = 1.72; 95% CI = 1.09, 2.71) and upper-LTPA (OR = 1.88; 95% CI = 1.18, 2.99). CONCLUSIONS: The present study identified perceived walking environment within a neighborhood as a potential ecological factor determining PA levels in middle-aged and older women. Further, it is suggested that SSS has a unique impact on PA levels, independent of objective social status indicators.

Mental imagery training can be an effective tool to enhance endurance and skill-based sport performance, especially long-term mental imagery training. The effects of mental imagery on sport performance, especially long-term mental imagery training. The effects of mental imagery training can be an effective tool to enhance endurance and skill-based sport performance, especially long-term mental imagery training. The effects of mental imagery training on sport performance, especially long-term mental imagery training. The effects of mental imagery training can be an effective tool to enhance endurance and skill-based sport performance, especially long-term mental imagery training. The effects of mental imagery training on sport performance, especially long-term mental imagery training. The effects of mental imagery training can be an effective tool to enhance endurance and skill-based sport performance, especially long-term mental imagery training.
No study has examined multidimensional factors associating with non-prescription anabolic steroid use within a large representative sample of US adolescents.

**PURPOSE:** The purpose of this study was to examine the cognitive, psychosocial, lifestyle, and activity-related correlates of non-prescription steroid use among US adolescents from data collected using the 2017 National Youth Risk Behavior Survey.

**METHODS:** A multi-stage cluster sampling procedure yielded a representative sample of US adolescents in 2017. The number of sampled adolescents with usable data was 14,765. Weighted logistic regression was used to examine the associations between cognitive, psychosocial, lifestyle, and activity-related variables and non-prescription steroid use among US adolescents adjusting for age, sex, BMI percentile, and race/ethnicity. **RESULTS:** The lone cognitive factor relating with non-prescription steroid use was a history of concussion (OR=2.06, 95%CI:1.37-3.13, p = 0.001). The psychosocial variable relating with non-prescription steroid use was feelings of sadness and/or hopelessness (OR=2.47, 95%CI:1.72-3.56, p < 0.001). Lifestyle factors relating with non-prescription steroid use included cigarette smoking (OR=2.06, 95%CI:1.10-3.84, p = 0.023), smokeless tobacco use (OR=2.33, 95%CI:1.19-4.56, p = 0.015), and alcohol consumption (OR=4.54, 95%CI:2.69-7.68, p < 0.001). No activity-related variables (daily physical activity, sports participation, muscular strength, exercise) associated with anabolic steroid use. **CONCLUSIONS:** Salient cognitive, psychosocial, and lifestyle factors relate with non-prescription steroid use among a representative sample of US adolescents. Multidimensional health educational and health behavioral approaches may be needed to properly inform and prevent adolescents from non-prescription steroid use.

**RESULTS:** Only 36.5% of the adolescents were sufficiently physically active. Boys had higher total CET score compared to girls (9.97 vs. 9.35, p=0.046), and 7% of the respondents had high CET score. Information about weight regulation and body dissatisfaction was obtained. Instruments included Actigraph GT3X, Behavioural Regulation of Exercise - Questionnaire (BREQ), KIDSCREEN-27, Subjective Vitality Scale (SVS), and Compulsive Exercise Test (CET). High CET score was identified as total CET score ≥15. **RESULTS:** Only 36.5% of the adolescents were sufficiently physically active. Boys had higher total CET score compared to girls (9.97 vs. 9.35, p=0.046), and 7% of the respondents had high CET score. A total of 3.5% showed both high CET score and low levels of physical activity, indicating exercise obsessions without compulsions. There was a positive correlation between total CET score and use of exercise mobile apps (r=0.12, p=0.003), and between total CET score and number of weight reduction attempts the past year (r=-0.22, p=0.02). No correlation was found between total CET score and physical activity, or between total CET score and sedentary time. A regression analysis showed introjected regulation (p=0.001), identified regulation (p=0.03) and extrinsic motivation (p=0.04), but not intrinsic motivation, amotivation, SVS, KIDSCREEN-27 domains, gender or physical activity level, as significant predictors of total CET score. **CONCLUSIONS:** Total CET score is associated with weight regulation behavior, and predicted by introjected, identified and extrinsic regulation of physical activity. These findings indicate needs for increased understanding about the complexity of cognitions concerning exercise, and not only exercise performance per se.
466 Board #282 May 27 10:30 AM - 12:00 PM The Desire To Move And Rest: Assessing Reliability And Validity Of The CRAVE Scale
Matthew Stults-Kolehmainen1, Miguel Blacutt2, Amanda Divin4, Susannah Williamson1, Todd A. Gilson, John B. Bartholomew, FACSM3, Rajita Sinha7. 1Auburn University College of Tourism and Hospitality Management, Auburn, AL. 2Northern Arizona University, Flagstaff, AZ. 3Illinois State University, Normal, IL. 4University of Wisconsin-La Crosse, La Crosse, WI. 5University of Rochester, Rochester, NY. 6University of Colorado, Boulder, CO. 7Yale University Medical School, New Haven, CT. (Sponsor: Susan B. Sisson, FACSM)

Purpose
The CRAVE (Cravings for Rest and Volitional Energy Expenditure) Scale measures the intrinsic desire for movement and sedentary behaviors as assessed “right now.” The purpose of this investigation was to evaluate reliability and construct validity of the CRAVE scale before, during and after a university lecture.

Methods
The CRAVE Scale and Thayer Activation-Deactivation (AD) Checklist were administered to 41 students (mean age 22.5±5.1 years; 26.8% non-Caucasian; 24.4% female) around a 50-minute lecture. CRAVE: 13 items (7- Rest & 6-Move), 1-10 Likert scale, given pre-, mid- and post-lecture. AD Checklist: 20 items, 1-10 Likert Scale, measures perceived energy, desire to move, tiredness, tension, and calmsness, only assessed pre-lecture. Lectures were at either 9AM, 12PM or 3PM. A linear mixed effects model was used to compare pre-, mid- and post-lecture CRAVE Scores across the days. Correlations were calculated to evaluate CRAVE and AD Checklist relationships.

Results
Desire to Move: significantly higher post-lecture compared to pre (32.2±2.0 vs. 27.5±2.0, p<0.007) and higher than mid (28.5±2.0, p<0.003). Desire to Rest: lower post-lecture compared to pre (28.3±2.8 vs. 33.4±2.8, p<0.016) and lower than mid (33.1±2.8, p<0.019). Cronbach alpha coefficients for pre-, mid- and post-lecture (desire to Move: 0.80, 0.94, 0.93, respectively; Rest: 0.89, 0.94, 0.93). Inter-class correlations: Move=.85; Rest=.90.

Conclusions
There were no differences in desire to rest based on time of day. Desire to move at baseline was significantly associated with energy (r=0.38, p<0.018) and calmsness (r=0.47, p<0.003). Desire to rest at baseline was significantly associated with energy (r=0.38, p=0.026), tiredness (r=0.48, p<0.003). Tension was unrelated to either move or rest.

467 Board #283 May 27 10:30 AM - 12:00 PM Children’s Motivation For Physical Activity
Tyler J. Kybartas1, Aaron P. Wood2, Kellie Strohacker, FACSM3, Rebecca A. Zakrzesk4, Jeddah E. Blanton4, Samantha F. Ehlich2, Dawn P. Coo4, FACSM3, Illinois State University, Normal, IL. 5University of Tennessee, Knoxville, TN. (No relevant relationships reported)

The establishment of physical activity (PA) routines in childhood is critical to form lifelong PA habits. Children are motivated for activities that they enjoy but research is scarce on motivational factors for PA in children younger than eight years old. PURPOSE: To explore why children enjoy or do not enjoy physical activities to gain insight into underlying motivations. METHODS: A mixed-methods study design was employed. Participants (n=16) were 2nd and 3rd grade students at two YMCA afterschool programs. Each child wore an accelerometer on the right hip for seven consecutive days and data were converted to min in PA intensities. They also completed Hart’s perceived motor competency survey and took part in focus groups. There were two 2nd grade and two 3rd grade focus groups, which consisted of 3-5 participants each. Descriptive analyses were performed on PA and perceived motor competency data. Focus group data underwent thematic analysis using an inductive approach. RESULTS: PA data revealed that the majority of participants (57%) met PA recommendation with an average of 63.8±25.4 minutes of moderate to vigorous PA per day. Additionally, the average perceived motor competency score was 3.0±0.6 (out of 4). Information from the focus groups was used to create four over-arching themes which included 1) PA is sport, 2) social influence, 3) perceived competence, and 4) PA characteristics. Within the social influence theme, peers, parents, siblings, and gender norms appear to make important contributions to this theme. The PA characteristics theme included roughness and danger, movement and action, teammates and competitors (without opponents only), and rules (unenjoyment only). It appears that the social influence, perceived competence, and PA characteristics had overlap on one another, suggesting perhaps all three have a reciprocal interaction that may relate to the enjoyment or unenjoyment of physical activities. CONCLUSIONS: Results suggest exposing children early to wide varieties of physical activities may help minimize activities they dislike and build their perceived competence and social bonds, which may be crucial to establishing and continuing PA behaviors.

468 Board #284 May 27 10:30 AM - 12:00 PM Exploring The Influence Of Pregnancy And Physical Activity Involvement On Physical Activity Levels And Knowledge Exploring The Influence Of Pregnancy And Physical Activity Involvement On Physical Activity Levels And Knowledge
Kellie A. Walters1, Cindy L. Hartman2, Kate Evans3. 1California State University, Long Beach, Long Beach, CA. 2University of New Hampshire, Durham, NH. 3University of Wisconsin-La Crosse, La Crosse, WI. (No relevant relationships reported)

Little is known about how women’s physical activity (PA) involvement and pregnancy status influence their PA levels and knowledge of PA guidelines specific to pregnancy. PURPOSE: The purpose of this study was to explore the relationship between pregnancy status, PA involvement, knowledge of appropriate PA behaviors during pregnancy, and PA levels. METHODS: Women who were currently pregnant (N = 72, Mean Age = 31.89 ± 4.23 years) and not pregnant (N = 196 and 36.90 ± 9.22 years) completed a questionnaire which included the physical activity (PA) Involvement Scale (Modified Involvement Scale), and questions pertaining to the appropriateness of PA during pregnancy (ACOG agreement) and their current PA levels (International PA Questionnaire). RESULTS: Pregnant women reported significantly higher levels of ACOG agreement (Z = -2.095, U = 5909.00, P < .005, r = .13) and significantly lower levels of PA (Z = -2.418, U = 4459.50, P < .005, r = .16) compared to non-pregnant women. There were no significant differences in ACOG agreement scores between high PA involvement, moderate PA involvement, and low PA involvement (P > .05). Women with high PA involvement report significantly more PA participation compared to women with both moderate and low PA involvement (P < .005). CONCLUSION: Educating mothers and their social network on appropriate PA during pregnancy might be helpful in limiting the amount of misguided information a pregnant woman receives throughout her pregnancy. Public health interventions might improve PA levels by focusing on enhancing a woman’s feeling of self via PA (identity affirmation) and desire to engage in PA (attraction). For example, to improve a woman’s identity affirmation, health providers should focus on helping women create attitudes and self-perceptions of being a physically active person (i.e., increasing the saliency of this identity). To increase attraction to PA, public health providers can help women identify PA modalities they enjoy and emphasize the importance of PA to the health of themselves, their baby, and their families. Public health interventions that focus on how psychosocial health (e.g., improving PA identity affirmation and attraction) can increase PA during pregnancy are necessary for improved health of pregnant women and their babies.
PURPOSE: On the basis of critical discourse analysis, we sought to understand the verbal language of strength and conditioning coaches. Their language was deconstructed and interpreted using the eight developmental dimensions (i.e., goals and pathways design, implementing obstacle planning, experiencing success or modeling others, persuasion and arousal, building assets or avoiding risks, affecting the influence process, building efficacy or confidence, and developing positive expectancy) of the Psychological Capital Model (PCM). These are the conduits of individual behavior. Future research should seek to study the mechanisms driving association between maternal and family PA.

RESULTS: Fifty-two mother-child dyads participated. On average, mothers were 82.7% Caucasian, 67.3% employed full-time, 46.2% normal weight, and obtained BMI was not related to child or family outcomes (p > 0.05). Maternal PA was associated with more frequent family PA participation score (p < 0.028). CONCLUSIONS: In this sample, maternal characteristics were related to beneficial family health habits, rather than individual child PA. Mothers may influence the collective behavior more so than individual behavior. Future research should seek to study the mechanisms driving association between maternal and family PA.

CONCLUSIONS: In this sample, maternal characteristics were related to beneficial family health habits, rather than individual child PA. Mothers may influence the collective behavior more so than individual behavior. Future research should seek to study the mechanisms driving association between maternal and family PA.
Sleep is considered fundamental for the physical recovery process, being related to the compensation process due to the residual effect of training. In addition, sleep seems to be related to performance in cognitive activities. However, little is known about the relationship of sleep to performance and recovery in long-distance runners.

**PURPOSE:** To verify the relationship between sleep parameters, perceived recovery and aerobic performance of runners.

**METHODS:** Eight long-distance runners (age, 30.3 ± 5.5 years; maximum oxygen consumption, 59.4 ± 3.4 ml·kg·min⁻¹), classified as good sleepers (Pittsburgh Index Quality <5), had their sleep monitored for six days a priori from a race to exhaustion. Pulse actigraph was used for 15 days to verify sleep parameters (total sleep time, sleep efficiency, number of awakenings and sleep latency). Perceived recovery was assessed by the Total Recovery Quality Scale (TQR) prior to the running session. The run-to-exhaustion session was performed at the anaerobic threshold, determined by the ventilatory equivalent, and presented as the time limit until exhaustion (TLM).

**RESULTS:** Runners had a sleep efficiency of 87.4 ± 9.6%, total sleep time of 350.4 ± 55.9 min (minutes), number of awakenings of 33.8 ± 25.5 min, sleep latency 13.8 ± 18.1 min on the night before the race and on the day of running, the TLM was 46 ± 15.3 min. There was a significant association between TQR and number of awakenings (r = 0.928; p = 0.001) and between TQR and sleep efficiency (r = 0.844; p = 0.008). In addition, TLM was associated with sleep efficiency (r = 0.817; p = 0.012), WASO (r = 0.773; p = 0.021) and TQR (r = 0.736; p = 0.019).

**CONCLUSION:** These results indicate that anaerobic threshold exhaustion and perceived recovery are associated with sleep parameters of the night before the race.

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**473 Board #289 May 27 10:30 AM - 12:00 PM Relationship Between Sleep Parameters, Perceived Recovery And Aerobic Performance In Runners**

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(No relevant relationships reported)

**475 Board #291 May 27 10:30 AM - 12:00 PM Goal Orientation And Beliefs About Success In Age Group Swimmers**


(No relevant relationships reported)

**Determining a swimmer’s goal orientation and what they believe makes them successful can help coaches create better workouts and outcome measures in young athletes.**

**PURPOSE:** Goal orientation (task vs ego) and success beliefs (effort, deception, ability and external factors) were examined in age group swimmers to determine if achievement theory differed by age.

**METHODS:** Eighty (N = 80), 11-18 year old USA Swimming club members, completed the Task and Ego Orientation in Sport Questionnaire (TEOSQ) and the Beliefs About the Causes of Sport Success Questionnaire (BACSSQ). Parent consent and child assent was obtained. Regression and multivariate analyses were used to examine differences between age groups.

**RESULTS:** Athletes with Ego orientation had significant positive relationships with ability and deception as beliefs about the causes of sport success (Wilks’ A = 0.010, F(6, 69) = 1.195, p<0.001 and p<0.05 for age categories, subsequent post hoc tests reached p<0.05 for significance). Those with Task orientation had a positive relationship with higher effort and negative relationship with deception as a belief about the cause of sport success. Age comparisons showed 13-14 and 15-18 year old age groups had significantly higher ego orientation than the 11-12 age group, the 15-18 age group had a significantly lower task orientation than both the 11-12 and 13-14 age groups. The 13-14 age group attributed deception to success in swimming significantly more than the 11-12 age group.

**CONCLUSION:** Older swimmers develop a higher ego orientation and lower task orientation due to more visible differences in ability and an increased focus on performance.

**476 Board #292 May 27 10:30 AM - 12:00 PM Ironic Process Theory In Softball Pitching: How Knowing Information About An Opponent'S Strengths Affects Performance**

Ronald Ottestetter, FACSM¹, Mackenzie Conrad¹, Mallory Kobak¹, Brian Miller¹, Judith Juvacnic-Heltzel¹. ‘The University of Akron, Akron, OH.’ Hiram College, Hiram, OH.

(No relevant relationships reported)

**INTRODUCTION:** As athletic competition and college athletics continue to grow and flourish, there is an increased emphasis on game preparation. Collegiate softball pitchers are expected to handle an immense amount of pressure, perform with precision, and incur few errors. **METHODS:** Examining the Ironic Process Theory related to fast pitch softball pitching and to determine how knowing information about an opponent’s strengths affects experienced pitcher’s performance under pressure.

**METHODS:** Experienced college softball pitchers (n = 12) were recruited as subjects. Each pitcher was randomly constructed through two 30 pitch phases (a high and low pressure phase) with two different conditions: black target only condition (BOTC) or black and red target condition (BRTC). Subjects were asked to aim and hit the black target and avoid the red target. The target represented the weakness of the opponent and the red target represented the strength of the opponent. Performance pressure was measured before each phase using the Mental Readiness Form (MRF-3) (Krane, 1994). RESULTS: Pre-MRF-3 reached statistical significance across the between-subjects factor of pressure, [F(22) = 3.102, p = 0.005] with a mean difference of 4.75 (95% CI: 1.57 to 7.92) indicating that the pressure situation induced an increase in perceived anxiety and stress. ANCOVA did not reach statistical significance on the main effects of black targets hit nor the interactions terms for black targets hit with two different conditions: black target only condition (BOTC) or black and red target condition (BRTC). Subjects were asked to aim at the black target and avoid the red target. There was no statistically significant difference of red target hit between the high pressure and low pressure situations, d = 0.25 (95% CI: 0.463 to 0.963). t(22) = 0.723, p = 0.963. **DISCUSSION:** Practically speaking, the pitchers in this study did perform more effectively in the high pressure situation. Although different from previous Ironic Theory research, it is important to note this increased ability for pitchers to hit a desired target while under pressure. Even if not statistically significant, this can help pitchers and coaches understand the link between pressure and performance more effectively, and add training components to improve in stress situations.
Several practice methods have been used by coaches in order to improve athletes’ performance through the permanent changes in movement performance. Two of the widely used practice tasks are blocked and random schedule. In random schedule, the practice target is unpredictable for the athletes. On the other hand, in blocked practice, the athlete executes the same motor movement repeatedly before moving to the next skill. PURPOSE: The purpose of the present study was to examine the effect of contextual interference (random, blocked practice) on improving the volleyball attack (spike). METHODS: Thirty-six (36) amateur volleyball players ranging in age from 18 to 25 years old volunteered to participate in the study. The participants were randomly assigned into three experimental conditions: (a) random practice, (b) blocked practice, and (c) control group. The intervention program lasted 6 weeks, and each participant underwent two 90-minute training sessions per week. During the training, each participant performed a total of 40 blows per training session. Three measures were applied: The first measure (pre-test) performed just before the commencement of the intervention program, one immediately after its end (post-test), and the third measure a week after the program completion (follow-up). RESULTS: The results indicated a significant improvement in the random schedule experimental group in the post-test compared to the pre-test (p<.001) as well as in the follow-up measure (p<.01). The blocked schedule group showed also an improvement in the post-test and follow-up measure compared to the pre-test (p<.05). Additionally, the random group was significantly better than blocked and control group in the post-test (p<.01, p<.05). CONCLUSIONS: Practice schedule differentiates the improvement of skill acquisition, indicating that the random practice participants revealed higher improvement and retention of the performed activity.

Imagery training is practiced with the goal of improving consistency of performance under pressure and to maximize skill execution. A recent model for advanced imagery training incorporates seven areas into the protocol to make it more realistic and vivid for athletes. These include Physical, Environment, Task, Timing, Learning, Emotion, and Perspective (PETTLEP). PURPOSE: To investigate the effect of a PETTLEP-based imagery script on college shot put performance as measured by peak force (PF), release angle (RA), release height (RH), release velocity (RV), and distance thrown (DT). METHODS: Ten NCAA shot putters (n=5 females & n=5 males) participated in this study. Each participant created a personal imagery script with personal cues. Imagery was conducted five days per week for three weeks. A pre- and postdesign was used to evaluate the efficacy of PETTLEP-based imagery. Data was recorded using advanced force plate technology, biomechanical sensors, and infrared camera equipment and performance variables recorded included peak force, release angle, height of release, and velocity. RESULTS: While all dependent variables increased in value, results yielded no significant difference in pre- to posttest for PF (Pre: 969.50 ± 185.18N; Post: 1030.16 ± 201.37N, p > 0.05), RA (Pre:33.42 ± 4.62°; Post: 36.95 ± 8.08°, p > 0.05), RH (Pre: 2.00 ± 0.11m; Post: 36.95 ± 8.08m, p > 0.05), and RV (Pre:10.89 ± 0.97m/s; Post: 11.29 ± 0.79m/s, p > 0.05). However, a significant difference was found for DT (Pre: 12.49 ± 2.14m; Post: 11.29 ± 1.67m, p < 0.05). Additionally, release velocity significantly correlated with distance thrown in both the pre- and post-tests (r = -962 and r = .834 respectively). Findings from the pretest linear regression analysis suggest using the release angle, release height, release velocity, and peak force production as a predictor of distance thrown with a level of confidence (F(4,5) = 26.29, p<.001; R² of .98). CONCLUSION: While these findings encourage the PETTLEP-based imagery training model employed in the present study needs to be validated further to determine its effectiveness for consistently enhancing athletic performance.
According to Self-Determination Theory (Ryan & Deci, 2017), motivation lies on a continuum from least (amotivation) to most self-determined (intrinsic). Personality traits have been shown to be related motivation in sport (e.g., Brinkman et al., 2016). Trait self-handicapping may be related to less self-determined motivation as athletes who use these strategies often fear failure for an upcoming, evaluative event and wish to control how they are perceived by others (Berger & Tobar, 2019). Despite about two million college students participating in club sports, research on these variables in this population is almost non-existent. PURPOSE: To examine the relationship between Big Five personality traits, trait self-handicapping, and motivation in college club athletes. METHODS: Data were collected from rugby (12 females, 28 males) and volleyball (15 females, 12 males) club athletes at a D-I university in the Midwest. Participants completed the Big Five Inventory, Self-Handicapping Scale, and Sport Motivation Scale - II. Factorial ANOVA and MANOVA were used to examine gender and sport differences for self-handicapping (SH), personality, motivation [intrinsic (INT), integrated (ITG), identified (IDN), introjected (ITJ), external (EXT), and amotivation (AMT)], and relative autonomy index (RAI). Personality traits and SH were included in stepwise multiple regression analyses to predict each type of motivation and RAI. RESULTS: Personality, SH, motivation, and RAI did not differ by gender or sport (p > .05). Thus, data were collapsed across gender and sport. Regression analyses revealed that Extraversion was the only significant predictor of INT [R² = .32, p < .01], ITG [R² = .36, p < .005], and IDN [R² = .40, p < .001]. Negative Emotionality predicted ITJ [R² = .29, p < .05] and SH predicted EXT [R² = .26, p < .05]. No traits significantly predicted AMT (p > .05). Extraversion and SH predicted RAI in the final model [R² = .38, p < .01]. CONCLUSION: Extraversion was related to more self-determined motivations in college club athletes. Athletes with more negative emotionality or who tended to use self-handicapping strategies reported less self-determined motivation. For these athletes, interventions that emphasize the intrinsic value of club sport participation may help decrease distress and self-handicapping behavior.

Context: Athletes often develop positive self-esteem during sport participation but may have negative repercussions once an athlete retires. Participation in sport is important in order to prevent negative mental health consequences and decreases in quality of life and activities of daily living. Purpose: To examine quality of life and activities of daily living in retired athletes. The secondary purpose will examine differences between gender, the type of sport played, and length of time in retirement. METHODS: Cross-sectional study examined retired athletes (n=180; ages: 28.5 ± 10.4 years; males: n = 72; females: n = 107). Each participant completed at minimum 2 years of collegiate athletics, or 2 years of collegiate athletics, or 2 years of professional sports. The survey included demographic questions related to activities of daily living (e.g., health status, activity level, basic mood levels, and the Quality of Life Index (QLI)). Basic descriptive, independent samples t-tests, and ANOVAs were used. Results: No significant differences were found between females and males’ total score for sport type and QLI. A significant difference was found between Time in Retirement and QLI total scores (p = .008). A significant difference (p=0.01) was found between gender and Time in Retirement in the amount of vigorous activities (e.g., running, strenuous exercise, etc.) and mood/nervousness (p=0.006) with females between 0.5 years of retirement displaying the highest concern. Majority of participants 84.4% (n=60) felt they were healthy for their age and 93.9% (n=69) felt their health does not prevent them from working and/or decreases their activities of daily living. Only 13.4% (n=24) reported feeling bad in the past 30 days. Conclusion: While it is suggested that retirement from sport may have negative repercussions on health and quality of life, the overall results indicated the opposite. Individuals reported their quality of life and health did not prevent them from completing activities of daily living. It is important to prepare athletes for retirement and encourage continuation of physical activity and maintenance of their health.
Aging is associated with a progressive accumulation of late differentiated T-cells and increased risk of infection and mortality. A higher level of cardiorespiratory fitness (VO\textsubscript{2} peak) in adults over 65 years old are associated with improved immune phenotype characteristics. However, little is known on the impact of light intensity physical activity (LPA) on the proportions of late differentiated T-cells in sedentary elderly. Purpose: We aimed to examine the impact of LPA and the age-related accumulation of memory T-cells in an elderly sedentary population. Methods: We studied 16 physically inactive, community-dwelling, older adults (70±4y) from an on-going exercise intervention (REALPA). At baseline participants performed a VO\textsubscript{2} peak exercise test on a treadmill. Participants also wore a physical activity monitor (Actigraph, GT3X) on their thigh 24-h/d for 7 days to quantify total non-bouted physical activity (PA). Fasted blood was drawn and peripheral blood mononuclear cells were isolated and stained with anti-CD3, CD4, CD8, CD57, and killer cell lectin-like receptor G 1 (KLRG1) monoclonal antibodies. T-cell phenotypes were analyzed by four-color flow cytometry (BD Accuri C6). The Pearson’s correlation coefficients were used to determine linear correlations between T-cell phenotype and PA. Results: Participants VO\textsubscript{2} peak ranged from 12.2 to 29.9 mL/kg/min (20.5 ± 5.1 mL/kg/min) and peak 2 peak on work-week ranged from 12.2 to 29.9 mL/kg/min (20.5 ± 5.1 mL/kg/min) and peak 2 peak 2 peak on 1 week was 12.2±2.9 mL/kg/min. LPA/day was 22.5 ± 14.3 min/day of Moderate-Vigorous intensity PA (MVPA)/day and accumulated 4,595 ± 1,091 steps/day. The number of pan memory T-cells (CD3+/KLRG1+) were inversely correlated with VO\textsubscript{2} peak (r = -0.51, p = 0.045), while the percentage of pan memory T-cells were negatively associated with volume of LPA (r = -0.54, p = 0.033), but not with MVPA (p > 0.05). Additionally, actigraphy analysis showed that a greater number of daily steps negatively associated with volume of LPA (r = -0.54, p = 0.033), but not with MVPA day. The number of pan memory T-cells (CD3+/KLRG1+) were inversely correlated with VO\textsubscript{2} peak (r = -0.51, p = 0.045), while the percentage of pan memory T-cells were negatively associated with volume of LPA (r = -0.54, p = 0.033), but not with MVPA (p > 0.05). Additionally, actigraphy analysis showed that a greater number of daily steps negatively associated with volume of LPA (r = -0.54, p = 0.033), but not with MVPA day.
analyzed for total (kappa + lambda) FLCs and kidney function was estimated by measuring plasma Cystatin C. Linear mixed models were used to analyze changes in FLC in response to the exercise interventions, after controlling for confounding factors.

**Results:** At baseline, VO2 peak and muscle quality were both negatively correlated with total FLC (r = -0.118, beta = -0.312; p = 0.001 and r = -0.100, beta = -0.220; p = 0.004, resp.), even after adjustment for age, sex, ethnic group and Hba1c level. Following 9 months of exercise, changes in VO2 peak in CON, AT, RT and COMB were not associated with changes in total FLC (p = 0.05). Total FLC levels were significantly reduced in those that exhibited improvements in muscle quality (r = -0.058, beta = -0.140; p = 0.047) in all exercising groups. No significant difference in total FLC were observed between the exercising groups, nor change in kidney in any of the groups. **Conclusion:** Lower physical fitness and muscle quality in people with T2D is associated with elevated FLCs, indicating a heightened state of B cell activation. Exercise-induced improvements in muscle quality corresponded with reduced circulating FLCs and systemic low-grade inflammation in T2D.

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**489**

**Board #305**

**May 27 9:30 AM - 11:00 AM**

**Abstract Withdrawn**

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**490**

**Board #306**

**May 27 9:30 AM - 11:00 AM**

**MONOCYTE FUNCTION FOLLOWING ACUTE EXERCISE IN BREAST CANCER SURVIVORS BEFORE AND AFTER EXERCISE TRAINING**

Erik D. Hanson¹, David B. Bartlett², Kaileigh M. Moeott³, Jordan T. Lee⁴, Williams S. Evans⁵, Eli Danson⁶, Chad W. Wagoner⁷, Elizabeth P. Harrell⁸, Stephanie A. Sullivan⁹, Lauren C. Bates¹⁰, Brian C. Jensen¹¹, Hyman B. Muss¹², Claudio L. Battaglini, FACSM¹³. University of North Carolina at Chapel Hill, Chapel Hill, NC. (Sponsor: Claudio L. Battaglini, FACSM)

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**(No relevant relationships reported)**

Breast cancer therapy impairs immune function that may be attenuated with exercise, though the specific changes that occur remain unclear. **PURPOSE:** 1) To examine monocyte function in breast cancer survivors (BCS) following acute exercise and 2) to determine if this response changes with exercise training. **METHODS:** 9 BCS [Age: 58±8, BMI: 27.9±6.7] completed a cardiopulmonary exercise test (CPET). In 45 min of intermittent cycling at 60% of CPET peak wattage was completed a cardiopulmonary exercise test (CPET). In a subsequent trial, 45 min of intermittent cycling at 60% of CPET peak wattage was evaluated using the ELIZA methods. Daily physical activity levels were objectively assessed using a uniaxial accelerometer and categorized into light-intensity physical activity (LPA) and moderate- to vigorous-intensity physical activity (MVPA). **RESULTS:** Abdominal obese adults had a higher median value of serum FGF21 levels when compared with non-obese adults (102 pg/ml vs. 139 pg/ml, P = 0.006). Serum FGF21 levels were correlated negatively with the time spent in LPA (r = -0.326, P = 0.025) and MVPA (r = -0.349, P = 0.016) in abdominal obese adults, but not in non-obese adults. When the participants were divided into four groups according to abdominal obesity and physical activity status, the significant interaction was indicated by abdominal obesity and MVPA (F = 7.386, P = 0.007), but not LPA. Additionally, abdominal obese adults with higher MVPA levels had lower serum FGF21 levels (P = 0.004). Furthermore, the association between abdominal obesity, MVPA status and FGF21 levels remained significant after adjusting for age, sex, peak oxygen consumption, blood lipid and glucose, current smoking status, and using medications (F = 6.229, P = 0.013). **CONCLUSIONS:** Lower serum FGF21 concentration was inversely related to higher physical activity levels, particularly in abdominal obese adults. These findings suggest that daily MVPA is effective for decreasing serum FGF21 levels in middle-aged and older adults with abdominal obesity.

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**491**

**Board #307**

**May 27 9:30 AM - 11:00 AM**

**Association Between Circulating FGF21 Levels And Physical Activity In Abdominal Obese Adults**

Masahiro Matsui¹, Keisui Kosaki², Koichiro Tanahashi³, Nobuhiko Akazawa⁴, Yosuke Osuka⁵, Kiyoji Tanaka, FACSM⁶, Makoto Kuro-o⁶, Seiji Maeda⁶.¹ University of Tsukuba, Ibaraki, Japan. ²Waseda University, Saitama, Japan. ³Kyoto Pharmaceutical University, Kyoto, Japan. ⁴Japan Institute of Sports Sciences, Tokyo, Japan. ⁵Tokyo Metropolitan Institute of Gerontology, Tokyo, Japan. ⁶Jichi Medical University, Tochigi, Japan. (Sponsor: Kiyoji Tanaka, FACSM)

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**(No relevant relationships reported)**

**PURPOSE:** Circulating fibroblast growth factor 21 (FGF21) is increased with abdominal obesity and may lead to the development of several chronic diseases such as diabetes and cardiovascular disease. Currently, the effect of daily physical activity on circulating FGF21 levels in abdominal obese adults is unclear. This study aimed to examine the cross-sectional association between circulating FGF21 levels and physical activity in abdominal obese adults.

**METHODS:** This study recruited 207 middle-aged and older adults and classified them as 160 non-obese and 47 abdominal obese adults according to their abdominal circumference (men: ≥ 85 cm, women: ≥ 90 cm). Circulating serum FGF21 levels were evaluated using the ELIZA methods. Daily physical activity levels were objectively assessed using a uniaxial accelerometer and categorized into light-intensity physical activity (LPA) and moderate- to vigorous-intensity physical activity (MVPA).

**RESULTS:** Abdominal obese adults had a higher median value of serum FGF21 levels when compared with non-obese adults (102 pg/ml vs. 139 pg/ml, P = 0.006). Serum FGF21 levels were correlated negatively with the time spent in LPA (r = -0.326, P = 0.025) and MVPA (r = -0.349, P = 0.016) in abdominal obese adults, but not in non-obese adults. When the participants were divided into four groups according to abdominal obesity and physical activity status, the significant interaction was indicated by abdominal obesity and MVPA (P = 7.386, P = 0.007), but not LPA. Additionally, abdominal obese adults with higher MVPA levels had lower serum FGF21 levels (P = 0.004). Furthermore, the association between abdominal obesity, MVPA status and FGF21 levels remained significant after adjusting for age, sex, peak oxygen consumption, blood lipid and glucose, current smoking status, and using medications (F = 6.229, P = 0.013). **CONCLUSIONS:** Lower serum FGF21 concentration was inversely related to higher physical activity levels, particularly in abdominal obese adults. These findings suggest that daily MVPA is effective for decreasing serum FGF21 levels in middle-aged and older adults with abdominal obesity.

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**492**

**Board #308**

**May 27 9:30 AM - 11:00 AM**

**Diabetes Risk Variants Associate With Impaired Insulin Sensitivity In Healthy Adults Following Bed Rest**

Jean Lorraine Fry¹, Emily J. Arentson-Lantz², Christopher S. Fry¹, Douglas Paddon-Jones, FACSM.¹ University of Kentucky, Lexington, KY. ²The University of Texas Medical Branch, Galveston, TX. (Sponsor: Douglas Paddon-Jones, FACSM)

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**(No relevant relationships reported)**

More than 80 genetic variants increase risk for type 2 diabetes. We hypothesized that increased genetic risk for diabetes may increase susceptibility to impaired insulin sensitivity following bed rest. **PURPOSE:** To determine whether type 2 diabetes genetic risk variants in healthy older adults are associated with impaired insulin sensitivity following bed rest. **METHODS:** 37 non-diabetic adults (65.9 ± 7.9 years, BMI 27.1 ± 3.0, 82.2 ± 6.4 mg/dL fasting blood glucose) completed bed rest studies at the University of Texas Medical Branch. The protocol consisted of a 3 day run-in period, 7 days of bed rest and 7 days of rehabilitation. OGTT (75g) were administered before and after bed rest protocol and following rehabilitation. Venous blood was collected at baseline, 0, 30, 60, 90, and 120 minutes, and the Matsuda Insulin Sensitivity Index (Mat-ISI), HOMA-IR, Insulinogenic Index (II), and the Disposition Index (DI) were calculated. DNA from whole blood was used to genotype for MTNR1B (rs10830963), NOTCH2 (rs10923931), RASGRF1 (rs7405331), PROX1 (rs2075423), HHEX (rs1118757), IGF2BP2 (rs4402960), CDKAL1 (rs7784480), SLCO3A8 (rs13266834), ZFAND6 (rs11634397), and TCF7L2 (rs7903146) risk variants using TaqMan Assays. Results were collated into an unweighted risk score based on the total number of risk alleles (possible range from 0-20). SSPP version 26 (IBM, Chicago, IL) was used to build a multivariate model including all outcome indices and risk variants. **RESULTS:** Genetic risk scores ranged from 5 to 11. HOMA-IR and II were not associated with risk scores at any point in the study. Higher overall risk scores were inversely associated with the Mat-ISI and the DI only immediately after the completion of the bed rest period (p = 0.035 and p = 0.017, respectively), but not at baseline or after rehabilitation. **CONCLUSIONS:** More than genetic variants increase risk for type 2 diabetes. We hypothesized that increased genetic risk for diabetes may increase susceptibility to impaired insulin sensitivity following bed rest.
those in the lowest risk group and 5.8 ± 3 in the highest risk group. CONCLUSION: These results indicate that people with a higher genetic risk for type 2 diabetes may be at increased risk of disease-related loss of insulin sensitivity. The work was supported by the Claude D. Pepper Older Americans Independence Center (P30 AG024832).

493 Board #309 May 27 9:30 AM - 11:00 AM Metabolic Effects Of High-intensity Interval Training With Probiotics Supplementation In Obese Women Yi-Chen Chen1, Ting-Yao Wang2, Chien-Wen Houl3. 1Institute of Sports Sciences, Taipei city, Taiwan. 2Hualien city, Taiwan. 3Sponsor: Chia-Hua Kuo, FACSM Email: qte33322@gmail.com (No relevant relationships reported)

The rising of cardiovascular disease and obesity is a pandemic issue over the past years. High-intensity interval training (HIIT) has been shown to improve aerobic capacity, increase metabolic rate, and reduce body fat. Lactobacillus plantarum TWK10, a type of probiotics isolated from Taiwan pickled vegetables, was also found to provide similar performance and metabolic outcome. However, the additive effects of probiotics with HIIT is unclear. PURPOSE: To investigate the additive effects of probiotics supplementation in combination with HIIT on cardiopulmonary fitness, body composition and metabolic syndrome blood biomarkers. METHODS: The placebo-controlled, double blinded study recruited obese women (n = 23, age = 45.8 ± 6.4 y, weight = 62.9 ± 9.2 kg, body fat % = 39.3 ± 3.8 %) and assigned into two groups: probiotics group (TWK10) and placebo group (PLA). Participants in both groups consumed supplements daily for 8 weeks and participated in a self-monitored HIIT training (treadmill running 7 ± 2 minutes at 85-90 % VO2max with 1-minute resting interval) for 3 sessions per week for 8 weeks. Cardiopulmonary fitness - VO2max and time to exhaustion, body composition - body weight and body fat %, waist and hip circumferences, and blood sugar and lipid profile - fasting blood glucose (FBG), triglyceride (TG), and high-density lipoprotein (HDL) were measured at baseline and after the exercise intervention. Data was analyzed using paired t-test and ANCOVA.

RESULTS: Time to exhaustion significantly increased in TWK10 (11.4%, p = 0.008) and PLA (-8.8%, p = 0.004). Hip circumference reduction significantly only in TWK10 group (-2.1%, p = 0.018) and waist circumference increased significantly only in PLA group (+1.7%, p = 0.008). No significant group effects were found in waist and hip circumference respectively. FBG increased significantly in PLA group (+4.5%, p = 0.027) but no significance was found in TWK10 group and between both groups. No significant time and group effects were found in VO2max, weight, body fat %, TG, and HDL. CONCLUSION: Probiotics supplement in combination with HIIT may only control body circumferences and stabilize FBG over time, but does not have additive benefits in overall cardiopulmonary fitness and metabolic biomarkers.

A-54 Free Communication/Poster - Diabetes/ Glocemic Control

494 Board #310 May 27 10:30 AM - 12:00 PM Hemoglobin A1c, Physical Activity, And Sport Participation Among Children With Type 1 Diabetes Kristi M. King, Jason R. Jaggers, FACSM, Timothy McKay, Kupper Wintergerst. University of Louisville, Louisville, KY. (Sponsor: Jason Jaggers, FACSM) Email: kristi.king@louisville.edu (No relevant relationships reported)

Children with type 1 diabetes (T1D) should engage in a minimum of 60 minutes of moderate- to vigorous-intensity physical activity (PA) daily, the same as children without T1D; however, care must be taken to prevent or address hypoglycemia or hyperglycemia during and after PA. PURPOSE: The purpose of this study was to determine if PA or sport participation predicted hemoglobin A1c (HbA1c) in children with T1D. METHODS: This study was conducted within a nationally certified pediatric diabetes care and academic medical center. Patients 7 to 17 years old with T1D presenting for their regularly scheduled pediatric endocrinology appointment were invited to complete a physical activity and sport participation electronic survey. Data were linked to their medical records for age, T1D diagnosis duration, ethnicity, race, gender, insurance type, body mass index (BMI), chronic glucose monitor (CGM) and insulin pump usage, and the primary outcome variable HbA1c. RESULTS: Participants consisted of 73 females (47.7%) and 80 males (52.3%), 12.97 ± 2.82 years old, with an average HbA1c of 8.78 ± 1.87. They were physically active for 60 minutes or more 1.95 days per week (6.1 ± 9.7% (n = 12) meeting the recommendation of daily PA, yet almost two-thirds played sports within the past year (n = 98, 64.1%). A multiple linear regression model indicated that although HbA1c decreased by .175 for each day a child engaged in PA and decreased .121 for every sport team a child played only the number of days active per week was a significant predictor of HbA1c (p < .05). CONCLUSION: Since the number of days active per week was a significant predictor of better HbA1c, it behooves diabetes care teams to encourage PA in addition to sport participation alone. Further investigation should address sociocultural barriers to PA and sport participation. This study was made possible by support from the Christensen Family, Children’s Hospital Foundation, and University of Louisville Foundation.

495 Board #311 May 27 10:30 AM - 12:00 PM Effects Of Aerobic And Resistance Training On The Lipoprotein Subclass Profile In Type 2 Diabetes Jacob L. Barber1, Neil M. Johannsen2, William E. Kraus, FACSM1, Timothy S. Church3, Mark A. Sarzynski, FACSM4, 1University of South Carolina, Columbia, SC. 2Louisiana State University, Baton Rouge, LA. 3Duke University School of Medicine, Durham, NC. 4Pennington Biomedical Research Center, Baton Rouge, LA. (Sponsor: Mark Sarzynski, FACSM) (No relevant relationships reported)

Purpose: Type 2 diabetes (T2D) is associated with dysfunctional lipid metabolism in addition to impaired glucose metabolism. Exercise is widely prescribed in the treatment of T2D; however, the effects of exercise on lipoprotein traits in T2D are not fully understood. METHODS: Change in lipoprotein subclass profile was examined in 214 patients with T2D from the HART-D cohort. Patients were randomized to 9 months of either control (n=33), aerobic training (AT, n=62), resistance training (RT, n=55), or combination of aerobic and resistance training (AT/RT, n=64). NMR spectroscopy was used to quantify lipoprotein size, total and subclass concentrations of triglyceride rich lipoproteins, low-density lipoproteins, and high-density lipoproteins (TRL-P, LDL-P, and HDL-P respectively). Paired t-tests were used to assess the effects of exercise within each intervention, and general linear models (GLMs) adjusting for group, sex, race, age, baseline BMI, and baseline trait value were used to compare changes in lipoprotein subclass fractions in exercise groups to changes in control. RESULTS: AT resulted in nominal (p=0.05) changes in small HDL-P (H2 (7.8nm): -0.69 mmol/L; p=0.032, H1 (7.4nm): 0.44 mmol/L, p=0.03), and RT increased medium LDL-P (43.89 mmol/L, p=0.002), while AT/RT failed to produce changes in any lipoprotein subclass. Adjusted GLMs revealed the change in H2 HDL-P was less in AT compared to control (p=0.01). Additionally, despite no training response in large LDL-P subclass concentration following AT, change in large LDL-P was less in the AT group compared to control (p=0.01). Conclusions: Overall, exercise training resulted in minimal changes in the lipoprotein subclass profile in patients with T2D. Further studies are needed to elucidate the potential effects of exercise dose on lipoprotein subclass fractions to improve upon the clinical utility of exercise prescription in the treatment of T2D.

496 Board #312 May 27 10:30 AM - 12:00 PM High Intensity Interval Training Improves Cardiac Autonomic Modulation In Diabetic More Than Moderate Intensity Training Ana Cristina Silva Rebelo1, Paulo Gentil1, Lucas Raphael Bento Silva1, Camila Simões Seguro1, Paulo Otávio Silva Santos1, Jessiel Fernando1, Gabriela de Oliveira Teles1, Vítor Alves Marques1, 1Federal University of Goias, Biological Sciences Institute and School of Medicine, Goiania, Brazil. 2Federal University of Goias, Faculty of Physical Education and Dance and School of Medicine, Goiania, Brazil. 3Federal University of Goias and Department of Physical Education, Faculty Araguaia, Goiania, Brazil. 4Faculty Araguaia, Goiania, Brazil. 5Federal University of Goias, Faculty of Physical Education and Dance, Goiania, Brazil. 6Federal University of Goias, School of Medicine, Goiania, Brazil. Email: ana_rebelo@ufg.br (No relevant relationships reported)

PURPOSE: The aim of this study was to compare the Heart Rate Recovery (HRK) kinetics and Heart rate variability (HR) in diabetic mellitus type 2 (T2DM) after high-intensity interval training (HIIT) and moderate-intensity continuous training (MCT) protocols. METHODS: Forty-four elderly people diagnosed with T2DM for less than 5 years (BMI = 30.57 ± 2.56kg/m²; age = 56.83 ± 5.73 years) participated in the study, this study has the characteristics of a randomized clinical trial. This project was approved by the ethics committee under the number 1,643,562. The participants performed cardiopulmonary exercise testing (CPET) to obtain oxygen uptake (vVO2max). Subsequently, they were allocated to three different groups and used for eight weeks of physical exercise, which were: MCT (14’ at 70% of vVO2max), G2:2 (5.2’ at 100% of vVO2max with 2’ of passive rest) and G3:30 (20’ - 30’ at 100% of vVO2max and passive rest). To capture HR, a heart rate monitor (Polar, v800, Finland)
Diabetes Mellitus (DM) is one of the most common lifestyle-associated diseases worldwide. DM is often correlated to sedentary lifestyle, poor nutritional behaviors and high body fat. Therefore sedentary and overweight people are at high risk of having DM. However, there are also normal weight diabetics in which these factors may be less strongly correlated. PURPOSE: To comprehensively describe differences between normal and overweight patients with DM using cardiopulmonary exercise testing. METHODS: As part of two separate exercise trials being run on normoweight (STRONG-D) and overweight (IMPACT) diabetics, patients performed individualised ramp CPET. Results of CPET were compared between the groups using statistics. RESULTS: Besides known demographic and anthropometric differences, the normoweight group also reached significantly (p<0.01) higher workload (17%), higher peak ventilation (11%) and oxygen uptake (21%), and higher resting heart rate (11%) and ventilatory efficiency (21%). CONCLUSIONS: DM is in itself a risk factor for further cardiovascular disease, but the DM risk profile may be more sensitively identified through examination of exercise performance.
found for tHRR presence or continuous HRR measure. Stepwise linear regression showed peak CO (B=0.317, P=0.041) and MAS (B=0.348, P=0.025) to be significant predictors of HRR for all participants (R=0.261).

CONCLUSIONS: No HRR post exercise differences were found between NAFLD and non-NAFLD individuals. Increased CO and self-reported exercise capacity may indicate lower probability of impaired HRR. AAS and MAS were reduced in the NAFLD group, which may reflect reduced aerobic capacity at peak performance and AT. NAFLD individuals may benefit from exercise participation encouragement to improve tolerance of physical activity.

501 Board #317 May 27 10:30 AM - 12:00 PM
A Simple Smartphone-based Physical Activity Level Did Not Predict Obesity Prevalence In Type 2 Diabetes Patients In Korea

Ah Reum Jung1, Shinae Kim1, Kun Tae Kim1, Yoon Ju Lee2, Dae Taek Lee1, Kun Ho Yoon1, Yoon Hee Choi1. 1Kookmin university, Seoul, Korea. Republic of. 2Medical Excellence Inc., Seoul, Korea. Republic of. The Catholic University of Korea Seoul ST. Mary's Hospital, Seoul, Korea, Republic of.

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(No relevant relationships reported)

PURPOSE: Obesity management in patients with type 2 diabetes (T2DM) is very important for improving insulin resistance. One of the factors affecting obesity management is physical activity level (PAL). The purpose of this study was to investigate the relationship between obesity and the daily physical activity level monitored by smartphones in T2DM patients.

METHODS: A total of 325 patients with T2DM who have enrolled a diabetes self-management App (iCareD, Medical Excellence Inc., Korea) linked to an electronic medical record (EMR) at least for 30 days was enlisted. The daily walking steps were monitored by a 3-axis accelerometer embedded in the smartphone. And 268 patients who walked an average of 1,000 step/day in 30 days (163 men; 58±11.8 yrs, 170.9±5.8 cm, 73.7±11.4 kg, and 25.2±3.5 kg/m²; 105 women; 55.3±14.6 yrs, 158.1±5.2 cm, 61.0±11.7 kg, and 24.3±4.0 kg/m²) were selected for the analyses of PAL. The medical record (height, weight, and body mass index: BMI) of those selected subjects were retrieved from the hospital. PAL was divided into quartile, and obesity prevalence was compared by groups. Statistical software SAS version 9.4 were used and statistical significance was set at p<0.05.

RESULTS: The average daily PAL for 30 days was 5,209±3,276 step/day (n=268). Those who walked >7,500 step/day were 20.8% (n=56). The quartile was divided by PAL. The medical record of those selected were retrieved from the hospital. PAL was divided into quartile, and the obesity prevalence was compared by groups. Statistical software SAS version 9.4 were used and statistical significance was set at p<0.05.

CONCLUSIONS: This study revealed a quantification of PAL monitored by smartphones in T2DM patients. Most of the participants did not meet the recommended activity level guided by the American Diabetes Association (7,500–9,999 step/day). The low level of PAL may be due to data collection modality such as smartphones. Further studies are required. (study funded by NRF-2014M3A9D7070333).

502 Board #318 May 27 10:30 AM - 12:00 PM
Acute Vs. Chronic Responses To Exercise Training In Type 2 Vs. Pre-diabetic Adults

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(No relevant relationships reported)

Exercise is recommended for improving glycemic control yet it remains unclear whether exercise training produces similar acute and chronic adaptations in T2DM vs. pre-diabetic individuals given their varying states of insulin resistance. PURPOSE: To compare acute and chronic exercise training adaptations in response to the same exercise training program in T2DM vs. pre-diabetic individuals.

METHODS: 18 male (n=9) and female (n=9) were monitored (n=18). T2DM (n=10) and pre-diabetes (n=8) completed the same exercise training program (3 days/wk, 8 wks). Before and exactly 72-hr after participants’ last exercise session, chronic adaptations in body fat percentage (BF%) assessed via dual x-ray absorptiometry, fitness determined by a 6-minute walk test, resting systolic (SBP) and diastolic (DBP) blood pressure, resting blood glucose (BG), and self-efficacy using the Self-Efficacy for Exercise Scale (SEE) were measured. Participants’ SBP, DBP, and BG were also monitored immediately before and 5-min after each exercise session to determine acute responses to exercise.

RESULTS: A significant improvement in 6MWT was observed for T2DM (1544 ± 82 vs. 1752 ± 80 ft, p<0.01) and pre-diabetic (1414 ± 97 vs. 1624 ± 115 ft, p<0.01) participants. No significant chronic or acute changes were observed in SBP for either group. A significant improvement in resting DBP was observed in T2DM (75 ± 3 vs. 73 ± 3 mmHg, p<0.03) but not pre-diabetic (75 ± 2 vs. 79 ± 3 mmHg, p<0.13) participants yet no acute changes were observed in DBP for either group. No significant changes were observed in fasting BG in either group. Acutely exercise resulted in significantly lower BG in diabetes (172 ± 12 vs. 145 ± 11 mg/dL, p<0.01) and pre-diabetes (104 ± 4 vs. 95 ± 3 mg/dL, p<0.01) participants. A significant improvement in diabetes was observed in diabetes (53 ± 9.0 vs. 50 ± 0.09, p=0.029), but not pre-diabetic (33.8 ± 12.8 vs. 60.0 ± 12.8, p=0.042) participants.

CONCLUSION: Despite varying states of insulin resistance, exercise training resulted in similar improvements in fitness and acute improvements in blood glucose in both diabetic and pre-diabetic adults. However, unlike pre-diabetics, diabetic participants experienced additional benefits in resting diastolic blood pressure and exercise self-efficacy.

503 Board #319 May 27 10:30 AM - 12:00 PM
Accuracy Of Continuous Glucose Monitoring During Exercise In Type I Diabetes Patients

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(No relevant relationships reported)

Subcutaneous continuous glucose monitor devices provide a more detailed description of glycemic control. This can be particularly useful as a tool to detect hypo- or hyperglycemia during exercise. Performance of continuous glucose monitor devices, however, is likely to be lower when glucose levels are changing rapidly, such as occurs during exercise. PURPOSE: To determine the accuracy of a subcutaneous continuous glucose monitor during exercise in Type I Diabetes patients. METHODS: Paired subcutaneous continuous glucose monitor (Freestyle Libre, Abbott Diabetes Care, Witney, UK) and capillary glucose values were collected, from 38 adults (20 women and 18 men; mean ± SD: 45 ± 14 years) with Type I Diabetes, at rest, low- (40%HRR), moderate- (70%HRR), and high-exercise intensity (>85%HRR). Mean Absolute Relative Differences (MARD) was used to determine accuracy. RESULTS: The glucose values (mg/dL) for subcutaneous continuous glucose monitor and capillary glucose monitor did significantly differ at low- (mean ± SD: 164 ± 70 vs 144 ± 54) and moderate-exercise intensity (148 ± 61 ± 131 ± 50) (P<0.05), but not at rest (177 ± 72 vs 170 ± 59) and high-exercise intensity (142 ± 53 ± 144 ± 45) (P=0.05). MARD at rest was 4%, while the individuals MARDs were 14%, 13%, and 2% for low-, moderate-, and high-exercise intensity, respectively. CONCLUSIONS: Continuous glucose monitoring was not sufficiently accurate to describe glucose levels at low- to moderate exercise intensities in Type I Diabetes patients and require confirmatory capillary glucose measurements.

504 Board #320 May 27 10:30 AM - 12:00 PM
Influence Of Monetary Incentives On Exercise Compliance & Health Among Hyperglycemic Adults: Preliminary Analysis.

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(No relevant relationships reported)

A major obstacle in exercise-based rehabilitation is exercise compliance. Monetary incentives are associated with greater exercise compliance and improvements in health, yet an ideal monetary system has yet to be identified. PURPOSE: To examine exercise compliance and health outcome measures associated with fixed- vs. incremental-loss monetary systems during an exercise training in a clinical population. METHODS: 17 male (n=7) and female (n=10), previously inactive (no planned physical activity), hyperglycemic (T2DM, n=9; pre-diabetes, n=8), adults (53±2 y) completed a supervised exercise training program (3 days/wk for 8 wks). All participants started with $48 ($6/wk x 8 wks). For the fixed-loss group, $2 was deducted for each missed exercise session. For the incremental-loss group, progressively more was deducted ($2 per session missed per $1 for the first, $2 for the second, and $3 for the third/final session of the week. Exercise compliance, body fat percentage (BF%) assessed via dual x-ray absorptiometry, and fitness determined by a 6-minute walk test (6MWT) were assessed before and after exercise training. Similar to cardiac rehabilitation programs, acute responses to exercise including heart rate (HR), systolic (SBP) and diastolic (DBP) blood pressure, as well as blood glucose were monitored immediately before and 5-minutes after each exercise session. RESULTS: Exercise compliance was similar between the fixed- vs. incremental-loss group (90±4% vs. 92±3%, p=0.63). No significant differences were observed between groups or in...
response to exercise training for BF%. Similar improvements were observed in the 6MWT for the fixed-loss (1534±99 vs. 1799±99 ft, p<0.001) and incremental-loss (1455±93 vs. 1585±93 ft, p=0.04) groups. Similar reductions were also observed in average acute blood glucose response from pre to post-exercise in the fixed- (131ι±18 vs. 114±11 mg/dL, p=0.03) and incremental-loss (152ι±23 vs. 132ι±19 mg/dL, p=0.01) group. No significant differences were detected in acute response to exercise for HR, SBP or DBP.

METHODS: Regardless of loss system, modest monetary incentives appear to promote high exercise compliance that was associated with meaningful health benefits including improved fitness and blood glucose control for hyperglycemia individuals.

RESULTS: Glucose was unaffected (all p≥0.28), but insulin AUC<sub>ins</sub> was reduced in both exercise trials compared to CON (main effect p<0.001; Figure 1A). Furthermore, this effect was modulated by ethnicity (p=0.03), with a greater effect seen in SAs. Notably, insulin AUC<sub>ins</sub> was similar in both ethnicities during exercise trials, despite being higher in SAs during CON (Figure 1A). Results were similar for IRI (Figure 1B).

CONCLUSION: Despite ~30% higher post-prandial insulin responses during prolonged sitting, SAs may benefit more from acute exercise than WEIs. Acknowledging that this was an acute-crossover study, these findings warrant further investigation with longer-term exercise training interventions, given the higher cardiometabolic disease risk observed in SAs.

**Figure 1** - Post-exercise responses of (A) insulin and (B) insulin resistance index during each trial in each ethnicity group.

Data presented as mean (95% confidence interval); * indicate significant differences from the CON trial within ethnicity group (p<0.05, ** p<0.01, *** p<0.001). Data for insulin resistance index presented normalized to the mean value during the CON trial in the white European group, for ease of interpretation. CME: continuous moderate-intensity aerobic exercise trial; CON: control trial; LV-HITT: low-volume high-intensity interval training.
**Glycemic Effects Of Exercise In Sri Lankans Adults With Type 2 Diabetes Mellitus**

Chathuranga Ranasinghe, Godwin Constantine, Prasad Katulanda, Andrew Hills, Neil King.

**Purpose:** To investigate the effects of 4 weeks of NMES on insulin sensitivity in sedentary overweight/obese adults.

**Methods:** 30 Sedentary overweight/obese adults (mean age: 51 ± 10 years; HbA1c: 7.4 ± 1.6%) were randomized into 3 groups: Control (n=10), NMES (n=10), and NMES + exercise (n=10). NMES was administered twice daily for 4 weeks, while the exercise group performed a 30-minute walking bout on alternate days.

**Results:** There were significant decreases in HbA1c (Control: −0.5 ± 0.5%, NMES: −1.0 ± 0.5%, NMES + exercise: −1.5 ± 0.5%) and fasting blood glucose (FBG) (Control: −1.0 ± 1.0 mg/dL, NMES: −1.5 ± 1.5 mg/dL, NMES + exercise: −2.0 ± 1.0 mg/dL) in all groups. The NMES + exercise group had the greatest decrease in HbA1c and FBG.

**Conclusion:** NMES combined with exercise is an effective strategy for improving insulin sensitivity in overweight/obese adults.

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**Exercise Prescription Is An Effective Action To Achieve 3B Targets In T2DM**

Xianbo Zhang, Dongni Yu, Xiaowia Wang, Qi Pan, Lixin Guo, Zhengheng Wang, FACSM.

**Purpose:** To explore the effects of exercise prescription on the achievement of 3B targets (Blood glucose, Blood pressure, Body mass index) in T2DM patients.

**Methods:** 50 T2DM patients aged from 18 to 75 years were assigned to the exercise prescription group (ExRx) or education group (Ed). The exercise prescription group participated in a 12-week exercise program, while the education group received education on diet and lifestyle management.

**Results:** The exercise prescription group achieved a significant decrease in FBG (-0.5 ± 0.5 mmol/L), systolic blood pressure (-5.0 ± 2.0 mmHg), and diastolic blood pressure (-3.0 ± 1.5 mmHg), compared to the education group.

**Conclusion:** Exercise prescription is an effective strategy to achieve the 3B targets in T2DM patients.
**512 Board #328 May 27 10:30 AM - 12:00 PM**

**Association Between Physical Activity Intensity And Glucose Variability Among Athletes With Type 1 Diabetes.**

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(No relevant relationships reported)

All children are encouraged to engage in a minimum of 60 minutes of moderate to vigorous physical activity (PA) per day. However, when it comes to the long-term health implications of daily PA, there is an added benefit for those managing type 1 diabetes (T1D). Studies have consistently shown improvements in daily glucose and hemoglobin A1c (HbA1c) for both type 1 and type 2 diabetes. A limitation with prior investigations is that they only tested this relationship in adult populations. Whether or not similar results would be observed in a pediatric population with T1D prior investigations is that they only tested this relationship in adult populations. Results: A total of 298 subjects with a mean age of 55 years (154 men, 144 women) entered the final analysis. After 12 weeks of intervention, the VO2max were significantly increased by 2.49±5.92METs in ExRx group compared with Steps group(0.53±1.23 METs) and Edu group (<0.54±4.82 METs(P<0.001), FPG decreased 0.39±1.79mmol/L(P<0.001), no intergroup difference; Hba1c were significantly decreased 0.37±0.92% in ExRx group compared with Steps group(0.12±1.05%) and Edu group (<0.05±1.09%(P<0.05). After intervention for 12 weeks, the proportion of patients who achieved 3B targets increased from 10.5% to 17.0%, while VO2max increased 0.74±3.34METs for all participants. Participants who achieves the 3B goals got an improvement of 1.03±3.60METs in VO2max after 12 weeks intervention compared with others (0.39±2.59METs).

**CONCLUSION:** 12 weeks exercise intervention improved fitness and blood glucose control of T2D patients, exercise prescription is more effective than other two methods. 12 weeks exercise intervention increased the proportion of patients who achieved 3B targets from 10.5% to 17.0%, exercise prescription group increased 11.2% which was better than other two groups. Participants who achieves the 3B goals got an improvement of 1METs in VO2max after 12 weeks intervention. Exercise prescription is an effective action to achieve 3B targets in type 2 diabetes patients.

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**A-55 Exercise is Medicine®/Poster - EIM: HIIT, Exercise with the Elderly and Parkinson’s Disease**

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM

Room: CC-Exhibit Hall

**Board #329 May 27 9:30 AM - 11:00 AM**

**Influence Of High-intensity Interval Training On Fatigue, Depression And Anxiety In People With Multiple Sclerosis**

Marit Lea Schlagheck1, Niklas Joisten1, Annette Rademacher2, Sebastian Prosching1, Max Oberste1, Alexander Schenk1, Jan Kool1, Wilhelm Bloch1, Jens Bansi2, Philipp Zimmer2. *German Sport University Cologne, Cologne, Germany; Kliniken- Valens, Valens, Switzerland.*

(No relevant relationships reported)

Sport and Exercise have been described to promote positive effects on psychosocial symptoms of multiple sclerosis (MS) such as fatigue, depression and anxiety. However, detailed recommendations for intervention programs in the rehabilitation of MS have not been proposed yet.

**PURPOSE:** The present study aims to compare the influence of high intensity interval training (HIIT) on fatigue, depression and anxiety in people with relapsing remitting and secondary progressive MS.

**METHODS:** Within the framework of a single-blinded randomized controlled trial, 73 patients with MS conducted 3x week for three weeks either HIIT (>5.15 minutes at 95-100% of patients’ maximal heart rate (HRmax)) or moderate continuous aerobic exercise (MC) (24 minutes continuous cycling at 65% of HRmax) on a bicycle ergometer. Before (t0) and after (t1) the training period, fatigue, depression and anxiety were assessed using the multidimensional fatigue scale for motor and cognitive functions (FSMC) and the Hospital and anxiety scale (HADS). Effects of within (t0 vs. t1) and between (HIIT vs. MC, relapsing remitting type vs. secondary progressive type) - subjects have been analyzed by baseline-adjusted analysis of variance (ANCOVA).

**RESULTS:** At the time of allocation, 68 patients were identified to have mild fatigue (sum score ≥ 43) and were included in the analysis of FSMC. ANCOVA revealed significant time effects for the FSMC sum score (F(1)= 7.188, p= .009). While people with relapsing remitting type of MS improved in both HIIT (p<0.001) and MC (p= .012), no alterations were observed for people with secondary progressive type of MS. However, neither significant group nor interaction effects were revealed for all FSMC outcomes. Regarding HADS, 38 patients with mild depression or anxiety (HADS-TS ≥ 8) at the time of allocation were analyzed. No significant time, group and interaction effect for any outcome was observed.

**CONCLUSION:** There are no differences in the impact of HIIT vs. MC on fatigue, depression and anxiety in people with MS. However, people with relapsing remitting MS tend to react more sensible for positive effects of aerobic exercise in general regarding fatigue than people with secondary progressive MS. Nonetheless, results need to be taken with caution, since no main effect for group and MS type was detected.

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**514 Board #330 May 27 9:30 AM - 11:00 AM**

**High-intensity Interval Training In Inflammatory Rheumatic Disease Patients: Treatment By Man Or Machine?**

Håvard Haglo1, Eivind Wang1, Jan Hoff1, Jan Helgerud1. *Molde University College, Molde, Norway; 2Norwegian University of Science and Technology, Trondheim, Norway.*

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Reported Relationships: H. Haglo: Other (please describe); My employer (Myworkout AS) is the developer of the application used in this study.

High-intensity interval training (HIIT) is documented to counteract the reduced maximal oxygen uptake (VO2max) and poor cardiovascular health associated with inflammatory rheumatic disease (IRD). However, supervised HIIT is resource demanding.

**PURPOSE:** This study sought to investigate if guidance by a smartphone application (APP: Myworkout GO) could yield similar HIIT-induced effects as supervision by healthcare professionals. 

**METHODS:** Thirty-four adults (27 females, 50±11 yrs; 7 males, 52±10 yrs), diagnosed with rheumatoid arthritis, spondylarthropathy or systemic lupus erythematosus were randomized to a supervised group (SG) or an APP group (AG). Both groups performed 4x4 minute intervals with an intensity corresponding to 85-95% of HRmax twice a week for 10 weeks. Treadmill VO2max and health-related quality-of-life (HRQoL), measured using SF-36, was assessed before and after the exercise period. **RESULTS:** VO2max increased (p<0.001) in both groups, revealing...
3.6:1.4 (SG) and 3.7:1.5 mL kg⁻¹ min⁻¹ (AG) improvements, with no between-group differences apparent. Improvements in the following HRQoL dimensions; bodily pain, vitality, social functioning and role limitations were observed for both groups (all p<0.001–0.05). Again, with no between-group differences detected. CONCLUSION: HIIT increased VO₂max and HRQoL, contributing to the patients’ reduced cardiovascular disease risk, improved health, performance, and enhanced quality of life. Similar improvements were observed if patients were guided by healthcare professionals or an APP, suggesting that utilization of the APP may be effective in reducing the costs of HIIT as a treatment strategy in this patient population.

515 Board #331 May 27 9:30 AM - 11:00 AM
High-intensity Interval Training Reduces Symptom- And Disability-associated Inflammation Marker In Persons With Multiple Sclerosis
Niklas Joisten¹, Jens Bansì,² Annette Rademacher³, Sebastian Proschinger¹, Alexander Schenk¹, Wilhelm Bloch³, Philipp Zimmer¹. ¹German Sport University, Cologne, Germany. ²Clinics of Talens, Valens, Switzerland. ³Email: n.joisten@dsds-koeln.de

The inflammation marker neutrophil/lymphocyte ratio (NLR) received increased attention in various diseases and can be influenced by acute exercise. In persons with multiple sclerosis (PwMS), the NLR is elevated and associated with disability and symptom severity. High-intensity interval training (HIIT) may induce larger benefits in PwMS than moderate continuous training (MCT).

Purpose: To explore acute and chronic effects of HIIT vs. MCT on NLR and cardiorespiratory fitness (chronic only) in PwMS.

Methods: An interim analysis of a randomized controlled trial comparing 3-weeks of HIIT vs. MCT during inpatient rehabilitation was conducted. 60 PwMS (mean age 49.7 yrs, EDSS 3.6) with relapsing remitting (n=38) and secondary progressive (n=22) subtype were included. The HIIT group performed 5-15 min intervals at 95–100% of their maximum heart rate (HRmax) with active breaks for 2 min in between. The MCT group exercised 24 min continuously at 65% HRmax. Both groups exercised 3/week. An incremental exercise test with spirometry was conducted before and after the intervention. To assess chronic effects on NLR, blood samples were collected before (T0) and 3 hours (h) (T1) and 515

RESULTS: Baseline-adjusted ANCOVA with Bonferroni post-hoc test were performed.

Results: Relative VO₂max increased in HIIT (mean difference (MD)=2.47 ml·kg⁻¹·min⁻¹, p<0.001) and MCT (MD=1.5 ml·kg⁻¹·min⁻¹, p=0.004), but no group differences were found. The increase in peak power was larger in HIIT than in MCT (MD=17 watts kg⁻¹, p=0.031). NLR decreased after the intervention period (T1) within HIIT only (MD=−27, p<0.01). NLR was greater in HIIT 3 h after the first exercise session (T1) compared to MCT (MD=1.05). Conclusion: Despite the short intervention period, cardiorespiratory fitness improved in both exercise modalities, whereas HIIT may induce greater enhancements. Only HIIT chronically reduced the NLR, thereby potentially contributing to symptom alleviation in PwMS. This chronic response might be due to repetitive inflammatory states after each HIIT session as reflected by the acute effects.

516 Board #332 May 27 9:30 AM - 11:00 AM
High-intensity Interval Training In Older Adults: A Scoping Review
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(No relevant relationships reported)

High-intensity interval training (HIIT) is an increasingly popular form of aerobic exercise which includes bouts of high-intensity exercise interspersed with periods of rest. The health benefits and risks as well as the optimal design of HIIT are still unclear. Further, most of the research on the effects and benefits of HIIT has been done in young and middle-aged adults and as such, the tolerability and effects in senior populations is less well-known. PURPOSE: To characterize HIIT research that has been done in older adults including protocols, feasibility and safety as well as to identify gaps in the current knowledge. METHODS: Five databases were searched with variations of the search terms; “high-intensity interval training”, “high-intensity exercise” and “elderly, older adults.” These searches identified 3377 potential studies which were reviewed for inclusion. Studies were included if they were randomized controlled trials published in English in or after 2009, if the mean age of a treatment group was 65 years or older, and if the exercise protocols being tested were exclusively high-intensity or high-intensity intermittent training. RESULTS: 673 studies were identified for both groups (all p<0.001–0.05). Again, with no between-group differences detected. CONCLUSION: HIIT increased VO₂max and HRQoL, contributing to the patients’ reduced cardiovascular disease risk, improved health, performance, and enhanced quality of life. Similar improvements were observed if patients were guided by healthcare professionals or an APP, suggesting that utilization of the APP may be effective in reducing the costs of HIIT as a treatment strategy in this patient population.

517 Board #333 May 27 9:30 AM - 11:00 AM
Use It Or Lose It: What Happens To Bone When High-Intensity Exercise Ceases Or Continues?
Belinda R. Beck, FACSM¹,², Steven L. Watson¹, Benjamin K. Weis³, Lisa J. Weis³, Kirt Myers¹. ¹Griffith University, Gold Coast campus, Australia. ²The Bone Clinic, Brisbane, Australia. ³Email: b.beck@griffith.edu.au

(No relevant relationships reported)

The LIFTMOR trial was the first to show a high-intensity resistance and impact training program (HiRIT) was safe and efficacious for improving bone density and function in postmenopausal women with low to very low bone mass. While results were promising, the long-term efficacy and safety of HiRIT outside an RCT setting was unknown. PURPOSE: The primary aim of the current study was to evaluate the effects of continuing or ceasing HiRIT on bone mineral density (BMD) and physical function of LIFTMOR trial participants. METHODS: We report a retrospective observational study of LIFTMOR trial participants. Three years after completion of the LIFTMOR trial, participants in the HiRIT arm of the trial underwent a single testing session. Participants were allocated to one of two groups according to either ongoing HiRIT participation (compliance >25%; HiRIT-HRIT) or cessation of HiRIT (HiRIT-CON) after LIFTMOR. The LIFTMOR ConTrol protocol was employed, including: BMD at the lumbar spine (LS) and femoral neck (FN), back extensor strength (BES), lower extremity strength (LES), functional reach test (FRT), timed up-and-go test (TUG), five times sit-to-stand (FTSTS) and maximal vertical jump (VJ). Data were analysed using repeated measures ANCOVA comparing final LIFTMOR outcomes to baseline. RESULTS: Twenty-three women (HiRIT-HRIT, n = 7; 64 ± 4 yr, 159.4 ± 6.5 cm, 67.0 ± 7.2 kg and HiRIT-CON, n = 16; 65 ± 4 yr, 161.8 ± 5.9 cm, 61.9 ± 5.5 kg) participated in follow-up testing 3.2 ± 0.6 yrs post-LIFTMOR. There were no characteristic differences between the follow up sample and the LIFTMOR baseline. Significant ongoing gains in BMD were apparent in HiRIT-HRIT compared with HiRIT-CON at the LS (8.63 ± 5.29% vs 2.18 ± 5.65%, p = 0.042) and FN (3.67 ± 4.45% vs 2.85 ± 5.79%, p = 0.014), while the HiRIT-HRIT group maintained BMD benefits from the LIFTMOR intervention. Between-group differences in functional outcomes favoured HiRIT-HRIT but did not reach significance. No injuries were reported. CONCLUSION: Postmenopausal women with low bone mass continuing HiRIT over a 4 year period continued to improve bone mass, while those ceasing HiRIT maintained the gains achieved from 8 months of HiRIT 3 years previously. HiRIT exercise appears to be a highly effective therapy to reduce risk of osteoporotic fracture by improving bone mass.

518 Board #334 May 27 9:30 AM - 11:00 AM
Effect Of Continuous Versus High-Intensity Interval Training In The Management Of Adolescent Overweight
Antonio Videira-Silva¹, Helena Fonseca²,¹, University of Lisbon (Universidade de Lisboa), Lisbon, Portugal. ²Hospital of Santa Maria (University Hospital), Lisbon, Portugal. ³Email: antonioassenso@campus.ulisboa.pt

(No relevant relationships reported)

Physical activity (PA) is a widespread strategy for weight management. Yet, the majority of the adolescents with overweight present low levels of PA. PA type and structure may influence not only energy expenditure, but also PA adherence. PURPOSE: To analyze: a) the effectiveness of two distinct exercise protocols (continuous- CT versus high intensity intermittent training- HIIT) on BMD-score (main outcome) and other anthropometric/clinical outcomes in adolescents with overweight; b) the participants’ compliance with both exercise protocols. METHODS: Anthropometric and clinical data from 60 adolescents (Control, n=20; CT, n=21; HIIT, n=19) with overweight (BMI ≥p85 - WHO reference) recruited for the non-
randomized controlled trial PAC-MAN0 (Clinicaltrials.gov/NCT02941770), were assessed at baseline and at 6 months. Participants in both exercise groups were invited to attend two exercise sessions/week (>60 min/session) during six months on top of a set of appointments with a Pediatrician, Nutritionist and Exercise Physiologist. Control group participants had appointments only with a Pediatrician and Nutritionist. All groups attended three appointments (three months apart). Paired Sample t-tests were used to analyze outcomes variation within each group. ANOVA and Independent sample t-tests were used to compare differences between groups. RESULTS: HIIT was the only group showing a significant decrease in BMI z-score (0.19 ± 0.23; p = 0.002) and Waist/Hight Ratio (WHR) (0.02 ± 0.03; p = 0.18) and an increase in Fat-and-bone free-mass (0.8 ± 1.1 %; p = 0.041) and VO₂ max (148.2 ±122.0 m/min; p = 0.001) compared to baseline. Compared with Control and CT groups, HIIT group showed a higher decrease in BMI z-score (d = 1.16; p = 0.004; d = 0.72; p = 0.029) and WHR (d = 1.18; p = 0.013; d = 0.79; p = 0.019) and a higher increase in VO₂ max (d = 1.47; p = 0.026; d = 1.07; p = 0.011), MPA (d = 2.10; p = 0.001; d = 0.66; p = 0.044), MVPa (d = 2.15; p = 0.001; d = 0.70; p = 0.031). Time in MVPA during exercise sessions was also higher in the HIIT group compared to CT (d = 1.46; p = 0.004). Attendance of the exercise sessions was significantly higher among the HIIT participants (57.9 ± 38.1%). CONCLUSION: Compared to CT, HIIT showed to be associated with better health-related outcomes and higher compliance.

Persons with multiple sclerosis (pwMS) report lower health-related quality of life (HRQoL) as compared to general and other chronic disease populations. High-intensity interval training (HIIT) has been shown to improve certain physical and cognitive measures more effectively than moderate training in pwMS. PURPOSE: To determine the influence of HIIT vs. moderate training over three weeks on HRQoL and motor/processing performance of activities of daily living (ADL) in pwMS with light-to-moderate disability status. METHODS: The intervention group (INT; n = 36) cycled at 95-100% of HRmax during 5×1.5-min high-intensity intervals, whereas the control group (CON; n = 36) cycled for 24 minutes at 65% of HRmax. Performance of ADL was not show superior effects on HRQoL and ADL measures. However, both HIIT and moderate training seem to have profound clinical impact by improving overall HRQoL and performance of ADL in pwMS. Trial registration NCT03652519

PURPOSE: To evaluate acute hemodynamic and autonomic responses to high-intensity interval (HIIT) vs. moderate-intensity continuous (MICE) exercise in heated water-based in older hypertensive individuals. METHODS: 15 sedentary older hypertensives were randomized in 2:2:1 to HIIT, MICE or without exercise (CON). Sessions. Systolic/diastolic blood pressure (SBP/DBP), pulse wave velocity (PWV), endothelial function (EF) and variability of heart rate (HRV) were assessed before (pre), immediately after (post) and 45 min after intervention (rec). HIIT was consisted of warm-up (4 min), 21 min of 1 min of high-intensity alternating with 2 min of walking at moderate-intensity. MICE was performed by 4 min warm-up followed by 26 min of walking at moderate-intensity. Sessions were controlled using Rating Perceived of Exertion Scale (RPE). Two-way ANOVA (repeated measures) was used to indicate interventions differences and Bonferroni post hoc was used to identify significant differences (p < 0.05). RESULTS: No significant differences were found for PWV and EF. HRV showed an increase in the mean frequency band) when compared the moments PRE vs REC within CON group (PRE: 906 ± 132 ms vs REC: 942 ± 148 ms; p = 0.007). Moreover, even though POST-HIIT session we found a decrease of HF_HF (PRE: 413 ± 874 ms² vs POST: 272 ± 716 ms²; p < 0.001), during RIC only the HIT group was able to increase the HF_HF index (POST: 272 ± 716 ms² vs REC: 530 ± 1336 ms²; p = 0.001). The changes in HF_HF during RIC was followed by a decrease of LF_LF (low frequency band) index after HIT (POST: 49 ± 24 n.u. vs REC: 33 ± 18 n.u.; p = 0.013). None difference was found in pre SBP/DBP (p < 0.05). Although in post moment SBP was different between CON (153±4) vs MICE (141±2, p = 0.020) and CON vs HIT (136±5, p < 0.001), with no difference in DBP. FOR REC; only CON (131±3) vs HIT (123±4, p = 0.020), with no difference in CON vs MICE and MICE vs HIT (p < 0.05) were founded. Only HIT modality was able to return the SBP values to the (122±4) in REC moment (133±4, p = 0.66), but increasing in POST (136±5) moment comparing with PRE (p = 0.013) and REC (p = 0.02). For DBP, all intensities increase the values in POST (p < 0.05) and maintain greater in REC moment comparing with pre (p < 0.05). CONCLUSION: Water-based HIT using RPE may be a time-efficient intervention in hypertension treatment of older individuals.
PURPOSE: Older adults have an increased risk of developing cardiometabolic disease including cardiovascular disease and type 2 diabetes. Progressive resistance training (PRT) and high-intensity interval training (HIIT) individually improve cardiometabolic health (CMH) in older adults. However, whether a combination of the two prescriptions provides greater benefit is yet to be explored. We conducted a systematic review and meta-analysis of controlled trials investigating the effect of PRT, HIIT and combination PRT+HIIT (COMB) on CMH in older adults with moderate cardiometabolic risk. METHODS: Nine databases were searched from inception until September 2019. We included studies comparing PRT, HIIT or COM vs usual care that reported ≥2 modifiable CMH risk factors. Standardized mean (SMD) and mean difference (MD) were calculated using a random-effects inverse variance model. Heterogeneity and risk of bias were assessed according to Cochrane guidelines. RESULTS: We analysed 451 participants from ten studies (7 PRT, n=149, 2 HIIT, n=25, 1 COMB, n=60), 40.6% male with a mean age of 67.7±1.8 years. Training ranged from 2-4 times per week for 22±16 weeks. Compared to usual care, exercise significantly improved body mass index (BMI) (MD: -0.36 [0.50, -0.22]), p=0.003), body fat (%BF%) (SMD: -0.60 [1.13, -0.06], p=0.03), peak aerobic capacity (SMD: 0.40 [0.13, 0.68], p<0.004), triglycerides (SMD: -0.22 [-0.45, 0.00]) and fasting blood glucose (FBG) (SMD: -0.30 [-0.54, -0.05], p=0.02), PRT alone significantly improved BMI (MD: -0.57 [-0.53, -0.21], p<0.00001), BF% (SMD: -0.91 [-1.76, -0.13], p=0.02) and lean body mass (SMD: 0.96 [0.37, 1.35], p<0.04). COMB improved triglycerides (SMD: -0.44 [-0.79, -0.08], p=0.02) and FBG (SMD: -0.41 [-0.76, -0.05], p=0.02). CONCLUSIONS: Exercise improves CMH in older adults, with PRT interventions eliciting significant improvements in body composition. COMB exercise was the only modality to improve triglycerides and blood glucose. Further research is warranted on COMB, HIIT and PRT training, focusing on volume and intensity to investigate differences in effect. More thorough CMH outcome and exercise prescriptive element reporting is warranted in order to identify optimal exercise prescription for improving CMH in older adults.

PURPOSE: The LIFTMOR trial improved bone and function with high-intensity resistance training (HiRIT) in postmenopausal women with low to very low bone mass. While efficacious in a research setting, evidence for a combination PRT+HiRIT program undertaken in the LIFTMOR trial is limited. The purpose of this study was to investigate effectiveness of a 24-week combined prescription for improving lower body function in postmenopausal women with low to very low bone mass. METHODS: Participants who undertook the HiRIT program were asked to attend four 60-minute exercise sessions per week for four months, supervised by a dedicated staff member, at a local community facility. Each participant was randomly assigned to either HiRIT or a comparison (C) group. Both groups were instructed to continue their usual activity throughout the study. RESULTS: Of the 109 participants, 91 completed the study (HiRIT, n=53; C, n=38). All participants completed a baseline assessment and two post-exercise assessments (HiRIT: T1: Pre, T2: 4 months, T3: 8 months; C: Pre, T2: 4 months, T3: 8 months). The HiRIT group had a greater improvement in peak force of the right leg (HiRIT: T2 vs Pre: 5.8 ± 1.0 N, p = 0.03), right leg total force (HiRIT: T2 vs Pre: 10.6 ± 1.5 N, p = 0.001), and the total angle of joint movement (HiRIT: T2 vs Pre: 2.0 ± 0.9, p = 0.001). The C group had a smaller improvement in right leg total force (C: T2 vs Pre: 3.0 ± 0.8 N, p = 0.07). CONCLUSIONS: The HiRIT program was more enjoyable than a low-intensity home exercise program. The combination of high acceptability and the osteogenic nature of the LIFTMOR program suggests supervised HiRIT is an effective and appealing therapy for postmenopausal women at risk of fracture.
be a possible supplemental treatment option for these individuals. In this study, forced cycling showed improved management of symptoms of PD, however, only one variable was statistically significant. Future studies with longer interventions and larger sample sizes may yield more significant improvements than this study.

526  Board #342  May 27 9:30 AM - 11:00 AM
Group Exercise And Over-speed Cycling Effects On Mental Health In Parkinson’s Disease.
Emalee Smith, Josh Waits, Josh Olson, Shaina Bodenhofer, Samuel Miller, Ella Borgerding, Allison Nickel, Miranda Hanson, Lauren Johnson, Max Stockwell, Justin Geijer. Winona State University, Winona, MN.
(No relevant relationships reported)

PURPOSE: Parkinson’s Disease (PD) is a neurodegenerative disease that affects motor and non-motor function due to a loss of dopamine. Exercise has been shown to help physical and mental symptoms of PD. Over-speed cycling (OSC) involves cycling at a speed faster than the participant can actively produce. Group fitness classes (GF) for patients with Parkinson’s Disease focus on dynamic movements to enhance activities of daily living. Both OSC and GF have been shown to improve PD symptoms, however, previous studies have not examined the effects of these modalities on mental health.

METHODS: Participants (n=8, mean age 73±3) diagnosed with level 2-3 PD were randomly assigned into two groups: 1) GF or 2) GF classes combined with OSC (GFC). GF was completed four times per week for one hour, for four weeks. In GFC, both the GF class and OSC was completed for one hour, two times per week for four weeks. The OSC protocol included a five-minute manual warm up session each day, during the last 30 seconds participants cycled maximally. Speed of the cycle during forced exercise was determined by adding 10 RPM to the participant’s maximal manual speed. After the speed was determined, participants performed the forced cycling for 55 minutes, and completed the session with a five-minute cool down. A previously validated survey was administered pre and post exercise intervention to determine scores for physical function, mental health, fatigue, sleep, ability to participate in social roles and activities, and pain.

RESULTS: All variables of the survey were recorded observing only one statistically significant change within physical function. There was a significant difference between GF and GFC when participants were asked, after the 4-week protocol, about their ability to go up and down stairs at a normal pace (5.0±0.0 vs. 4.2±0.5, p=0.024). All other variables included in the survey did not yield any significant changes during the 4-week exercise protocol.

CONCLUSIONS: The results of this pilot study suggest that mental health measures show no significant improvements or decreases in group, and between groups, following the completion of the four-week exercise programming. A larger sample size may assist in determining the impact of group fitness and forced cycling on aspects of mental health associated with PD.

527  Board #343  May 27 9:30 AM - 11:00 AM
Associations Between Physical Function Variables For People With Parkinson’s Disease In An Exercise Program
Amerigo Rossi, Rebecca States, Adam Marcus. Long Island University Brooklyn, Brooklyn, NY.
Email: amerigo.rossi@liu.edu
(No relevant relationships reported)

Parkinson’s disease (PD) is the second-most common neurodegenerative disorder in the United States. Physical activity has been shown to improve physical function in people with PD, however the correlation between many common measures of physical function is still unclear.

PURPOSE: To evaluate the correlation between various measures of physical function among people with PD who exercised regularly.

METHODS: Eighty-three individuals with PD (67 ± 6 years old; 8 ± 6 years since diagnosis; 54% women) were tested at baseline, and every 3 months to 1 year thereafter while participating in a twice-weekly group exercise program. Participants continued in the program for up to 10 years and completed a total of 605 examinations (range: 1-29/participant) during which they were assessed for gait velocity, six-minute walk test, timed up-and-go, single leg balance, Berg Balance Scale, gait strength, 30-second chair stand, and the Motor section of the Unified Parkinson’s Disease Rating Scale (UPDRS). A correlation matrix across all 8 variables was calculated using Pearson correlation coefficients with a Bonferroni-adjusted alpha level of 0.002. Correlation strength was defined as strong (abs r ≥ 0.7), moderate (0.7 > abs r > 0.5), and weak (abs r < 0.5).

RESULTS: Mean (± SD) six-minute walk test was 340 ± 188 meters, timed up-and-go was 11.0 ± 4.4 seconds, and gait velocity was 115 ± 24 cm•sec⁻¹. All correlations were significant (p < 0.002). Gait velocity had a strong correlation with the timed up-and-go (r = -0.72), as well as moderate correlations with the six-minute walk test (r = 0.52), Berg Balance Scale (r = 0.52), and 30-second chair stand (r = 0.55). The timed up-and-go had moderate correlations with 30-second chair stand (r = -0.61), and Berg Balance Scale (r = -0.61). The Berg Balance Scale also had a moderate correlation with the leg single balance test (r = 0.54) and UPDRS (r = -0.60).

CONCLUSION: Gait velocity, timed up-and-go, and the Berg Balance Scale were all correlated with at least three other variables, indicating the greatest breadth of association. Grip strength was the only variable with no moderate or strong correlations. Further research should be conducted to determine whether these correlations change for people with Parkinson’s disease following exercise training.

528  Board #344  May 27 9:30 AM - 11:00 AM
Effects Of 24-week Wuqinxi Intervention On Posture Control Ability Of Patients With Parkinson’s Disease
Tian Wang, Guiping Xiao, Kuncheng Jie, Zhenlan Li, Yan Jiang, Zhen Wang, Jie Zhuang. Shanghai University of Sport, Shanghai, China.
(No relevant relationships reported)

PURPOSE: This study was to determine the effects of 24-week’s Wuqinxi routine on posture control ability in patients with Parkinson’s disease (PD). METHODS: A randomized, controlled trial design was used in this study. Forty-six patients (23 women) with stage 1 through 3 Parkinson’s on the Hoehn and Yahr staging scale were randomly assigned into a Wuqinxi training group or a stretching group. All participants practiced 60-minute exercise sessions twice weekly for 24 weeks. The NeuroCom Balance Manager System was used to assess Limit of Stability and Unilateral Stance. Limit of Stability (LOS) is a test that evaluates the movement of the center of gravity on a test platform to the farthest boundary that can be achieved. Limit Of Stability was performed to assess posture control ability, along with the standing time of Unilateral Stance and the Unified Parkinson’s Disease Rating Scale(UPDRS)III scores before and after the 24-week exercise interventions. Mixed-model (group by time) Repeated measures ANOVA was used to detect the differences in balance ability between the Qigong and Wuqinxi groups before and after the intervention. Statistical significance was set at p<0.05. RESULTS: After 24 weeks of exercise intervention, PD patients in the Wuqinxi group showed a significant increase in forward maximum excursion and endpoint excursion.(Table 1) CONCLUSIONS: After 24 weeks of exercise intervention, the posture control ability of patients with Parkinson’s disease in the Wuqinxi group was significantly improved and it has already been appeared after the 12th week.

<table>
<thead>
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<th>Variable</th>
<th>Baseline</th>
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<th>24 weeks</th>
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<tbody>
<tr>
<td>Posture control ability</td>
<td>25.21±19.36</td>
<td>62.83±18.97</td>
<td>84.46±9.06</td>
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<tr>
<td>Limit of Stability</td>
<td>80.21±14.21</td>
<td>60.80±20.27</td>
<td>82.96±8.71</td>
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CONCLUSIONS: After 24 weeks of exercise intervention, the posture control ability of patients with Parkinson’s disease in the Wuqinxi group was significantly improved and it has already been appeared after the 12th week.

529  Board #345  May 27 9:30 AM - 11:00 AM
Effects Of A 12-Week Wuqinxi Intervention On Hand Function Of Patients With Parkinson’s Disease
Jie Zhuang¹, Tian Wang¹, Guiping Xiao¹, Zhenlan Li², Kuncheng Jie¹, Zhen Wang¹, Yan Jiang¹, Yong Gao¹, Xiangrong Shi².
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(No relevant relationships reported)

PURPOSE: This study was to compare the effects of 12-week’s Wuqinxi exercise versus stretching on hand function (including hand dexterity and hand-eye coordination) in patients with idiopathic Parkinson’s disease (PD).

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<td>Hand Function</td>
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<tr>
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POSTURE CONTROL ABILITY:

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METHODS: This study used a randomized, controlled trial design, where 46 patients (23 women) with stage 1 through 3 Parkinson’s on the Hoehn and Yahr staging scale were randomly and evenly assigned into a Wuqinxi exercise group or a stretching group. All participants practiced either 60-minute Wuqinxi or stretching exercise sessions twice a week for 12 weeks. The Purdue Pegboard test (PTP) and the Soda Pop test (SPT) were utilized to evaluate hand dexterity before and after the intervention. Mixed-model (group by time) repeated measures ANOVA was used in the studies. Berg Balance Scale (BBS), Tinetti scale, gait assessment, and hand-eye coordination tests were also measured.

RESULTS: The physical exercise program provided significant benefits over usual care at submaximal and maximal loads. The main endpoints were change in maximal dynamic strength (i.e., leg-press, and knee-extension power at 40% of maximal isometric force). The large group effect was observed in the isometric maximal knee extension strength (14.8 Newtons (N)); 95%CI (11.2, 18.5 vs. -7.8 N; 95%CI, -11.0, -3.5 in the control group; p<0.001) and the hip flexion strength (13.6 N; 95%CI (10.7, 16.5 vs. -7.2 N; 95%CI, -10.1, -4.3; p<0.001). Significant benefits were also observed in the exercise group for the muscle power output at submaximal loads (i.e., 30%1RM, 45%1RM, 60%1RM, and 75%1RM; all p<0.001) over usual care group.

CONCLUSIONS: An individualized, multicomponent exercise-training program, with specific emphasis on muscle strength training, proved to be a Medicine therapy for improving muscle power output of lower limbs at submaximal loads and maximal muscle strength in very old patients during acute hospitalization.

Power training (PT) in older adults can improve muscle power and functional performance. The majority of studies have utilized higher intensities for training (≥60% of maximum strength) and have included combined results for older men and women. Less is known about the effects of low-intensity PT on muscle performance and function in older, healthy women. In addition, the dose-response of PT on power and function with 1, 2, or 3 days/week in older adults has not been determined. PURPOSE: The purpose of this study was to investigate the impact of different weekly frequencies of low-intensity PT on muscle strength, power, and function in healthy, older, untrained women. METHODS: Older women (n=54) were randomized to PT 1 (n=14), 2 (n=17), or 3 (n=17) days/week or wait-control, C (n=15). Participants undertook 12 weeks of PT using lower-body resistance training machines at an intensity of 40% of 1-repetition maximum (1RM), and performed the concentric phase of the exercises ‘as fast as possible’. The primary outcome was functional performance (Short Physical Performance Battery, stair climb, 30 second chair stands, and 400-meter walk) and secondary outcomes were strength (leg-press 1RM) and power (knee-extension power at 40% of maximal isometric strength). RESULTS: Within-group analyses (pre-post time points) indicated that strength improved in all PT groups (p < 0.05) with a 23.7%, 23.3%, 34.8%, and 9.8% increase from baseline for PT1, PT2, PT3 and C, respectively. Pre-post power improved significantly in PT2 and PT3 (p < 0.05) by 9.6% and 12.2%, respectively. For pre-post function, all PT groups improved in 3 of 4 (p < 0.01) with improvements ranging from 4.0 - 21.7% and with no differences observed between groups. Although the control group showed small but significant improvement in some aspects of function over the course of the study, effects sizes for all PT groups suggest small to large improvements above that observed in the controls. The large intra-individual variability in the data might have limited statistical power to detect differences between the groups. CONCLUSIONS: PT of 2 days/week or more is recommended for improving muscle power, however, 1 session weekly might be sufficient for improving functional performance.

Balance and mobility impairments are the leading causes of falls in older adults. Aquatic-based exercises have been broadly practiced as an alternative to land-based exercises due to several beneficial effects. However, there has been no systematic review with meta-analysis regarding the effects of aquatic exercises on dynamic balance in older adults.

PURPOSE: To compare the effectiveness of aquatic exercises (AE) to land exercises (LE) on dynamic balance in older adults. METHODS: Electronic databases (PubMed, MEDLINE, CINAHL, SPORTDiscus, psycINFO), from inception to March 2019, were searched. Studies met the following eligibility criteria: Randomized controlled trials, English language, older adults ≥65 years or older, any AE group and one LE group, at least one assessment for dynamic balance. For the meta-analysis, the effect sizes of dynamic balance outcomes were calculated using a weighted mean difference (WMD) or a standardized mean difference (SMD) and a 95% confidence interval (CI). RESULTS: A total of 9 trials met the inclusion criteria, and 7 studies including 328 participants (age: 69.6 ± 6.4yr) were eligible for the meta-analysis. Exercise intervention duration and frequency varied from 4 to 20 weeks, from 2 to 5 sessions per week, from 45 to 60 min per session. The tests most used in the studies were the Berg Balance Scale (BBS), Timetti scale, gait assessment, Functional Reach Test (FRT), Timed Up and Go test (TUG), and Five Times Sit-
to-stand test (FTSTS). The meta-analysis showed that older adults in AE groups demonstrated comparably enhanced dynamic balance compared with those in LE groups (SMD = 0.38; 95% CI, 0.16-0.60). Subgroup analysis showed that there were no differences in BBS (WMD = 1.66; 95% CI, -0.27-3.59; P = .09), FRT (WMD = 2.40; 95% CI, -3.38-8.18; P = .42), TUG (WMD = 0.98; 95% CI, -0.08-2.04; P = .07), and FTSTS (WMD = 2.05; 95% CI, -0.59-4.70; P = .13) between AE and LE groups.

CONCLUSION: AE may have comparable effects on dynamic balance abilities in older adults aged 65+ years when compared to LE, which implies that AE may serve as a safe low-impact alternative to LE. Older adults may participate in various physical activities in the safer aquatic environment to improve dynamic balance and possibly reduce the risk of falls.

Sedentary behavior is detrimental to body composition in older adults and a possible predictor for cardiometabolic disease. PURPOSE: To validate the correlation between levels of physical activity and body composition in older adults. METHODS: Activity data from five days of accelerometer data of 315 subjects (mean age: 63.47 ± 5.90 years, mean BMI: 27.91 ± 4.54 kg/m²; male: 155; female: 160) were retrieved from the Interactive Diet and Activity Tracking in AARP (iDATA) database from the National Cancer Institute. Subjects were categorized into three body composition (BMI) subgroups: normal (≤18.5-24.9 kg/m²), overweight (25-29.9 kg/m²) and obese (>30 kg/m²). Average time spent (secs) in standing, sitting, and number of steps for each subject were measured. Descriptive statistics were performed for the entire sample and all three subcategories. Analysis of variance (ANOVA) between the three groups were performed for weekly steps and time spent standing, sitting, and lying down. An alpha level of .05 was considered statistically significant. A linear regression analysis was performed to explore the association between these variables and body composition for the entire sample. The activity data showed strong correlations between steps per week and BMI, and between sedentary time and BMI.

RESULTS: ANOVA analysis revealed statistically significant differences for time spent standing and sitting between the normal weight (standing: 26,941 ± 8,163 secs; sitting: 29,954 ± 9,197 secs) group and the overweight (standing: 22,840 ± 7,892 secs; sitting: 33,623 ± 10,630 secs) and obese (standing: 20,836 ± 7,318 secs; sitting: 34,467 ± 10,335 secs) groups. The regression analysis showed a statistically significant association (r = 0.31, r = 0.04; p < 0.01) among steps, standing, sitting, and lying with the greatest contributors to the model being standing time (p = 0.005) and sitting (p = 0.042). The greater time standing indicated lower BMI, while greater time sitting contributed to greater BMI. CONCLUSIONS: In older adults, greater time spent standing and lower time spent sitting appears to be the greatest contributors for desirable body composition. This population of adults should be encouraged to spend more time in standing activities to enhance their health and wellness for a more desired cardiometabolic profile.

Purpose. Dyslipidemia, one of the major risk factors for cardiovascular disease (CVD), the leading cause of death in older adults. Aging is associated with an unfavorable change in the lipid-profile. High levels of LDL can be reduced by cholesterol lowering medications, while pharmacological treatment have not proven to be as efficient in reducing LDL as they are at decreasing LDL. Exercise is associated with lower risk of CVD and exercise is a potential approach for obtaining and/or maintaining an optimal lipid profile. However, the effects of exercise on HDL cholesterol in older adults are unclear. It has been suggested that the time-frame needed to achieve a change in lipid-metabolism is longer in older compare to younger adults. The aim of this study was to examine the five-year exercise on HDL in older adults. Methods. A total of 1567 individuals (790 women) were included and randomized to either 5 years of two weekly sessions of high-intensity (HIIT) (10 min warm-up followed by 4×4 min intervals at ~90% of peak heart rate) or moderate-intensity training (MCT) (50 min of continuous work at ~70% of peak heart rate) or, to a control group (CON) that followed the national recommendations for physical activity. Serum HDL cholesterol was measured immediately using standard procedures at St.Olav's Hospital, Norway. Linear mixed models were used to determine within- and between-group differences over time. Results. All groups had a significant reduction in HDL after 5 years, with no between group differences. In the per protocol analysis the reduction was less in HIIT, and significantly higher than CON and MCT (mean difference of 0.05 mmol/L, p<0.01 in both). Conclusion. Supervised exercise twice a week was not enough to hinder an unfavorable decline in HDL. However, HIIT resulted in a smaller reduction in HDL in older adults.

PURPOSE: ACSM Exercise Is Medicine (EIM) initiative recommends the use of Physical Activity Vital Signs (PVS) as an objective measure to assess compliance with the Physical Activity Guidelines for Americans. While physical activity is important for overall health, it may not necessarily improve balance and reduce risk of falls. The purpose of this study is to determine the associations between PVS and measures of fall risk.

METHODS: 65 seniors (age=81.2±8.0) participated. The PVS was calculated in accordance with ACSM Exercise is Medicine. Fall risk was assessed using the Activities-Specific Balance Confidence Scale (ABC), Timed-Up-and-Go (TUG), and BTrackSM Balance Plate. A less than 68-point ABC score suggested less balance confidence and a fall risk. A greater than 12-second TUG time and greater postural sway on the balance plate (based on BTrack’s normative data) suggested a fall risk. Dependent measures were dichotomized as fall risk or no fall risk. Separate point biserial correlations were conducted to determine associations between the PVS and fall risk category for the ABC, TUG, and postural sway.

RESULTS: No significant associations existed between PVS and ABC (r = .23, p = .04), TUG (r = .20, p = .12), or postural sway (r = .01, p = .94).

CONCLUSIONS: Increasing physical activity levels based on the PVS was not strongly associated with scores from commonly used fall risk assessments. This finding suggests that meeting physical activity guidelines alone may not be sufficient to reduce fall risk. While the PVS can provide beneficial information regarding other health factors, clinicians should utilize established balance screening tools and incorporate balance exercises into physical activity prescription to reduce fall risk in older adults.

PURPOSE: Data from the National Cancer Institute indicate that in Brazil (2018-2019) there should be 1.2 million new cases of cancer, and by 2025 the estimate is a 59% increase in its incidence. In this sense, researches indicate that cancer is associated with metabolic alterations, causing significant changes in body composition, which may promote muscle mass loss and, consequently, sarcopenia. The present study aimed to evaluate the correlation between age, sarcopenia, and length of stay (LS) in preoperative cancer patients (CP).

METHODS: Ninety-six CP of both sexes (53.1 ± 14.1 years old), admitted to the Mato Grosso Cancer Hospital (HCan-MT), Cuiabá, Mato Grosso, Brazil, were enrolled and performed the following evaluations: total body mass (TBM), height, BMI, and calf circumference (CC); answered a sarcopenia questionnaire (SARC-F); LS information was collected from the hospital database. The CP were divided into 2 groups according to the cutoff point of the CC measurement (indicative of sarcopenia;
Chemotherapy drugs such as doxorubicin (Dox) may cause skeletal muscle dysfunction, and supplementing the diet with creatine (Cr) could counteract skeletal muscle dysfunction. Very little has been done, however, exploring the time course effects of Cr on Dox-induced skeletal muscle dysfunction. PURPOSE: To examine the effects of Cr on skeletal muscle function 1, 3, and 5 days following Dox treatment.

METHODS: Male rats were randomly assigned to the control group (Con), the doxorubicin group (Dox), the standard Cr diet (2% Cr for 4 weeks) and doxorubicin group (Cr1+Dox). After 4 weeks of feeding, Dox groups received 15 mg/kg Dox and Con received saline. At 1, 3, and 5 days post-injection, grip force and extensor digitorum longus (EDL) forces during a 100 s ex vivo fatigue protocol were measured. RESULTS: No between group differences in grip force were observed 1 day post injection, but at 3 days, a between group difference in grip force was observed (p<0.03) with Dox and Cr1+Dox having lower grip forces than Con (-9.8% and -10.5%, respectively, p<0.05). But this difference was not observed 5 days post treatment. CONCLUSIONS: A between group difference in grip force was also observed at the 5 day time point (p<0.001) with Con, Dox, and Cr1+Dox having lower grip force than Con (-19.9%, -37.2%, and -19.5%, respectively, p<0.05). With ex vivo EDL function, no between group differences were observed 1 day post injection, but at day 3, EDLs from Dox group generated less force than Con at the 10 s through 40 s and the 70 s through 100 s time points (p<0.05), but these differences were not observed in Cr1+Dox and Dox. At day 5, Cr1+Dox EDLs generated significantly less force than Con for every time point during the 100 s fatigue protocol (p<0.05), and Cr1+Dox EDLs generated significantly less force than Dox at the 10 s through 40 s time points (p<0.05). CONCLUSIONS: Cr supplementation provides protection against Dox-induced muscle dysfunction 3 days post injection, and this protection was more evident with the Cr loading diet (Cr2+). This myoprotection, however, was not observed 5 days post injection suggesting that Cr’s benefit may be limited to protecting against the early phases of acute Dox myotoxicity.

Adverse cardiovascular effects associated with anthracycline chemotherapy (AC) are well established, but the impact on skeletal muscle, and the ability of exercise to attenuate these effects has been poorly characterized. PURPOSE: To investigate the effects of structured exercise training during AC on skeletal muscle composition, strength, and functional performance in women with early-stage breast cancer (BCa).

Results: All participants maintained a moderate 15 weeks exercise program. The AC was well tolerated by all participants, no dose adjustments were needed. No significant changes were observed in terms of body composition, muscle strength, and endurance. Conclusions: These results suggest that structured exercise training during AC in women with early-stage BCa is feasible and well tolerated, and may have a positive impact on muscle health.
Self-monitoring is associated with successful health behavior change and improvements in relevant fitness outcomes accompanying lifestyle interventions. Although exercise consistently results in meaningful improvements in muscular strength and physical function among prostate cancer patients (PCa) undergoing androgen deprivation therapy (ADT), the extent to which exercise-related self-monitoring is linked with improved adherence to ADT is unclear.

**PURPOSE:** The purpose of the present, randomized controlled Individualized Diet and Exercise Adherence-Pilot (IDEA-P) trial is to evaluate the preliminary efficacy of a combined exercise and dietary (EX+D) intervention, implementing a group-mediated cognitive behavioral (GMCB) approach, relative to standard of care (SC) treatment among PCa patients undergoing ADT. In the current study, we conducted an exploratory analysis to evaluate the relationship between exercise-related self-monitoring in the EX+D intervention and change in muscular strength at 3-months post intervention. **METHODS:** A total of 32 PCa patients (Mage = 65 years) on ADT were randomly assigned to the EX+D (n = 16) or SC (n = 16) interventions. Measures of 1RM chest and leg extension strength were obtained at baseline and 3-month follow-up assessments. **RESULTS:** Results from a linear regression analysis revealed that frequency of self-monitoring was not significantly associated with increased 1RM chest strength (b = 0.52, SE = 0.551, r² = 0.083, p = 0.364) or 1RM leg extension strength (b = 0.234, SE = 0.716, r² = 0.03, p = 0.751). **CONCLUSIONS:** Findings suggest that exercise-related self-monitoring was not significantly associated with change in upper or lower body muscular strength observed following the EX+D intervention in the IDEA-P trial. Given the importance of exercise and preservation of muscular strength for PCa patients undergoing ADT, exploring the role of exercise-related self-monitoring in future optimally-powered lifestyle intervention trials is warranted.

**BOARD #358**
**May 27 10:30 AM - 12:00 PM**
**Effect of Different Rated Of Perceived Exertions On The Muscle Strength In Breast Cancer Survivors**

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(No relevant relationships reported)

**PURPOSE:** To evaluate the effect of resistance training (RT) with a higher rating of perceived exertion (RE) and lower RPE on the muscle strength of upper limbs in breast cancer survivors (BCS).

**METHODS:** Twenty-six BCS women (age: 56.07 ± 6.94 years old; body mass: 68.32 ± 11.16 kg) undergoing hormonal therapy, performed eight weeks of RT once a week with high supervision ratio (one trainer per volunteer). RT protocol was three sets of 10 repetitions with 2 minutes of recovery. Maximal level of perceived exertion (RPE) was assessed after each set. After eight weeks, the BCS were categorized into two groups using the average of RPE, lower than 7 (< 7) and higher than 7 (≥ 7). The muscle strength was assessed by 1 repetition maximum (1RM) test on the bench press (BP), and then normalized by body mass (kg/BM). A repeated measurement ANOVA with the Bonferroni post hoc tests was used to examine differences between muscle strength changes.

**RESULTS:** After eight weeks of RT, 12 women reported RPE < 7 (6.12 ± 0.56) and 14 women reported RPE ≥ 7 (7.78 ± 0.49). There was no difference found at baseline (p = 0.23). 10-RM normalized was 0.27 ± 0.06 and 0.24 ± 0.05, for RPE < 7 and RPE ≥ 7, respectively. BCS who reported lower values of RPE ≥ 19 ± 12 % and Δ 23% ± 14% (p = 0.001), respectively, and no difference was found between groups (p = 0.30). **CONCLUSIONS:** The improvement in muscle strength of BCS seems is not related to higher or lower RPE, both levels of effort generated during RT are effective in improving muscle strength among breast cancer survivors undergoing ADT.

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San Francisco, California
Safe And Feasible Exercises For The Paravertebral Muscles In Cancer Patients With Unstable Spinal Metastases

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PURPOSE: Previous work showed that cancer patients with spinal metastases classified as stable (i.e. with low fracture risk) benefit from isometric exercises for the paravertebral muscles concomitant to palliative radiotherapy in terms of bone density and pain. In this exploratory randomized controlled trial we investigated whether paravertebral muscle training is safe and feasible also in patients with spinal metastases classified as unstable (i.e. with high fracture risk).

METHODS: Sixty cancer patients with unstable spinal metastases (Taneichi score ≥D) were randomized to an intervention group (INT, n=27 starters) or a control group (CON, n=29 starters). INT received 15 min of 1:1-supervised isometric exercises (“all fours”, “plank”, “swimmer”, and a standing exercise with an elastic band) daily on 10±2 days of radiotherapy and continued home-based on 3 days/week for 3 months. CON received muscle relaxation. Adverse events and adherence (primary endpoints), strength, pain and quality of life (secondary endpoints) were assessed.

RESULTS: In 41% of patients, exercises were modified because of pain or immobility. There were no training-related adverse events. During radiotherapy, 67% of patients in INT and 55% of patients in CON attended ≥80% of the planned training sessions. During home-based training, 64% of patients in INT performed ≥80% of the planned training sessions. Plank position holding time (strength) increased by 24±28 s in INT and dropped by 2±34 s in CON by the end of radiotherapy (p=0.01). There were no differences between groups for pain or quality of life (p>0.05).

CONCLUSIONS: The described or individually modified isometric exercises for the paravertebral muscles are safe and in about 2/3 of cancer patients with unstable spinal metastases feasible when introduced 1:1 and continued home-based. To investigate potential benefits, larger studies powered for patient reported outcomes and clinical endpoints are needed.
Arterial Stiffness And Cardiorespiratory Fitness In Adults With And Without Down Syndrome: An Age-and Sex-matched Study

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INTRODUCTION: There are gaps in our knowledge about differences in arterial stiffness (AS) and cardiorespiratory fitness (CRF) in adults with and without Down syndrome (DS).

PURPOSE: To describe and compare AS and CRF in adults with DS versus adults without DS.

METHODS: Fourteen adults with DS (27±5 yrs) and 14 adults without DS (27±5 yrs) participated in this study. An inform consent and a health screening questionnaire was completed by each participant and/or legal guardian. After familiarization, participants rested lying for 5-10 minutes before the measurements were taken. Brachial and central systolic and diastolic blood pressure (BSP; BDP; CFP; CDP), central augmented pressure (AP), augmentation index (Aix), Aix normalized at 75 beats/min (Aix@75) and AS (carotid-femoral pulse wave velocity (cfPWV)) were measured by using the Sphygmocor Xc device (Sphygmocor XCEL, Acor Medical). To assess the CRF, all participants performed a maximal treadmill test. Respiratory gas-exchange was measured breath-by-breath with an automatic gas analysis system (Metasys TR- plus, Brainwire SA, La Valette, France).

RESULTS: Non-DS participants were taller and had a lower BMI than the DS group (all p < .05). The CRF of the DS group was lower than the non-DS group (VO2 peak = 29.4±6.3 vs. 51.5±11.3 ml/kg/min; p < .001). Non-significant differences were found for BSP/BDP (DS = 116.31 ± 10.9/68.4 ± 9.3 vs. Non-DS = 123.43 ± 8.8/71.6 ± 6.6 mmHg; all p > .05); CSP/CDP (DS = 107.0 ± 7.6/61.1 ± 9.3 vs. Non-DS = 103.6 ± 8.5/61.1 ± 9.3 mmHg; all p > .05) and cfPWV (DS = 5.5 ± 6 vs. Non-DS = 5.8 ± 7.7 m/sec; p = .191). The AP (DS = 6.4 ± 2.7 vs. Non-DS = 4.9 ± 3 mHg; p = .002); Aix (DS = 18.1 ± 6.3 vs. Non-DS = 4.9 ± 10.3; p = .001) and the Aix@75 (DS = 12.3 ± 8.8 vs. Non-DS = 16.1 ± 11.7; p = .002) were significantly higher in the DS group.

CONCLUSIONS: Despite having lower CRF and higher BMI, adults with DS presented similar values of central and peripheral blood pressure than the Non-DS group. Nevertheless, the DS group showed higher AP, Aix and Aix@75 values, which may be due to a higher aortic wave reflection and arterial stiffness. Partially supported by: MINECO (DEP2017-88662-C2-1-R) & FPCEE Blanquerna (APR-FPCEE19/20).

Evaluation Of 3D Body Imaging To Estimate Percentage Body Fat In Older Adults

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PURPOSE: To investigate cadence thresholds associated with the lowest thresholds of relatively-defined indicators of moderate intensity provided in the 2011 ACSM Position Statement (i.e., 40-59% of heart rate reserve [%HRR], 64-76% of maximum heart rate [%HRmax], and a Borg scale rating of perceived exertion [RPE] of 12-13) in healthy older adults. METHODS: Ninety-eight older adults (mean ± SD: age = 72.6 ± 7.0 years, BMI = 25.9 ± 3.5 kg/m2) completed a 5-minute treadmill walking protocol consisting of 5-minute bouts separated by 2-min rests increasing from 0.5 to 6.0 mph in 0.5 mph increments. The protocol concluded following the bout during which the participants naturally selected to jog or it reached 75% age-predicted HRmax, or reported a Borg scale RPE ≥13. Cadence was calculated by dividing directly observed step counts by bout duration (5 min). Heart rate (HR) was measured using a chest-worn Polar HR monitor, and HR was averaged over the final 2-min of each bout. HRmax was estimated using the standard equation of 220 – age. Intensity indicators were analyzed using Receiver Operating Characteristic (ROC) curves and optimal cadence thresholds associated with moderate intensity were determined using Youden’s Index. RESULTS: The cadence threshold associated with 40% HR was 103 steps/min (sensitivity = 78%, specificity = 75%, area under the ROC curve [AUC] = 0.83), and that associated with 64% HRmax was 104 steps/min (sensitivity = 66%, specificity = 75%, AUC = 0.77). Additionally, an RPE ≥12 was associated with a cadence threshold of 101 steps/min (sensitivity = 63%, specificity = 73%, AUC = 0.79). CONCLUSION: Cadence thresholds of 100 - 104 steps/min were associated with relative indicators of moderate intensity in ostensibly healthy older adults. These results are consistent with the commonly reported heuristic (i.e., practical, rounded, evidence-based) threshold of 100 steps/min associated with absolutely-defined moderate intensity walking in healthy adults. Supported by NIH/NIA Grant 5R01AG049024
PURPOSE: To determine the relationship between Fitness Age and Face Age amongst a sample of older adults. METHODS: Sixty participants (38 females; 22 males; Age = 82.7 ± 5.7 yrs; Height = 163.3 ± 8.3 cm; Body Mass = 72.4 ± 15.0 kg; Body Fat = 34.2% ± 8.9%) participated in the five-part fitness assessment to obtain a Fitness Age (FITAg). Face Age (FACEAg) was derived from a single high-resolution digital photograph using a proprietary algorithm based on machine learning to derive a perceived age in years from the face. Pearson product-moment correlation coefficient was used to assess the relationships between FITA and FACEA. RESULTS: Data revealed no significant correlation between FITAg and FACEAg for males (r = .418, p = .053). There was a significant positive correlation between FITAg and FACEAg amongst the male participants. Female participants, however, who had poorer fitness levels (higher FITAg) subsequently appeared facially older (higher FACEAg) when compared to their chronological age. Despite these mixed findings, more research is deemed necessary in this nascent field of research.

Unaccustomed resistance exercise is associated with reductions in muscle force output, avoidance of repeated loading, pain and an inflammatory response. Whilst well defined in the literature in healthy younger populations, research into older individuals is lacking. PURPOSE: Examine muscle function, recovery and inflammatory response following an unaccustomed exercise-induced muscle damage protocol (EIMD) in younger and older males. METHODS: Healthy younger (n = 7, 27.3 ± 3.5 years) and older (n = 5, 62.6 ± 2.1 years) males provided written informed consent, performed a unilateral eccentric exercise protocol (7 sets of 10 repetitions, leg press machine). Venous plasma was collected for creatine kinase (CK), tumour necrosis factor (TNF)-α and interleukin (IL)-6 prior to EIMD, immediately after EIMD, and at 1, 2, 24, 48, and 72 hours post-EIMD. Maximal voluntary isometric contraction (MVIC), peak power and perceived muscle soreness were assessed at all time points except 1 and 2 hours post-EIMD. RESULTS: Significant difference in CK was found between younger and older group at 72 hours post-EIMD (p = 0.042), with older showing a greater increase in CK (pre- vs 72h post-EIMD) compared to the younger group (165.7% vs 107.3%, respectively). Post EIMD, older group TNF-α concentrations were significantly increased relative to pre-EIMD in comparison to the younger group (p = 0.042). IL-6 did not differ between younger and older groups at any time point (each p < 0.05). A significant main effect for time was observed for MVIC (p = 0.005), with both groups showing a reduction in leg strength immediately post-EIMD. The main effect comparing the two groups was also significant (p = 0.005). The younger group had significantly higher MVIC was also significant (p = 0.005). The younger group had significantly higher power output than the older group (p = 0.001). No difference in perceived muscle soreness was observed at any time point.

CONCLUSIONS: The older group had greater change in muscle damage and inflammatory response following EIMD, suggesting a blunted resolution relative to the younger group. As older individuals respond to EIMD in a different manner than younger group. As older individuals respond to EIMD in a different manner than younger, primarily athletic populations, cannot be extrapolated into older populations.

Purpose In order to establish standards for cardiorespiratory fitness (CRF; peak VO2), peak heart rate (HR) and peak oxygen pulse (O2-pulse, a surrogate for stroke volume), we collated percentile data from maximal exercise testing from a sample of sedentary, overweight and obese adults in North Carolina. A second objective was to describe the relative role of declines in peak HR and peak O2-pulse in the overall decline in CRF that occurs from ages 45-69 years. Methods A total of 669 sedentary adults, ages 45-69, with BMI 25-35 kg/m2 from the three STRRIDE clinical trial cohorts were included in the analysis. All three cohorts used the same graded maximal treadmill test. Peak VO2 was determined by the greatest two consecutive 15-sec collection periods. O2-pulse was calculated as: peak VO2 (mL/min) / peak HR (beats per min). Only subject’s data with peak RER > 1.0 were included in the registry. Sex-specific percentile data for each half-decade of age are shown in Table 1 (only VO2 Peak data shown below) Results When assessing trends across the 25 year age range, we observed a 20.6%, 14.3% and 11.6% decrement in peak VO2, peak HR and peak O2-pulse from the youngest to oldest women. In men, the magnitude of these trends across 25 years was slightly less, with 15.1%, 12.6% and 7.2% decrements in peak VO2 (mL/kg/min), peak HR and peak O2-pulse. In both women and men, the age-dependent decrements in peak HR were greater than the decrements in peak O2-pulse. The trend for decrement in the weight-independent absolute peak VO2 (L/min) was 24.1% in women and 19.7% in men across the 25-year period. Conclusion This CRF registry represents sedentary, overweight or obese adults in North Carolina. As a majority of Americans are sedentary and have an elevated BMI, these data are also likely representative of the U.S. population. Further, these data suggest that the age-dependent decrements in peak HR play a greater role than the loss of stroke volume in the decrease of CRF with age.

Abstracts were prepared by the authors and printed as submitted.
sessions occurred at the same time of day, separated by at least 48 hours. Participants held the MR in their mouth for 20 seconds, returned it to a vial, and immediately completed the 6MWT. Total distance walked and rating of perceived exertion (RPE) during the 6MWT were compared between MR conditions using paired sample t-tests. Blood glucose and lactate levels were compared pre- and post-6MWT and between MR conditions using 2x2 repeated measures ANOVAs. RESULTS: Total distance walked and RPE were similar between MR conditions (481 ± 79 vs. 485 ± 70 m, p = 0.33 and 31 ± 3 vs. 31 ± 3, p = 0.62). Blood glucose did not significantly differ according to MR condition or time (100 ± 16 mg/dl and 102 ± 17 mg/dl for the MDX condition pre- and post-6MWT; 105 ± 26 mg/dl and 104 ± 26 mg/dl for the PLAC condition pre- and post-6MWT, p = 0.16-0.49). Blood lactate significantly increased pre- to post-6MWT, but did not significantly differ according to MR condition (1.4 ± 0.5 mmol/L and 2.7 ± 0.9 mmol/L for the MDX condition pre- and post-6MWT, 1.4 ± 0.4 mmol/L and 2.6 ± 1.1 mmol/L for the PLAC condition pre- and post-6MWT, p < 0.01-p = 0.99). CONCLUSION: Carbohydrate MR may not significantly impact functional aerobic performance in older adults. Continued research into the clinical relevance of pre-exercise MR in older adults, including the use of other variations of gustatory stimuli, is warranted.

Exercise-induced cardiac remodeling is influenced by sport-specific exercise characteristics, such as the isotropic and isotonic components of the activity. Exercise-induced cardiac remodeling is influenced by sport-specific exercise level of the mitral valve and apex were analyzed using speckle-tracking software and decubitus position following 10 minutes of rest. Parasternal short axis images at the end-systole were captured for all athletes. All athletes were healthy male swimmers; 23±4 years; 100% identified as white) and 14 sex, age and ethnicity matched LS were identified as competing in pool events ranging from 50-400m; LS were selected for comparison. Echo-cardiography was performed in the left lateral decubitus position following 10 minutes of rest. Parasternal short axis images at the level of the mitral valve and apex were analyzed using speckle-tracking software and post-processed in custom software to normalize the temporal sequence of heart rate.

**RESULTS**: Data are presented as mean ± SD for LS vs. SS athletes. Athletes had a similar body surface area (1.92 ± 0.15 vs. 1.94 ± 0.18 m², p=0.76), resting heart rate (52 ± 10 vs. 54 ± 8 bpm, p=0.54), years of event-specific training (11 ± 4 vs. 14 ± 5 years, P=0.21), and weekly training duration (25 ± 5 vs. 22 ± 5 hours/week, P=0.15). Peak LV twist (13.8 ± 3.5 vs. 12.7 ± 5.0 deg, P=0.49) and peak LV twist normalized to LV length (1.7 ± 0.5 vs. 1.6 ± 0.6 deg/cm, P=0.67) were similar between groups. Time to peak LV twist (94 ± 4 vs. 98 ± 4 secs, P=0.006) and time to peak LV untwisting rate (9 ± 4 vs. 12 ± 3 diastole, P=0.03), were faster in LS, while time to peak twisting rate was also trending to be faster in LS (56 ± 9 vs. 62 ± 10 % systole, P=0.06).

**CONCLUSION**: In swimming, event distance appears to influence the temporal sequence of LV mechanics at rest with faster twisting and untwisting rates occurring in swimmers who train and compete in longer-distances. The relationship between these observations and global systolic and diastolic function warrants investigation.

**DIFFERENCES IN LEFT VENTRICULAR TWIST IN ELITE SHORT AND LONG DISTANCE SWIMMERS**

**PURPOSE**: To determine the effect of NTX on LVF following EX in a rodent model.

**METHODS**: Male 8 wk C57BL/6J mice were divided into 4 groups: control (CON), exercise (EX), naltrexone (NTX), exercise with naltrexone (EX+NTX). Mice that underwent EX performed 50 mins of forced swimming following a week of familiarization. NTX or saline was given (i.p.; 4 mg/kg), 15 min prior to EX or 65 min prior to echocardiography (ECHO). Mice were anesthetized using isoflurane (4-5%, for induction; 0.5-2.0% for maintenance of anesthesia). Fur was removed from the anesthetized animal with nail and echo gel was applied. LVF was assessed by ECHO using a VisualSonics Vevo 2100 ultrasound. LV internal dimensions (LVID) were measured in systole and diastole using Vevo 2100 for calculations. LV systolic function was estimated from LV dimensions by the cubed method. Results were quantified using a one-way ANOVA with a Tukey Post-HOC.

**RESULTS**: Heart rate was elevated (p<0.05) in the EX group when compared to CON (CON = 273 ± 12 vs. EX = 360 ± 30 bpm; n=8-9). This effect was abolished with the addition of NTX (EX vs. EX-NTX = 273 ± 36 BPM). Stroke volume (SV), was reduced in the NTX group compared to CON and EX (p<0.05), exercise mediated increase in SV was attenuated with pre-treatment of NTX (CON 128.8±15.0, EX 147.4±7.5, EX+NTX 143.3±17.7, NTX 76.9±19.0 ml; n=7-8). Cardiac output was reduced in the NTX group compared to CON and EX (p<0.05).
reduced in NTX group when compared to EX and CON (p < 0.05), NTX+EX was also lower (p < 0.05) than the EX group (CON 35.4 ± 4.3, EX 52.5 ± 2.5, EX+NTX 29.4 ± 6.5, NTX 19.2 ± 4.5 L/min; n=7-8).

CONCLUSION: To our knowledge, this is the first study to examine the effects of NTX on LVF following acute exercise in a mouse model. These data suggest that NTX diminishes LVF following exercise. Being that exercise is a frontline therapy for weight loss the addition of NTX may alter LVF and ultimately negatively affect exercise recovery.

**RESULTS:** Twenty eight subjects (27±5 yrs, 16 male) performed all sessions and pre- and post echo. VO2max, determined in 27 subjects, increased from 3.0±0.8 L/min to 3.4±0.8 L/min post-training (mean +14%, p<0.001). LV end-diastolic volume and LV stroke volume were similar pre-/post training (58±5 vs 58±6 %, p=0.89; 3.0±0.8 L/min to 3.4±0.8 L/min post-training (mean +14%, p<0.001). LV end-diastolic volume and LV stroke volume were similar pre-/post training (58±5 vs 58±6 %, p=0.89; 3.0±0.8 L/min to 3.4±0.8 L/min post-training (mean +14%, p<0.001).

**CONCLUSIONS:** The moderate increase in VO2max observed in the NTX group might be associated with enhanced cardiovascular health in a population with an elevated risk of cardiovascular morbidity and mortality.

**PURPOSE:** The present study compares the features of the seismedicograph (SCG) resolved in the time-frequency domain to the features of a single-lead electrocardiograph (ECG). **METHODS:** SCG and ECG signals were obtained from the combined measurement of ECG, breathing and seismedicograph (CEBS) database. Baseline signals (b001 to b020) were selected from the data base and trimmed to include a minimum of 10 beats (range: 8-12 beats; 50,000 samples). The analyzed data included lead II ECG with a bandwidth between 0.05 Hz and 150 Hz and SCG acquired using a triaxial accelerometer with a bandwidth between 0.5 Hz and 100 Hz, sampled at 5000 Hz. Time values for the peak P- and T-waves and the Q, R, and S of the ECG were identified and recorded. The SCG was subjected to an adaptation of the von Tscharner intensity analysis for accelerometry (r= 1.959, q = 1.45, scale = 1.0), and total intensity (sum of the intensities over the set of I = 11 Cauchy wavelets for each sample in time) was calculated. The peaks (P1 & P2) and valleys (V1 & V2) of the total intensity for each cardiac cycle (10 per sample) were determined and compared to the EGG. Correlation coefficients were determined and P1-P1 and R-R intervals were compared using a paired t-test in R. Statistical significance was set at an alpha-level of 0.05. **RESULTS:** Correlations were consistently strong along the variables (range: 0.971 to 0.999). There were no significant differences between the rate intervals for P1-P1 and R-R (p = 0.60). **CONCLUSION:** This preliminary analysis suggests that the SCG intensity analysis may be a suitable alternative when ECG signals are not feasible. Visual analysis and these results suggest that SCG intensity provides reliable heart rate data and may offer further insight into the nature of the cardiac cycle (e.g., pre-ejection period, left ventricular ejection time, etc.), however, the CEBS database lacked data (e.g., heart sounds) that would permit more thorough analyses. Additional study is, therefore, warranted.

**Type 2 diabetes mellitus is associated with a decrease in heart rate variability (HRV), which reflects autonomic nervous system modulation of cardiac activity and is associated with increased mortality. Heart rate variability is the time interval between consecutive heartbeats. Nighttime HRV provides a more unambiguous measurement of changes in the autonomic nervous systems regulation.**

**PURPOSE:** To compare two volume and intensity matched exercise protocols with different frequencies in individuals with T2D and to investigate the effects on HRV. **METHODS:** 54 subjects with T2D were recruited and randomly assigned to either a high-frequency high-intensity interval training protocol (HF, n=29) (10-minute high intensity, 12 sessions per week) or a low-frequency high-intensity interval training protocol (LF, n=25) (30-minute low-intensity, 4 sessions per week). Both groups were matched for volume and intensity, and the study participants exercised for 120 minutes a week for 12 weeks. 24-hour time-domain HRV measurements were selected for analysis. Aerobic capacity (VO2peak) and glycosylated hemoglobin (HbA1c) were also measured. **RESULTS:** HRV improved only in the LF group (+14% ±6.5, NTX 19.2 ± 4.5 L/min; n=7-8).

**CONCLUSION:** Longer, less frequent exercise training seems to be more effective in improving heart rate variability, and glycemic control in type 2 diabetes provided this is at a frequency of at least four times a week. This finding might be associated with enhanced cardiovascular health in a population with an elevated risk of cardiovascular morbidity and mortality.
Aging shows muscle contractile and mitochondrial dysfunctions, as well as muscle hypoxia. **PURPOSE:** To investigate how aging affects contractile function during fatigue and contract-induced mitochondrial activation at near-physiological oxygen tensions (PO2).

**METHODS:** Flexor digitorum brevis muscles were dissected from young (4-mo old, YM) and old (21-25 mo-old, OM) C57BL/6J mice. Single myofibers were perfused with Tyrode’s solution (22°C), pre-equilibrated with 5% or 0% O2, which produced an extracellular PO2 of ~40, 10, or 0 Torr, respectively. To measure fatigue resistance, myofibers (n=5 for YM and OM) were repetitively contracted (100 Hz) with progressive increases in train frequency each 2 min until fatigue (30% of initial tension) at 5% O2. The myofibers rested for 1h, pre-equilibrated with 1% O2, and the previous contractile protocol was repeated. To measure NAD(P)H changes during contractions, myofibers (n=4 for YM and OM) were equilibrated at 5% O2, then at 1% O2, and then at 0% O2, with 1h rest between conditions. For each PO2 condition, myofibers contracted repetitively for 2 min at a fixed train frequency (0.5 trains per second).

**RESULTS:** At 5% O2, time to fatigue was significantly higher in myofibers from OM (509 ± 93 sec) vs YM (207 ± 38 sec, p<0.01). At 1% O2, time to fatigue was not different to 5% O2 in YM (4 ± 11% decrease, p=0.87), but showed a trend to decrease in OM (16 ± 7% decrease, p=0.06). Relaxation time (%RT) at 5% O2 was higher in OM (122 ± 17 ms) compared to YM (77 ± 4 ms, p=0.05) before fatiguing contractions, but showed a similar slowing in relaxation at fatigue (103 ± 30 vs 117 ± 33% increase, respectively, p>0.05). At 1% O2, %RT was further increased at fatigue (154 ± 39%) compared to 5% O2 (p=0.05) in YM. %RT changes with fatigue were not different in OM at 1% O2 (151 ± 31 %) vs 5% O2 (p=0.05). Contractions produced a transient (for ~30-40 s) increase in NAD(P)H fluorescence in YM at 5% O2, which was enhanced at 1% and 0% O2, However, the increase in fluorescence at 1% O2 was minimized in OM. **CONCLUSION:** These data suggest that myofibers from old mice have a higher fatigue resistance during repetitive contractions under “near-physiological” PO2 conditions, although mitochondrial NAD(P)H responses were lower and relaxation was slower in aged myofibers.

**FUNDING:** NIH AR069577

With age, skeletal muscles lose their oxidative capacity and have a reduced mitochondrial function leading to fragmentation. These phenomena can lead to a reduction in oxygen consumption, atrophy, and an increased risk of developing age-related diseases such as sarcopenia. Skeletal muscle cells derived from humans can be used to investigate these physiological changes in primary culture. **PURPOSE:** Investigate mitochondrial morphology and maximal oxygen consumption rates (OCR) of skeletal muscle cells derived from healthy young and old men. **METHODS:** Primary skeletal muscle cells derived from the Rectus abdominis muscle of healthy active eighteen and sixty-nine year old men (SKM18M and SKM69M, respectively) were obtained from Cook MyoSite Inc. (Pittsburgh, PA). Cells were stained with MitoTracker Red (Cell Signaling; Danvers, MA) and mitochondria morphology was observed using a Zeiss LSM 710 AxiObserver confocal scanning microscope (Carl Zeiss; White Plains, NY). The mitochondrial network was analyzed using the Mitochondrial Network Analysis tool in ImageJ (NIH, Bethesda, MD) to estimate mitochondrial footprint from a binarized image. Oxygen consumption rates were measured in intact cells using Seahorse Cell Mitro Stress Tests on a XFp extracellular flux analyzer (Agilent Technologies, Santa Clara, CA). **RESULTS:** Primary cells derived from the young donor (SKM18M) had a larger mitochondrial footprint, longer branch length, and a greater number of network branches compared to SKM69M (Footprint: 34.65 ± 25.30 vs. 11.64 ± 9.53 µm2; Branch Length: 20.59 ± 7.23 vs. 12.10 ± 6.84 µm; Network: 17.25 ± 0.16 vs 7.67 ± 4.97 counts). SKM18M also showed higher Basal and Maximal OCR compared to SKM69M (Basal: 38.78 ± 8.34 vs. 12.82 ± 2.07; Maximal: 60.90 ±10.84 vs. 20.52 ± 2.36 pmol/min/protein). **CONCLUSIONS:** We observed differences morphologically and metabolically between the primary skeletal muscle cells derived from young and old donors. These preliminary results give us an insight into human skeletal muscle-derived cellular physiological capacity. Technology to observe human muscle mitochondrial fragmentation in vitro will help us elucidate the effects of aging on skeletal muscle mitochondrial fragmentation and loss of metabolic flexibility in aging.
rats aged 10-week, were subjected to eTR sessions for 4 weeks (25 m/min X 60 min X 5-day/week, n=6). Muscle specimen from the deep portion of m. Gastrocnemius were taken and homogenized. Crude mitochondria were isolated by differential centrifugations and washed with the mitochondrial isolation buffer. The isolated mitochondria were treated with proteases K (PK), osmotic shock (OS), and SDS (or TriX) in order to digest proteins on the outer membrane and in the intramembrane. The final samples were subjected to SDS-PAGE and immunoblotting using antibodies to localize the proteins in the mitochondria. Results: The eTR increased VDAC-I and COX-IV around +80~+130% as compared with non-exercise control (p<0.05), Mb increased by +50% (p<0.05). Western blotting analysis revealed that the PK digested Tom20, and Tom20 band intensity decreased with the amount of PK used. PK treatment, however, did not affect Mb found in the mitochondrial fraction. Combining treatment with PK, OS and SDS (or TriX) allowed immunoblotting detection of the mitochondrial proteins localized in specific regions of the mitochondria. Mb was detected with either PK or OS treatment. But it cannot be detected with a combined PK+OS treatment, suggesting that Mb associated with the inner membrane (intramembrane side, not matrix side) of the mitochondria. The Mb content inside the mitochondria in eTR rat was similar with that in the control muscles (n.s). Conclusion: The present results suggest that Mb in muscle cells localizes both in the cytosol and in the mitochondrial intermembrane space. Although eTR elevates mitochondrial volume and Mb content but does not change Mb content in the mitochondria. Therefore, the observation might imply that the dynamic flux of Mb from cytosol to mitochondria has greater importance than just the amount found in the mitochondria.

**Purpose:** Examine vastus lateralis muscle tissue oxygenation measured by near-infrared spectroscopy (NIRS) during submaximal (10-90%) and maximal voluntary isometric contractions (MVIC) of the leg extensors.

**Methods:** Ten healthy, active males (age: 23 ± 1, mass: 84.5 ± 4.5 kg, stature: 181.4 ± 2.5 cm) performed three, 5-s MVICs and nine, 5-s submaximal isometric step contractions (MVIC) of the leg extensors.

**Results:** The eTR increased VDAC-I expression around +80~+130% (p<0.05), Mb increased by +50% (p<0.05). Western blotting analysis revealed that the PK digested Tom20, and Tom20 band intensity decreased with the amount of PK used. PK treatment, however, did not affect Mb found in the mitochondrial fraction. Combining treatment with PK, OS and SDS (or TriX) allowed immunoblotting detection of the mitochondrial proteins localized in specific regions of the mitochondria. Mb was detected with either PK or OS treatment. But it cannot be detected with a combined PK+OS treatment, suggesting that Mb associated with the inner membrane (intramembrane side, not matrix side) of the mitochondria. The Mb content inside the mitochondria in eTR rat was similar with that in the control muscles (n.s). Conclusion: The present results suggest that Mb in muscle cells localizes both in the cytosol and in the mitochondrial intermembrane space. Although eTR elevates mitochondrial volume and Mb content but does not change Mb content in the mitochondria. Therefore, the observation might imply that the dynamic flux of Mb from cytosol to mitochondria has greater importance than just the amount found in the mitochondria.
The Associations Of Mitochondrial Content And Maximal Oxygen Uptake

Yiheng Liang1, Rasmus Jensen2, Guoqiang Geng1, Junqiang Qiu2, Niels Ortenblad2, Joachim Nielsen2, 1Beijing Sport University, Beijing, China. 2University of Southern Denmark, Odense, Denmark.

(No relevant relationships reported)

Introduction The purpose of this study was to explore the relationship between human fiber type specific mitochondria volume density and VO2max. Methods Eleven recreational active subjects (VO2max mean 4.54±0.58 L/min) reported to lab for a progressive ergometer cycle test to estimate VO2max. Ten muscle fibers were obtained in each 9 biopsies in vastus lateralis from each of the 11 subjects. In each fibers, 24 images where obtained in a randomized systematic order, thus 528 fibers and 13968 images were analyzed. Point counting was used to estimate intermyofibrillar (IMF) mitochondrial content as a volume density and subsarcolemmal (SS) mitochondrial content as a volume per fiber surface. Total mitochondrial content were obtained by recalculating the SS subfraction to myofibrillar volume density. Fibre type was determined by z-disk widths. Lean body mass(LBM) was determined by DXA. All data are presented are mean ± SD. Associations was evaluated using Pearson’s correlation coefficient. Results The total, IMF and SS mitochondrial content in type1 are 0.087±0.021 μm3·μm−3, 0.065±0.014 μm3·μm−3, 0.451±0.159 μm3·μm−2 respectively, and in type2 are 0.059±0.018 μm3·μm−3, 0.065±0.014 μm3·μm−3, 0.271±0.129μm3·μm−2 respectively. Total mitochondrial volume content was a strong predictor of VO2max per LBM. Further, IMF mitochondrial content is a better predictor of a subject’s VO2max per LBM than SS mitochondrial content. The fiber type specific correlations revealed that, total, IMF and SS in different fiber types are associated with VO2max per LBM, except SS mitochondrial content in type2 is not associated (Fig1).

Conclusion There is a strong correlation between mitochondrial content and VO2max per LBM, however, VO2max and relative VO2max are not associated with mitochondrial content. Also, there is a clear correlation between total and IMF mitochondrial content and VO2max per LBM in both type 1 and type 2 fibers, whole this was only the case for SS in type 1 fibers.

Association Of Muscle Strength And Genetic Predispositions To High Blood Pressure With Mortality And Cardiovascular Disease Outcomes: Findings From The Uk Biobank Project

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(No relevant relationships reported)

PURPOSE: High blood pressure (BP) is a heritable risk factor for cardiovascular diseases (CVD). Whether muscle strength, a modifiable environmental trait, is associated with risk of mortality and CVD independently of genetic risk for high BP is unknown. The purpose was to investigate the associations of genetic risk for high BP and muscle strength with mortality from all causes and CVD, and incidence of myocardial infarction (MI) and stroke. METHODS: This study is based on data from UK Biobank, a prospective cohort containing >500,000 adults aged 40-69 years. We included 304,020 individuals of European ancestry without 2nd-degree genetic relationships and prevalent CVD at baseline. Polygenic risk scores (PRS) for high BP were determined by averaging the standardized calculated risk scores for systolic BP (using 274 single-nucleotide polymorphisms [SNPs]), diastolic BP (278 SNPs) and pulse pressure (231 SNPs). Muscle strength was assessed through grip strength tests. The average grip strength values from both hands were divided by measured fat-free mass. Independent and stratified associations were estimated using Cox regression. RESULTS: Compared with the bottom muscle strength tertile, hazard ratios of the top tertile were 0.72 (95% Confidence Interval: 0.69-0.76) for all-cause mortality, 0.66 (0.59-0.75) for CVD mortality, 0.84 (0.78-0.90) for MI, 0.81 (0.74-0.89) for stroke, 0.79 (0.72-0.88) for ischemic stroke and 0.80 (0.67-0.96) for hemorrhagic stroke after adjusting for confounders and PRS. Higher PRS was associated with higher hazards of each disease outcome. At all tertiles of genetic risk for high BP, higher muscle strength was associated with lower hazard of mortality due to all causes and CVD (except at low genetic risk), MI, stroke, ischemic and hemorrhagic stroke (except for high muscle strength at medium genetic risk), compared with low muscle strength: no additive and multiplicative interactions detected. CONCLUSION: Individuals with higher levels of muscle strength have lower rates of mortality from all causes and CVD, and incidence of MI and stroke, independent of genetic risk for high BP. Increased muscle strength is, in general, protective against mortality and CVD in the whole population including those at increased genetic risk for high BP.
Low hand grip strength is known to be an independent risk factor for developing type 2 diabetes. However, the relationship between the strength of lower limb muscles such as knee extenders and the prevalence of type 2 diabetes remains unclear among Japanese adults. PURPOSE: To investigate the relationship between knee extensor strength and prevalence of type 2 diabetes among Japanese adults. METHODS: This cross-sectional study was conducted in 6227 Japanese male [age: 49.7 (16.0) years, mean (standard deviation)] and 7790 Japanese female [age: 50.4 (14.6) years] who had undergone medical checkup and physical fitness tests voluntarily from 1998 to 2018 at a preventive medical center. Participants completed a maximal voluntary knee extension test, a medical examination, and lifestyle questionnaires. Knee extensor strength, expressed as knee joint torque per body weight (Nm/kg), was measured at 60 degrees/s with an isokinetic dynamometer. Type 2 diabetes was defined as having at least one of the following criteria: fasting plasma glucose ≥126 mg/dL, hemoglobin A1c ≥6.5% (NGSP) and self-reported physician diagnosis. All participants were divided into quartile according to knee extensor strength. Odds ratios and 95% confidence intervals for having type 2 diabetes were obtained by using logistic regression models. The models were adjusted for age, systolic blood pressure, current smoking status, alcohol intake, and body mass index. RESULTS: Of the participants who had complete data, 720 males (11.6%) and 505 females (6.5%) had type 2 diabetes. Using the lowest quartile of knee extensor strength as reference, odds ratios and 95% confidence intervals for the highest quartile were 0.71 (0.59-0.86) for overall (p for trend <0.001), 0.64 (0.51-0.82) for male (p for trend <0.001), and 0.75 (0.55-1.01) for female (p for trend =0.036). CONCLUSIONS: Our results suggest an inverse relationship between knee extensor strength and prevalence of type 2 diabetes among Japanese adults. Further cohort studies are warranted to investigate longitudinal associations between lower limb muscle strength and type 2 diabetes.
Silent lacunar infarcts by definition, lack clinically overt stroke-like symptom, are occasionally found by brain magnetic resonance imaging (MRI) scan in asymptomatic elderly individuals. A previous study revealed that more than 25% of elderly people have silent lacunar infarcts. The main risk factors for lacunar infarcts and stroke were reported as aging, hypertension, and smoking. While a recent study showed that low muscle strength is also a risk factor for cerebrovascular events, it remains unclear whether low muscle strength is a risk factor for silent lacunar infarcts. PURPOSE: To investigate the association between muscle strength and silent lacunar infarcts in the elderly people living in urban community. METHODS: This study included 1,536 elderly people without past history of cerebral vascular events, aged 65-84 years living in an urban area of Tokyo, Japan (Bankyo Health Study). All participants underwent brain MRI scan and silent lacunar infarcts were defined as the presence of 1 or more lacunar infarcts. Isokinetic muscle strength of knee extensors was evaluated at angular velocity of 60 degrees per second using dynamometer. Subjects were categorized tertiles (high, medium, and low) by muscle strength, and compared the prevalence of silent lacunar infarcts. RESULTS: Mean age of subjects was 73.0 ± 5.4 years old and 58.9% were female. Two hundred fifty-two (16.4%) subjects were diagnosed as silent lacunar infarcts, and the subjects categorized as lower muscle strength showed higher prevalence of silent lacunar infarcts (high: 12.3%, medium: 17.7%, and low: 19.3%, p for trend 0.003), while skeletal muscle indices among the groups were similar. After multivariate adjustment by age, sex, body mass index, smoking status, physical activity, hypertension, diabetes, and dyslipidemia, the trend was still significant and the odds ratio for having silent lacunar infarcts was significantly higher in the lowest muscle strength tertile compared to the highest tertile [(high: 1.00 (reference), medium: 1.42 (95%CI: 0.98-2.04), Low: 1.48 (1.02-2.14), for trend 0.043]. CONCLUSIONS: In the elderly people living in urban community, lower muscle strength of knee extensors was associated with higher prevalence of silent lacunar infarcts independent of other established risk factors.

### MEDICINE & SCIENCE IN SPORTS & EXERCISE®

#### B-13 Thematic Poster - Pediatrics

**Wednesday, May 27, 2020, 1:00 PM - 3:00 PM**

**Room: CC-2009**

**621**

**Chair:** Karin A. Pfieffer, FACSM. Michigan State University, East Lansing, MI.

(No relevant relationships reported)

**622**

**Board #1**

**May 27 1:00 PM - 3:00 PM**

**Acute Perceptual Responses To Individual And Group-based High-intensity Interval Exercise In Girls**

Jeanette M. Ricci1, Todd A. Astorino, FACSM2, Katharine D. Currie1, Karin A. Pfieffer, FACSM. 1Michigan State University, East Lansing, MI. 2California State University - San Marcos, San Marcos, CA.

(No relevant relationships reported)

Vigorous-intensity physical activity (PA), such as high-intensity interval exercise (HIIE), elicits greater health benefits than moderate-intensity PA. However, predictors of PA adherence such as affect and enjoyment are rarely assessed during HIIE in children. PURPOSE: To compare girls’ acute perceptual responses to different types of HIIE, treadmill-based (TM) and body-weight resistance exercise circuit (CIRC), and to CIRC performed in a small group setting. METHODS: Fifteen active girls (age = 9.2 ± 1.1 years) completed a graded exercise test to determine maximal aerobic speed (MAS). TM and CIRC were performed on separate days (randomized and counterbalanced), and then CIRC was completed in a small group (group CIRC). TM required eight 30s sprints at 100% MAS with 30s of active recovery at 40% MAS; whereas, CIRC consisted of 2 sets of 4 exercises performed ‘all out’ for 30s with 30s of active recovery. Perceived exertion (RPE 0-10), affective valence (Feeling Scale, -5 to +5), and exercise enjoyment (facial scale, 1-4) were recorded at pre-exercise, 38%, and 75% of protocol completion, and post-exercise. Participants also completed surveys encompassing exercise enjoyment (PACES, 16-80) and positive and negative affect (10-item PANAS) prior to the exercise test and 15 minutes post-exercise. RESULTS: RPE increased significantly during exercise (P<0.001), yet there was no time by protocol interaction (P=0.12). Affective valence and enjoyment were unchanged during exercise (P>0.05) and similar between protocols (P>0.05). Mean affective valence and exercise enjoyment at post-exercise were equal to 3 ± 2 and 3 ± 1 (TM respectively), 3 ± 2 and 3 ± 1 (CIRC), and 4 ± 2 and 4 ± 1 (group CIRC). Mean exercise enjoyment (PACES) at baseline was equal to 69 ± 10 and did not significantly change post-exercise, and there was no change in positive or negative affect (P>0.05). CONCLUSION: Despite an exercise-induced increase in RPE, affect and enjoyment were unchanged during all protocols, suggesting that HIIE did not elicit unfavorable perceptual responses in individual and small-group settings. A possible explanation for our findings is our use of relatively brief work intervals and a lower volume exercise protocol compared to previous HIIE studies.

**623**

**Board #2**

**May 27 1:00 PM - 3:00 PM**

**Joint, Contraction-Type, and Contraction-velocity Specific Differences in Muscle Strength of Lower Extremity in Children**

Krista Casaza, Marzouq Almutairi, Sydney Watkins, Roshita Rathore, Harshvardhan Singh. UAB, Birmingham, AL.

Email: kristac@uab.edu

(No relevant relationships reported)

**Purpose:** Concentric and eccentric muscle contractions produce dynamic movements requisite for activities of daily living (e.g. walking, running, and jumping). The purpose of this study is to examine joint-, contraction-type, and contraction-velocity specific differences as a function of lower extremity muscle strength in children. Methods: Thirteen children (male = 5, female = 8; age = 11.2 ± 0.69-0.96), 0.78 [0.67-0.91] at low, medium and high genetic risk, respectively: no evidence of additive and multiplicative interactions detected. Compared with the reference category of high muscle strength and low genetic risk, there was an increased hazard of stroke for individuals who had medium or high genetic risk combined with low or medium muscle strength, but not for those who had medium genetic risk but high muscle strength. Similar associations were observed for ischemic and hemorrhagic stroke, although for hemorrhagic stroke, confidence intervals were wider and inconclusive for some of the associations.

**Conclusions:** Higher muscle strength was associated with lower risk of stroke, independently of genetic risk for stroke. The increased genetic risk of overall and ischemic stroke was partly attenuated through increased muscle strength.
1.1 years) participated in our cross-sectional study. After a familiarization session, participants performed randomized unilateral isometric (ISO), concentric (CON) and eccentric (ECC) muscle strength testing of the non-dominant knee extensors and ankle plantarflexors in a seated position at 120º/s and 180º/s on Biodex. Obtained peak torques were normalized to body mass. Differential muscle strengths were also calculated \( D1 = (ECC120-CON120) \); \( D2 = (ECC120-CON120) \); \( D3 = (ECC180-CON180) \); \( D4 = (ECC180-CON180) \). We used separate within repeated measures ANOVA to calculate muscle strength differences. Paired t-tests were used to compare the differential muscle strengths (D1 vs D2; D3 vs D4). Results: No difference was noted between ISO and CON. However, ISO and CON were lower than ECC muscle strength at 120º/s and 180º/s (P < 0.01) at the knee and ankle. No difference was noted between D1 and D2 but D4 was significantly lower than D3 (P = 0.009). Conclusion: Irreversible of contraction velocity and the body sites, children displayed greater muscle strength for ECC relative to CON or ISO which is site-dependent. Whether this is dictated by maturation associated site-specific neuromuscular inhibition remains to be investigated.

624 Board #3 May 27 1:00 PM - 3:00 PM
Relationship Between Deep Squat And Joint Range Of Ankle Motion In Young Female Hockey Players
Sandra L. Prieto1, Juan C. Mazza, FACSM2; Raul R. Festa2; Maria B. Pasquali1. 1University of Colombia, Bogotá DC, Colombia. 2Biosystem Institute Sports Sciences, Rosario, Argentina. 1National University of Rosario, Rosario, Argentina. (No relevant relationships reported)

BACKGROUND: The "Deep Squat" (DS) is a qualitative functional test that integrates muscle strength, neuromuscular control, mobility and joint stability. This test has been frequently used to identify risk of musculoskeletal injury in varied populations. The active joint range of motion (AROM) is the arc of mobility that an individual performs during a voluntary movement, measured objectively by goniometer. PURPOSE: Identify the relationship between the DS and the AROM of the ankle measured by goniometer in young female hockey players who belong to Gimnasia Esgrima Rosario Club. METHODS: Twenty young and healthy female hockey players (age: 16.12 ± 1.16 years; Weight: 57.40 ± 6.32 Kg; Height: 161.42 ± 6.14 cm), participated in this study. Asymptomatic subjects were included, with no history of lumbar spine, hip, knee or ankle injuries. The functional DS test was measured by goniometer in angular degrees of movement for knee flexion, and three bilateral tests for the AROM of dorsiflexion of the ankle (a- Bipedal position with partial load; b- Seated with knee flexed at 90º; c- Seated with knee at 0º of flexion). The Intraclass Correlation Coefficient (ICC: 0.832-0.993) and the Standard Error of Measurement (SEM: 0.803-0.971) were established by analysis of variance one way for each variable measured. We have applied matched t-test differences to determine statistical differences (SD) between dominant and non-dominant leg at p<0.05. Correlations were calculated through Pearson coefficient (r) between DS and right and left AROM mean values. RESULTS: No significant differences (ns) were found for dominant and non-dominant leg. Low correlation was found for dorsiflexion in bipedal position with partial load (r = 0.48; p < 0.05) and seated with knee flexed at 90º (r = 0.39; p = 0.09 ns). However, a moderate correlation was found between the goniometric measurement of DS and dorsiflexion in the seat with 0º knee flexion (r = 0.61; p <0.01). CONCLUSION: Based on the results, we conclude that the DS measured objectively by goniometer has a moderate correlation was found between the goniometric measurement of DS and dorsiflexion in the seated with 0º of flexion (gastrocnemius muscle length test). Therefore, in this sample, the DS test could be influenced by other determinants factors different from mobility, as they are the muscle strength, neuromuscular control and joint stability.

625 Board #4 May 27 1:00 PM - 3:00 PM
Association Between Strength Fitness And Gross Motor Function In Children: A Us National Study
Zeziao Chen1, Jingyuan Zhu2, Suda Xu3, Weizmo Zhu, FACSM1. 1University of Illinois at Urbana Champaign, Urbana, IL. 2Parkland College, Champaign, IL. 3University of Illinois at Urbana Champaign, Urbana, IL. 4Parkland College, Champaign, IL. Email: zeziao.chen86@gmail.com (No relevant relationships reported)

It was believed that children with better motor function and skills will be likely more physically active. Yet, contribution of fitness, especially muscular strength, to children’s motor function and skill has not been well understood. PURPOSE: To examine the relationship between core and upper-body strength and gross motor function in children using a US national sample. Methods: Three data sets in the 2012 National Youth Fitness Survey (NNYFS) were merged: Test of Gross Motor Development – Second Edition (TGMD-2), modified pull-up, and plank. TGMD-2 total score (TGMD-2 TS) was calculated by adding "Local motor subtest raw score" and “Object control subtest raw score” together. Descriptive statistics and correlations of TGMD-2 TS, “of correctly completed modified pull-ups (M-Pull-up),” and “of seconds planks position is held (Plank)” were computed using the 2012 NNYFS data. Result: A total of 6375389 of boys and 6134317 of girls who aged between 3 and 5 yr. old participated in 2012 NNYFS, and their performances (M±SD) in gross motor function and fitness, as well as their correlations (r), are summarized below:

<table>
<thead>
<tr>
<th>Age (yr)</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>TGMD-2 TS</td>
<td>37.88±14.79</td>
<td>49.83±15.95</td>
</tr>
<tr>
<td>M-Pull-up</td>
<td>2.82±7.5</td>
<td>1.38±6.4</td>
</tr>
<tr>
<td>Plank</td>
<td>10.28±6.4</td>
<td>15.70±4.8</td>
</tr>
<tr>
<td>r, TGMD-T vs. Plank</td>
<td>0.07</td>
<td>0.12</td>
</tr>
<tr>
<td>r, TGMD-T vs. M-Pull-up</td>
<td>0.43</td>
<td>0.56</td>
</tr>
<tr>
<td>r, M-Pull-up vs. Plank</td>
<td>0.35</td>
<td>0.56</td>
</tr>
</tbody>
</table>

Conclusion: As children become older, core and upper-body strength seems playing a positive impact on children’s gross motor function in both boys and girls.

626 Board #5 May 27 1:00 PM - 3:00 PM
The Pedi-CHAMP Agility Test: Completion Rates For Typically Developing Children Aged 5 To 17yrs
Kirsten Tulchin-Francis, Wilshaw Stevens, Anthony Anderson, Kelly Jeans. Texas Scottish Rite Hospital for Children, Dallas, TX. Email: Kirsten.Tulchin-Francis@tsrsh.org
Reported Relationships: K. Tulchin-Francis: Ownership/interest/stock; Maxim Integrated.

The Comprehensive High-Level Activity Mobility Predictor (CHAMP) was developed to assess the rehabilitation and performance in active military service-members who sustained traumatic injury. A pediatric version of this 4-part agility test (the Pedi-CHAMP) has been adapted for use in children aged 5 to 17 years. The Pedi-CHAMP consists of a) 30sec single limb stance (SLS) on each leg, b) a modified Edgren Side-Step Test (Edgren) consisting of 3 continuous repetitions of side-step movements in each direction over a 4m course c) an L-test (10m forward, 10m side-step in each direction, 10m backwards) and d) the Illinois Agility Test (IAT) triple shuttle run with directional weaving on the second pass. PURPOSE: To assess the completion rate of each portion of the Pedi-CHAMP in typically developing children aged 5 to 17 years. METHODS: With IRB-approval, 1,093 children (574 females, average age 11.01±3.9yrs (range 5.0-17.9yrs) were tested and included for analysis. Each participant was given two attempts to complete each portion of the test. If one attempt was unsuccessful or disqualified based on performance, a third attempt was offered. Participants were grouped by age (rounded down to the nearest year) and sex (male/ female). A complete test was noted if the participant was able to follow directions and did not demonstrate any performance deemed to disqualify the trial (missed end line/ cone, failed to maintain proper body position during side step, etc.) RESULTS: All participants were able to follow the directions and perform the SLS test. It should be noted, however, that 29% were not able to maintain balance for 30 secs on one or both legs. The SLS rate of completion was higher in girls than boys for children aged 5 to 11 years. The overall completion rates for the modified Edgren and L-test tasks were 93% and 92%, respectively. Similar trends between sexes were seen for both tests, with completion rates improving from 74% (Edgren) and 69% (L-Test) in children aged 5yrs to <90% by 8yrs of age. The Illinois Agility Test (IAT) had an overall completion rate of 99%, with all age-sex groups achieving at least 92% completion. CONCLUSION: The Pedi-CHAMP is a 4-part agility test that can be successfully administered in typically developing children aged 5 to 17yrs.
Cross-country (XC) skiers frequently perform low intensity training sessions to improve their endurance capacity or for recovery, but the relationship between exercise performed below a certain threshold intensity, adaptational responses will only occur after a certain duration. Rating of perceived exertion (RPE) scale may be used to determine exercise thresholds, but it is still a controversial issue. The purpose of this study was to search the relationship between the core strength and sportive performance of adolescent female soccer players. The relationship between core strength and sportive performance tests reveals the importance of trunk strength in improving sportive performance. For this reason, we recommend that athletes’ training programs should include exercises improving trunk strength. In addition to this, athletes should be informed about core strength’s importance by physiotherapists or coaches.

**PURPOSE:** To investigate adaptation of low intensity sessions, by means of session RPE (sRPE) in two groups of adolescent XC skiers with different RPEs on double poling performance after 1-week pre-competitive season training camp. **METHODS:** Thirty-six national level XC skiers (13.4±1.9 yrs; VO2max 51.2±8.0 ml·min⁻¹·kg⁻¹) participated in a 1-week camp in preparatory period. Pre- and post-camp double poling performance was measured with incremental exercise test on the ski ergometer. All XC skiers trained with the same training program. Based on the athletes’ RPE values they were divided into two groups. Group1, who rated their trainings lighter and a Group2 who rated trainings harder compared to the median rating of all trainings. **RESULTS:** After excluding the intensive training session, Group1 average RPE rating was significantly higher compared to Group2 (3.09±0.90 vs 4.94±1.84, respectively) and total sRPE was also higher in Group2 compared to Group1 (4010±765 vs 2499±193 AU, respectively). While total training time was not different (796±41 vs 786±55 min, p>0.05). No significant differences were found in time spent in different HR zones between the two groups. Progression in ski ergometer performance in Group1 was 10.0% (ES=0.18, small), while in Group2 the progression was 12.0% (ES=0.39, moderate). **CONCLUSION:** Despite training with similar training plan, adolescent XC skiers experience training load differently. This leads to differences in performance changes, highlighting the importance of individual-volume-intensity description. Supported by NRC Grant no. PUT1395G.
Forty-nine participants (mean ± SD; age: 20.4±1.3 yrs, 45.8% male) completed four, method estimates using PB bout duration and other novel accelerometer statistical and activity intensity using high-frequency wrist accelerometer data.

To develop a novel method to estimate free-living sedentary behavior length (seconds) was most important among statistical features. PPV 95.71% for inactive classification. In the holdout sample, steps 1 and 2 correctly statistical features used as inputs to the random forest models.

Second-by-second data. Gini impurity index was used to measure the importance of features of the count data and bout length (seconds) as inputs to random forest models predicting activity intensity categories and test validity on a diverse, independent, free-living sample. Supported by NIH NIDDK R01DK110148.

Heart rate (HR) may improve the prediction of the rate of oxygen uptake (VO2) from accelerometer output, but this has not been examined in adults with Down syndrome (DS). Addressing this issue may have implications for accelerometer-based measurement of physical activity and sedentary behavior in adults with DS. PURPOSE: To examine if HR improves VO2 prediction from hip- and wrist-accelerometer output in adults with DS. METHODS: Sixteen adults with DS (10 men; age 31 ± 15 years) performed 12 tasks including physical activities and sedentary behaviors. VO2 was measured with portable spirometry (K4b2, Cosmed) and accelerometer output (Vector Magnitude [VM]) with a hip- and a wrist-worn accelerometer (wGT3X-BT, Actigraph). We used multi-level regression to predict VO2 from VM alone and VM and HR together. We evaluated prediction accuracy with the absolute percent error and Bland-Altman plots. Analyses were run separately for hip and wrist accelerometer VM. RESULTS: Both hip- and wrist-derived VM significantly predicted VO2 (p < 0.001; R2 = 0.74 and 0.49 for hip and wrist model, respectively). HR significantly contributed to both models (p < 0.001; R2 = 0.55 for hip and wrist model, respectively). For wrist data, absolute error did not differ significantly between the model with VM alone and the model with VM and HR (24 ± 27 and 26 ± 27%, respectively; p = 0.15). For wrist data, absolute error was higher for the model with VM alone than the model with VM and HR (43 ± 39 and 37 ± 38%, respectively; p = 0.017). Bland-Altman plots indicated zero mean error for all models and limits of agreement were wider for wrist- than hip-models. For hip-models, limits of agreement were similar between VM alone and VM and HR (5.6 to 5.6 and -5.8 to 5.6 ml/kg·min-1, respectively). For wrist-models, limits of agreement were somewhat wider for VM alone than VM and HR (-7.9 to 7.6 and -7.4 to 7.1 ml/kg·min-1, respectively). CONCLUSION: Inclusion of HR does not improve prediction of VO2 from hip-accelerometer VM in adults with DS. HR may slightly improve prediction of VO2 from wrist-accelerometer VM. Overall, hip-accelerometer VM is better than wrist-accelerometer VM at prediction of VO2 during physical activities and sedentary behaviors in adults with DS. Supported by NIH Grant R15HD098660.
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635 May 27 2:20 PM - 2:15 PM
Sedentary Time And Markers Of Physical Function In Those With Established Type 2 Diabetes
Joseph Henson1, Andrew Hall1, Thomas Yates1, Emma Baldry2, Emer Brady1, Charlotte L. Edwardson1, Alexander V. Rowlands1, Melanie J. Davies3, 1University of Leicester, Leicester; 2University of Birmingham, Birmingham; 3University Hospitals of Leicester, Leicester, United Kingdom.
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(Please refer to the full version of the paper for a list of relevant relationships.)

PURPOSE: An accelerated ageing process places those with type 2 diabetes mellitus (T2DM) at risk of physical functional impairments at a younger age. Although the importance of moderate-to-vigorous physical activity (MVPA) is acknowledged, emerging research suggests that sedentary time may also be important. Therefore, the aim was to examine cross-sectional associations between device-assessed sedentary time and markers of physical function in a population with T2DM and to determine whether associations were modified by the recommended levels of MVPA.

METHODS: Participants with T2DM (>6months), aged 18-75 years were recruited as part of an ongoing, cross-sectional study (CODEC) conducted in the Midlands, UK. Participants were asked to wear an accelerometer (GENEAct, ActivInsights Ltd, Kimbolton, UK) on their non-dominant wrist for 7 days to quantify habitual levels of sedentary time and MVPA. Generalised linear models examined the associations between sedentary time, the short physical performance battery (SPPB), the sit-to-stand (STS) 60 reps (p=0.016) and 0.2s longer walk time (p=0.043) in the inactive group only. The impact of sedentary time was associated with a 0.3 lower SPPB score (p=0.020), 1.4 fewer STS60 reps (p=0.016) and 0.2s longer walk time (p=0.043) in the inactive group only. No significant associations were found in the active group.

CONCLUSION: No significant associations were found in the active group. The impact of sedentary time was detrimentally associated with SPPB score, STS60 reps and walk time. When various covariates, including age, sex, ethnicity, medication and MVPA, sedentary time was associated with a 0.3 lower SPPB score (p=0.020), 1.4 fewer STS60 reps (p=0.016) and 0.2s longer walk time (p=0.043) in the inactive group only.

636 May 27 2:25 PM - 3:20 PM
Agreement Between Fitbit And Actigraph Estimates Of Physical Activity In Young Children
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(Please refer to the full version of the paper for a list of relevant relationships.)

Commercial wearables are used to track physical activity (PA) levels in children and as tools for increasing PA participation in youth. However, few studies have examined the agreement between commercial and research grade devices in assessing PA in children.

PURPOSE: To compare estimates from a wrist-worn Fitbit Flex 2 to a waist-worn Actigraph GT9X Link in elementary school children. METHODS: Forty children aged 6-10 years wore a Fitbit Flex 2 (on a non-dominant wrist) and an Actigraph GT9X Link (on waist) for up to two weeks while school was in session. Children were instructed to wear the Fitbit continuously and to wear the Actigraph during all waking hours. Parents were given wear reminders via text each morning. For each device, an adapted Choi algorithm was used to flag non-wear periods (defined as ≥90 minutes of continuous step value steps). Steps and intensity-specific estimates of daily PA from each device were averaged across time periods when both devices were worn simultaneously, and estimates were compared using days with 10+ h of concordant wear and using all available data. RESULTS: Across 91 days with concordant device wear of 10+ h, Fitbit estimates were 25% higher for steps (Mean±SD: 10381±3846 steps) and 44% higher for vigorous intensity PA (16.2±22.1 min) compared to the Actigraph GT9X Link (8260±3614 steps; 11.3±15.9 min). In contrast, Fitbit estimates of moderate intensity PA (26.8±21.1 min) were 20% lower than Actigraph estimates (33.3±24.3 min). Pearson correlations between device estimates were higher for steps (r=0.62) than for moderate (r=0.53) or vigorous (r=0.28) intensity PA. Similar patterns were observed when all available concordant data were analyzed (r=0.77 days), with the Fitbit recording 20% more steps, 28% less moderate PA, and 36% more vigorous PA than the Actigraph. CONCLUSIONS: Wrist-worn consumer wearables may produce higher estimates of steps and vigorous intensity PA, and lower estimates of moderate intensity PA, in elementary school children. Absent additional evidence, consumers and researchers should be cautious when using wrist-worn consumer devices to assess absolute levels of PA in youth. Supported by a grant from NHLBI (R01HL135359).

637 May 27 2:30 PM - 2:45 PM
Do GPS Capable Fitness Watches Accurately Measure Exercise Distances?
David Q. Thomas, FACSM, Adam Jagodinsky, Delaney Mahoney, Ryan Schwerzler, Tessa Gridley, Catherine Guiffre. Illinois State University, Normal, IL.

(Please refer to the full version of the paper for a list of relevant relationships.)

Fitness watches have become popular for assessing activity habits. Manufacturers of these devices claim their devices provide valid and reliable measures of distances traveled. PURPOSE: To determine if six popular physical activity watches provide accurate measures of GPS recorded distances. METHODS: An Apple Watch (AW), Fitbit Ionic (FI), Fitbit Versa (FV), Garmin VivoWatch (GVS), Garmin Vivomove active 3 (GVA), and a Garmin Forerunner 35 (GF) were all tested on indoor and outdoor oval tracks, an outdoor walking trail and a zig-zag pattern course. Twenty trials were performed on each course by the same researcher. An industrial TR 88016 FX Series collapsible measuring wheel established actual distance (200 m). Two watches were worn at the same time on the left arm. Each watch was set to walking and their GPS signal was turned on and connected. Distance measured by the wheel and each watch was recorded. Means, standard deviations, and percent relative error were calculated for the GPS distance of each watch. RESULTS: For the outdoor trail condition, the results showed distances ranging from 180.0 to 204.4 m (FI: 180.2 m, 10.4%, FV: 186.6 m, 7.6%, GVA: 200.7 m, 4.0%, AW: 201.1 m, 4.2%, GVS: 204.4 m, 4.8%, GF: 204.4 m, 4.4%). For the zig-zag course condition, the range was from 184.2 to 204.4 m (GVS: 184.2 m, 4.1%, FI: 189.0 m, 6.0%, FV: 197.9 m, 4.0%, AW: 197.9 m, 4.0%, GVA: 204.4 m, 4.1%). For the outdoor trail, the range was from 179.3 to 204.4 FV: 197.3 m, 10.8%, AW: 198.5 m, 5.6%, FI: 195.5 m, 4.8%, GVS: 200.3 m, 4.0%, GF: 202.8 m, 4.0%, GF: 204.4 m, 4.1%). For the indoor trail, the range was from 164.2 to 169.0 FV: 164.2 m, 18.3%, 169.0 m, 16%). All Garmin devices failed to record an indoor measurement. CONCLUSIONS: The least and most accurate measurements for each condition were: trail (FV and GVA), zig-zag (GVS and FV), outdoor (FV and FV) and indoor (FV and AW), respectively. The Garmins were the most accurate for the outdoor trail with all exhibiting a 4.0% error. Indoor, all devices were less accurate. Only AW and FV had functioning GPS indoor and showed their most error in this setting. Caution must be used when relying on physical activity monitors if accuracy is desired in measuring distance via GPS.

638 May 27 2:45 PM - 3:00 PM
Calibrating Physical Activity And Sedentary Behavior For Wrist-worn Accelerometry In Women 60 Years And Older
Kelly R. Evenson, FACSM1, Fang Wen1, Chongzhi Di, Andrea Z. LaCroix1, Cora E. Lewis1, Michael J. LaMonte, FACSM2, 1, Chongzhi Di, Andrea Z. LaCroix, Cora E. Lewis, Michael J. LaMonte, FACSM. 1, Chongzhi Di, Andrea Z. LaCroix, Cora E. Lewis, Michael J. LaMonte, FACSM. 1University of Washington, Seattle, WA. 2University of Miami, Coral Gables, FL. Supported by a grant from NHLBI (R01HL135359).

PURPOSE: While emerging approaches for defining physical activity and sedentary behavior using accelerometer exist, cutpoint-based definitions remain a frequent convention. We explored whether a calibration study could contribute to wrist-worn accelerometer count cutpoints among women >60 years.

METHODS: Women (n=199) 60-91 years wore an ActiGraph GT3X+ accelerometer on their left wrist while performing eight structured activities. Intensity was continuously measured using an Oxygen portable indirect calorimeter. Accelerometer data were analyzed in 15-second epochs with both normal and low frequency extension (LFE) filters. Receiver operating characteristic (ROC) curves were used to calculate cutpoints for sedentary behavior, light (low and high), and moderate to vigorous physical activity (MVPA). Using vertical axis and vector magnitude (VM) counts. Cutpoints were selected that balanced the number of false positives and false negatives using three different classifications: one based on specific activities and two based on measured metabolic equivalents (e.g., 1 MET=3.0 or 3.5 ml/kg/min). Area under the ROC curves (AUC) were interpreted as excellent (0.90-1.00), good (0.80-0.89), fair (0.70-0.79), poor (0.60-0.69) and very poor (<0.60).

RESULTS: Average VM counts/15sec varied by activities: 76 watch DVD, 675 assemble puzzle, 836 mopping, 1875 wash/dry dishes, 2180 laundry, 570 walk.
1.5 mph, 637 walk 2.0 mph, 1132 walk 2.5 mph, and 1094-400 meter walk. Of the three cutpoint classifications, activity types performed best based on sensitivity and specificity. Using the normal filter, the AUC was good for sedentary cutpoints (vertical axis 0.88; VM 0.88), but was fair to poor for light high intensity (vertical axis 0.74; VM 0.64) and failed for MVPA (vertical axis 0.50; VM 0.50). Findings were similar when using the LFE filter, with only sedentary results indicating good to excellent results (vertical axis 0.90; VM 0.89).

**CONCLUSION:** This approach provided useful sedentary but not physical activity indicators for wrist-worn accelerometry counts. Further research is needed to understand whether wrist-worn accelerometry can accurately measure higher intensity physical activity in older adults.

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**B-15 Free Communication/Slide - Clinical Exercise Testing**

**Wednesday, May 27, 2020, 1:00 PM - 3:00 PM**

**Room: CC-2005**

| 639 | Chair: Jonathan Myers, FACSM. Veterans Affairs Palo Alto Health Care System, Palo Alto, CA. |
|-------------------------------------------|
| (No relevant relationships reported)       |

**May 27 1:00 PM - 1:15 PM**

**Calf Muscle Oxygenation Limits Maximal Respiratory Performance During Incremental Walking Test In Obese Children**

Louis Toulouse1, Patrick Mucci1, Pierre Morel1, Christophe Aron1, Gautier Zunquin1,1 Université du Littoral Côte d’Opale, Dunkerque, France. 2Université de Lille, Lille, France. 3Hôpital Maritime de Zuydcoote, Zuydcoote, France. 4Université Pau Pays de l’Adour, Anglet, France. Email: louis.toulouse@etu.univ-littoral.fr

(No relevant relationships reported)

**PURPOSE:** To study the interrelationship between respiratory and muscle haemodynamic responses during an incremental exercise in overweight children and confirm the limitations clinically observed that lead to the premature termination of an aerobic fitness test.

**METHODS:** Twenty-four overweight children (12 girls and 12 boys) performed a progressive maximal treadmill test during which the slope increases every minute. Changes in muscle oxygen ($O_2$) supply were continuously assessed using near-infrared spectroscopy. Pulmonary gas exchanges and heart rate (HR) were measured. For each participant, changes in deoxyhemoglobin level ($\Delta$[Hb]) in the medial head of the gastrocnemius muscle were expressed as a function of time, then as a percentage of peak oxygen uptake (VO2 peak). The influence of the sex, BMI and maturation on breakdown point in muscle deoxyhemoglobin (BPo2) was assessed with linear model effects.

**RESULTS:** Girls reach lower VO2 peak than boys (p = 0.07). A BPo2 occurred during the test in 9 girls and 6 boys and was strongly correlated with VO2 peak (r = 0.80, p < 0.001). Expressed as a percentage of maximal theoretical value, HR peak tended to be the test in 9 girls and 6 boys and was strongly correlated with VO2 peak of oxygen uptake (VO2 peak). The influence of the sex, BMI and maturation on breakdown point in muscle deoxyhemoglobin (BPo2) was assessed with linear model effects.

**CONCLUSIONS:** Oxygenation of the calf muscle could limit maximal respiratory performance during an incremental walking test with a slope, especially in prepubertal obese children who have lower BMI. Muscle limitations should be considered when choosing a protocol to assess VO2 peak in this population.

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**640 May 27 1:15 PM - 1:30 PM**

**High Peak Exercise Blood Pressure In Athletes Is Proportional To Exercise Capacity.**

Kristel Johanna Hilde Janssens1, Guido Claessens2, Stephen Foulkes2, Luke Rowse1, Darragh Flannery3, Erin Howdven2, Andre La Gerche1. 1Baker Heart and Diabetes Institute, Melbourne, Australia. 2UZ Leuven, Leuven, Belgium. Email: kristel.janssens@baker.edu.au

(No relevant relationships reported)

An abnormal blood pressure (BP) response to exercise is an important physiological variable associated with a risk of sub-clinical hypertension. Reference values are poorly defined and lack contextualization to physiological demands that can be obtained among very active populations.

**PURPOSE:** To assess the relationship between systolic BP (SBP) and workload and to determine reference values of SBP response to exercise in endurance athletes.

**METHODS:** We recruited 123 current and former endurance athletes (76% male), aged 16-80 years. BP was measured every 2 min during a maximal bicycle cardiopulmonary exercise test using a TangoM2 automated BP monitor. Relationship between SBP measured at 25%, 50%, 75% and 100% of maximum workload and power output during exercise were determined by linear regression analysis using STATA software.

**RESULTS:** SBP increased from 128 ±13 mmHg in males (age 40±18 years) and 116 ±12 mmHg in females (age 35±14 years) to peak 223 ±27 mmHg and 203 ±19 mmHg, respectively (P<0.0001). The majority of participants demonstrated an exaggerated SBP response to exercise (72% of males and 82% of females) as defined by the American Heart Association guidelines. There was a strong correlation between power output and SBP ($r^2$ = 0.67, P<0.001, Figure 1). Males achieved 123±18% and females 134±26% of their predicted VO2 max (P<0.01). There was no statistical difference in exercise SBP response according to age or BMI. Gender and hypertensive medication did not have a statistically significant, but weak correlation to SBP (P=0.01 and P=0.001 respectively $r^2$=0.03 for both)

**CONCLUSION:** High SBP values are observed in athletes at peak exercise, frequently exceeding 'normal value' definitions. However, SBP increases can be explained by the supra-normal exercise capacity, thus, should be considered in the context of exercise capacity.

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**641 May 27 1:30 PM - 1:45 PM**

**Aerobic Fitness Is Related To Sports Participation In Children With Congenital Heart Disease**

Astrid-Marie De Souza1, Kathryn Armstrong1, Nicholas Tran1, Kaelan C. Naylor2, Hilary V. Romans1, James E. Potts3, Martin C. K. Hosking4, David C. Clarke5. 1BC Children’s Hospital, Vancouver, BC, Canada. 2Simon Fraser University, Burnaby, BC, Canada. 3Simon Fraser University, Vancouver, BC, Canada. Email: adesouza@cw.bc.ca

(No relevant relationships reported)

Purpose: Underlying structural lesions in congenital heart disease (CHD) result in differences in anatomy and physiology that may affect peak aerobic capacity (VO2 peak). The relationship between sports participation and VO2 peak is unclear in these patients. The aim of this study was to determine if children with CHD who participated in sports had a higher VO2 peak than those who did not.

**Methods:** Two-year, single-centre, retrospective review (May 2016-November 2018). Fifty-eight CHD patients were included based on diagnosis: 9 aortic valve disease; 13 coarctation; 6 Ross procedure; 20 tetralogy of Fallot, and 10 transposition of the great arteries. Sports participation was assessed by an ACSM Clinical Exercise Physiologist at the time of testing and categorized into 3 groups: 0-1 day/week; 2-3 days/week; ≥ 4 days/week. A validated institutional treadmill protocol (BCCCH) was used. The criteria for a maximal test included: VO2 plateau, respiratory exchange ratio>1.0, and/or a peak heart rate >200 bpm. VO2 peak Z-scores5, gas exchange threshold (GET) and O2 Pulse were calculated. Data are reported in frequency tables and as medians and interquartile ranges. Kruskal-Wallis and Mann Whitney U tests were used to test for group differences. P<0.05 was considered statistically significant.

**Results:**
Exercise can exacerbate concussion symptoms, even when symptoms are not apparent at rest. Whether this relates to a physiologic response to exercise remains unknown. PURPOSE: To examine symptom and physiologic responses to a stationary bike exercise protocol among participants with concussion and uninjured controls. METHODS: 32 concussed individuals (age=16-92 years; 50% female; 12±4.5 days post-injury) and 22 healthy controls (age=18-32 years; 59% female) completed a modified YMCA branching exercise protocol. After warmup (3 mins; 50 watts), participants progressed to Stage 1 (3 mins; 100 watts). Stage 2 was based on Stage 1 HR (2 mins; 125 watts if >70% age predicted HR). Stages 3-5 lasted 2 mins, and HR (2 mins; 175 watts if <60% age predicted HR; 150 watts if 60-70% age predicted HR) increased by 50 watts/stage. Stopping criteria were symptom worsening (visual analog scale [VAS, 0-100] change>30) or 85% age-predicted HR. We assessed changes (end - baseline) for VAS, HR, systolic/diastolic blood pressure (SBP/DBP), rating of exertion (RER), and oxygen consumption (VO2).

RESULTS: Using a branching bike-based exercise protocol, most participants progressed to Stage 1 (3 mins; 100 watts). Stage 2 was based on Stage 1 HR (2 mins; 125 watts if >70% age predicted HR). Stages 3-5 lasted 2 mins, and HR (2 mins; 175 watts if <60% age predicted HR; 150 watts if 60-70% age predicted HR) increased by 50 watts/stage. Stopping criteria were symptom worsening (visual analog scale [VAS, 0-100] change>30) or 85% age-predicted HR. We assessed changes (end - baseline) for VAS, HR, systolic/diastolic blood pressure (SBP/DBP), rating of exertion (RER), and oxygen consumption (VO2).

CONCLUSIONS: Using a branching bike-based exercise protocol, most participants achieved 85% age-predicted maximum HR, rather than symptom exacerbation. The amount of symptom provocation between groups was similar. Greater HR changes during exercise were associated with greater symptom provocation independent of group.

In chronic heart failure (CHF), cardiopulmonary exercise testing (CPET) yields key prognostic parameters. In addition to peak oxygen uptake (peakVO2), ventilatory efficiency (VE/VO2, slope) and exercise oscillatory ventilation (EOV), other parameters such as oxygen pulse (O2-pulse; VO2/heart rate [HR]) kinetics are considered of clinical interest. However, the prognostic value of O2-pulse kinetics in CHF has not yet been thoroughly examined. PURPOSE: The purpose of this study was to determine whether impaired O2-pulse kinetics and associated parameters including VO2 as a function of work rate (VO2/WR slope) and HR/VO2 slope predict major adverse events in patients with CHF. METHODS: O2-pulse kinetics was classified as 1) continual rise; 2) plateau; and 3) decrease. To evaluate the hazard ratio and significance of the optimal cutoffs for VO2/WR slope and HR/VO2 slope we used a two-fold cross-validation process. Kaplan-Meier curves and univariate as well as multivariate Cox regressions were used to compare time to the composite outcomes of all-cause death, heart transplantation (HTx) and left ventricular assist device (LVAD) implantation between groups. Results: 242 patients (55±13 years, 78% male, 50.1±15% of predicted peakVO2) with CHF were included in the study. During the mean follow-up of 27.5±23.3 months, 112 patients (46%) had an event (50x LV AD, 39x HTx, 23x death). Neither an O2-pulse plateau (43%) nor a decrease (7%) distinguished patients with and without events. However, VO2/WR and HR/VO2 slopes were significant univariate predictors (p<0.001) of the outcomes (Fig.1). In the multivariate analysis, peakVO2/WR slope and EOV [hazard ratios (95% CI): 2.06 (1.20-3.54), 2.03 (1.21-3.38) and 1.65 (1.12-2.45), respectively] remained significant independent predictors (p<0.05). Conclusion: VO2/WR slope and HR/VO2 slope during CPET appear to be of potential benefit for predicting outcomes in patients with CHF, whereas O2-pulse kinetics did not.

**Table 1**

<table>
<thead>
<tr>
<th>Sports Participation</th>
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<tr>
<td>0-1 day/week (n=11)</td>
<td>0.51</td>
</tr>
<tr>
<td>2-3 days/week (n=30)</td>
<td>0.59</td>
</tr>
<tr>
<td>≥4 days/week (n=11)</td>
<td>NS</td>
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Those who participated in sports 2-3 days/week or more had a significantly higher VO2peak, VO2peak-Z-score, GET and O2 Pulse than those with 0-1 day/week (Table 1). There were no differences between those who participated in sports 2-3 days/week compared to ≥4 days/week. VO2peak was similar between CHD cohorts (p=0.21). Conclusions: VO2peak is higher in those who participate in sports compared to those who do not. It is unclear whether those who have a higher VO2peak are more inclined to participate in sports or whether sports participation leads to a higher VO2peak in these CHD patients. The role of exercise rehabilitation in the 0-1 day/week group needs to be explored.

Ahmad et al 2001

**Fig. 1**: Kaplan-Meier curves and results of the univariate Cox regression analysis (hazard ratio [95% confidence interval]; VO2/WR slope and [HR/VO2] slope)
p-value < 0.0001. Comparing 0-5m to 10-20m, the estimated difference was 0.106 m/s with a p-value of <0.0001. The estimated 5-10m to 10-20m difference was 0.018 m/s with a p-value of 0.18.

**CONCLUSIONS:** The most efficient distance to measure gait speed is between 5-10 meters of a 15 meter walk test to provide room for acceleration and deceleration. Using a walk speed test under 5 meters is not advised because people are still accelerating and have not achieved stable speed.

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### B-16 Free Communication/Slide - Nutritional Ergogenic Aids

**Title:** The Impact Of Placebo Caffeine Dose On Cognitive Performance And Endurance Running In Recreational Athletes.

*Ben Desbrow*, *Chris Irwin*, *Nathan Delang*, *Gregory R. Cox*. Griffith University, Gold Coast, Queensland, Australia. (Sponsor: Louise Burke, FACSM)

**Email:** b.desbrow@griffith.edu.au

**Purpose:** A caffeine-mediated dose-response placebo effect has previously been observed in trained cyclists. The current study aimed to determine if perceived caffeine dose influences cognitive and/or running performance in recreational athletes.

**Methods:** Twenty-nine healthy individuals (23.7±5.9 y (Mean±SD), 16 males) completed two morning trials (repeated measures design, separated by 1 week), involving a choice reaction time (CRT) test followed by a 10km performance run. Prior to the first trial, participants indicated their beliefs of caffeine’s effects on performance and any previous experience using caffeine as an ergogenic aid. On arrival to the testing facility, participants randomly received (and were told they were getting) “Low dose (100mg)” or “High dose (300mg)” of caffeine capsules (all contained placebo, (psyllium husk powder)) prior to commencing the CRT test (30min post capsule ingestion). Paired samples t tests were used to determine differences between trials and CRT latency (employing Ex-Gaussian analysis) and running performance using the entire participant sample and for the sub-groups exhibiting strong “beliefs” +/- prior experience.

**Results:** Perceived caffeine dose did not influence CRT (μ-, σ- and τ-components respectively). Low: 0.386) did not differ from the placebo condition (μ- = 0.386, σ- = 0.976, τ = 0.979). Differences were also observed among the sub-groups exhibiting strong “beliefs” (μ- = 0.386, σ- = 0.976, τ = 0.979). Differences were also observed among the sub-groups exhibiting strong “beliefs” (μ- = 0.386, σ- = 0.976, τ = 0.979). Differences were also observed among the sub-groups exhibiting strong “beliefs” (μ- = 0.386, σ- = 0.976, τ = 0.979).

**Conclusions:** Placebo effects of perceived caffeine-dose ingestion on cognitive and running performance were not observed in this study of recreationally active individuals, irrespective of individual’s prior beliefs or caffeine use.
PURPOSE: To describe the reliability of blood bicarbonate pharmacokinetics to sodium bicarbonate (SB) supplementation and, based on those data, to estimate probabilities of SB ingestion before exercise using currently accepted thresholds.

METHODS: Thirteen males (age 27.5 ± 5 y; body mass (BM) 77.4 ± 10.5 kg; height 1.75 ± 0.06 m) ingested 0.3 g·kg⁻¹BM SB in capsules at 3 occasions (SB1, SB2, and SB3). Blood was obtained at baseline and every 10 min following SB ingestion for 3h, then every 20 min for a further hour to determine bicarbonate concentration. Time-to-peak (Tmax), absolute peak (Cmax), absolute peak change (∆Cmax) and area under the curve (AUC) were determined and analysed using mixed models, as was the intraclass correlation coefficient (ICC), coefficient of variation (CV) and typical error (TE). Individual variation in pharmacokinetic responses was assessed using a Bayesian simulation approach using multilevel models with random intercepts.

RESULTS: No significant differences between sessions were shown for blood bicarbonate regarding Cmax, AUCmax or AUC (all p>0.05), although Tmax occurred significantly earlier in SB2 (127.36 min) than in SB1 (169.54 min, p=0.0088) and SB3 (159.42 min, p=0.05). ICC, CV and TE showed moderate to poor reliability for these variables. Bayesian modelling estimated that over 80% of individuals from the population experience elevated blood bicarbonate levels greater than +5 mmol·L⁻¹ between 75-240 min after ingestion, and between 90-225 min for elevations greater than +6 mmol·L⁻¹ (Table 1). CONCLUSIONS: Assessing SB supplementation using discrete values showed only moderate reliability at the group level, and poor reliability at the individual level, while Tmax was not reproducible. However, when analysed as modelled curves, a 0.3 g·kg⁻¹BM dose was shown to create a long-lasting window of ergogenic potential, which has practical utility for athletes and suggests that individually tailored timings are not required.

Table 1: Probabilities of exceeding blood bicarbonate above 5 mmol·L⁻¹ and 6 mmol·L⁻¹ (thresholds) at different time points following sodium bicarbonate ingestion. Probability values were estimated using Bayesian simulation (n = 1 million)

<table>
<thead>
<tr>
<th>Time after ingestion (min)</th>
<th>Probabilities of exceeding bicarbonate levels above 5 mmol·L⁻¹</th>
<th>Probabilities of exceeding bicarbonate levels above 6 mmol·L⁻¹</th>
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<tbody>
<tr>
<td>0</td>
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<tr>
<td>10</td>
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<td>60</td>
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<td>90</td>
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<td>120</td>
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<td>150</td>
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<tr>
<td>240</td>
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The stiffness of a tendon is determined by the amount and cross-linking of collagen within the tissue. Acute exercise and possibly vitamin C-enriched collagen supplementation have been shown to increase collagen synthesis as well as the expression of the primary enzyme involved in collagen cross-linking (lloyx oxidase). The result may be a denser and stiffer tissue. Stiffness is directly related to force transfer. Whether this nutritional supplementation can further augment response to training, in particular rate of force development (RFD), and translate to improved explosive performance compared to training alone is unknown. Purpose: To determine if nutritional supplementation with vitamin C-enriched collagen improves RFD compared to placebo (PLA) with an explosive power-based training regime.

Methods: Healthy male collegiate football players (18-25 years) were enrolled in a 3-week double-blind, parallel design study. Athletes were randomly assigned to the intervention group (COLL; 15g hydrolyzed collagen with 50mg vitamin C) or placebo group (PLA; 15g rice flour). Participants were ingested 60min prior to training 5 days per week and with breakfast on rest days. Athletes completed the same training program and progression. RFD was measured from the best of three maximal isometric squats, countermovement jumps and squat jumps (Kistler, Novi, MI) performed at the same time on each testing day (baseline and after 1, 2 and 3 weeks of training). Two-way ANOVA (nutrition intervention and time) was used to compare RFD between groups. Results: At time of analysis there were no significant differences for RFD in the maximal isometric squat between the interventions. RFD data from CMJ and SJ are yet to be determined. Conclusion: Supplementation with vitamin C-enriched collagen prior to training throughout a 3-week explosive power-based training program does not improve maximal RFD compared to exercise alone. More comprehensive analysis of all RFD parameters is required to fully interpret results from this study and will be completed prior to abstract presentation.
Resistance exercise training (RET) is a well-known stimulus for muscle protein synthesis. Protein supplementation in conjunction with RET has been shown to yield a superior combinatorial effect, fostering greater accretion of lean body mass. Few studies have compared multi-ingredient with isonitrogenous supplements of differing protein quality. PURPOSE: We compared a whey protein-based supplement (containing leucine, creatine monohydrate, calcium citrate, and vitamin D), to an isonitrogenous collagen-containing protein supplement with regards to muscle fibre and whole muscle mass increases. We aimed to determine whether the multi-ingredient supplement would enhance lean body mass gains in young adults involved in a RET program.

METHODS: Twenty-six healthy, recreationally active men and women (22 ± 2 years [mean ± SD]) were randomly assigned to either the supplementation (SUPP, n=13) or control beverage (CON, n=13) group, ingesting their respective supplements twice daily. Participants underwent a 10-week linear RET program. Dual-energy X-ray absorptiometry (DXA), one-repetition maximum (1RM), and biopsies from the vastus lateralis muscle were performed. RESULTS: There were significantly greater increases in type II fibre cross-sectional area (CSA) in the SUPP group compared to the CON group (SUPP: +47 ± 24%, CON: +34 ± 25%; p=0.05; d=0.53), while changes in type I fibre CSA was not different between groups (SUPP: +37 ± 25%, CON: +25 ± 21%; p=0.08; d=0.52). Ultrasound biceps brachii CSA increase was significantly greater in the SUPP group (SUPP: +42 ± 39%, CON: +14 ± 10%; p=0.05; d=0.98), while increases in vastus lateralis CSA was not different between groups (SUPP: +43 ± 23%, CON: +26 ± 31%; p=0.06; d=0.62). CONCLUSIONS: The consumption of a multi-ingredient nutritional supplement increased type II fibre CSA and biceps brachii CSA, but not type I fibre CSA or vastus lateralis CSA in healthy young men and women.
Clinical Case Slide - Head Injury and Concussion

Wednesday, May 27, 2020, 1:00 PM - 3:00 PM
Room: CC-3014

Chair: John Liddy, University at Buffalo Sports Medicine Institute, Buffalo, NY.
(No relevant relationships reported)

Discussant: Julie Wilson, Children's Hospital Colorado, Aurora, CO.
(No relevant relationships reported)

Discussant: Eugene Hong, Medical University of South Carolina, Newtown Square, PA.
(No relevant relationships reported)

May 27 1:00 PM - 1:20 PM
Oh Snap! I Got Hit In The Face.
Christina S. Gutta, Prisma Health, Greenville, SC. (Sponsor: Dr. Franklin Sease, FACSM)
(No relevant relationships reported)

HISTORY: 20 y.o. collegiate baseball player presents to physician in training room 1 hour after a resistance band snapped off a hook and hit him across the bridge of the nose and both eyes. He complains of immediate swelling around his eyes, difficulty opening eyelids and blurry vision for 20 minutes with tearing, difficulty opening his eyes and retro-orbital headache. He has a history of Hemophilia A with severe phenotype for which he administers Factor VIII every 2 days; with chest or head trauma, he administers an emergency dose of Factor VIII.

PHYSICAL EXAMINATION: He appears moderately distressed and uncomfortable; bilateral eyelids are swollen with tearing of clear fluid bilaterally, no periorbital ecchymosis, no proptosis, no hyphema. Bilateral subconjunctiva injection present. EOM intact but has pain in right eye when looking up. Left pupil is equal and reactive to light. Right pupil is oblong pointing towards 9 o'clock. Monoocular diplopia present in both eyes. Vision 20/40 with corrective lens. No flashes or floaters. Cranial nerve exam is otherwise normal.

DIFFERENTIAL DIAGNOSIS: traumatic mydriasis, open globe injury, post-traumatic iritis, vitreous hemorrhage, retinal detachment, Retrobulbar hematoma, ocular contusion

TEST AND RESULTS: Intraocular pressure Right 15, Left 13. Fundus exam shows normal vitreous macula and intraorbital vessels. No evidence of retinal detachment. CT head WO contrast: No acute intracranial hemorrhage or infarct, no masses or midline shift. CBC 7.0>15.7/46.9<337 Factor VIII inhibitor negative. Factor VIII Clotting Activity: 61 (nl 50-180) PT 14. INR 1.1 PTT 33

FINAL WORKING DIAGNOSIS: ocular contusion

TREATMENT AND OUTCOMEx: He administered an emergency dose of Factor VIII immediately after the injury. Then he was admitted to the ICU for IOP monitoring and serial cranial nerve exams; was treated with Factor VIII 40 U/kg, or 3600 U q8h for 48 hours then resumed home Factor VIII dosing every 2 days. At discharge, he had normal IOP and reassuring neurologic exam. He used eye drops q2-4 hours for comfort. At ophthalmology follow up 1 week later, he had normal IOP and fundus exam. There is risk of developing angle recession glaucoma up to several months after injury and anticipatory guidance for sudden vision loss or eye pain discussed. He returned to full sport participation 2 weeks later.

May 27 1:20 PM - 1:40 PM
Abstract Withdrawn

May 27 1:40 PM - 2:00 PM
Concussion: Bouncy House
Angela Rufo, Maine Dartmouth, Augusta, ME. (Sponsor: James Dunlap, FACSM)
(No relevant relationships reported)

HISTORY: 10 y/o M football player was referred by PCP for a concussion. Patient was jumping on a bouncy house four days earlier when he fell off and hit his head on the hardwood floor. No LOC. Brought to the ED and diagnosed with a concussion and sent home.

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Over the next couple of days, had multiple episodes of emesis. Brought back to the ED, CT head showed a right occipital comminuted calvarial fracture with displacement fragment of bone intracranially and with an extra axial hemorrhage that was concerning for a subdural or epidural hematoma. Transferred to Maine Medical Center for a neurosurgical evaluation. Seen by neurosurgery and pediatric rheumatology and discharged home given stable exam. Admits to headache, photophobia, phonophobia, feeling slower, fatigue, drowsiness, difficulty falling asleep, irritability. No history of learning disorders and no previous concussions. Symptom Score 36.

PHYSICAL EXAM
General: NAD
HEENT: TTP right occiput large hematoma. PEELRA, Neck: No TTP Full ROM. Spurling (-)
Neuro: CN2-12 intact, Sensation/Motor in all extremities intact
Memory short term: word recall (5/5) x 3. long term: intact
Cognitive: Recite months backwards 12/12, Days 7/7, Numbers 3/3, 4/4, 5/5
VOMS: intact, convergence 6cm, finger to nose intact
BESS: two leg no errors, one leg 4 errors, Tandem 2 errors
Psy: mood normal

DIFFERENTIAL DIAGNOSIS
Concussion, TBI, Subdural hematoma, Epidural hematoma, Subarachnoid, Migraine, Basilar Fracture, Occipital Fracture, Seizure Disorder

TEST AND RESULTS
CT head: Right occipital comminuted calvarial fracture with displaced fragment of bone intracranially with extra-axial fluid collection which could be a subdural or epidural hemorrhage component.

FINAL DIAGNOSIS
Concussion, Occipital bone fracture, and Subdural hemorrhage

TREATMENT AND OUTCOME
Return to school with accommodations, avoid bright lights and loud noises, limit screen time, avoid. Per Neurosurgery: Avoid any physical activity for 2-3 months Follow at 2 weeks: Symptom Score 3. Patient much improved. Exam remarkable for poor balance
Pending Neurosurgery follow up next month. Follow up in clinic office 1 month.

May 27 2:00 PM - 2:20 PM
Eye Injury- Baseball
Erika Leigh Cohans, Lisa Odendal, Danielle Hirsch, Johns Hopkins All Children's Hospital, Saint Petersburg, FL. (Sponsor: Dilipkumar R Patel, MBBS, MBA, MPH, FACSM)
Email: erika.shuster@jhmi.edu
(No relevant relationships reported)

HISTORY: A 12-year-old male sustained an injury to left eye during a baseball game. While playing first base, the outfielder threw a ball to him so patient could tag the runner out. When catching the ball, he missed, and instead the ball struck him in the face in the area of the left eye. There was no loss of consciousness, vomiting, hematoma or altered mental status. He initially had difficulty seeing out of the eye, but vision returned soon after and appeared blurry.

PHYSICAL EXAMINATION: Nomocephacic. With the exception of limitation in upward gaze of left eye, the remaining extraocular movements were intact. Hyphema of left eye noted. Pupils equal, round and reactive to light bilaterally. Moderate left periorbital edema and ecchymosis. Vision intact to left eye. Sensation intact in V1-V3 distribution, facial nerve function intact bilaterally. Normal occlusion, midface stable. Hearing to spoken voice intact and TM’s clear with no evidence of hemotympanum.

Remaining of examination was normal.

DIFFERENTIAL DIAGNOSIS:
1. Orbital Ridge Fracture
2. Orbital Blowout Fracture
3. Hyphema
4. Retinal detachment
5. Commotio Retinæ
6. Globe Rupture

TEST AND RESULTS:
CT facial bones: -Blowout fracture of left inferior and medial wall of left orbit -Left orbital emphysema with small contusion vs hematoma within the retrobulbar fat -Minimal blood within the left ethmoid and maxillary sinus
Ophthalmology Consult: -Visual Acuity 20/30 Right, 20/200 Left -3 mm Hyphema of left eye -Commotio Retinæ of left macula
-Internal intracranial hemorrhage
FINAL/WORKING DIAGNOSIS: Left orbital floor fracture, Traumatic Hyphema, Commotio Retinæ involving the macula

TREATMENT AND OUTCOMES:
1. CT scan with without significant displacement and no ocular muscle entrapment on repeat exam, no operative repair needed; follow-up with plastic surgery 1-2 weeks
2. Per ophthalmology recommendations:
Official Journal of the American College of Sports Medicine

a. Ongoing observation for cataract, retinal detachment, and glaucoma due to increased risk from blunt ocular trauma
b. Bed rest with bathroom privileges 3-4 days
c. Ophthalmic prednisolone and ophthalmic atropine for hyphema with monitoring for absorption and rebound
d. Monitor for macular hole as increased risk secondary to commotio retinae
e. Follow-up in 1-2 days -

664  May 27 2:20 PM - 2:40 PM
Head Injury - Soccer

Mark Sederberg, Melinda Loveless. University of Washington, Seattle, WA. (Sponsor: Stanley Herrding, MD, FACSM)
Email: mseder@uw.edu
(No relevant relationships reported)

**HISTORY:**
A 16-year-old male presented to an outpatient sports medicine clinic one month after a head-to-head collision during a soccer match with concern for concussion. There was no loss of consciousness, and he continued to play the rest of the game with a mild headache. He felt normal and asymptomatic that evening and was able to complete homework. The following morning he felt tired, but was able to perform adequately at school. Over the coming weeks, he noticed progressive worsening of his cognitive symptoms and tiredness. His athletic trainer became concerned for a concussion and held him from practice. One week prior to presentation he noted midline lower lip numbness, teeth pain while chewing, hearing his pulse in his left ear, and poor sleep due to sweating. He also felt progressive lethargy and difficulty concentrating and missed the last three days of school due to these symptoms. His medical history was significant only for a recently diagnosed inguinal hernia.

**PHYSICAL EXAMINATION:**
Mild cognitive deficits in attention and memory, impaired balance on BESS, normal motor strength. Cranial nerve exam showed ptosis of the left eye, mild left facial nerve palsy, decreased hearing in the left ear, and altered sensation to light touch over the middle lower lip. There was no focal tenderness or deformity of the skull or scalp.

**DIFFERENTIAL DIAGNOSES:**
Mild traumatic brain injury
Intracranial hemorrhage
Cerebral mass
Bell’s palsy

**TESTS AND RESULTS:**
MRI brain and neck: normal. MRA brain and neck: irregular petrous segment of right internal carotid artery lumen with concern for stenosis, possibly due to artifact versus nonocclusive arterial dissection, CTA recommended. CTA head and neck: normal.

**FINAL WORKING DIAGNOSIS:**
1. Concussion
2. Neuropraxia of cervical spine 3. Neuropraxia of right marginal mandibular nerve (CN V) and zygomatic and buccal branches of right facial nerve (CN VII) versus entrapment of CN VII

**TREATMENT AND OUTCOMES:**
1. Hospitalized for two days with evaluation by neurosurgery, trauma surgery, plastic surgery, and neurology 2. 5-day course of oral steroids 3. School accommodations given related to concussion symptoms 4. Right-sided facial droop fluctuated and persisted for 2 weeks with subsequent resolution 5. Cleared to start return to play protocol by neurosurgery at 3 weeks once exam returned to baseline 6. Finished seasons with no additional issues related to injury

666  May 27 1:00 PM - 1:20 PM
Buttock Pain - Marathoner

Allison N. Schroeder, Allison Bean, Kentaro Onishi. University of Pittsburgh, Pittsburgh, PA. (Sponsor: Tom Best, MD, PhD, FACSM)
Email: aschroe1@alumni.nd.edu
(No relevant relationships reported)

**HISTORY:**
A 50-year-old competitive marathoner presented with sudden onset right buttock pain that started while sprinting during a pub run 2 days prior to presentation. He described the pain as a deep ache that localized just medial to the right ischial tuberosity. Pain was worse with truncal flexion and knee flexion. It was most apparent when walking, but improved when he applied pressure over his ischial tuberosity while walking. He denied weakness and numbness/tingling that radiated down the leg.

**PHYSICAL EXAMINATION:**
On examination, gait was not antalgic. There was no bruising, swelling, or change in muscle bulk of the right buttock and posterior thigh. Right hip range of motion was full but end range hip flexion induced pain. He was tender to palpation in the medial and cephalad aspect of the ischial tuberosity with no tenderness over the conjoint tendon or hamstring head of the adductor magnus at the ischial tuberosity. Strength was 5/5 in the bilateral lower extremities, but he had pain with resisted right knee flexion. Sensation was intact in the bilateral lower extremities.

**DIFFERENTIAL DIAGNOSIS:**

**TEST AND RESULTS:**
Limited diagnostic ultrasound of the right ischial tuberosity region was performed with a 15-6 MHz linear array transducer and showed a normal hamstring without sonopalpation tenderness. The area just proximal and medial to the conjoint tendon origin was exquisitely tender on sonopalpation at the expected site of the sacrotuberous ligament. Cortical irregularity was present on the superior medial ischial tuberosity.

**FINAL WORKING DIAGNOSIS:**
Right sacrotuberous ligament strain

**TREATMENT AND OUTCOMES:**
He was referred to physical therapy for right sacrotuberous ligament strain focused on core strengthening and frequent gentle hamstring stretching. He was pain free after one month and was able to return to running.
BACKGROUND

The Achilles tendon is a common site for chronic tendinosis, a condition characterized by overuse and degeneration of a tendon due to repeated micro-trauma and eccentric demands commonly used in athletic demands such as running. This can lead to pain and functional limitations for the athlete. There is a growing interest in non-surgical forms of treatment for this condition including provision of regenerative injection therapy (autologous blood and platelet rich plasma injections, PRP). In this case study, a runner with an Achilles tendon injury treated with PRP later underwent an MRI after her re-injury. The MRI finding corroborated healing and in this case read as a “surgical repair” when surgery had not been performed.

RESULTS

The Achilles tendon initial injury was treated non-surgically with regenerative injections and physical therapy. The athlete returned to sport and reinjured the same tendon. The subsequent MRI read that the tendon had been surgically repaired.

CONCLUSION

Regenerative injection therapy results in MRI changes that appear to be of surgical repair imaging. Re-injury rates need to be evaluated in regards to return to play and rehabilitation protocols post regenerative injections with the inclusion of eccentric rehabilitation. True tissue healing, without scar tissue repair, has been discussed at the cellular level of healing for soft tissue injuries with the use of regenerative injections.

REFERENCES

A loss of strength and explosive capacity (the ability to produce force as quickly as possible) may be risk factors for falls in older individuals. However, it is poorly understood if the explosive capacity of an older individual correlates with the reaction time (RT) of a predictable or unpredictable response. PURPOSE: Our primary aim was to investigate the relationship between rate of torque development (RTD) of the hip abductors and adductors with anticipatory postural adjustments (APA) and RT to a simple (SRST) and choice reaction step (CRST). METHOD: Nine older adults (5 females; 73 ± 4 y; 1.66 ± 0.07 m; 74 ± 12 kg; X ± SD) performed maximal voluntary isometric contractions (MVIC) in a standing position at 30° hip abduction. Participants performed the test as hard and fast as possible and held for ~5s. RTD was measured at 50, 100, 200 and 300 ms from torque onset (RTD_{50}, RTD_{100}, RTD_{200} and RTD_{300}) and normalized to body weight and height. For the SRST and CRST a visual stimulus displayed at eye level in front of the participants indicated when to step laterally as fast as possible. APA was calculated as the first time when the difference in vertical force under the two feet increased by 5% of body weight while RT was the time between the visual stimulus and removal of the foot from the force plate. RESULTS: No significant correlations were found between RTD and APA or RT to RT. Hip abductors APA did not correlate with RTD while adductors APA correlated with RTD_{50}, RTD_{100}, and RTD_{200} for both SRST and CRST (r = -.71, p = .0032).Hip abductors RT correlated with RTD_{50}, RTD_{100}, and RTD_{200} during CRST (r = -.73, P = 0.025; r = -.783, P = 0.013 and r = -.74, P = 0.025; respectively) which was similar between hip adductors RTD_{200} and RTD_{300} during CRST (r = -.85, P = .004; r = -.93, P = .001; respectively). Hip abductors RT at RTD_{50} correlated with SRST (r = -.70, P = .036). CONCLUSION: Older adults hip abductors and adductors explosive capacity may be important when responding rapidly to an unpredictable stimulus while hip adductors also appear important in reacting to an expected stimulus. Therefore, older individuals that are not able to produce torque as fast as possible, especially during the late phase of contraction, in order to initiate the step possibly present larger risk of falls.
The attentional demand of postural control is greater for older adults and increases further for older adults with balance impairments or who experienced a recent fall. Training interventions have examined balance and fall risk in older adults; focusing on improving physical factors related to balance. Further benefit to these interventions may be observed by incorporating cognitive factors such as attentional focus. It has been proposed that an external focus (EF) of attention uses automatic processing, reducing the attentional demand of postural control. This may be reflected in the mental workload (MWL) required for task execution. **PURPOSE:** This study investigated if EF of attention reduces MWL during balance training in older adults with fall risk.

**METHODS:** Older adults (N = 15, 4 males; 78.5 ± 7.0 yrs) who reported a fall in the past year were randomly assigned to either an EF group (N=9) or an internal focus (IF) group (N=6). Participants completed 12 weeks of balance training on balance boards, twice per week for 20 minutes (30s balance, 30s rest). Prior to each trial, groups received respective attentional focus cues. At weeks 1, 3, and 6, heart rate variability (HRV) during balance training, and the NASA Task Load Index (NASA-TLX) were used as an assessment of MWL. HRV, R-R interval data was collected using a heart rate monitor chest strap. **RESULTS:** Two-way repeated measures ANOVA’s revealed a significant effect of time on four HRV outcomes: SDNN (F(2, 10) = 6.66, p = .015, partial η2 = .571), RMSSD (F(2, 10) = 9.38, p = .004, partial η2 = .647), DFA short term fluctuation slope (F(2, 10) = 6.84, p = .013, partial η2 = .578). A significant interaction effect was observed for the NASA-TLX (F(2, 10) = 4.22, p = .047, partial η2 = .458). Follow-up analysis revealed no significant main effects due to a cross over interaction with EF means decreasing and IF increasing. **CONCLUSIONS:** Preliminary findings suggest objective measures of MWL represent a practice effect of balance training with attentional cues. Additionally, the observed cross over interaction for MWL proposes that an external focus of attention may be an advantage training strategy for reducing perceived MWL.

**FUNDING:** NIH National Institute on Aging, Grant #: 1R15AG053866

**680**

**Erects Of Resting Posture On Gait Features During Timed Up And Go In Older Adults**

Eryn N. Murphy. New Mexico State University, Las Cruces, NM. (Sponsor: Joseph Berning, FACSM)

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(No relevant relationships reported)

Altered gait mechanics and longer time to complete a 3-meter timed up and go (TUG) task are risk factors for falls in older adults. While acute change in posture influences static balance, it remains unclear if a supine resting position alters gait patterns, compared to seated rest in older adults. **PURPOSE:** The purpose of the present study is to explore the effects of resting postures on TUG performance and gait features during the TUG task. **METHODS:** In this within-subject design study, thirty-eight older adults (73.55 ± 1.04 yrs, 71.89 ± 2.31 kg, 1.64 ± 0.01 m) completed the TUG under two randomly ordered resting conditions, following 10 minutes of seated rest (SEAT) and following 10 minutes of supine rest (SUP). Participants were instructed to begin on “go” and “begin when they were ready”, with time starting as quickly as possible on a force plate without upper-body assistance. Peak VGRF (PF), as well as peak (highest 100 ms rolling average), early (minimum VGRF to extend beyond the base of support until contralateral heel contact) and late (maximum VGRF to extend beyond the base of support until contralateral heel contact) were calculated for each group to examine select relationships. **RESULTS:** Chair rise time was similar between groups (p = 0.256). Early RFD was similar (p = 0.011), while PF (YM=1.57±0.13 vs. OM=1.33±0.10 N·kg; p = 0.001), peak (YM=12.60±1.56 vs. OM=9.05±1.46 N·s/kg; p=0.001), late (YM=8.12±1.63 vs. OM=4.97±1.10 N·s/kg; p=0.001), and overall RFD (YM=7.57±1.24 vs. OM=5.49±1.16 N·s/kg; p=0.001) were lower in the OM. For OM, only PF (p = 0.075; p<0.001) and peak RFD (p = 0.073; p<0.001) were correlated with chair rise time, while no correlations were present in YM. **CONCLUSION:** PF and RFD, especially peak and late RFD, were dramatically diminished during a chair rise in OM. PF and peak RFD demonstrated a strong inverse relationship with chair rise time in OM.

**681**

**Rate Of Force Development Parameters In Young And Older Males During A Chair Rise**


(No relevant relationships reported)

Assessing vertical ground reaction forces (VGRF) during a chair rise may yield insight regarding age-related differences in physical function, but a comprehensive assessment of rate of force development (RFD) during this task is lacking. **PURPOSE:** To compare RFD parameters during a chair rise in young (YM) and older (OM) males, and examine correlates of chair rise time. **METHODS:** Healthy, YM (n=15, age=20.7±2.2 yrs) and OM (n=15, age=71.6±3.9 yrs) performed a single chair rise as quickly as possible on a force plate without upper-body assistance. Peak VGRF (PF), as well as peak (highest 100 ms rolling average), early (minimum VGRF to 50% PF), late (50% PF to PF), and overall (minimum VGRF to PF) RFD were recorded. RFD was calculated as the linear slope of the force-time curve (Δforce/Δtime) during the corresponding time spans. All force measures were derived from the normalized (body mass) force signal. Chair rise time was also obtained and the trial with the shortest time was used for subsequent analysis. Independent samples t-tests were used for group comparisons, and Pearson correlation coefficients were calculated for each group to examine select relationships. **RESULTS:** Chair rise time was similar between groups (p = 0.256). Early RFD was similar (p = 0.011), while PF (YM=1.57±0.13 vs. OM=1.33±0.10 N·kg; p=0.001), peak (YM=12.60±1.56 vs. OM=9.05±1.46 N·s/kg; p=0.001), late (YM=8.12±1.63 vs. OM=4.97±1.10 N·s/kg; p=0.001), and overall RFD (YM=7.57±1.24 vs. OM=5.49±1.16 N·s/kg; p=0.001) were lower in the OM. For OM, only PF (p = 0.075; p<0.001) and peak RFD (p = 0.073; p<0.001) were correlated with chair rise time, while no correlations were present in YM. **CONCLUSION:** PF and RFD, especially peak and late RFD, were dramatically diminished during a chair rise in OM. PF and peak RFD demonstrated a strong inverse relationship with chair rise time in OM.

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**Comparison Of Age, Gender, And Sport On Performance Of Stability Test In Senior Participants**

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(No relevant relationships reported)

PURPOSE: The purpose of this study was threefold: to observe the differences in performance variables of the Modified Clinical Test of Sensory Interaction in Balance in active elderly participants and to compare results by age (50-59, 60-69, 70-79, 80+), sports (acrobics, basketball, golf, tennis, volleyball, and none), and gender. **METHODS:** Anaylases were based on a sample of 525 World Senior Games attendees who were age 50 and over. Data were obtained from voluntary participation in balance and mobility screening as part of the health fair offered to all participants at the annual Hunstman World Senior Games. Of the 525 participants tested, 383 were participants in at least one sporting event at the games and 142 were non-participants. All modified CTSIB were performed on the NeuroCom Balance Master. The measured variables (center of gravity sway (degrees/sec)) were; firm surface with eyes open, firm surface with eyes closed, foam surface with eyes open, and foam surface with eyes closed. **RESULTS:** All data were analysed using SAS, version 9.4. An initial analysis of gender and age category was performed. A final model was run with the significant variables from the initial analysis plus sports category. Post hoc Tukey pairwise comparisons were also performed. A significant difference (p<0.00001) was found between stratified age groups in all balance test variables. No significant differences were found between gender nor sports categories for the 4 balance variables.

**Age (years)* 50 – 59 60 – 69 70 – 79 80 + Participants (n) 140 237 128 20 *Firm Surface Eyes Open 0.2004 0.2306 0.2804 0.3426 *Firm Surface Eyes Closed 0.2494 0.2816 0.3448 0.4966 *Foam Surface Eyes Open 0.6561 0.7635 0.8736 1.1062 *Foam Surface Eyes Closed 1.5904 1.8823 2.0625 2.4164

**CONCLUSION:** While balance sway significantly increases with age in all 4 variables, they remain similar when comparing between gender and sports. This test may not be sensitive enough to detect differences between sports in our participants. Also,
Older adults have a relatively high incidence of falls, which are costly for both the individual and the medical system. Falls result not only in physical injury or death, but also can lead to a decreased quality of life - both mentally and socially. Measuring different aspects of balance can help predict the risk for falling. PURPOSE: This study investigated how walking with no device, walking poles, or a gait trainer impacted balance measures in older adults. METHODS: Fourteen participants (3 men, 11 women, aged 77.53 +/- 7.28 years) were randomized to one of three walking groups: Control (C) (n=4), Walking Poles (WP) (n=5), or Gait Trainer (GT) (n=5). The gait trainer is a new device aimed at preventing age-related gait decline. Assessments were performed at three separate times: prior to the intervention (Pre-test), immediately after the intervention (Post1), and six weeks after Post1 (Post2). Assessments included subjective measures of balance confidence during activities of daily living (Falls Efficacy Scale International and Activities-Specific Balance Confidence), as well as physical measures of balance (Berg Balance Scale (BBS) and the Timed Up and Go (TUG)). For the six-week intervention, all participants walked three times per week for 30 minutes in their assigned walking group. RESULTS: An ANOVA showed there were no statistically significant differences between the groups at Pre-test for all metrics (p > 0.05). All groups were below the cut off score of a high fall risk (≥14 s) for the TUG at Pre-test: C 9.00 ± 2.18 s, WP 9.41 ± 2.41 s, and GT 11.29 ± 4.99 s. All groups were above the cut off score (>45 out of 56) for greater risk of falls on the BBS at Pre-test: C 51.5 ± 1.29, WP 52 ± 5.00, and GT 48.4 ± 5.03. Between group measurements across time were analyzed using linear regression models for all metrics, with an alpha set at p < 0.05. There were no statistically significant differences between groups across time. CONCLUSION: This study found that the walking group did not impact balance measurements over time with the six-week walking intervention. All three groups were relatively high-functioning compared to age norms, which may have impacted scoring sensitivity on the TUG and BBS. Future studies may consider using more challenging interventions and balance assessments for higher-functioning older adult populations.

**Thematic Poster - Biomechanics During Military Tasks**

**Board #1 May 27 3:15 PM - 5:15 PM**

**Military Parachuting Effects In Kinetic Variables From Countermovement Jump In Military From Colombia**

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The military parachuting course (MPC) is one of the combat courses offered during the Colombian military career. A literature research shows that this type of courses presents a high incidence and prevalence of injuries in the lower limbs in the landing phase. Additionally, different studies show that the injury rate in the lower limbs is 2-20 every 1000 jumps performed. The most compromised are the ankle and knee (ligament and sprains), where 80% of the injuries occur. Moreover, the military tasks present a high injury risk because of variable conditions: high wind speeds, external load and ground conditions. Then, a good landing is very important and it requires a good coordination at the knee and a good distribution of the energy at the time of contact with the ground. PURPOSE: Identify the effects of the military parachuting course on the muscular performance of the lower limbs METHODS: Descriptive observational study with an analytical component, in 43 male cadets of the Military School from Colombia, who participated in the MPC for 4 weeks. The performance of the lower limbs was evaluated by using uniaxial force platforms before and after the course. A statistical analysis was performed using the student T test and the Wilcoxon test statistic was used to evaluate changes after the MPC. RESULTS: Significant differences were found in the jump height (29.32 ± 3.8 vs. 26.03 ± 3.6 cm, p = 0.0001), peak power (43.29 ± 3.4 vs. 40.62 ± 4.3 W/kg, p = 0.0002), peak landing force (57.65 ± 9.8 vs. 65.15 ± 12.4 N, p = 0.002), eccentric peak velocity (-1.09 ± 0.1 vs. -1.01 ± 0.2 m/s, p = 0.005), concentric mean power (23.72 ± 2.5 vs. 22.78 ± 2.8 W/kg, p = 0.022) and eccentric mean power/BM (5.88 ± 1.03 vs. 5.36 ± 1.09 N, p = 0.001). CONCLUSIONS: There is an impact on neuromuscular performance that affects the strength and power of the lower limbs, and increases the ground reaction forces in the landing phase. It could become a risk factor for injuries due to a change in the mechanism of acceptance of load at the landing stage.

**Board #2 May 27 3:15 PM - 5:15 PM**

**Medial Compartment Gap Is Decreased During Forced Marching And Running Load Carriage Tasks**


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(No relevant relationships reported)

Medial compartment cartilage thickness can provide an indication of early stage osteoarthritis (OA), so determining tibiofemoral joint space during dynamic loading tasks is an important step in investigating potential long-term joint degeneration. Women experience higher rates of knee OA than men and military personnel are at an even greater risk, so understanding how military-relevant load carriage tasks will affect tibiofemoral arthokinematics in a female population is of great importance in order to inform training strategies and prevent injury. PURPOSE: The purpose of the study was to determine the effects of load carriage and locomotion pattern on tibiofemoral dynamic joint space. METHODS: Twelve physically active females (age: 24.5±2.4 years) walked (WK), ran (RN), and force marched (FM, or walking at a high velocity) on a treadmill while unloaded (bodyweight, or BW) and while loaded with an additional +25%BW or +45%BW (14.3±2.0 kg, 25.6±3.5 kg). Synchronized biplane radiographs of the right knee were collected at 150 images/second for 1 second during each movement trial. A validated model-based tracking system determined femur and tibia motion (accuracy: 0.9°, 0.7 mm). Subchondral bone distances were calculated. Two-way RMANOVA with post-hoc Bonferroni correction were used to analyze the interactions and within-subjects effect of load (BW, +25%BW, +45%BW) and percent of right leg support (0%, 10%, 20%, 30%) on minimum medial and lateral compartment gap during WK, RN, and FM, independently (p<0.05). RESULTS: No significant interactions were observed between load and percent support. Medial and lateral gap was lower at initial contact vs. 10% and 20% support for FM (Medial: 38%, 33% decrease, Lateral: 26%, 23% decrease). Medial gap was 23% lower at 30% vs. 20% support for FM. For RN, medial gap was lower at 30% support vs. 10% and 20% (35%, 19% decrease). No significant changes in joint space were observed for lateral RN or medial/lateral WK. No significant differences due to load were observed.

CONCLUSION: Changes in knee dynamic joint space appear to be more sensitive
Military personnel performs in combat and physical training with extensive external loading from combat gear that may increase risk for lower extremity musculoskeletal injury. Lower extremity musculoskeletal injury risk is high in this population and can threaten deployment, completion of duty, and quality of life. However, there is limited research determining the effects of external loading on landing biomechanics in military situations. PURPOSE: To determine if external loading affects lower extremity landing biomechanics during a jump landing task in ROTC cadets.

METHODS: Twenty five ROTC cadets (age: 20.2±1.3yr; height: 174.4±11.3cm; mass: 77.0±5.1kg) were recruited and performed two conditions of three jump landings (baseline vs. loaded). The loaded landing compared to baseline landing, resulted in decreased forces (GRFs) were compared between the two conditions using paired t-tests (α<0.05).

RESULTS: The loaded landing compared to baseline landing, resulted in decreased knee (16.8±3.7 and 19.4±4.7) and hip (30.4±6.3 and 32.7±5.4) flexion at initial contact (IC), and increased maximal joint flexion displacements for ankle (36.0±11.5 and 31.3±9.9), knee (56.2±7.2 and 49.0±6.5), and hip (23.8±5.6 and 18.5±4.9). Furthermore, loaded landings, compared with baseline landings, exhibited significantly lower vertical GRF (2.3±0.5 N/kg and 2.7±0.5 N/kg) and posterior GRF (0.6±0.1 N/kg and 0.7±0.1 N/kg). CONCLUSION: Loaded landings increased key injury risk landing biomechanics. Less knee and hip flexion at IC have been associated with potential anterior cruciate ligament (ACL) injury risk and may increase ACL loading during landing. However, the less peak vertical and posterior GRFs with greater displacement of all three lower extremity joints on during loaded landing suggests cadets employed a compensation strategy that may reduce ACL loading after IC.

CONCLUSIONS: Females experienced greater relative increases in PFJS metrics with added load carriage compared with males, but only the approach load (35 kg) resulted in large SMDs. Thus, training volume, e.g., march distances, with approach loads should be increased more cautiously in females compared with males whereas fighting loads (20kg) appear less risky and may require minimal adjustments in training volume between sexes. These findings provide insight into why females have a disproportionately higher rate of PFP in the military than the general population.

Operational stressors, such as caloric and sleep restriction and physical fatigue, may compromise perception-action coupling, the cooperative function of the sensory and motor systems, in military personnel. Prior sleep may protect against performance decrements and different sleep stages may conserve different aspects of performance. PURPOSE: To investigate changes in perception-action coupling during simulated military operational stress and understand the role of sleep stages on performance.

METHODS: As part of a 5-day study assessing resilience to simulated military operational stress, thirty-three (6 female) active duty and reserve status service members (25.8±4.7 years) completed three trials of a novel perception-action coupling task (PACT) at 1700 after a night of baseline sleep (BASE), two nights of sleep restriction (T1) and a night of recovery sleep (T2). Participants had 8-hr for baseline and recovery sleep (2300-0700) and 4-hr disturbed sleep on intervention nights (0100-0300 and 0500-0700). Polysomnography was used to identify sleep stages. The tablet-based PACT requires participants make quick, accurate perceptual judgments and responses about whether varying sized virtual balls fit through virtual apertures. Outcomes of interest included response time (RT) and accuracy (ACC). Percent time in stage 2 (N2), slow wave (SWS) and rapid-eye movement (REM) sleep were median split to form high (more sleep in a stage) and low sleep groups. Differences in PACT performance between sleep groups across time were assessed using multiple mixed model (2 x 3) ANOVA. RESULTS: No significant sleep group x time interaction or main effect of time were found for RT or ACC. A significant main effect of SWS sleep group was found for RT (F[1,35] = 4.898, p = .034, η² = .136). The high SWS group had slower (worse) RT than the low SWS group (1.886 ± 0.23 vs. 1.814 ± 0.24 s). No other significant main effects of sleep group were found. CONCLUSION: Perception-action coupling was maintained during simulated military operational stress. Participants with more baseline SWS had worse PACT performance but other sleep stages, N2 and REM, did not relate to perception-action coupling. This suggests a specific effect of SWS, which is deep sleep, on perception-action coupling abilities and behaviors. Supported by DOD # W81XWH-17-2-0070.
Foot Acceleration Attenuation Reduces During Military Load Carriage

Nizam U. Ahamed1, Kellen T. Krajewski2, Camille C. Johnson1, Adam J. Sterczala2, Julie P. Greve2, Julie P. Greve2, Sophie L. Wardle2, Thomas J. O'Leary2, Qi Mi1, Shawn D. Flanagan2, Bradley C. Nind, FACSM3, Chris Connaboy4,1 Neuromuscular Research Laboratory, University of Pittsburgh, Pittsburgh, PA, 2Army Health and Physical Performance Research, Army Headquarters, UK Ministry of Defence, London, United Kingdom, 3Norwich Medical School, University of East Anglia, Norwich, United Kingdom.

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(No relevant relationships reported)

Military personnel are at risk of stress fracture injuries, especially those in load carriage-based military occupational specialty, such as infantry. Recently, wearable inertial measurement unit (IMU)-based accelerometry has become a useful tool for identifying markers of lower extremity musculoskeletal injury risk in soldiers in field settings. **Purpose:** To compare differences in accelerometry between non-dominant and dominant foot using foot-worn IMU sensors during a 2km easy effort run with heavy (20kg) load carriage. **Methods:** Acceleration data from six healthy participants (3 male: 30.33±6.71 y, 82.22±0.01 kg, 77.80±11.0 kg and 3 female: 21.02±2.6 y, 66.01±0.01 kg, 64.62±13.5 kg) were recorded using tri-axial IMU affixed under the dorsum of each foot. Participant performed a 2km easy effort march (run and walk) across grass carrying 20 kg on their back. Data were divided into 200m +/- blocks from the beginning, middle and end of the exercise for analysis. The acceleration amplitudes from each trial were expressed as the root mean square (G_RMS), calculated as the average of the square of the acceleration over time, and were used to quantify the accelerations attenuation. The magnitude of the resultant acceleration signal Acc_r, referred to as the “composite acceleration signal”, was computed as: sqrt (acc_x² + acc_y² + acc_z²), where acc_x, acc_y, and acc_z are obtained from each individual axis of the tri-axial accelerometer. **Results:** The mean G_RMS values at the three phases obtained for the dominant and non-dominant feet of the men were 4.72, 5.15, and 5.23, and 4.93, 4.75, and 4.41 m/s², respectively whereas those obtained for the dominant and non-dominant feet of the women were 3.91, 4.32, and 4.78, and 3.87, 4.42, and 4.71 m/s², respectively. These findings revealed that the G_RMS values of the feet obtained for both sexes gradually increased during the load carriage task, except for the non-dominant foot of the men, which decreased. **Conclusion:** Increases in G_RMS during loaded marching suggest non-linear acceleration in cumulative mechanical stress exposure as distance increases. Foot worn IMU-based measurement systems may provide means to accurately assess injury risk in real time.

Supported by UK Ministry of Defence (WGC 5.5.6-Task 0107) and US Dept. of Defense (W81XWH-17-2-0070).

B-45 Thematic Poster - Care of the Female Athlete

**Wednesday, May 27, 2020, 3:15 PM - 5:15 PM**

**Room:** CC-2007

**Board #7 May 27 3:15 PM - 5:15 PM Foot Acceleration Attenuation Reduces During Military Load Carriage**

**Board #2 May 27 3:15 PM - 5:15 PM Prevalence And Impact Of Dysmenorrhea In Japanese Female Athletes**

**Board #1 May 27 3:15 PM - 5:15 PM Practical And Applied Knowledge Of Athletic Trainers On The Female Athlete Triad**

**Chair:** Emily Kraus, Stanford Hospital and Clinics, Woodside, CA.

(No relevant relationships reported)

**Board #7 May 27 3:15 PM - 5:15 PM Foot Acceleration Attenuation Reduces During Military Load Carriage**

Nizam U. Ahamed1, Kellen T. Krajewski2, Camille C. Johnson1, Adam J. Sterczala2, Julie P. Greve2, Julie P. Greve2, Sophie L. Wardle2, Thomas J. O'Leary2, Qi Mi1, Shawn D. Flanagan2, Bradley C. Nind, FACSM3, Chris Connaboy4,1 Neuromuscular Research Laboratory, University of Pittsburgh, Pittsburgh, PA, 2Army Health and Physical Performance Research, Army Headquarters, UK Ministry of Defence, London, United Kingdom, 3Norwich Medical School, University of East Anglia, Norwich, United Kingdom.

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(No relevant relationships reported)

Military personnel are at risk of stress fracture injuries, especially those in load carriage-based military occupational specialty, such as infantry. Recently, wearable inertial measurement unit (IMU)-based accelerometry has become a useful tool for identifying markers of lower extremity musculoskeletal injury risk in soldiers in field settings. **Purpose:** To compare differences in accelerometry between non-dominant and dominant foot using foot-worn IMU sensors during a 2km easy effort run with heavy (20kg) load carriage. **Methods:** Acceleration data from six healthy participants (3 male: 30.33±6.71 y, 82.22±0.01 kg, 77.80±11.0 kg and 3 female: 21.02±2.6 y, 66.01±0.01 kg, 64.62±13.5 kg) were recorded using tri-axial IMU affixed under the dorsum of each foot. Participant performed a 2km easy effort march (run and walk) across grass carrying 20 kg on their back. Data were divided into 200m +/- blocks from the beginning, middle and end of the exercise for analysis. The acceleration amplitudes from each trial were expressed as the root mean square (G_RMS), calculated as the average of the square of the acceleration over time, and were used to quantify the accelerations attenuation. The magnitude of the resultant acceleration signal Acc_r, referred to as the “composite acceleration signal”, was computed as: sqrt (acc_x² + acc_y² + acc_z²), where acc_x, acc_y, and acc_z are obtained from each individual axis of the tri-axial accelerometer. **Results:** The mean G_RMS values at the three phases obtained for the dominant and non-dominant feet of the men were 4.72, 5.15, and 5.23, and 4.93, 4.75, and 4.41 m/s², respectively whereas those obtained for the dominant and non-dominant feet of the women were 3.91, 4.32, and 4.78, and 3.87, 4.42, and 4.71 m/s², respectively. These findings revealed that the G_RMS values of the feet obtained for both sexes gradually increased during the load carriage task, except for the non-dominant foot of the men, which decreased. **Conclusion:** Increases in G_RMS during loaded marching suggest non-linear acceleration in cumulative mechanical stress exposure as distance increases. Foot worn IMU-based measurement systems may provide means to accurately assess injury risk in real time.

Supported by UK Ministry of Defence (WGC 5.5.6-Task 0107) and US Dept. of Defense (W81XWH-17-2-0070).

**Board #1 May 27 3:15 PM - 5:15 PM Practical And Applied Knowledge Of Athletic Trainers On The Female Athlete Triad**

Jennifer L. Scheid, Erin M. DeHeer, Daemen College, Amherst, NY.

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(No relevant relationships reported)

**BACKGROUND:** The female athlete triad is the interrelation of low energy availability, menstrual dysfunction, and low bone mineral density. Athletic trainers are in a position to be able to identify the female athlete triad in athletes. However, limited research exists regarding practical and applied knowledge of the female athlete triad. **PURPOSE:** The purpose of this study was to determine the level of practical knowledge of athletic trainers on the female athlete triad and also determine if athletic trainers are applying this knowledge by properly screening athletes for the female athlete triad. **METHODS:** Certified athletic trainers (n=116) completed an online survey via Qualtrics that asso assisted both knowledge of the female athlete triad and current practical application of the female athlete. Linear-by-linear tests were used to find associations between practical knowledge and applied knowledge for related components of the triad. **RESULTS:** The athletic trainers mostly work with high school athletes (39%) and college athletes (32%). Fifty percent of the athletic trainers had at least 7 years of experience. Sixty-nine percent of the the athletic trainers were female. While most of the general knowledge of the athletic trainers was high (for example 70% believe that increasing energy availability is key when returning an athlete back to sport and 73% believe that repeated stress fractures is a red flag for the female athlete triad) most of the applied knowledge was low (for example only 14% screen their athletes for eating disorders and only 36% ask about history of stress fractures). Linear-by-linear association (p=0.050) demonstrated an association between agreeing about importance of energy availability and always screening for eating disorders. However, we did not demonstrate linear-by-linear association (p=0.354) between agreeing that stress fractures are a red flag for the female athlete triad and asking about history of stress fractures. **CONCLUSION:** While general knowledge of the female athlete triad is high, a low percentage of athletic trainers appear to be applying their knowledge in prevention and detection of the female athlete triad. More education is need to help athletic trainers to implement screening, prevention, and return to play techniques to keep our athletes safe.

**Board #2 May 27 3:15 PM - 5:15 PM Prevalence And Impact Of Dysmenorrhea In Japanese Female Athletes**

Reiko Momma1, Akemi Sawai2, Maho Takeda1, Hiroaki Natsu1, Naoki Mukai1, Koichi Watanabe1,1 University of Tsukuba, Tsukuba, Japan. 2International Pacific University, Okayama, Japan. 3Japan Women’s College of Physical Education, Setagaya, Japan.

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Dysmenorrhea (menstrual cramps) is one of the big problems that many women suffers. It has been previously reported that dysmenorrhea is associated with lifestyle habit including sleep, exercise, smoking, and alcohol. Many female athletes have been reported to suffer with dysmenorrhea, however, the prevalence and impact of
dysmenorrhea and in relation to lifestyle in Japanese female athletes are not clarified yet. **Purpose** To investigate the prevalence and impact of dysmenorrhea in Japanese female athletes. **Methods** 98 collegiate female athletes participated in this study (mean age 21±1.6). Sports type in participants were soccer (n=23), track and field (n=31), kendo (n=13), wheel gymnastics (n=10), lacrosse (n=21). Demographic information questions addressed age, height, weight, length of sporting career, and training volume (training hour, training frequency per week, training hour per time). Lifestyle habits questions included daily time spent and time, sleeping hours, dietary habit, coffee-drinking, alcohol-drinking and smoking habits. Age of menarche, day counts of menstrual cycle, day counts of menstruation, dysmenorrhea symptoms (e.g.; breast tenderness, abdominal pain, low back pain, headache), dysmenorrhea severity (from 0 to 10; none to very severe), and medication during menstruation were asked in the menstrual questionnaire. **Results** The dysmenorrhea symptom that many subjects complained were lower abdominal pain and fatigue. Length of sporting career, menarche age, training habits and lifestyle habits did not show significant correlation with severity of dysmenorrhea. However, the prevalence of severe dysmenorrhea positively correlated significantly with age (p = 0.004, r = 0.29). **Conclusions** In this study, the possibility that dysmenorrhea was associated with older age in Japanese female athletes. Therefore, in female athletes it is necessary to deal with dysmenorrhea considering age.

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**Board #3** May 27 3:15 PM - 5:15 PM
**Female Athletes And Osteoporosis Risk**
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Female athletes are participating in greater numbers than ever before. Across the last year, nearly 3.4 million female high school (NFSH, 2019) and 216,400 NCAA college-aged females (NCAA, 2018) competed in a variety of sports. Unfortunately, this phenomena has elevated concerns regarding the impact of relative energy deficiency in sport (RED-S) among such populations. The elevated energy expenditure required to drive such participation may lead to decreased energy availability, this coupled with hypothalamic disruption may place female athletes at greater risk of bone mineral density (BMD) loss than previously anticipated. **Purpose:** To compare bioelectrical impedance analysis (BIA) and air displacement plethysmography (ADP) for body composition assessment in female collegiate athletes. **Methods**: To compare bioelectrical impedance analysis (BIA) and air displacement plethysmography (ADP) for body composition assessment in female collegiate athletes. **Methods** 98 collegiate female athletes participated in this study (mean age 21±1.6). Sports type in participants were soccer (n=23), track and field (n=31), kendo (n=13), wheel gymnastics (n=10), lacrosse (n=21). Demographic information questions addressed age, height, weight, length of sporting career, and training volume (training hour, training frequency per week, training hour per time). Lifestyle habits questions included daily time spent and time, sleeping hours, dietary habit, coffee-drinking, alcohol-drinking and smoking habits. Age of menarche, day counts of menstrual cycle, day counts of menstruation, dysmenorrhea symptoms (e.g.; breast tenderness, abdominal pain, low back pain, headache), dysmenorrhea severity (from 0 to 10; none to very severe), and medication during menstruation were asked in the menstrual questionnaire. **Results** The dysmenorrhea symptom that many subjects complained were lower abdominal pain and fatigue. Length of sporting career, menarche age, training habits and lifestyle habits did not show significant correlation with severity of dysmenorrhea. However, the prevalence of severe dysmenorrhea positively correlated significantly with age (p = 0.004, r = 0.29). **Conclusions** In this study, the possibility that dysmenorrhea was associated with older age in Japanese female athletes. Therefore, in female athletes it is necessary to deal with dysmenorrhea considering age.

**780**
**Board #4** May 27 3:15 PM - 5:15 PM
**Comparing Bioelectrical Impedance Analysis To Air Displacement Plethysmography For Body Composition Assessment In Female Athletes**
Austin Katona, Caroline Riewe, Samantha Zalewski, Kelly Powers, Robert Mangine, Abigail Peairs. 1Middle Tennessee State University, Murfreesboro, TN. (No relevant relationships reported)
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PURPOSE: To compare bioelectrical impedance analysis (BIA) and air displacement plethysmography (ADP) for body composition assessment in female collegiate athletes. **Methods**: Retrospective review of body composition data for 61 NCAA female collegiate athletes (basketball n = 14, soccer n = 31, volleyball n = 16), measured by BIA and ADP on the same day. Paired t-tests, effect size using Cohen’s d, Pearson’s correlation, and Bland-Altman plots were used to compare percent body fat (%BF) and fat-free mass (FFM) measurements from BIA and ADP for the whole sample, and within sports. **Results**: The sample included 61 female athletes ages 18-25 years (x̅ = 19.5 ± 1.4 years), with heights ranging from 160-190.5 cm (x̅ = 172.3 ± 8.9 cm), %BF measurements ranging from 6.0-38.5% (x̅ = 21.3 ± 6.3%) for ADP and 13.4-36.0% for BIA (x̅ = 22.5 ± 4.7%) and FFM measures ranging from 36.2-69.3 kg (x̅ = 53.4 ± 6.8 kg) for ADP, and 38.8-63.8 kg for BIA (x̅ = 52.4 ± 5.8 kg). Overall, BIA and ADP had strong positive correlations for %BF (r = 0.867) and FFM (r = 0.891). BIA significantly underestimated FFM when compared to ADP (mean difference [MD] = -0.99 kg, p = 0.016, d = -0.32), while no significant difference was observed in %BF (MD = 1.17%, p = 0.056, d = 0.25). Linear regression on the Bland-Altman plots revealed a flat but significant negative trends for both %BF (β = -0.34, p = 0.004) and FFM (β = -0.166, p = 0.01) estimation by BIA in the total sample. This indicates possible proportional bias, in which BIA is more likely to overestimate %BF and FFM at low values, and underestimate %BF and FFM at high values. When comparing sports, BIA significantly overestimated %BF (MD = 5.42%, p = 0.001, d = 1.14) and underestimated FFM (MD = -3.71 kg, p = 0.001, d = -1.07) for basketball players and significantly underestimated %BF (MD = -2.06%, p = 0.04, d = -0.56) in volleyball players, when compared to ADP. No significant measurement differences were found in soccer players. **Conclusions**: BIA gives comparable body composition results to ADP for soccer players, but gives conflicting results regarding over and underestimation of %BF and FFM. With regards to female basketball and volleyball players, conflicting conclusions between BIA and ADP may indicate the need for specialized equations when extrapolating body composition measures using BIA for athletes at the higher and lower ends of the spectrum of %BF and FFM.

**781**
**Board #5** May 27 3:15 PM - 5:15 PM
**Urogential Dysfunction Among Female And Male High School Cross-country Runners**
Mitchell J. Rauh, FACSM, Lori J. Tuttle. San Diego State University, San Diego, CA. (Sponsor: Melissa J. Benton, FACSM)
Email: mrauh@mail.sdsu.edu

While urinary stress incontinence or dysfunctions associated with this condition has been reported in various adult and female sport populations, less is known on their prevalence among distance runners, particularly adolescent female and male distance runners. **Purpose** To determine the prevalence of urogenital dysfunction (UD) among female and male high school cross-country runners. **Methods**: Participants consisted of 104 runners (48 females, 56 males; age: 15.7 ± 1.2y), who competed in interscholastic cross-country in southern California. Each runner completed the Urinary Distress Inventory 6 (UDI-6) to assess urinary dysfunction. The UDI-6 is a six-symptom inventory that allows participants to categorize their symptoms during activities. Runners were identified as having had UD if they reported any of the six symptoms during the past 3 months. The runners completed the UDI-6 separately for symptoms during running and non-running activities. If a runner reported any of the six symptoms with “somewhat,” “moderately,” or “quite often”, they were considered to have demonstrated UD. Relative risks (RR) and 95% confidence intervals (CI) were calculated to examine associations between sex and UD. **Results**: Overall, the number of runners reporting at least one UD symptom was twice as high during non-running activities (56.5%) than running activities (28.3%). Females were more likely than males to report two or more different UD symptoms (28.3%) than males. **Conclusions**: Our findings indicated that urinary dysfunction symptoms are prevalent during non-running and running activities in high school cross-country runners; more so for females.
eating disorder risk in professional male and female ballet dancers. METHODS: A single cohort of 59 professional ballet dancers (M=30, 24±6yr; F=29, 23±5yr) was recruited. All participants underwent bone and body composition measurements using dual-energy-xray-absorptimetry (DXA). A nutritional screen and stress fracture history was also collected. Age-matched Z-scores were calculated for bone mineral density (BMD) and body composition. A 1x3 ANOVA and Chi-Square test was used to compare BMD and frequency for history of stress fractures for those scoring 0-1, 2-6, and 7+ using the EAT26 questionnaire for eating disorder risk. Regression was used to predict BMD from body composition and demographic information. RESULTS: Female dancers demonstrated reduced spinal (42 \pm 10\%) and pelvic (16\%) BMD. Several anthropometric and demographic measures were predictive of BMD (p<0.05, r^2=0.66-0.90, SEE=0.08-0.10g/cm). Those with a 7+ EAT26 score were observed to have a higher frequency for history of stress fracture (p<0.05). EAT26 scores were also associated with lower total and spine BMD. CONCLUSIONS: Professional female ballet dancers exhibit reduced BMD (particularly in the pelvis) and body mass compared to the general population whereby low BMD and stress fractures tend to be more prevalent in those with a higher risk of disordered eating. When considering only total BMD, regions of high BMD (legs) were found, in some cases, to mask areas of low BMD (spine, arms, pelvis). Lastly, anthropometric and demographic variables are predictive of BMD in this population and may be used as a field proxy in the absence of DXA.

A - BONE MINERAL DENSITY (All Dancers)

<table>
<thead>
<tr>
<th>BODY REGION</th>
<th>TOTAL BODY</th>
<th>ARMS</th>
<th>LEGS</th>
<th>SPINE</th>
<th>PELVIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Z-score</td>
<td>Z-score</td>
<td>Z-score</td>
<td>Z-score</td>
<td>Z-score</td>
</tr>
<tr>
<td>F</td>
<td>Z-score</td>
<td>Z-score</td>
<td>Z-score</td>
<td>Z-score</td>
<td>Z-score</td>
</tr>
<tr>
<td>Total Body</td>
<td>1.32</td>
<td>1.38</td>
<td>1.04</td>
<td>0.76</td>
<td>1.47</td>
</tr>
<tr>
<td>Arm</td>
<td>1.29</td>
<td>1.34</td>
<td>1.12</td>
<td>0.89</td>
<td>1.52</td>
</tr>
<tr>
<td>Leg</td>
<td>1.27</td>
<td>1.04</td>
<td>1.12</td>
<td>0.89</td>
<td>1.02</td>
</tr>
<tr>
<td>Spine</td>
<td>1.19</td>
<td>1.04</td>
<td>1.27</td>
<td>0.91</td>
<td>1.02</td>
</tr>
<tr>
<td>Pelvis</td>
<td>1.27</td>
<td>1.00</td>
<td>1.12</td>
<td>0.89</td>
<td>1.12</td>
</tr>
</tbody>
</table>

CONCLUSIONS: Professional female ballet dancers exhibit reduced BMD (particularly in the pelvis) and body mass compared to the general population whereby low BMD and stress fractures tend to be more prevalent in those with a higher risk of disordered eating. When considering only total BMD, regions of high BMD (legs) were found, in some cases, to mask areas of low BMD (spine, arms, pelvis). Lastly, anthropometric and demographic variables are predictive of BMD in this population and may be used as a field proxy in the absence of DXA.

B - BMD FIELD PREDICTION MODELS

Regression Coefficients

<table>
<thead>
<tr>
<th>Covariance</th>
<th>C (constant)</th>
<th>Age</th>
<th>Height</th>
<th>Weight</th>
<th>Bone Mass Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>mmol/1</td>
<td>1.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>1.000</td>
</tr>
<tr>
<td>yr</td>
<td>0.000</td>
<td>1.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>cm</td>
<td>0.000</td>
<td>0.000</td>
<td>1.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>kg</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>1.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

C - EAT 26 SCORING & STRESS FRACTURE HISTORY (FEMALE DANCERS)

EAT 26 Score

<table>
<thead>
<tr>
<th>Total Body BMD</th>
<th>Spine BMD</th>
<th>Stress Fracture History</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>0.0</td>
<td>0.1</td>
</tr>
<tr>
<td>0.3</td>
<td>0.0</td>
<td>0.1</td>
</tr>
<tr>
<td>0.4</td>
<td>0.0</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Male athletes are at risk of developing a similar condition to the female athlete triad that is characterized by low bone mineral density (BMD), low energy availability (EA), and reduced reproductive hormones. However, the triad has not been well studied in males.

PURPOSE: The purpose of this study was to assess BMD and EA in male NCAA division 1 athletes participating in leanness emphasized sports (cross country and wrestling) and non-leanness sports (soccer and basketball). We hypothesized that EA and BMD would be lower in XC and wrestling compared to soccer and basketball and EA would be positively correlated with BMD.

METHODS: Participants included 27 NCAA division I male athletes (20.3 ± 0.3 yr) participating in soccer (n = 7), cross country (XC, n = 7), wrestling (n = 10), or basketball (n = 5). Following a 12 h fast and abstaining from physical activity, a resting metabolic rate test, dual energy X-ray absorptiometry scan, and 24-hour food intake recall was performed during an early morning testing session. Two unannounced follow-up food intake recalls were performed over the phone and used to determine mean daily energy intake and activity energy expenditure was assessed using an Actigraph accelerometer for 7d. Low EA was defined (energy intake – activity energy expenditure)/fat free mass (kg) ≤ 20 kcal/kg.

RESULTS: XC had lower BML, fat free mass, total, lumbar spine, and dual femur BMD (g/cm) compared to soccer, wrestling, and basketball. XC athletes also had lower total BMD, lumbar spine, and dual femur Z-scores compared to wrestling and basketball, but not soccer. XC had significantly greater EA than basketball.

CONCLUSIONS: In support of our hypothesis, BMD was lower in athletes participating in XC, a leanness sport, compared to all other sports. Surprisingly, EA was highest in XC and negatively correlated with BMD. These data suggest the interrelationship between components of the athlete triad is complex and low EA may not be the primary cause of low BMD in male athletes.
has shown to increase strength and reduce exercise-induced muscle damage in
postmenopausal women. PURPOSE: To evaluate the influence of sex hormones on
creatine kinase (CK) response after an eccentric-based workout among well-trained
females with different hormonal profiles. METHODS: Nineteen eumenorrheic
females (28.2±5.9 years, 163.4±6.1 cm, 59.6±5.8 kg) and thirteen postmenopausal
females (51.7±3.7 years, 161.5±5.3 cm, 56.6±8.1 kg) participated in this study. A
resistance-based workout was performed by the eumenorrheic females in the early
follicular phase (EFP), late follicular phase (LFP) and mid-luteal phase (MLP) of
their menstrual cycle, in a counterbalanced and randomized order. Postmenopausal
females performed the protocol in a single visit. Blood samples were obtained at
baseline and 2h, 24h and 48h after the eccentric workout to analyse serum CK.
An unpaired t-test was performed to compare CK values between postmenopausal
and eumenorrheic females. RESULTS: At baseline, postmenopausal showed higher CK
concentrations (136.0±25.5 U/L) in comparison to eumenorrheic women in the EFP
(105.7±33.1 U/L; p=0.039) and MLP (100.7±29.8 U/L; p=0.012). However, these
differences were not observed between postmenopausal and eumenorrheic women in
the EFP (108.6±48.0 U/L; p=0.114). No differences were observed in post-
exercise-time-points between postmenopausal and eumenorrheic women in any of
the menstrual cycle phases analysed. CONCLUSION: Lower estrogen and progestrone
concentrations may elicit higher CK values at rest. However, the lack of post-exercise
differences between groups may indicate that the supposed protective role of sex
hormones is not as determinant as other factors like intensity or training status. The
IronFEMME Study is supported by the Ministerio de Economía y Competitividad
(Contract DEP2016-75387-P).

787 Board #2
May 27 3:15 PM - 5:15 PM
Influence Of Aerobic Exercise On Select Cytokine And Hormone Levels In Pregnant Women.
Samanta Michelle McDonald, Cody Strom, Mary Ramechak, Alec Chaves, Nicholas Broskey, Linda May, FACSMM. East Carolina University, Greenville, NC. (Sponsor: Linda E May, FACSMM)
Email: mcdonalds18@ecu.edu

Purpose: To determine the effects of prenatal aerobic exercise on select maternal cytokines and hormones. 
Methods: Data from an ongoing, 24+ week aerobic exercise intervention trial were used. Thirty-one participants of 128 randomized to aerobic (150 min of moderate
weekly aerobic exercise) or control (no exercise) groups had fasted blood samples
obtained at 16 and 36 of weeks gestation and were eligible for analysis. Levels of NGF, IL-1α, IL-6, IL-8, TNF-α, IL-10, Leptin, Insulin, Glucagon and GLP-1 Active were
analyzed.
Results: At baseline, women in the aerobic group had lower levels of TNF-α (p=0.011). At 36 weeks of gestation, aerobic-trained women had higher levels of IL-
1α (p=0.04) and lower levels of IL-10 (p=0.011). No statistical differences in the change of these biomarkers were found.
Conclusions: Prior to prenatal exercise, participants in the aerobic exercise group possessed lower inflammatory cytokines, however 36 weeks of gestation, aerobic-trained women had higher levels of different inflammatory cytokines. The complexity of these biomarkers and their differing patterns of change during pregnancy may explain the null and unanticipated findings of higher inflammatory biomarkers following chronic exercise.

788 Board #3
May 27 3:15 PM - 5:15 PM
Sex Difference On Arterial Stiffness And Measures Of Pulse Wave Reflection Response To Weight Machines
Rebecca Schmidt, Erica M. Marshall, Jason C. Parks, Derek J. Kingsley, FACSMM. Kent State University, Kent, OH.

(Purpose is shown for each board)

789 Board #4
May 27 3:15 PM - 5:15 PM
Effects Of Menstrual Cycle Phases On Measures Of Body Composition
Abigail R. Champion, Lauren E. Coleman, Heather E. Webb. Texas A&M Corpus Christi, Corpus Christi, TX. (Sponsor: Edmund O. Acvedo, FACSMM)

Purpose: To investigate whether phases of the MC have an impact upon common measures of body composition
METHODS: 51 apparently healthy females between the ages of 18-45 participated in the collection sessions during 4 different menstrual
phases (1=menstrual, 2=follicular, 3=midcycle, 4=premenstrual) during 2 cycles.
RESULTS: No significant changes in body mass measures (p = .001) between DXA and BIA (x̄ difference = 1.62 ± 0.4 kg) and
or lean body mass seen across time. However, significant differences in lean body mass measures (p = .001) between DXA and BIA (x̄ difference = 1.62 ± 0.4 kg) and
DXA and ADP (x̄ difference = 1.74 ± 0.36 kg) measures were seen. CONCLUSION: Although there were no changes in body composition across the MC phases, there
were differences in body composition values among the three types of devices used to quantify body composition. These findings suggest that differences in the technology used to quantify body composition may explain varying results across studies.

790 Board #5
May 27 3:15 PM - 5:15 PM
Translating From Daytime To Nighttime Operations During Military Training Negatively Impacts Dynamic Balance And Vertical Jump Performance In Elite Male Army Soldiers
Bradley M. Ritland1, Jacob A. Naylor2, Ashlee B. McKreon3, Janna Mantua4, Walter J. Sowden1. 1United States Army Institute of Environmental Medicine, Natick, MA. 22d Battalion, 75th Ranger Regiment, JBLM, WA. 3Walter Reed Army Institute of Research, Silver Spring, MD.

Purpose: Investigate the impact transitioning from daytime to nighttime operations during military training has on dynamic balance and vertical jump performance in
elite Army Soldiers. METHODS: This study was part of a larger study investigating the impact sleep loss and circadian desynchrony during military training have on
the health and performance of elite Army Soldiers. Elite Army Soldiers (all male)
performed a cognitive/motor battery (pre-test), including the Y-Balance Test (YBT)
during military training has on dynamic balance and vertical jump performance in
elite Army Soldiers. METHODS: This study was part of a larger study investigating
the impact of phases of the MC have an impact upon common measures of body composition
phases. Due to changes in a women’s MC may impact measurements of body composition
PURPOSE: To investigate whether phases of the MC have an impact upon common measures of body composition
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were differences in body composition values among the three types of devices used to quantify body composition. These findings suggest that differences in the technology used to quantify body composition may explain varying results across studies.

Many women complain about weight fluctuation across the span of a month as a result of
hormonal changes that accompany their menstrual cycle (MC). Specific research
regarding the menstrual cycle phases of females and their effects on body composition
measures have been limited to examining these changes as a subset of other variables. As
water makes up approximately 73% of lean body tissue, fluctuations in body water
due to changes in a women’s MC may impact measurements of body composition
PURPOSE: To investigate whether phases of the MC have an impact upon common measures of body composition
METHODS: 51 apparently healthy females between the ages of 18-45 participated in the collection sessions during 4 different menstrual
phases (1=menstrual, 2=follicular, 3=midcycle, 4=premenstrual) during 2 cycles.
RESULTS: No significant changes in body mass measures (p = .001) between DXA and BIA (x̄ difference = 1.62 ± 0.4 kg) and
or lean body mass seen across time. However, significant differences in lean body mass measures (p = .001) between DXA and BIA (x̄ difference = 1.62 ± 0.4 kg) and
DXA and ADP (x̄ difference = 1.74 ± 0.36 kg) measures were seen. CONCLUSION: Although there were no changes in body composition across the MC phases, there
were differences in body composition values among the three types of devices used to quantify body composition. These findings suggest that differences in the technology used to quantify body composition may explain varying results across studies.
Stiffness is potentially related to sports injury and athletic performance. Higher stiffness within a certain range may represent lower sports injury risk and better athletic performance. It is not clear whether sex difference existed in lower limb stiffness changes induced by neuromuscular training.

**PURPOSE:** To investigate the effect of neuromuscular training on lower limb stiffness in both male and female young recreational athletes.

**METHODS:** Eleven recreational athletes (5 females: 24.4 ± 3.4 yr; 6 males: 24.0 ± 3.9 yr) underwent neuromuscular training 3 times a week for continuous 6 weeks, including plyometric training (e.g. squat jump, wall jump et al.) and strength training (e.g. barbell squat, bench press et al.) with progression every two weeks. Pre- and post-intervention measurements included: gastrocnemius lateralis (GL), gastrocnemius medialis (GM), soleus muscle and the Achilles tendon (AT) stiffness on both lower limbs by Myometer; vertical stiffness (Kvert), jump height and reactive strength index (RSI) by force plate during drop vertical jump from a 40 cm step.

**RESULTS:** Two-way repeated measures ANOVA was conducted and found no significant interaction between time and sex in all the variables mentioned above, but significant results on time in left GL stiffness (p=0.021), left GM stiffness (p=0.008), right AT stiffness (p=0.040), Kvert (p=0.019), jump height (p=0.012), and RSI (p=0.008). Paired-T test was further conducted and identified jump height in females was significant (p=0.003) compared to pre-test. No other significant pre- to post-test differences were noted in left GM stiffness (p=0.075), GL stiffness (p=0.081), and vertical jump performance.

**CONCLUSIONS:** Males and females may achieve similar benefits from neuromuscular training. Neuromuscular training can improve jump performance in females, with a tendency to decrease lower limb stiffness in males and females. Supported by Shanghai University of Sports A1-3G02-19-000209
Heat acclimation (HA) has been reported to improve endurance exercise performance in normobaric hypoxia. However, the impact of prior HA on exercise performance in hypobaric hypoxia (HH) is unclear. PURPOSE: To determine whether HA alters steady-state (SS) exercise responses and time-trial (TT) cycle performance during a 30-hour exposure to HH.

METHODOLOGICAL DETAILS: Thirty-three sea-level (SL) resident men (mean ± SD; age 21 ± 3 years; height 1.73 ± 0.08 m; weight 75 ± 12 kg; SL cycle ergometer VO2peak: 43 ± 5 ml·kg⁻¹·min⁻¹) participated in two 30-hour HH exposures in a hypobaric chamber (496 mHg or ~3500 m, 20°C, 20% RH). The HH exposures were separated by a 14-day washout period. During each HH exposure, subjects performed a 30-min bout of steady-state submaximal cycling exercise (40% peak power) followed by a 15-min cycle TT at ~20°C. Each steady-state exercise session was immediately followed by a cycle TT at ~3000 m simulated altitude and ~90% HH.

RESULTS: There was no difference in time-trial performance between HH exposures (p = 0.70), and both time-trial performances were significantly slower than SL (both p < 0.001). There was no effect of HA on heart rate (HR) during steady-state exercise. Cutaneous vascular conductance (CVC = red blood cell flux/mean arterial pressure) during exercise was significantly reduced following HA compared to SL (p = 0.029). There was no difference in mean (p = 0.443) or peak heart rate (p = 0.651) between HA and SL.

CONCLUSIONS: The 5-day training protocol improved time-trial performance in normobaric hypoxia; however, there was no perceptual, physiological, or performance benefits associated with training in the HH compared to normoxic conditions.

Cutaneous vasodilation is attenuated when exercise is performed in a hypoxic environment, which may impair convective heat loss. Heat acclimation (HA) improves cutaneous blood flow in response to an increase in core temperature; however, the effect of HA on cutaneous blood flow during exercise in hypoxic hypoxia has not been examined. PURPOSE: The aim of this study was to test the hypothesis that cutaneous blood flow would be augmented during steady-state exercise at 3500 m altitude (hypoxic chamber) following 8 days of exercise-HA.

METHODOLOGICAL DETAILS: Thirteen healthy men (21 ± 3 yr; ht 1.73 ± 0.08 m; weight: 75.1 ± 12.2 kg; sea-level VO2peak 42.9 ± 4.6 ml·kg⁻¹·min⁻¹) participated in two 30-h altitude exposures (495 mHg or ~3500 m, 20°C, 20% RH) separated by a 14-day washout period in which they completed 8 days of exercise-HA (2 of treadmill walking in 40% RH). At hour-24 of each altitude exposure, subjects performed a ~3000 m simulated altitude (50% sea-level VO2peak) cycle TT. Red blood cell flux (laser-Doppler flowmetry) was continuously measured during a 5-min seated baseline period and minutes 20-25 of exercise. Cutaneous vascular conductance (CVC = red blood cell flux/mean arterial pressure) was significantly increased during exercise in hypoxic hypoxia.
Hyponatremic conditions, exercise, and athletic performance: A review. Exploring the role of biochemical and physiological markers

INTRODUCTION: Hyponatremia is a condition characterized by low sodium levels in the blood, which can occur as a result of excessive fluid intake or inadequate sodium intake. It poses a significant risk to athletes, particularly those participating in endurance events, as it can lead to dehydration, fatigue, and electrolyte imbalances.

METHODS: The study reviewed the medical records and research literature on the prevalence, causes, and effects of hyponatremia in athletes. It also examined the role of biochemical and physiological markers in identifying and managing hyponatremic conditions.

RESULTS: The study found that hyponatremia is relatively common among endurance athletes, with prevalence rates ranging from 3% to 15% in certain populations. The condition is more prevalent among female athletes and those participating in long-distance events. The study also highlighted the importance of monitoring electrolyte levels and hydration status during training and competition.

CONCLUSIONS: Hyponatremia is a significant concern for athletes and coaches, and early detection and intervention are crucial for maintaining optimal performance and preventing serious health complications. The use of biochemical and physiological markers can help in identifying at-risk individuals and guiding hydration strategies to prevent hyponatremia.

Keywords: Hyponatremia, athlete, electrolyte, endurance, training, competition, prevention

Abstracts were prepared by the authors and printed as submitted.
Supported by USAMRDC; author views not official US Army or DoD policy.

How does the dancer’s spine move? Application of a multisegmented model.

Purpose: Historically, most biomechanical studies of the spine used a rigid single segment model. However, recent studies show that spinal segments do not move together predictably and that a multi-segmental model improves discrimination between patients and healthy controls. Although professional dancers experience low back pain equal to or more than the general and sporting population, to date, no study has described multi-segmented spinal motion of the dancer during any dance specific tasks which may place unique mechanical demands on the spine. The purpose of this study was to describe spinal motions of professional dancers during a common dance task, the arabesque, using a multi-segmented spinal model. METHODS: As part of larger study, 25 professional dancers (ages 24.8 ± 6.2; 5 males) performed two trials each of a right and left arabesque at their own pace while spinal kinematics were captured using a five-segment model (pelvis (PEL), lower lumbar (LL), upper lumbar (UL), lower thoracic (LT) and upper thoracic (UT)). Motion was captured from initiation of vertical floor movement and ended at maximal foot height. Two trials were averaged and all values were time normalized. Results: Means and standard deviations of motion in all segments in three planes were identified. In all three planes, the upper two segments (UT-LT and LT-UL) contributed 69-87% of the total spinal motion. In the coronal plane, side-bending of all segments occurred ipsilateral to the lifted leg with 54% of all motion occurring within a single segment (LT-UL). In the sagittal plane the spine generally extended, however the upper segment (UT-LT), began and remained in a flexed position throughout the motion, although it extended during the motion. In the transverse plane all segments rotated contralateral to the lifted leg. However, the lower two spinal segments contributed almost no motion. Conclusion: This study demonstrated that segmental motion was not uniform in degree or direction across multiple spine segments during an arabesque. Most spinal motion occurred in the upper spine. Using a multi-segmental model may improve understanding of the biomechanical stressors experienced by professional dancers.

Board #2
May 27 3:15 PM - 5:15 PM
How Does The Dancer’s Spine Move? Application Of A Multisegmented Model.

Marjieanne Liederbach1, Christopher T.V. Swain2, Ian J. Krenenovic3, Karl F. Orishimo3, Marshall Hagniss2. 1NYU Langone Orthopedic Hospital, New York, NY. 2Australian Catholic University, Melbourne, Australia. 3Lenox Hill Hospital, New York, NY. (Sponsor: Malachy McCueh, PhD, FACSM)

(No relevant relationships reported)
CONCLUSIONS: These results suggested that thrown player’s break-fall technique, with appropriate neck flexion to avoid head-hitting, decreases the BrIC value effectively and the risk of serious brain injuries in judo.

807 Board #4 May 27 3:15 PM - 5:15 PM
The Effectiveness Of Electromyography Biofeedback At Improving The Upper Trapezius To Serratus Anterior Activation Ratio
Julia E. Holton, Robert D. Clark, Cory J. Gooever, Heather Smith. California Polytechnic State University, San Luis Obispo, CA.

(No relevant relationships reported)

The upper trapezius (UT) to serratus anterior (SA) muscle activation ratio is essential for optimal shoulder function. An alteration of this ratio is a main area of focus in shoulder rehabilitation. Electromyography (EMG) biofeedback has been shown to be an effective technique used during rehabilitation but there is limited research on the retention of improvements. **Purpose:** To determine if EMG biofeedback can be used to improve scapular control by decreasing the UT to SA activation ratio. A secondary purpose was to determine if the predicted improvements can be retained beyond the treatment period of four weeks. **Methods:** 20 college aged (21.75±1.77 yrs) subjects participated in this study. Subjects were randomized to the exercise only (EO) group or EMG biofeedback group. Both groups performed 30 repetitions of three exercises twice a week for four weeks under supervision. The EMG biofeedback group performed them with the addition of EMG biofeedback. They were given the instructions to decrease the UT and increase the SA activation by adjusting the corresponding EMG trace on the monitor. The percent voluntary contraction for each muscle during each exercise was measured on visit one, visit nine (after the four weeks) and visit 10 (after a two-week retention period) and presented as a percent change value. **Results:** There was no statistically significant effect of group on the ratio comparing visit one to visit nine (p=0.084), nor when comparing visit nine to visit 10 (p=0.065). The EMG biofeedback group had a significant decrease in UT activation (-10%) compared to the EO group (+27%) (p=0.007) at the end of the four weeks with no effect seen after the retention period (p=0.358). There was a significant increase in SA activation in the EMG biofeedback group (+19%) compared to the EO group (+9%) (p=0.000) comparing visit one to nine. There was a significant increase in SA activation comparing visit nine to visit 10 in the EMG biofeedback group (+14%) compared to the EO group (+12%) (p=0.001). **Conclusion:** EMG biofeedback was not found to decrease the UT to SA activation ratio, but the individual muscle activation changes indicate that EMG biofeedback can be effective at altering muscle activation rates in individual muscles and that those changes can be retained beyond the timeframe of the intervention.

808 Board #5 May 27 3:15 PM - 5:15 PM
Lumbopelvic Rhythm Prediction Using Machine Learning And Its Use As A Biomarker For Low Back Pain Identification
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(No relevant relationships reported)

Lumbopelvic (LUM-PEL) rhythm has the potential to be used as biomarker for diagnosis and rehabilitation of athletes predisposed to mechanical low back pain (LBP). Studies till date have mostly focused on discrete variables from the time series to explain movement patterns. Machine learning algorithms provide opportunity to analyze continuous time series data for predictive classification of movement patterns into pathological and non-pathological, adding value to early diagnosis and clinical decision making for conditions such as LBP. **PURPOSE:** Use of machine learning to categorize healthy LUM-PEL rhythm.

**METHODS:** 79 participants with no LBP (Young: n=42; 18-40y; 27±6±6.5yr; Older: n=37; 41±6±5yr; 51±7±3yr). 3D segmental kinematics of lumbar (LUM; L1-L5) and pelvis (PEL) were calculated for maximum trunk flexion-extension. Coordination patterns were divided into in-phase, anti-phase, superior and inferior-only based on the coupling angles of LUM and PEL. K-means clustering, an unsupervised machine learning algorithm, was employed to create clusters of movement patterns of the coupling and segmental angles based on dynamic time warping similarity. Sample distribution within each cluster was compared for different age groups. **RESULTS:** LUM-PEL rhythm fell under k=3 major movement pattern clusters (Fig. 1). No difference between age groups was observed. Non-pathological LUM-PEL rhythm clusters suggest flexion movement initiation and return from hyperextension typically have segments in anti-phase (LUM leading: 40.4%), PEL/ LUM only (35.3%) and in-phase (LUM leading: 24.3%). The 2 segments predominantly move in-phase except at start and end of movement. Patterns were not apparent when using segment angles

or through discrete variable of mean coupling angles. **CONCLUSIONS:** Using the discovered movement pattern clusters, individuals with LBP could be identified and training prescriptions can be based on healthy segmental coordination.

809 Board #6 May 27 3:15 PM - 5:15 PM
Lumbo-pelvic Ratio And Conjoint Movements Differ Between Pain Intensity Groups In Low Back Pain Patients
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(No relevant relationships reported)

Back pain is linked to alterations in movement behaviour. Yet, the interaction between pain intensity and movement is not fully understood. In particular, it remains unknown if the movement quality differs between (chronic) pain intensities. **PURPOSE:** To compare trunk movement behaviour, assessed by lumbar/pelvic and conjunct lateral flexion contributions to the total range of motion (RoM) during trunk flexion, between people with low and moderate to high back pain intensities. **METHODS:** A multi-centre study on 607 people with back pain was performed. Chronic pain intensity scores (INT [0-100]; sub-score of the Graded Chronic Pain Scale) were used to group participants into comparably low (LP; Score <30 points) and moderate to high pain intensity (HP; Score ≥ 30 points). Accordingly, 211 participants (49% f; 37±13y; 73±15kg; 173±9cm; INT 18±7) were allocated to LP and 393 participants (57% f; 41±14y; 75±16kg; 173±9cm; INT 46±13) were allocated to HP. Motion was assessed during maximal trunk flexion in upright standing. A mobile IMU system (six sensors), distinguishing between total, lumbar and pelvic motion in all three movement planes, was used. Outcome measures were total RoM, lumbo-pelvic ratio (LPR) and amount of conjunct lateral motion (CLM; sum of angular changes in lateral flexion, RoM-normalized). Between-group comparisons using adjusted unpaired t-tests/Mann-Whitney U test for RoM and LPR and two-way ANOVAs for CLM were performed. **RESULTS:** Significant between-groups differences in trunk flexion movement were found for LP (LP 0.92±0.65; HP 0.72±0.49; p<0.0001) but not for RoM (LP 101±27; HP 104±25; p=0.28). CLM differed significantly between groups during downward movements in lumbar (LP 8.6±3.3; HP 8.5±3.2; p=0.02; pelvic: LP 8.5±4.1; HP 9.2±4.0; p=0.08) during upward movements of the trunk. **CONCLUSION:** Though total RoM between subclinical and clinical back pain patients is not different, lumbar contribution on total trunk flexion movement is reduced and conjunct lateral movements at the lumbar area are increased with higher pain intensities. This might reflect a strategy to reduce potential pain at the lumbar back during flexion movements of the trunk.
Board #7 May 27 3:15 PM - 5:15 PM
Use Of Machine Learning To Predict Low-back Pain From Motion Capture Data Using Multi-segment Spine Model

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Purpose: Machine learning-based methods, which include Artificial Neural Networks [ANN], have been used successfully in varied classification problems. If these methods can successfully classify those vulnerable to musculoskeletal problems such as low-back pain [LBP], they may have utility in screening and management of such conditions and aid in identifying what assessment methods provide optimal information for practitioners. We examined whether ANN techniques could correctly classify whether subjects experienced LBP in a convenience sample of dancers.

Methods: 60 subjects [48 women], 36 of whom [24 women] reported an episode of back pain in the past two months, were instrumented with a multi-segment spine marker set [Swain et al., 2019] and recorded [Motion Analysis Corp Eagle, 250 Hz] while performing standing and seated rotations, walking and several functional and dance-related movements [step-over task, arabesque, passé]. The multi-segment model has five segments: pelvis, lower and upper lumbar [L/UL], lower and upper thoracic [LUT]. 3D rotations were computed both between adjacent segments, and with respect to the lab coordinate system. To determine variables of interest, 1-dimensional statistical parametric mapping [SPM1D; Patsy, 2008] analysis was performed. Features [min, max, time to min/max, and side-side difference] were extracted from these variables and used to train an ANN pattern recognition tool [MATLAB].

Results: Approximately 75% of the data were used for training, with the remainder used for validation and testing. Because of the dearth of men, analysis was performed on the entire cohort, and of women only.

Conclusions: Based on our small sample, ANN techniques show promise for identifying subjects with LBP based on their movement patterns. A larger training set of data is needed for better results. Future work should optimize feature selection by focusing on areas of difference between data rather than by selecting fixed features [e.g., max value] and examine the effect of different ANN architectures.

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Board #8 May 27 3:15 PM - 5:15 PM
Unilaterally Implemented Trunk Modification Associated With Asymmetrical Increase In Spinal Load

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Trunk modification (TM) is associated with reduced knee adduction moment during gait in both healthy and symptomatic individuals. Reported reductions are dependent on the magnitude of modification implemented. Evidence however suggested that increased trunk motion augments structural loading at the spine. Despite the positive adaptations at the knee, potential unanticipated changes in spinal load are yet to be investigated.

Purpose: To investigate changes in trunk joint reaction force (JRF) during ipsilateral (IP) and contralateral (CT) stance phases subsequent to implementing unilateral subject-specific TM.

Methods: 19 healthy participants (26.7±4.8 years, 1.69±0.17 m, 72.3±11.8 kg) were recruited. Trunk lean was implemented towards the side of the preferred kicking limb. Participants average trunk angle (TA) was assessed during 10 baseline trials using a motion capture system (200Hz) and force plates (1000Hz). Subject-specific TA range was determined by adding 1-3 standard deviations (smallest), and 5-8 standard deviations (large) to baseline value. Participants completed 5 trials using both small and large subject-specific TM angles. Real-time TA projected as a line graph which was visible to participants during TM trials reinforced performance. Visual 3D was used to deliver feedback and determine trunk JRF (N/kg). Changes to trunk JRF was assessed using a Friedman test with Wilcoxon signed-rank test and Bonferroni-adjusted significance level. Analyses were conducted using a significance level of p<0.017.

Results: Peak lateral JRF during IP and CT stance were significantly greater during TM trials (z (2) = 32.9, and 30.7, p<0.001 respectively). Participants experienced increased lateral JRF during both IP (d=1.5, and d=1.7, small and large TM respectively), and CT (d=1.6, and d=1.7, small and large TM respectively) compared to baseline. Conclusion: Changes in trunk JRF are indicative of elevated spinal loads. During CT stance, lateral JRF in the direction of the modified side persisted which is indicative of continued asymmetric trunk load. Findings suggest TM could result in detrimental adaptations and may be contraindicated for certain individuals. Further research employing longitudinal design is needed to investigate if observed acute changes are transient in nature.

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Board #7 May 27 3:15 PM - 5:15 PM
Vigorous Physical Activity Is Protective Against Unfavorably Health Trajectory In Active Children

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Purpose: To prospectively investigate the associations between PA intensity and unfavorable health trajectories among physically active children aged between 6 and 12 yrs.

Methods: This prospective study (2.5 yrs) included 391 students (8.1 ± 1.4 yrs) from ten public schools participating in the Childhood Health, Activity, and Motor Performance School Study Denmark (CHAMPS-dk). All children performed a daily minimum of 60-min of moderate-to-vigorous physical activity (MVPA), measured by accelerometers, at baseline and 30 months. Trajectories of body mass index (BMI), waist circumference, and aerobic fitness were constructed with a group-based multi-trajectory model and associations between PA measures and health trajectories were modeled with logistic regression.

Results: Overall, 9.1% of guideline-concordant children were classified as members of an unfavorable health trajectory with BMI and waist circumference indicating overweight/obesity, and lower aerobic fitness. Time in sedentary [OR 0.98 95%CI (0.94-1.02)] and moderate intensity activity were not associated with membership in an unfavorable health trajectory [OR 0.86 95%CI (0.71-1.04)]. Each 5-min in MVPA was associated with a 23% reduction [OR 0.77 95%CI (0.66-0.91)] in the odds of being in the unfavorable health trajectory group. For every 5-min spent in vigorous PA, there was a 39% reduction in the odds of being classified as a member of the unfavorable health trajectory [OR 0.61 95%CI (0.46-0.80)].

Conclusion: Additional 5-min in MVPA and vigorous PA are associated with better health-related outcomes among children who adhere to PA guideline recommendations. Vigorous PA was the strongest predictor of health outcomes. PA guidelines should place greater emphasis on vigorous intensity PA.

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Board #8 May 27 3:30 PM - 5:30 PM
An Intervention For Fundamental Motor Skills And Physical Activity In Pre-schoolers: A Cluster-randomized Controlled Trial

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Purpose: Physical activity (PA) is important for health and development in preschool-aged children yet only 34% of Australian pre-schoolers achieve the...
recommended levels. Fundamental motor skill (FMS) interventions have been shown to improve FMS proficiency and PA levels, however, whether these changes are maintained post-intervention is unknown. We determined if a 12-week FMS program improved FMS and PA in pre-schoolers; and if so, whether these improvements were maintained 12 weeks post-intervention. METHODS: The Physical, ActivityY and Fundamental Motor Skills in Pre-schoolers (PLAYFun) Program was a cluster randomized controlled trial. Participants were recruited from 4 University pre-schools. The PLAYFun Program was a 12-week, games-based, FMS program delivered directly into the centers by an exercise physiologist. Primary outcomes included FMS proficiency, objective PA and parent perceived PA assessed at baseline, 12 weeks and 12 weeks after the completion of the intervention (week 24). Differences within and between groups were assessed via a one-way analysis of variance.

RESULTS: Forty-nine participants (mean age 4.0±0.6; 54% male) were recruited. Children attended on average 2.0±1.0 sessions per week for 40 minutes per session. Participants in the PLAYFun Program demonstrated a significantly greater increase in object control (p=0.003) and total FMS (p=0.019) proficiency at week 12 compared to controls. Locomotor skills (M 14.8±3.95%, CI 95% (3.90 to 25.75); p=0.012), object control skills (M 24.11 [9.93 to 38.29]; p=0.003) and gross motor quotient (M 20.14 [8.33 to 31.96]; p=0.003) all significantly improved when children attended twice a week, but these improvements were not maintained at 24 weeks. Girls in PLAYFun significantly increased moderate to vigorous PA post-test’= -3.8; ∆ control group ‘baseline to post-test’= 6.3; p=0.04) and minimize on SPSS, 25.0 version, 95% of significance. RESULTS: Total of 70.27% (n=260) were adjusted by sex, peak height velocity, baseline data and social economic level were used and pre-specified interactions were tested (i.e., group*time). All analyses were measured. PA level was evaluated by wrist-worn accelerometers (Actigraph, GT3X+), and Chandler’s cut-points were considered. Generalized linear mixed models were used and pre-specified interactions were tested (i.e., group*time). All analyses were adjusted by sex, peak height velocity, baseline data and social economic level on SPSS, 25.0 version, 95% of significance. RESULTS: Total of 70.27% (n=260) of data accelerometer was valid at baseline (600 minutes per day, minimum 3 days). The proposed intervention presented decreased SED (Δ intervention group ‘baseline to post-test’ = -3.8; Δ control group ‘baseline to post-test’ = 6.3; p=0.04) and minimize the reduction of vigorous PA (Δ intervention group of ‘baseline to follow-up’ = -0.2; Δ control group ‘baseline to follow-up’ = -0.4; p=0.03). Time spent in MVPA did not differ between the groups over time. CONCLUSION: The multicomponent program was effective to decrease SED and can maintain students’ vigorous PA level.

Regular high intensity physical activities have been associated with healthy outcomes in adolescents. Previous studies have reported positive changes on physical activity (PA) level and sedentary time (SED) in participants of multicomponent school-based programs. The main research question was whether School in Action program is effective on promote active life style in Brazilian adolescents. PURPOSE: To examine the effects of a multicomponent school-based program on students’ PA and SED. METHODS: A cluster randomized controlled trial with 370 adolescents (aged 11.7 years, SD=0.6) from four public schools from Presidente Prudente-SP, Brazil, were randomized to either an intervention or control group. School in Action program was based on ecological and self-determination theory principles and strategies consisted of: (a) 15 minutes of PA program in physical education (PE) class, (b) PA practice during the lunch break, (c) active breaks during theoretical classes, (d) monthly meeting and (f) school playground adaptation and acquisition of material resources to participation of school’s health education project, (e) parent’s counseling during school during the lunch break, (g) active breaks during theoretical classes, (h) monthly meeting and (f) school playground adaptation and acquisition of material resources to participation of school’s health education project, (e) parent’s counseling during school during the lunch break.

In the intervention group, the Physical Activity and Physical Education Program (PAPEP), a multicomponent program was implemented. The components of the program were: (a) PA Assessment and Follow-up (PAF), (b) PA Evaluation and Reflection (PAER), (c) PA Planning and Intervention (PAPI), and (d) PA Monitoring and Evaluation (PAME). The program was implemented for 12 weeks, and the adherence rate was 95%. The program was delivered by a team of professionals, including a physical education teacher, a nutritionist, and a psychologist. The program was evaluated using a questionnaire and an accelerometer. The questionnaire consisted of questions about the frequency, duration, and intensity of PA, and the accelerometer was used to measure the number of steps and PA intensity. The program was effective in increasing PA and reducing SED in the intervention group. The effect size was large (Cohen’s d=0.8), indicating a significant improvement in PA and SED.

Children with Autism Spectrum Disorder (ASD) are disproportionately impacted by childhood obesity, with one contributing factor being low levels of physical activity (PA). There is a paucity of interventions for promoting PA that are responsive to the unique needs of young children with ASD. One promising approach designed for teachers working with typically developing preschoolers is WE PLAY (Wellness Enhancing Physical Activity for Young Children), an online-based training system. It was adapted to be responsive to the needs of children with ASD through a stakeholder-engaged approach. PURPOSE: To determine the impact of WE PLAY-Autism on the moderate-to-vigorous PA (MVPA) of preschoolers with ASD during school hours.

METHODS: A multiple baseline design across participants was used, which allowed for a rigorous experimental evaluation of the impact of WE PLAY-Autism through the repeated measurement of children’s MVPA as the intervention was implemented sequentially across classrooms. Children’s (N = 5) MVPA was measured daily during school hours using accelerometers (Actigraph GT3X+ Link) worn at the iliac crest. Data were analyzed using accelerometer count cut-points for PA categories, with min-hour of MVPA as the dependent variable. RESULTS: Following current best practices in single case designs, visual analysis and effect size calculations were used, indicating higher average min/hour of MVPA among preschoolers with ASD in the intervention phase (tau-U = -53, p < 0.001, Hedges’ g = 0.99, 95% CI [0.56, 1.43]) and post-training phase (tau-U = -55, p < 0.001, Hedges’ g = 1.17, 95% CI [0.73, 1.60]) in comparison to the baseline phase. The average increase in min/hour of MVPA from baseline to post-training was 2.51 (range = 1.35 - 4.32), which translates to approximately 38 additional minutes of MVPA across the 15-hour preschool week.
CONCLUSION: This study is, to our knowledge, the first to implement and report the impact of a preschool PA intervention adapted to be responsive to the needs of preschoolers with ASD. The results provide preliminary evidence that WE PLAY- Autism increases MVPA among preschoolers with ASD to a similar magnitude as preschool-based interventions for typically developing children.

818 May 27 4:30 PM - 4:45 PM
Dearborn SHINES: The Impact Of A Comprehensive School Health Intervention
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(Purpose: Arab Americans account for almost 3.7 million people in the U.S., however, limited health data is available on youth and adult populations. In order to better understand the health behaviors of Arab Americans and aid in the push for healthy lifestyles in children, more research should be conducted. Therefore, the purpose of this study was to implement a culturally relevant healthy eating (HE) and physical activity (PA) intervention known as D-SHINES in a primarily Arab-American school district and understand the impact it had on students’ overall PA, attitude toward PA and HE, as well as PA and HE knowledge, and perceived social support.

METHOD: Eight schools participated in the D-SHINES intervention over one school year, with 264 (Mage=11.1; Male = 106) randomly selected students participating in pre-post testing. The intervention consisted of physical education utilizing SPARK, PA afterschool clubs, gardening and nutrition programming, and classroom physical activity breaks. Students participated in a pre-post survey with validated measures for overall PA level, HE and PA attitude, knowledge, and perceived social support. Implementation of the garden, HE, and PA curriculum tools were also tracked for fidelity.

RESULTS: T-tests were used to determine differences among students from pre-post intervention. Results showed that students significantly increased their HE and PA knowledge over the course of the year (p<.001), as well as their PA attitude (p=.021). There was no significant difference observed in overall PA levels (p=.92), vigorous PA (p=.08), and perceived social support. Additionally, MANCOVA’s showed significant differences among the variables between grade and gender (p<.001).

CONCLUSIONS: Although limitations exist, the results show that while the D-SHINES program was implemented in the school, students’ significantly improved their attitudes and knowledge toward HE and PA, yet, failed to show a significant increase in overall PA. Additionally, great strides were made with teachers and schools to build and implement the garden curriculum. Additional research should be conducted to better understand successful comprehensive school programming among urban Arab American youth, a population that is often understudied.

819 May 27 4:45 PM - 5:00 PM
CHANGES IN PHYSICAL ACTIVITY, PHYSICAL FITNESS AND WELL-BEING FOLLOWING A SCHOOL-BASED HEALTH PROMOTION PROGRAM
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(Purpose: School-based physical activity (PA) has mostly been examined in a preventive perspective. The purpose of this study was to examine the changes in physical activity, physical fitness and psychosocial well-being in early adolescents after the implementation of a school-based health promotion program in secondary school.

METHOD: Four municipalities with 15 secondary schools in Telemark County, Norway, were recruited into an intervention or a control group. A total of 644 pupils participated in the study (response rate: 79%). The schools in the intervention group implemented the Active Healthy Kids program, where the physical activity component consisted of: (1) 120 min/week of physically active lessons (PAL), (2) 25 min/week of physical active breaks during classroom lessons and (3) 135 min/week of curriculum based normal physical education. Primary outcome was physical activity assessed by accelerometer and expressed as counts per minutes. Secondary outcomes were sedentary time, physical fitness, vitality, school effort and health-related quality of life in the five domains; physical health, psychological wellbeing, parent, peers and school environment.

RESULTS: There was a Group X Time effect for school-based, but not full-day, physical activity (p=0.005), and for cardiorespiratory fitness (p=0.02) and vitality (p=0.008). A Group effect was found for the perceived exerted effort in classes (p=0.001) and the health-related quality of life domains "psychological well-being" (p=0.04) and "school environment" (p=0.001).

CONCLUSIONS: A multi-component, school-based, health-promotion intervention with emphasis on the use of PAL led to positive changes in school-based physical activity, cardiorespiratory fitness, vitality and health-related quality of life among early adolescents in a county with poor public health profile. This might have implications for the development and promotion of general health and well-being throughout adolescence.

Trial registration: Approved by the Norwegian Data Protection Services (ID 54327), and registered in ClinicalTrials.gov, (ID NCT03906851).

Keywords: School-based physical activity, adolescents, Physical activity, physical fitness, Health Related Quality of Life, Norway

B-50 Free Communication/Slide - Investigating Maternal and Child Health

Chair: James M. Pivarnik, FACSM. Michigan State University, East Lansing, MI.

821 May 27 3:15 PM - 3:30 PM
Influence Of Maternal Exercise And DHA Levels During Pregnancy On Maternal Lipids
Cody J. Strom, Kimberly Kew, Samantha McDonald, Christy Isler, Kelly Haven, Ed Newton, Linda May. East Carolina University, GREENVILLE, NC. (Sponsor: Dr. Linda May, FACSM)

Elevated levels of Total Cholesterol (TC), low-density lipoprotein (LDL) and triglycerides (TG) during pregnancy have been associated with risks of gestational diabetes, preeclampsia, fetal macrosomia and cardiovascular disease. Exercise is
known to decrease TC, LDL and TG, while increasing HDL within normal ranges. Similarly, supplementation of polyunsaturated fatty acids (PUFA), such as DHA, help control and mitigate excessive triglycerides, while increasing HDL. Research has not investigated the potential relationship of maternal exercise and PUFA levels on maternal lipid profiles.

**PURPOSE:** To determine the relationship between maternal exercise and plasma levels of DHA on maternal lipid levels at 16 and 36 weeks.

**METHODS:** 22 women with a singleton pregnancy (<16 weeks) were randomized to either aerobic (n=9) or non-exercising control (n=4) group. Participants exercised 3x50 minutes per week at moderate intensity for ~24 weeks, with average weekly METmins/wk calculated based on standard MET values*average minutes. Maternal plasma was collected at 16 and 36 weeks of gestation and analyzed for DHA and lipid levels. Multiple linear regression and Spearman correlation models were performed to determine relationships between maternal METmins/wk, DHA levels, and lipid levels. **RESULTS:** There is a significant negative correlation between DHA levels and METmins/wk with DHA (r = -0.500, p = 0.08) and TG (r = -0.440, p = 0.13) at 36 wks. There was not a significant regression equation found for TC (F = 0.690, p = 0.52) and TG (F = 2.092, p = 0.174), however METmins/wk showed a negative relationship to TC (-0.094, p = 0.307) and tended to significantly predict TG (-0.185, p = 0.081) while DHA levels showed a positive relationship with TC (p = 0.059, p = 0.311) and TG (p = 0.105, p = 0.125).

**CONCLUSION:** The current study suggests a potential relationship between exercise and DHA levels during pregnancy on maternal lipids. These findings showed a negative and stronger relationship with METmins/wk compared to DHA levels, thus suggesting exercise may be more important to control excessive increases in TC and TG during pregnancy.

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**823 May 27 3:30 PM - 3:45 PM Physical Activity Knowledge And Sources Of Advice During Pregnancy**

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| (No relevant relationships reported) |

**Physical activity (PA) during pregnancy is known to be beneficial for the health of both the mother and fetus, but most pregnant women do not engage in the recommended volume of activity. Lack of personal and healthcare-professional knowledge is frequently cited as a barrier to PA participation during pregnancy in both low-activity and athletic populations.**

**PURPOSE:** To explore the sources of advice used by women to guide their PA participation during pregnancy.

**METHODS:** Women who had recent experience of pregnancy in Ireland (n = 102, age 35±4 years) completed an online survey with questions regarding their activity type immediately pre-pregnancy (activities of daily life only (DAILY), recreational exercise (EXERCISE) or competitive sport (SPORT)), knowledge of PA guidelines, experiences of receiving PA advice from healthcare professionals during pregnancy, and perceptions regarding different sources of advice. Between-group comparisons were made by Chi-square analysis.

**RESULTS:** Knowledge of the recommended volume of activity for health was significantly poorer in EXERCISE than DAILY or SPORT (X2 = 16, p = 0.037, V = 0.283); there were no differences in knowledge of recommended intensity or type. Women in the EXERCISE and SPORT groups were significantly more likely to have felt that they needed to initiate discussion about PA with their healthcare providers than those in the DAILY group, for whom the professional was more likely to initiate the discussion (X2 = 19, p = 0.004, V = 0.310). While 48% of respondents perceived their healthcare professionals to be their most useful source of PA advice during pregnancy, the other 52% cited sources such as friends, exercise professionals or online media, with no between-group differences. Furthermore, many women reported that they never received PA advice during their pregnancy from their general practitioner (27% of women), midwife (45%) or obstetrician (46%).

**CONCLUSION:** Knowledge of guidelines for PA during pregnancy is low among pregnant women in Ireland; low levels of guidance from healthcare professionals may help control and mitigate excessive triglycerides, while increasing HDL. Research has not investigated the potential relationship of maternal exercise and PUFA levels on maternal lipid profiles. **Purpose:** To determine the relationship between maternal exercise and plasma levels of DHA on maternal lipid levels at 16 and 36 weeks.

**Methods:** 22 women with a singleton pregnancy (<16 weeks) were randomized to either aerobic (n=9) or non-exercising control (n=4) group. Participants exercised 3x50 minutes per week at moderate intensity for ~24 weeks, with average weekly METmins/wk calculated based on standard MET values*average minutes. Maternal plasma was collected at 16 and 36 weeks of gestation and analyzed for DHA and lipid levels. Multiple linear regression and Spearman correlation models were performed to determine relationships between maternal METmins/wk, DHA levels, and lipid levels. **Results:** There is a significant negative correlation between DHA levels and METmins/wk with DHA (r = -0.500, p = 0.08) and TG (r = -0.440, p = 0.13) at 36 wks. There was not a significant regression equation found for TC (F = 0.690, p = 0.52) and TG (F = 2.092, p = 0.174), however METmins/wk showed a negative relationship to TC (-0.094, p = 0.307) and tended to significantly predict TG (-0.185, p = 0.081) while DHA levels showed a positive relationship with TC (p = 0.059, p = 0.311) and TG (p = 0.105, p = 0.125).

**Conclusion:** The current study suggests a potential relationship between exercise and DHA levels during pregnancy on maternal lipids. These findings showed a negative and stronger relationship with METmins/wk compared to DHA levels, thus suggesting exercise may be more important to control excessive increases in TC and TG during pregnancy.

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**824 May 27 3:45 PM - 4:00 PM Maternal Physical Activity Correlates With Fasted And Postprandial Insulin Resistance And Lipids During Late Pregnancy**

Rachel A. Tinus1, Maire M. Blankenship1, Kevin J. Pearson2, W. Todd Cade1, Elizabeth Alitzer3, Nikki B. Zite2, Jill M. Maples4. 1Western Kentucky University, Bowling Green, KY. 2University of Kentucky, Lexington, KY. 3Washington University School of Medicine, St. Louis, MO. 4University of Tennessee Graduate School of Medicine, Knoxville, TN. Email: rachel.tinus@WKU.EDU

(No relevant relationships reported)

**PURPOSE:** Physical activity (PA) has been shown to be effective for lowering insulin resistance and blood lipid profiles during pregnancy. Recent evidence indicates sedentary time is also associated with poor pregnancy outcomes. The purpose of this study was to determine the relationships between sedentary time and moderate PA, assessed during late pregnancy, and insulin resistance (HOMA-IR) and triglycerides in fasting and postprandial conditions. Postprandial conditions are important to study as humans spend the majority of their time in a fed-state.

**Methods:** Healthy pregnant women (N=61, 32-36 weeks gestation) were recruited for this study. Sedentary time and moderate intensity PA were objectively assessed using a wrist-worn Actigraph GT3X Link Accelerometer. The device was worn 24 hrs/day for 7 days. Fasting blood lipids, insulin, and glucose were assessed. A standardized high-fat breakfast was consumed and these measures were collected again 120-minutes postmeal (postprandial). All relationships were analyzed with Pearson Product Moment Correlation Coefficients while controlling for pre-pregnancy BMI.

**Results:** Sedentary time was positively correlated with fasting and postprandial insulin resistance (fasting HOMA-IR: r=0.471, p=0.001; postprandial HOMA-IR: r=0.433, p=0.002), while these measures were negatively correlated with light PA (fasting HOMA-IR: r=-0.395, p=0.005; postprandial HOMA-IR: r=-0.364, p=0.010) and moderate PA (fasting HOMA-IR: r=-0.520, p<0.001; postprandial HOMA-IR: r=-0.477, p=0.001). Sedentary time was positively correlated with fasting triglycerides (r=0.296, p=0.039). Moderate PA was negatively correlated with fasting triglycerides (r=0.403, p=0.004) and postprandial triglycerides (r=0.343, p=0.016).

**Conclusions:** Decreasing sedentary time and increasing PA may positively impact metabolic health during pregnancy by reducing fasting and postprandial insulin resistance, as well as reducing fasting and postprandial triglycerides. This is important as, during pregnancy, insulin resistance is associated with poor pregnancy and neonatal outcomes and increased triglycerides are associated with increased risk of preeclampsia, pre-term birth, and increased maternal cardiovascular risk later in life.

NIH NIGMS IDEA Grant 5R20GM130436

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**825 May 27 4:00 PM - 4:15 PM Influence Of Physical Activity And Sedentary Behavior During Pregnancy On Labor And Delivery Type**

Melissa A. Jones1, Janet Catov1, Kara Whitaker2, Bethany Barone Gibbs3. 1University of Pittsburgh, Pittsburgh, PA. 2University of Iowa, Iowa City, IA. Email: maj133@pitt.edu

(No relevant relationships reported)

**Physical activity (PA) during pregnancy is known to be safe and does not increase risk of medical intervention during labor and delivery. While it is known that sedentary behavior (SED) and PA have independent health effects, whether higher SED during pregnancy increases risk for medical intervention in labor and delivery is unknown.**

**Purpose:** To examine the relationship of SED and PA patterns across pregnancy with labor and delivery outcomes. **Methods:** In this prospective cohort study, objective SED (high-wear activityPal micro3) and physical activity (waist-worn ActiGraph GT3X-BT) were assessed in women for ≥ 4 days with ≥210 hours in each trimester of pregnancy. This secondary analysis includes women with available labor and delivery records, and PA and SED measures in >10 hours in each trimester. Trajectory analysis was used to identify patterns of PA and SED across pregnancy and assign women to the groups most closely related to their dominant activity patterns. Labor and delivery information was abstracted from participant medical records. Labor types were categorized as: spontaneous, induced-elective, or induced-medical. Delivery types were categorized as: vaginal, cesarean, medically induced, and 13% elective induction. Deliveries were 79% vaginal, 13% medically indicated c-section, and 8% elective c-section. Type of labor (L) or delivery (D) did not significantly differ by SED (L: p=0.185, D: p=0.134) or PA (L: p=0.756, D: p=0.120) trajectories. When elective induction and c-sections were removed to only consider risk for medical intervention, differences remained insignificant by SED (L:...
Three reviews of antenatal behavioral lifestyle interventions did not find significant intervention effects on maternal complications and adverse neonatal outcomes, perhaps due to the inclusion of low to medium quality studies. PURPOSE: To evaluate the effect of a lifestyle intervention program on pregnancy outcomes in overweight and obese pregnant women. METHODS: This study was a randomized controlled trial. Overweight and obese pregnant women were recruited from Columbia, South Carolina and were randomized to a behavioral intervention group (n=110) or to a standard care group (n=104). The antenatal intervention was designed to target weight self-monitoring, increasing physical activity, and increasing healthy dietary behavioral practices. Intervention contents were delivered through one in-depth counseling session, followed by phone counseling, behavioral podcasts, and social media support. Standard care women received monthly mailings and a maximum number of podcasts focused on a healthy pregnancy. Participants wore a SenseWear armband ≥ 2 minutes each week until 40 minutes were achieved and then maintain this walking 21 hrs/d for ≥ 5 d at baseline (early pregnancy, n=205) and 32-wk gestation (n=167). We tested Randomization x Time interaction effects (SAS PROC MIXED) for min/d of MVPA, min/d of light PA, and steps/d. RESULTS: Participant demographics were: 30±5 years, 44% African American, 56% white, 60% college graduate, 61% employed full-time, 67% married, 42% multiracial, and 13±2 wk gestation at baseline. While the time main effects indicated that MVPA (p=.007), light PA (p=.04), and steps (p=.0001) decreased significantly, intervention effects (Randomization x Time) were not significant for these PA variables (see Table). Table: Changes in MVPA, Light PA, and Steps Over Time, by Randomization Group, Least Squares Means (SEs)

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Standard Care</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>32-wk</td>
<td></td>
</tr>
<tr>
<td>MVPA, min/d</td>
<td>38 (2)</td>
<td>36 (3)</td>
</tr>
<tr>
<td>Light PA, min/d</td>
<td>219 (8)</td>
<td>206 (8)</td>
</tr>
<tr>
<td>Steps/d</td>
<td>5574 (196)</td>
<td>5041 (209)</td>
</tr>
</tbody>
</table>

CONCLUSION: A behaviorally based lifestyle intervention did not significantly lessen the decline in PA typically seen from early to late pregnancy. Assessments will be repeated at 6- and 12-mo postpartum. Funded by NIH/NICHD.

Gestational hypertension disorders and diabetes affect 6-15% of all pregnancies worldwide and are associated with adverse maternal and neonatal outcomes that can have a programming effect on future chronic disease risk. Pregnant women who receive lifestyle interventions, including healthy eating and/or physical activity, may have a decreased risk of developing complications. PURPOSE: To analyze the effects of a supervised healthy lifestyle intervention (nutrition and exercise) during pregnancy on diagnosis of gestational diabetes, hypertension, caesarean delivery, stillbirth, macrosomia (babies > 4500g), and low birth weight (babies < 2500g) in a cohort in London, Canada. METHODS: From 2016 to 2019, 111 women were enrolled at 12-18 weeks gestation in the Nutrition and Exercise Lifestyle Intervention Program (NELIP; Clinical Trials #NCT02804061) up to delivery. The nutrition goals for the intervention were: 1) Submit a weekly 24 hour-food intake record; 2) Consume approximately 1800-2200 kcal/d; and 3) Consume 200-250g carbohydrates/d (40-55% of total energy intake). The exercise goals were: 1) Duration of session: Walk for 25 minutes and add 2 minutes each week until 40 minutes were achieved and then maintain this walking duration until delivery; 2) Frequency: 3-4 times per week; and 3) Submit a weekly step log (pedometers were provided to each participant). RESULTS: As of October 2019,
the average duration of the intervention was 20.9 ± 3.9 wks. Out of the 75 participants that completed the intervention, maternal age was 32.2 ± 3.3 yrs, self-reports of pre-pregnancy weight was 71.2 ± 15.3 kg, and gestational age at delivery was 278.1 ± 9.0 days. No participants were diagnosed with gestational diabetes or hypertension. Data from 52 babies indicated: birth weight was 3456.0 ± 442.4 g and length was 50.7 ± 3.1 cm. None were born with low birth weight and there were no cases of stillbirth. The rate of macrosomia was 1.9% (n = 1) and caesarean delivery was 27% (n = 14).

CONCLUSION: A healthy lifestyle intervention during pregnancy may help to prevent gestational diabetes and hypertension, and help to reduce the prevalence of stillbirth, macrosomia, low birth weight, and caesarean deliveries. Taken together, these findings may have major positive implications for the long-term health of both mothers and babies.

B-51 Clinical Case Slide - Cardiovascular
Wednesday, May 27, 2020, 3:15 PM - 4:35 PM
Room: CC-2005

830 Chair: Paul D. Thompson, FACSM. Hartford Hospital, Hartford, CT.
(No relevant relationships reported)

831 Discussant: Benjamin D. Levine, FACSM. Presbyterian Hospital, The University of TX SW Medical Center, Dallas, TX.
(No relevant relationships reported)

832 Discussant: Matthew Sedgley, FACSM. U of Maryland Sports Medicine, frederick, MD.
(No relevant relationships reported)

833 May 27 3:15 PM - 3:35 PM
Cardiovascular-Track And Field
Mitchell J. Odom. University of Michigan, Ann Arbor, MI.
(Sponsor: Robert Kiningham, FACSM)
(No relevant relationships reported)

HISTORY: A 21-year-old senior male track and field athlete who competes in mid-distance running events in a Division I university was evaluated for a family history of hypertrophic cardiomyopathy. During his pre-participation physical exam, he denied history of dizziness, syncope, or chest pain. There was no family history of an abnormally thickened heart or early sudden cardiac death. However, his father was recently diagnosed with hypertrophic cardiomyopathy by his primary care provider. There is no other known history of hypertrophic cardiomyopathy in the family.

PHYSICAL EXAMINATION: There were no abnormalities during his cardiac exam. There were no murmurs on standard exam or with provocative maneuvers.

DIFFERENTIAL DIAGNOSIS:1. Family history of hypertrophic cardiomyopathy
2. Physiologic hypertrophy response to exercise
3. Normal physiologic response to exercise

TEST AND RESULTS:
1. Standard electrocardiogram
2. 24-hour Holter monitor
3. Stress echocardiogram
4. Treadmill test
5. Cardiac MRI

FINAL DIAGNOSIS: Normal physiologic response to exercise. False positive resting echocardiogram. TREATMENT AND OUTCOMES:1. After discussion with a sports cardiologist, a cardiac MRI was ordered as his resting echocardiogram was concerning for hypertrophic cardiomyopathy.2. Cardiac MRI showed no evidence of hypertrophic cardiomyopathy.3. No restrictions were placed on activity or participation.
2. Concern for high-risk pathway as pre-excitation persisted at higher heart rates on stress test. Cardiology recommended electrophysiology study and ablation.
3. Underwent uncomplicated catheter ablation of left posterior accessory pathway.
4. 1 week post-ablation, some degree of pre-excitation noted on follow-up EKG (however, similar to post-elimination and initial EKG).
5. 2 weeks post-ablation, ambulatory monitor with no events.
6. 6 weeks post-ablation, remained asymptomatic and received cardiac clearance to return to sport.

836 May 27 4:15 PM - 4:35 PM
Chest Pain - Football
Courtney Nicole Hintz, UCLA Health, Los Angeles, CA.
(Sponsor: Aurelia Nattiv, FACSM)
Email: courtney.hintz@gmail.com
(No relevant relationships reported)

HISTORY: A 23-year old male division I football linebacker developed acute-onset exertional chest pain 30 minutes into practice. The pain was substernal, radiated to his back and was associated with shortness of breath. He was immediately transferred to the ED and after two hours had resolution of his pain with intravenous ketorolac. The patient admitted to suffering from a viral upper respiratory infection with mild unreported chest pain for two weeks prior to the episode. He has a past medical history of well-controlled asthma and sickle cell trait. He denied previous episodes of chest pain or syncope and also denied family history of sudden cardiac death.

PHYSICAL EXAMINATION: Initial vital signs were BP 141/85, HR 74, O2 saturation 96%, T 97.8°F. Athlete was in visible distress in right lateral decubitus position, clutching chest. Cardiac examination revealed regular rate and rhythm, no murmurs or rubs. Chest pain was not reproducible on palpation of anterior chest. Pain was positional and worse with leaning forward. Lungs were clear to auscultation bilaterally with no wheezing or rhonchi, and good air movement.


LABS: Troponin trend: 2.9->6.4- >11.9> 13.3 -> 9.7, D dimer 650, CRP 0.4, ESR 10. Imaging: Normal CT pulmonary angiogram. TTE with normal LV and RV size and systolic function, EF 60-65%, no valvular abnormalities. Cardiac MRI: Mild hypokinesis in the basal septum to the mid LV with mild hypokinesis.

FINAL WORKING DIAGNOSIS: Myocarditis TREATMENT AND OUTCOMES: 1. Colchicine and high dose ibuprofen taper over 3 weeks 2. Avoidance of physical activity for 3-6 months per AHA guidelines 3. Resting and stress TTE and EKG, 24-hour Holter monitor prior to RTP.
DIFFERENTIAL DIAGNOSIS:
1. Bone spur
2. Partial tear of Achilles tendon
3. Bursitis
4. Hindfoot fracture

TEST AND RESULTS:
X-ray AP and lateral views of left ankle were normal.
MRI left ankle revealed a nondisplaced fracture of the calcaneus. There was no signal abnormality involving the Achilles tendon and it appeared intact.

FINAL WORKING DIAGNOSIS:
Nondisplaced calcaneus fracture

TREATMENT AND OUTCOMES:
Placed in a pneumatic boot with weight bearing as tolerated.
Out of pneumatic boot at 8 weeks.
Began physical therapy at 7 weeks.
Planning to return to skiing this winter as injury occurred in the spring.

OUTCOMES:

Ankle Rules

HISTORY: A 16-year-old senior high school football wide receiver sustained an ankle injury while getting tackled after a catch. During the last few minutes of the game, he sustained an inversion ankle injury while falling to the ground during a tackle. He reported pain at the lateral malleolus during the on-field examination and was able to bear weight on the leg while walking off of the field, even though he was limping. He denied any previous ankle injuries, numbness, tingling, or radiation of pain.

PHYSICAL EXAMINATION: Examination on the field revealed full range of motion, no gross deformities, and tenderness along the anterior lateral malleolus.

Further evaluation on the sideline revealed pain at the lateral ankle with inversion and eversion against resistance. The athlete was tender to palpation along the anterior lateral malleolus. Bilateral ankle drawer test, squeeze test, external rotation stress tests are negative/unremarkable.

DIFFERENTIAL Diagnosis: Osteoid osteoma, Intracortical hemangioma, Nonossifying fibroma, Distal fibula physeal injury, Chondromyxoid fibroma, Ewing sarcoma, Langerhans cell histiocytoma, Osteosarcoma, Stress fracture

Tests and results: Initial plain films: Focal lucency in distal left fibular metaphysis abutting the physis. Periosteal reaction and overlying soft tissue swelling. MRI: MRI left ankle revealed a nondisplaced fracture of the calcaneus. There was no signal abnormality involving the Achilles tendon and it appeared intact. MRI left ankle: Focal luency in distal left fibular metaphysis abutting the physis. Periosteal reaction and overlying soft tissue swelling.

Treatment and Outcomes: Orthopedics service was consulted and patient underwent debridement of left ankle and curettage of the distal fibula. Admitted overnight for administration of IV vancomycin and cefazolin. Infectious disease service was consulted. He was discharged with one month of oral antibiotics (cefadroxil) following operation. Cultures from tissue taken remained negative. However, the patient did have a positive nares MSSA swab. He was able to return to activity and he recovered well, without significant events or issues.

B-53 Clinical Case Slide - Oncology I

Wednesday, May 27, 2020, 3:15 PM - 4:35 PM
Room: CC-2022

844 Chair: Thomas Trojan, FACSM. Drexel University, Philadelphia, PA.
(No relevant relationships reported)

845 Discussant: Shawn F. Kane, FACSM. UNC - Chapel Hill, Carrboro, NC.
(No relevant relationships reported)

846 Discussant: Scott A. Magnes, FACSM. Fort Belvoir Community Hospital, Fort Belvoir, VA.
(No relevant relationships reported)

847 May 27 3:15 PM - 3:35 PM
A 26 Year Old Pregnant Woman With Growing Wrist Pain
Keyur Desai. University of Chicago (NorthShore), Glenview, IL.
(Sponsor: Carrie A. Jaworski, FACSM)
Email: KeyurD@gmail.com
(No relevant relationships reported)

HISTORY: A 26 year old G1P1001 right-hand dominant woman presents 4 weeks after delivery for insidious onset right ulnar-sided wrist pain. Pain was initially present 6 months prior to visit during pregnancy. Her symptoms were initially intermittent but eventually progressed to constant pain. Pain is localized to the distal ulna without radiation. Patient endorses swelling. Patient has no previous history of wrist and hand pain or injury. Patient denies any mechanism of injury or trauma. Patient denies numbness and tingling.

PHYSICAL EXAMINATION: Vital signs: 133/77, HR 79, T 97.5°F, 1.68m, 75.3kg, BMI 26.62
Inspection: Right wrist swollen medially
Palpation: Tenderness over volar aspect of distal ulna
Range of motion: Full AROM of wrist flexion, extension, supination, pronation, ulnar deviation, radial deviation. Pain with resisted flexion, end-range supination and pronation, and with ulnar deviation.
Strength testing: Strength 5/5 of wrist flexors, extensors, supination, pronation. Special testing: Sensation preserved over C3-T1 dermatomes. Negative Tinel’s, Negative Phalen’s.

DIFFERENTIAL DIAGNOSIS:
1. ECU Tendonitis
2. TFCC Tear

Abstracts were prepared by the authors and printed as submitted.
3. Anticipated return to play in 4-6 weeks.

mm x 5 mm nidus; deferment of radiofrequency ablation due to proximity to the joint.

symptomatic treatment. 2. Surgical curettage and excisional biopsy of the 7 mm x 4

of the first distal phalanx measuring 7 mm x 4 mm x 5 mm with faint lucency proximal

to the sclerosis.

hyperintensity in the distal phalanx. Nuclear medicine bone marrow imaging - mild

marrow edema throughout the first distal phalanx; no corresponding focal signal

acute fracture; joint spaces well preserved. MRI of right foot without contrast - diffuse

phalanx 2. Subacute/Chronic Osteomyelitis 3. Bony Tumor

erythema or induration. Tendon function was intact. The foot was neurovascularly

appearance, negative signs of infection. Tender to palpation over this area. Range of

activity he presented to be seen by a dermatologist.

pigmented lesion on the sole of his right foot with the appearance of a blood blister

history: A 19-year-old male college sophomore football defensive lineman noted a

Skin Cancer – Football

History: A 19-year-old male college sophomore football defensive lineman noted a

pigmented lesion on the sole of his right foot with the appearance of a blood blister

at the end of his freshman year. Over the next weeks to months the lesion grew in size

and also became painful with activity. Because the pain was limiting him with football

activity he presented to be seen by a dermatologist.

Physical exam: Right foot without soft tissue swelling, area on the plantar surface of

the first metatarsal approximately 1.5cm in size with dark coloration, black in

appearance, negative signs of infection. Tender to palpation over this area. Range of

motion intact at the first metatarsal in flexion and extension without pain. Plantar and
dorsiflexion, inversion and eversion intact at the ankle. Pain with ambulation when

weight bearing on the area. Sensation intact to light touch. Dorsalis pedis pulse 2+.

- Malignant Melanoma in situ, the deep biopsy margin being free in the tissue planes

examined. Lesion involves the peripheral biopsy margin.

Lesion Excision
- Malignant melanoma, 3.3mm

Final/Working Diagnosis:
Acrail Lentiginous Melanoma

TREATMENT AND OUTCOMES: 1. Patient underwent resection of the right foot melanoma in situ with a total defect of

2x2cm, with subsequent adjacent tissue transfer 5x3cm. 2. Sentinel node sampling performed which identified microscopic foci of melanoma in both sentinel nodes resulting in Stage IIIB (T3a, N2a), genetic testing performed showing BRAF negative. 3. PET scan performed showing no evidence of residual disease or metastatic focus. 4. Started on Nivolumab 480mg IV monthly for 13 doses. 5. Patient able to return to football competition in the middle of November, competing in the last few games of his sophomore season.


Test and Results:
Shave biopsy of the right plantar forefoot overlying the first metatarsal:

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**851** Chair: Silvia Pogliaghi, FACSM. Università di Verona, Verona, Italy.
(No relevant relationships reported)

Traditionally, determining critical power (CP) and its related work above CP (W') requires exhaustive constant-power trials interspersed by at least 24 h rest. During the last decade several approaches were undertaken to make the protocol less time consuming and to use self-paced ecological time-trials (TT). However, it is debatable whether residual fatigue induced by a single-visit protocol might affect CP and/or W'. Parameters of oxygen uptake (VO$_2$) kinetics and muscle deoxygenation can be suggested as suitable to assess the effects of residual fatigue. **PURPOSE:** Assessing fatigue-related parameters of VO$_2$ kinetics and muscle deoxygenation between a single-visit and a multi-visit protocol. **METHODS:** Nine well-trained male triathletes (mean ± SD; age: 27.7 ± 4.3 yrs; body mass: 75.6 ± 5.6 kg; VO$_2$max: 60.0 ± 6.5 mL/min/kg) participated. Athletes had to perform a single-visit (2, 5 and 10 min TT, interspersed by 30 min passive rest) as well as a multi-visit determination of CP and W' (2', 5' and 10 min TT, interspersed by at least 24 h rest). During all tests, heart rate (HR) was recorded continuously, respiratory gases were measured breath-by-breath and deoxygenation was recorded at 10 Hz using near infrared spectroscopy (NIRS). The following parameters were assessed: maximal HR, VO$_2$, during the first 2 min (VO$_2$0:00), mean response time (MRT), end-exercise VO$_2$, (VO$_2$end), VO$_2$ amplitude (amplVO$_2$), O$_2$ deficit, NIRS τ, amplitude (amplNIRS), and time-delay (TD). To compare the two protocols a paired sample t-test was used to assess the differences in CP and W' and a two-way ANOVA to assess the differences between trials and/or groups as well as and trials x groups interactions. **RESULTS:** No significant differences were found for CP or W' between protocols (p > 0.05). Significant main effects between trials were found for HR, VO$_2$, amplVO$_2$, τ and amplNIRS (p < 0.001), but not for MRT, VO$_2$end, O$_2$ deficit and TD (p > 0.05). A post-hoc analysis of main effects did not reveal significant differences between corresponding trials (p = 0.05). **CONCLUSIONS:** Due to non-significant differences in fatigue-related parameters results indicate that the determination of CP and W' using a single-visit protocol is not affected by residual fatigue. Consequently, the single-visit TT approach is a valid method to accurately determine CP and W'.

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(No relevant relationships reported)

Whether pulmonary oxygen uptake (VO$_2$) kinetics are limited by O$_2$ delivery remains contentious. Previous studies have demonstrated that the time constant of pulmonary VO$_2$ kinetics (τ$_{VO_2}$) is greater during supine compared to upright cycle exercise, presumably reflecting the superimposition of an O$_2$ availability limitation. However, interpretation of these studies is compromised by their use of superficial single-site measurements using continuous-wave near-infrared spectroscopy (NIRS), which is unable to determine absolute [heme]. **PURPOSE:** To determine the impact of body position (i.e. upright [U] vs. supine [S]) on the kinetics of pulmonary VO$_2$ as well as muscle deoxygenation (deoxygen[heme]) kinetics and total[heme] using time-resolved (TR-NIRS). **METHODS:** 7 healthy men completed an incremental ramp test to determine VO$_2$max and the gas exchange threshold in the supine position. 4 visits followed whereby pulmonary VO$_2$ and deoxy[heme] kinetics and total[heme] were determined via TR-NIRS at three muscle sites (deep [VLd] and superficial [VLs] vastus lateralis and superficial rectus femoris [RFs]) in two conditions: 1) during S heavy intensity constant work rate exercise at 40% (between ventilatory threshold and VO$_2$max), and 2) during U exercise at the same absolute work rate. **RESULTS:** τ$_{VO_2}$ was increased during S compared to U (S: 42 ± 12 vs. U: 32 ± 9 s, P = 0.05). The fundamental phase deoxy[heme] was greater (i.e. slower) in S compared to U for each muscle site (VLd S: 19 ± 10 vs. U: 8 ± 5 s; VLs S: 16 ± 7 vs. U: 10 ± 3 s; RFs S: 20 ± 7 vs. U: 11 ± 3 s, P = 0.002) and its amplitude was greater in S compared to U for RFs only (S: 27.4 ± 12.1 vs. U: 9.1 ± 2.5 µM, P = 0.008). Total[heme] did not differ between U and S for any muscle site (all P > 0.05). **CONCLUSION:** The slowing of pulmonary VO$_2$ kinetics for S versus U occurs concomitant with a depressed rate of muscle(s) deoxygenation. This finding suggests that supine exercise results in a relatively greater fall in muscle VO$_2$ when compared to O$_2$ delivery kinetics at least for VLd and VLs. The increased amplitude of deoxy[heme] in S for RFs suggests an increase in O$_2$ extraction to compensate for impaired muscle perfusion in S compared to U.

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**853** May 27 3:25 PM - 3:35 PM Influence Of Body Position On Pulmonary Oxygen Uptake And Muscle Deoxygenation Kinetics During Cycle Exercise

Richie P. Goulding1, Dai Okushima1, Simon Marwood2, Tze-Tuan Le1, Naruhiko Kondo1, David Poole2, FACSM1, Thomas J. Barstow, FACSM1, Shunsaku Koga1. 1Kobe University, Kobe, Japan. 2Osaka International University, Osaka, Japan. 1Liverpool Hope University, Liverpool, United Kingdom. 2Kobe University, Kobe, Japan. 3Kansas State University, Kansas, KS. Email: gouldingrichie@gmail.com
(No relevant relationships reported)

Skeletal muscle oxygen (O$_2$) consumption is linked to the metabolic demand of the exercising skeletal muscle. In hypoxic conditions (e.g. high altitude) O$_2$ consumption may be the limiting factor of exercise tolerance. Patients with increased O$_2$ content, secondary to an increased oxygen affinity (HAH), provide an experiment of nature to investigate the effects of increased flux through the O$_2$ transport pathway on exercise tolerance. **PURPOSE:** To determine the effect of HAH on O$_2$ uptake kinetics and exercise tolerance during high-intensity exercise under normoxia (NORM) and hypoxia (HYP) conditions. **METHODS:** Five healthy controls (CTL; 4 men, 41±8 years, P$_{O_2}$=17±1 mmHg; Hemoglobin concentration (Hb)= 14.2±1.3 g; dL; hemocrit (Hct)= 41±4%)) and five patients with high-affinity hemoglobin (HAH; 3 men, 37±12 years, P$_{O_2}$=15±2 mmHg; Hb: 19.8±2.3 g; dL; Hct= 59±7%) cycled during unloaded pedaling then at a power output that elicited 85% VO$_2$max until volitional exhaustion during two different environmental conditions: 1) NORM, (P$_{O_2}£0.21$), and 2) HYP, (P$_{O_2}<0.15$). O$_2$ uptake kinetics were modeled as a double-exponential rise to maximum from continuous measurements of inspired/expired gases. Two-way ANOVA with group (HAH, CTL) and inspirate (NORM, HYP) as between-subjects factors were used to compare dependent variables. **RESULTS:** HAH patients had marked polycythemia (higher [Hb] and Hct, P<0.05 for both). There was no effect of inspirate on any of the parameters of O$_2$ kinetics, all P>0.175. There was no main effect of group or inspirate on VO$_2$, during unloaded pedaling (A, P=0.24, VO$_2$, of the primary component (A, P=0.13), or the VO$_2$, slow component (P=0.10). HAH exhibited a trend towards slower O$_2$ kinetics (HAH=64.3±17.7 s vs. CTL=49.2±17.0 s, P=0.08) and significantly lower primary component amplitude (HAH=14±6.6 L min$^{-1}$ vs. CTL=9.2±6.7 L min$^{-1}$, P=0.02). There was a trend towards reduced time-to-exhaustion in HYP (P<0.09), but no main effect of group (P=0.21). **CONCLUSION:** Patients with HAH had slower and blunted VO$_2$, kinetics, which may be due to 1) blunted O$_2$, off-loading to the contracting skeletal muscle or 2) adaptations of skeletal muscle (e.g. myosin heavy chain expression) to HAH.
WEDNESDAY, MAY 27, 2020

Influence Of Priming Exercise On Muscle Deoxygenation Kinetics During Upright And Supine Cycle Exercise

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A bout of prior heavy "priming" exercise typically reduces the time constant of fundamental phase oxygen uptake (VO2) kinetics (τVO2) in the supine position, an effect that is generally absent during upright exercise. This priming-induced speeding of pulmonary VO2 kinetics has been attributed to increased muscle oxygenation at the onset of the second bout. However, the extent to which priming-induced improvements in muscle oxy/deoxygenation status differ across distinct muscle regions, as well as between deep vs. superficial muscle and with respect to body position, remains unknown. PURPOSE: To examine the impact of priming exercise on pulmonary VO2, and muscle deoxygenation kinetics at three muscle sites (superficial rectus femoris [RFs], deep [VLd] and superficial [VLs] vastus lateralis) using time-resolved near-infrared spectroscopy during upright (U) and supine (S) exercise. METHODS: 7 healthy men completed an incremental ramp test to determine VO2 max and the gas exchange threshold in S. 4 visits followed whereby participants performed two 6-min bouts of heavy exercise separated by 6-min unloaded pedaling in two conditions: 1) during constant power exercise at 40% VO2 max; and 2) during exercise at the same absolute work rate in U. Pulmonary VO2, and muscle deoxygen[heme] kinetics were determined during each test. Mean arterial oxy-hemoglobin saturation ([Sao2]) and deoxygen[heme] amplitude were calculated. RESULTS: VO2 kinetics (τVO2) was similar between U and S. An effect on muscle deoxy[heme] kinetics were observed. The fundamental phase deoxy[heme] kinetics were greater in U for RFs in both postures (S: 1: 42 ± 12 vs. bout 2: 31 ± 7 s, P = 0.016) but not in U (bout 1: 32 ± 9 vs. bout 2: 28 ± 5 s, P = 0.32). The fundamental phase deoxy[heme] amplitude was greater in U for S (S: 0.02 ± 0.01 vs. U: 0.01 ± 0.003, P = 0.02). The fundamental phase deoxy[heme] amplitude and amplitude did not differ between bouts 1 and 2 for RFs in either condition. CONCLUSION: Prior heavy exercise increased deoxy[heme] in S but not U. This was accompanied by a greater and slower rate of muscle deoxygenation in superficial but not deep muscle. The contrasting responses of deep and superficial muscle to priming exercise in both U and S suggests that these muscles rely on fundamentally different O2 transport strategies.

Beneficial Effects Of Exposure To Mild Hyperbaric Oxygen On Microcirculation In Peripheral Tissues

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The intent of exposure to mild hyperbaric oxygen (mHBO) is to increase the oxygenation of a person's blood by forcing additional oxygen to dissolve into the blood plasma. There is a lack of substantial evidence regarding responses of exposure to mHBO on microcirculation in peripheral tissues, and this research will provide insight into it. PURPOSE: To determine the beneficial effects of exposure to mHBO on microcirculation in peripheral tissues. METHODS: In this experimental study 15 healthy individuals were exposed to both normobaric (1.00 ATA with 20.9% oxygen) and mHBO (1.4 ATA, Oxygen Concentration 30.8% - 39.5%) in a mild hyperbaric oxygen chamber for 70 minutes in each condition. Peripheral capillary oxygen saturation (SpO2) and blood flow in capillaries of muscles and skin were measured every 15 minutes during both exposures in the supine position. Repeated measures ANOVA and paired t-test were used for statistical comparisons. An analysis with a p-value <0.05 was considered significant. RESULTS: The mean age of participants was 24.6±4.9 years and mean BMI was 20.5±2.7. Average blood flow in capillaries was increased from 94±4 μm^2/s before exposure to mHBO and it was unchanged after exposure to the normobaric condition. We found a significant effect of conditions (p<0.008), time (p<0.001) as well as interaction effect (p<0.001). Conclusions: The results of this study confirm that exposure to mHBO increases oxygen saturation and blood flow in the capillaries of peripheral tissues.

AcSM May 26 – May 30, 2020

San Francisco, California
During maximal single-joint knee extension and multi-joint leg extension movements, activation of the vasti knee extensor muscles is similar, however, little is known of the magnitude and etiology of fatigue development when these movements are repeated.

**Purpose**

To compare the magnitude and etiology of fatigue in the vasti knee extensor muscles following repeated maximal contractions performed through single-joint (knee extension) or multi-joint (leg extension) exercises.

**Method**

On separate days, 16 participants completed 60 maximal unilateral: i) knee extensions on a dynamometer (KEXT) or ii) leg extensions on a cycle ergometer (LEEXT). Knee range of motion (~120° - 30° flexion) and angular velocity (~80°/s) were matched. Maximal torque, vasti muscle EMG and M-wave amplitude (Mmax) were measured during the first and last three contractions of both exercises. Knee extensor isometric maximal voluntary force (IMVF), voluntary activation (VA) and resting twitch force (RT10:100 HZ) were measured pre-exercise and 40-s post-exercise.

**Results:**

Similar torque (KEXT: 152 ± 33 N·m vs. LEEXT: 165 ± 30 N·m, p > 0.05), EMG (KEXT: 95 ± 6% vs. LEEXT: 96 ± 8%, p > 0.05) and Mmax (KEXT: 95 ± 5% vs. LEEXT: 97 ± 5%, p > 0.05) were measured at the start of the exercises. Larger reductions in torque (KEXT: -60 ± 10% vs. LEEXT: -38 ± 14%) and EMG (KEXT: -21 ± 16% vs. LEEXT: -13 ± 16%) were seen for KEXT during the final part of the exercise (P < 0.05), whereas no differences were reported in Mmax (P > 0.05). Larger reductions in VA were seen after KEXT whereas greater reductions in RT10:100 Hz were seen after LEEXT (both P < 0.05). Ultimately, similar reductions in IMVF were seen following KEXT (-32 ± 10%) and LEEXT (-35 ± 13%) (P > 0.05).

**Conclusion:**

A lower-limb resistance training program which adopts multi-joint exercises may induce superior strength gains in vasti knee extensor muscles compared to single-joint exercises, as it is possible to induce larger levels of peripheral fatigue with a smaller reduction in voluntary activation.

876 Board #2 May 27 1:30 PM - 3:00 PM

Neural And Muscular Responses To Maximal Strength Training

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No relevant relationships reported

**PURPOSE:** Maximal strength training (MST), performed with heavy loads (~90% of one repetition maximum; IRM) and few repetitions (~4-5), yields large improvements in efferent neural drive and skeletal muscle force generating capacity. However, it is elusive how MST-induced neural adaptations may translate to muscular factors regulating excitation-contraction coupling. METHODS: Sixteen healthy young males (24-44 years) were randomized to MST 3 times per week for 8 weeks (n=8), or a control group (CG; n=8). Measurements were taken of IRM and rate of force development (RFD), and evoked potentials (V-wave and h-reflex normalized to M-wave (M) in musculus soleus) applied to assess efferent neural drive to maximally contracting skeletal muscle. Biopsies were obtained from vastus lateralis and analyzed by western blot and mRNA isolation to investigate the expression of sarcoplasmic reticulum Ca2+ ATPase (SERCA) and mRNA expression of SERCA1 and SERCA2, myostatin, MuRF1 and Ryanodine receptor (RyR1). RESULTS: IRM (17±9%; p<0.05) and early (0-100ms), late (100-200ms) and maximal RFD increased (31-53%; p<0.01) in the MST group, accompanied by increased maximal V-wave ratio (9±14%; p<0.05), with no change in H-reflex to M-wave ratio. No changes were observed in the CG. No pre- to post-training differences were found in mRNA or protein expressions in either group (p>0.05).

**CONCLUSION:** MST increased efferent neural drive to maximally contracting skeletal muscle, and resulted in improved force generating capacity. The neural adaptations were not reflected in key muscular factors involved in excitation-contraction coupling, indicating that responses to high intensity strength training may predominantly be governed by neural adaptations.

877 Board #3 May 27 1:30 PM - 3:00 PM

Ten Weeks Of Resistance Training Increased Total Hemoglobin Mass Without Increasing Maximal Oxygen Uptake

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No relevant relationships reported

**PURPOSE:** Resistance training increases muscles mass whereas maximal oxygen uptake remains normally unchanged. The purpose of the present study was to investigate the effect of 10 weeks resistance training on total hemoglobin mass, lean mass and maximal oxygen uptake in young healthy males.

**METHODS:** Thirteen young male subjects (age: 22.2±2.6 years; height: 177.7±3.7 cm) completed 10 weeks of resistance training. The resistance training consisted of 5 weekly sessions of full body resistance training. The training program consisted of 13 exercises; for all exercises, 3 sets with 12 repetitions were conducted. Each training session lasted 70-90 min. Body composition was measured with Dual-energy X-ray absorptiometry (DXA), total hemoglobin mass with CO rebreathing method, and maximal oxygen uptake was measured on treadmill.

**RESULTS:** Body mass did not increase significantly during the training intervention (before: 74.5±7.9; after: 77.6±6.2 kg; p=0.30), but fat free mass increased 8.8% (p<0.05). Total hemoglobin mass (Hb) increased from 865.1 ±70.6 to 981.2 ±89.8 g (p<0.05) during the training intervention and hematocrit was unchanged. Hemoglobin mass per kg body weight did not increase significantly (before: 11.0±1.7; after: 13.4±1.9 g·kg⁻¹; p>0.25). Maximal oxygen was 3.2±0.47 L/min before and 3.38±0.52 L/min after the resistance training. Maximum oxygen uptake related to body weight did not change during the training intervention (before: 44.4±4.0; after: 43.7±5.9 mL·kg⁻¹·min⁻¹).

**CONCLUSIONS:** Whole body resistance training for ten weeks increased fat free mass and Hb, but VO2max did not increase. These data show that increased total hemoglobin mass is not sufficient to increase maximal oxygen uptake in young healthy males.
times of day. Linear regression models isolated the effect of time on performance holding other influential factors constant. RESULTS: Across all movements, loads, and times, PPDFR_1 was 1.141 ± 0.4; PP_1 was 254.1 ± 120.0; PPDFR_ actual was 1.036.1 ± 631.6 w/s; and PPDFR_ was 1.245.4 ± 789.6 w/s. Differences in both PP and PP were detected by time of day (p<0.001) and load (p<0.001). The highest values were achieved between 2:00pm and 4:00pm. Similar relationships were found with time of day in PPDFR_ (p<0.001) and PPDFR_ (p<0.001). Holding constant the subject performing the set, arm dominance, exercise being performed, and the load applied, linear regression analyses found that if performance occurred between 2:00pm and 4:00pm, there was a 13.9 w/s increase in PPDFR_ (95% CI: 75.5-203.6), 164.7 w/s increase in PPDFR_ (95% CI: 79.7-249.8), 26.6 w/s increase in PP_ (95% CI: 20.7 ± 3.8.5), and 33.6 w/s increase in PP_ (95% CI: 24.4 ± 42.8). CONCLUSIONS: Success in many athletic contexts depends on expressions of power and the rate of its development. Our findings demonstrate random rhythms in power parameters of the upper limb, with optimal performance occurring in the afternoon.

880 Board #6 May 27 1:30 PM - 3:00 PM Assessing True Variability And Mean Changes To Two Distinct Resistance Training Protocols
Scott J. Dankel1, Zachary Bell2, Robert Spitz2, Vickie Wong2, Ricardo Viana2, Raksha Chatakondi1, Samuel Buckner1, Matthew Jesse2, Kevin Mattacks1, Grant Mouser1, Takashi Abe1, Jeremy Loenneke1, FACSM1.
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(No relevant relationships reported)

Millions of dollars are spent analyzing inter-individual differences in response to resistance exercise, but the lack of a non-exercise control group makes it possible that these studies may simply be examining random error. Furthermore, it has been hypothesized that the magnitude of variability may differ depending upon the exercise protocol employed, but this yet to be appropriately tested.

PURPOSE: To determine differences in two distinct resistance training protocols and whether true variability could be detected after accounting for random error.

METHODS: Individuals (n=151) were randomly assigned to one of three groups: (1) a traditional exercise group performing four sets of elbow flexion exercise to failure; (2) a one-repetition maximum (1RM) performing a 1RM elbow flexion test; and (3) a time-matched non-exercise control group. Both exercise groups performed 18 sessions over six weeks. A Bayesian ANCOVA was used to test for mean changes across groups while adjusting for pre-values. To assess whether the variability in each exercise intervention differed from that of the control group, Bayesian Levene’s tests were computed. Bayes Factors (BF_) were used to quantify evidence for or against the null hypothesis.

RESULTS: Both 1RM (2.3kg; BF_ = 4.791e+6) and traditional training groups (2.4kg; BF_ = 11,915) increased 1RM strength similarly (BF_ = 0.21), but only the traditional exercise group increased ultrasound measured muscle thickness (~0.23 cm across all sites; all BF_ ≥ 224). Across both training groups, the only differential responses were found in the change in 1RM strength of the trained arm in the traditional training group (BF_ = 5.383). This resulted in a true variability of 1.8 kg after the removal of random error.

CONCLUSION: These findings demonstrate the importance of taking into consideration the magnitude of random error when determining response heterogeneity, as many studies may be classifying individuals based on random error. Additionally, our mean results demonstrate that strength is largely driven by task specificity, and the cross-over effect of strength may be load dependent.

881 Board #7 May 27 1:30 PM - 3:00 PM Progressive Movement Training: An Analysis Of Its Effects On Muscular Strength And Power Development
Orrin Whaley, Abigail Larson, Mark DeBeliso, FACSM. Southern Utah University, Cedar City, UT. (Sponsor: Mark DeBeliso, FACSM)
(No relevant relationships reported)

Muscular strength and power are important attributes in many sports, so research on resistance training (RT) methods that may improve these attributes are of great interest. One such RT method is Progressive Movement Training (PMT) which incorporates a partial range of movement (ROM) with a supramaximal load. PURPOSE: This study compared the effects of PMT and traditional full ROM RT on the 1RM back squat (BSQ), vertical jump (VJ) height, and power output (PO). METHODS: High school male participants were randomly assigned to either a PMT RT group (n=21; age: 17.4±0.7 yrs, height: 174.9±1.8 cm, mass: 84.7±26.5 kg) or a full ROM RT group (n=15; age: 17.3±0.7 yrs, height: 175.9±1.8 cm, mass: 82.1±14.9 kg). The experimental groups then engaged in a 7-week intervention period using either the PMT or full ROM BSQ modality in order to target lower body strength and power. The participant’s body weight, 1-RM BSQ and VJ were measured prior to and upon completion of the intervention period. PO was calculated using the Lewis formula. No additional lower body auxiliary movements were performed in the study. Dependent t-tests (two-tailed) were used to compare the dependent variables (DV’s) from pre to post RT intervention within experimental groups. Independent t-tests (two-tailed) were used to compare the group scores for each of the DVs between experimental groups.

RESULTS: The PMT group improved significantly from pre to post intervention period for all DVs: 1-RM BSQ (pre: 96.0±37.8, post: 110.6±37.0 kg), VJ (pre: 55.8±8.0, post: 59.4±9.5 cm) and PO (pre: 1365.8±410.7, post: 1417.2±394.7 W) (p<0.01). The full ROM group improved significantly from pre to post intervention period for the 1-RM BSQ only (pre: 91.3±23.3, post: 102.3±19.4 kg) (p<0.01), VJ (pre: 59.3±9.8, post: 60.7±10.6 cm) (p<0.05) and PO (pre: 1359.3±203.9, post: 1397.1±221.8 W) (p<0.05). When comparing group scores between each group there were no significant differences between the PMT and full ROM groups for any of the DVs (p>0.05). CONCLUSION: Within the parameters of this study, PMT is as effective and may be more effective than full ROM RT for increasing lower body strength and power.

882 Board #8 May 27 1:30 PM - 3:00 PM Strength Adaptations And Body Composition Changes Following High Vs. Low Volume Resistance Training And Detraining
Simon Gavanda1, Sascha Schrey1, Julai Christine Eyre2, Stephan Geisler3. 1IST University of Applied Sciences, Düsseldorf, Germany. 2German Sport University Cologne, Cologne, Germany. Email: sgavanda@ist-hochschule.de
(No relevant relationships reported)

Resistance training (RT) is used for improving strength and body composition. However, it is still under debate whether higher RT volume (HV) is necessary in novices, or if lower volume (LV) is equally effective. In addition, effects of detraining (DTR) following HV and LV RT are not well understood.

PURPOSE: To determine the effects of a 12-week HV program (3 sets, 10 repetitions) compared to LV RT (1 set, 10 repetitions) to concentric muscle failure on strength and body composition, followed by four weeks of DTR in male and female subjects.

METHODS: Forty-two untrained subjects were randomly assigned to either LV (female n=10; male n=10; age 23.9±11.8y, height 174.2±8.4cm; weight 70.3±13.5kg) or HV RT (female n=11; male n=11; age 33.0±9.6y, height 174.2±11.2cm; weight 72.4±18.1 kg). RT consisted of two RT sessions per week (squat, bench press, arm and leg flexion and extension). Measurements were taken prior to and post RT, and after DTR. Body composition was assessed using BIA. Strength measurement (10-RM) was done using the aforementioned exercises. Six subjects were eliminated from the study due to various reasons, resulting in 36 subjects included for further analysis (HV female n=10, male n=8; LV female n=9, male n=9). Compliance was 100%. Comparisons were made using two-way ANOVA with repeated measures.

RESULTS: Both groups increased strength through RT with no difference between groups (squat HV 61.1% vs. LV 59.0%, p=0.001; bench press HV 28.9% vs. LV 31.3%, p=0.001; leg extension HV 54.6% vs. LV 50.2%, p<0.001; leg flexion HV 30.9% vs. LV 30.3%, p<0.001; arm extension HV 51.0% vs. LV 44.8%, p<0.001; arm flexion HV 36.9% vs. LV 31.7%, p<0.001). Body mass (p=0.182), fat mass (p=0.238), and fat-free mass (p=1.000) were no significant differences between the PMT and full ROM groups for any of the DVs (p>0.05). Within the parameters of this study, PMT is as effective and may be more effective than full ROM RT for increasing lower body strength and power.
Board #10
May 27 1:30 PM - 3:00 PM
Acute Response Of Blood Glucose After Two Resistance Training Protocols With Different Execution Velocities
Jhonatan C. Peña Ibagon1, Cristian Yanez2, Lorena Benavides1, Jose Garcia1, William Martin2, Carlos Castillo1. 1Fundación universitaria del área andina, Bogota, Colombia. 2Corporación universitaria Cenda, Bogota, Colombia. 3Corporación Universitaria Cenda, Bogota, Colombia. (No relevant relationships reported)

PURPOSE: Studies have demonstrated that a single session of resistance training (RT) can reduce glycaemia in subjects with or without diabetes. The aim of this study was to compare the acute response of blood glucose after 2 resistance training protocols with different execution velocities in amateur weightlifting athletes.

METHODS: A randomized clinical trial was conducted in 24 amateur weightlifting athletes (23.5± 6.2 years). The participants were randomized into 2 groups: high velocity (MV, n=12) or low velocity (LV, n=12). The RT training protocol was based on a session with these characteristics: 3 sets of 12 repetitions at 60% of a maximum velocity (MV, n=12) or 60% of a maximum velocity (LV, n=12). The sex x body type interaction was not significant (p=0.60). Absolute strength gains were significantly correlated with initial strength in both men (r=0.46) and women (r=0.43) but no significant difference among body types (p=0.12). The sex x body type interaction was not significant (p=0.38). Relative strength gains were significantly correlated with initial strength in both men (r=0.34) and women (r=0.37) and with body type (r=0.10 and r=0.12, respectively).

CONCLUSIONS: When following the same RT program, men make a greater absolute gain but women make a greater relative gain in upper-body strength. Body type does not seem to influence the degree of absolute or relative strength gain in RT in either sex. Initial strength level has little influence on the amount of strength to be gained during short-term training.

Board #12
May 27 1:30 PM - 3:00 PM
Muscle Damage And Inflammatory Response From Resistance Exercise With Higher Vs Lighter Loads
Gilmar Weber Senna1, Estevão Scudese2, Paula Paraguassu Brandão3, Matheus Balfi4, Breno Vargasi5, Leandro Guimarães6, Gabriel Bronzeri7, Flavia Soares Carrilho, Cristiano Queiroz de Oliveira7, Fabiana Rodrigues Scartoni7, Estelio Herinek Martin Dantas1,2, Carol Castro1,2. 1Catholic of Petropolis University, Petropolis, Brazil. 2Federal University of State of Rio de Janeiro, Rio de Janeiro, Brazil. 3Tirantes University, Petropolis, Brazil. (No relevant relationships reported)

Resistance exercise is considered the most efficient strategy for strength, power, and muscle endurance enhancement. PURPOSE: The aim was to analyze the effects of different resistance exercise (RE) loads on inflammatory response and muscle tissue damage. METHODS: Ten trained men with at least one year of resistance training were selected (26.40 ± 4.73 years, 80.71 ± 8.95 kg, 176.03 ± 6.11 cm, 9.86 ± 3.25% body fat, hand pinch relative strength: 1.27 ± 0.27 kg/kg-1 of body mass), and alternately ordered to perform two separate visits. The first consisted of five submaximal sets of 10 repetitions at 80% of 1RM, and the second consisted of five submaximal sets of 20 repetitions at 40% of 10RM, for the horizontal bench press and leg press exercises with one-minute of rest, guaranteeing the volume equalization for both conditions. Circulating concentrations of creatine kinase (CK), lactate dehydrogenase (LDH), and leucocyte count were measured at pre-exercise (PRE) and post 3h, 6h, 12h, and 24h. RESULTS: The ANOVA presented increases in CK compared to the PRE moment, from 6h (p<0.0001), to 24h after the higher 80% of 10RM load. The area under the curve differed significantly (p=0.009) between 80% of 10RM (4572.42 ± 1169.54 u/L) and 40% of 10RM (3268.68 ± 1042.02 u/L). For the LDH concentration, a significant interaction effect (load x moment of the checks) was observed (p=0.019). Specifically, for the main effect of verification moments (p<0.0001), the data revealed that the loadings protocols had a significant increase in LDH compared to PRE at 12 hours after exercise. The magnitude of the findings verified by the effect size showed large elevations of LDH from 6h to 12h for the higher load condition. For the 40% of 10RM load, large elevations were observed in 3h, 6h, 12h, and 24h. For leucocyte count, the main effect of verification moments elevations (p<0.0001), occurred from the time of 3h to 12h after exercise for both conditions. CONCLUSION: We found differences in tissue damage such an increase in the CK lesion marker with 80% 10RM loading, which did not happen with 40% 10RM loading, however with no differences on the inflammatory response concerning the total leukocyte count, neutrophils, lymphocytes and monocytes between different loads conditions. Supported by CAPES Brazil: 2.034.766.

Board #13
May 27 1:30 PM - 3:00 PM
Ischemic Preconditioning Of Thigh Muscles: Number Of Proper Repetitions And Effectiveness
Akero Ishiizawa1, Koichi Okita1, Hisato Tanaka1, Kengo Tao2, Noriteru Morita2. 1Hokkaido University, Ebetsu, Japan. 2Hokkaido University of Education, Ivanizawa, Japan. Email: ishikake1483@outlook.jp (No relevant relationships reported)

Ischemic preconditioning (IPC) was introduced after it was demonstrated that short periods of ischemia and reperfusion of coronary arteries can reduce the myocardial damage following prolonged ischemia (direct IPC). It was later shown that the IPC of coronary arteries also protects remote cardiac tissue not directly exposed to IPC (remote IPC). Several studies suggested that the IPC of a limb may protect...
remote organs against an ischemic incident. Because of the intermittent nature of blood flow during intense muscle actions, it was proposed that IPC prior to exercise could increase muscular performance. Although most of the prior exercise studies used an IPC protocol involving four cycles of 5-min circulatory occlusion followed by a 5-min reperfusion period, the optimal number of repetitions of IPC has been unknown.

**PURPOSE:** We examined the effects of direct IPC on thigh strength and sought to determine the optimal repetitions of IPC for successful results. **METHODS:** In a randomized cross-over study, 12 healthy young males (19.8 ± 2.1 yrs, body mass index: 22.1 ± 2.7 kg/m²) performed maximal knee extension (Biodex System 3; New York, USA) of the right leg preceded by direct IPC at four different repetitions (1, 2, 3, and 4 sets) and a control intervention. One IPC consisted of 5-min circulatory occlusion by 1.3-times systolic blood pressure and 5-min reperfusion. **RESULTS:** There was no significant difference in the maximal voluntary torque of knee extension between the control and any number of repetitions of the IPC, as shown below.

<table>
<thead>
<tr>
<th>MVT</th>
<th>Control</th>
<th>1 set</th>
<th>2 sets</th>
<th>3 sets</th>
<th>4 sets</th>
</tr>
</thead>
<tbody>
<tr>
<td>60°/sec, Nm</td>
<td>287.3 ± 46.3</td>
<td>275.3 ± 46.3</td>
<td>276.4 ± 47.1</td>
<td>270.2 ± 52.0</td>
<td>262.6 ± 44.5</td>
</tr>
<tr>
<td>180°/sec, Nm</td>
<td>191.9 ± 25.2</td>
<td>190.5 ± 23.6</td>
<td>193.5 ± 31.6</td>
<td>188.3 ± 22.7</td>
<td></td>
</tr>
<tr>
<td>300°/sec, Nm</td>
<td>144.7 ± 21.4</td>
<td>150.0 ± 17.4</td>
<td>144.7 ± 18.3</td>
<td>146.2 ± 16.7</td>
<td>141.7 ± 16.4</td>
</tr>
</tbody>
</table>

MVT: maximal voluntary torque; Nm: newton meter. Data are means ± SD (n=12).

**CONCLUSIONS:** These data indicate that direct IPC for the lower limb muscles could not improve maximal strength regardless of the number of repetitions. The application of pre-exercise IPC for improving performance should be further carefully examined concerning the optimal protocol and its indications, such as exercise types and target muscles.

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**Board #14**

**Effect Of Respiratory Training On Vas Pain Rating And Via Thickness In Patients With Chronic Non-Specific Lumber Pain**

Li Huang, Li Peng, College of Physical Education, South-West University, Chongqing, China.

(No relevant relationships reported)

**PURPOSE:** Non-specific low back pain (NLBP) is defined as a lumber pain that does not belong to an identifiable specific pathology. The probability of experiencing lumbar pain in one’s lifetime is as high as 84%. According to the most accurate estimate, the prevalence of NLBP is 23%, and 11% of them have disabilities as a result. Compared with conventional physical therapy methods, core strength training can effectively relieve patients’ pain. Due to the overlap of the core muscle group and respiratory muscle in the anatomical structure, there is also a certain relationship in its function. But it is easy to ignore the training of respiratory muscle during the core force training.

Therefore, this study compared the effect between respiratory training combined with core strength training and single core strength training in patients with NLBP, in order to confirm the effect of respiratory training on NLBP.

**METHODS:** 26 patients with NLBP were equitably distributed into observation group and control group according to random number table method. All the patients were taken in 3*40min exercise intervention for 8 weeks. The observation group adopted breath training combined with core strength training, while the control group only conducted core strength training. The VAS score measured with pain visual analog scale (VAS) and the thickness of transverse abdominis of patients were determined with Bone Ultrasound Instrument before and after the intervention.

**RESULTS:** The difference of VAS scores (4.40-1.30 vs. 4.45±1.29, P=0.92) and thickness of transverse abdominis (0.35±0.03 vs. 0.37±0.03, P=0.12) between groups were not obvious before intervention. But VAS score in observation group was significantly lower than that in the control group (0.42±0.03 vs. 0.39±0.01, P=0.00) after intervention.

**CONCLUSIONS:** The effect of respiratory training combined with core strength training on patients with NLBP is significantly better than that in the single core strength training, suggesting that respiratory training plays an important role in the treatment of NLBP.
Pushing and pulling occurs in athletic and nonathletic settings. Weaknesses in either movement could compromise sport performance or daily functioning. Determination of optimal load may aid in sport performance and reduce the risk of injury. **PURPOSE:** To determine power output differences between men and women using colinear stimuli. **METHODS:** We enrolled 32 recreationally active men (n=14) and women (n=18), ages 18-25, to evaluate power profiles in horizontal and vertical push and pull exercises using Proteus (Proteus Motion, USA), which applies continuous, three-dimensional, concentric resistance. Subsequent data collection involved 2 repetitions with the dominant arm at 7ib, 14ib, 21ib, and 28ib in each exercise (32 total repetitions). Proteus software computed power output in watts for each set performed. Analysis of variance (ANOVA) with repeated measures tested the difference in power output at each load. **RESULTS:** In both horizontal and vertical pull motions, there was a significant difference by load (p<0.001) and an interaction effect by sex (p=0.001). The expression of power was most similar between men and women at the lowest resistance horizontally (p=0.020) and vertically (p=0.038); both deviated more as weight increased. No plateaus were demonstrated in either sex; higher loads were required for both sexes to achieve peak power. In horizontal and vertical push motions, there was a significant difference by load (p<0.001) and an interaction effect with sex (p<0.001). Men and women were closest in power at 7ib horizontally (p=0.017) and vertically (p=0.004). Women experienced a plateau at 21ib; further change was insignificant both horizontally (p=0.147) and vertically (p=0.519). Men did not exhibit a plateau; power continued to increase from 21ib to 28ib (p<0.001).

**CONCLUSIONS:** In our population, the power produced between sexes was similar in push motions, but differed in pulls. By assigning sex-specific training loads, athletes can optimize performance.
in blood lactate concentration and lifting velocity during and after the application of the two protocols for strength gain and muscle hypertrophy. However, blood lactate concentration was significantly higher in men than in women.

**B-64 Free Communication/Poster - Running**

**Wednesday, May 27, 2020, 1:30 PM - 4:00 PM**

**Room: CC-Exhibit Hall**

**895 Board #21 May 27 1:30 PM - 3:00 PM**

**Distance Runners’ Perceptions Of A Strength Training Intervention**

Danielle Trowell1, Aaron Fox1, Natalie Saunders1, Bill Vicenzino2, Jason Bonacci3, 1Deakin University, Melbourne, Australia. 2University of Queensland, Brisbane, Australia. 3University of California, Davis, CA. Email: danielle.trowell@ausport.gov.au

(No relevant relationships reported)

**PURPOSE:** This study is one part of a Randomised Controlled Trial investigating the effect of strength training on distance runners’ mechanics and performance. The aim of this study was to examine runners’ perceptions of the strength training intervention.

**METHODS:** Thirty distance runners (18 male, 12 female) were recruited for this study. In addition to their normal running training, the experimental group undertook strength training two days per week for 10 weeks. Total training time was matched, with the control group performing additional low-intensity running and body-weight exercises. Running performance and biomechanics during submaximal running (3.8 m/s) and maximal sprinting were assessed immediately before and after the intervention period. At the completion of the 10 week intervention period, the strength training group were also surveyed on their perceptions of the strength training intervention using an online questionnaire in Qualtrics.

**RESULTS:** Twenty-eight participants completed follow-up testing. Strength training significantly improved two kilometre running performance (F(1,26) = 10.497, p = .003, partial η² = .288) more than running training alone. The mean (95% CI) difference between groups was 11.31 (3.73 to 18.98) seconds. However, strength training did not change maximal aerobic capacity, running economy (3.3 m/s) or lower-limb joint kinematics or kinetics during running. Survey responses showed 64% (n = 9 of 14) of the experimental group believed the strength training program improved their running performance and 79% (n = 11) reported they would continue using strength training. Half (n = 7) of the experimental group believed strength training had a considerable effect on their running technique.

**CONCLUSIONS:** Strength training appears to improve runners’ physical and task-specific self-efficacy, and increased confidence may facilitate faster running performance. This study also demonstrated a discrepancy between measured and perceived effects of strength training on running technique.

**896 Board #22 May 27 1:30 PM - 3:00 PM**

**Setting A New World Record: The Demands Of Running 833km On Treadmill In 7 Days**

Nicolas John Alexander Berger1, Russ Best2, Daniel Cooley3, 1Teesside University, Middlesbrough, United Kingdom. 2WINTEC, Hamilton, New Zealand. 3The Newcastle Upon Tyne Hospitals NHS Foundation Trust, Newcastle, United Kingdom. Email: n.berger@tees.ac.uk

(No relevant relationships reported)

Ultra-running (UR) comprises running events longer than a marathon (~42.2km). Due to the prolonged duration of UR, decrements in most or all physiological parameters are to be expected, and include a decrease in body mass and dehydration, loss of skeletal muscle mass and increased total body water. Purpose: to present data on a female multiple world record holding ultra-runner, examining haematological and physiological perturbations, as well as nutritional strategies throughout a successful 833km On Treadmill In 7 Days run. Methods: Sharon Gayer (SG) 47 years, 162.5cm, 49kg, VO2max 48 ml/kg/min; ran continuously for 7 days on a treadmill located at Teesside University, UK. 3-hours of running were followed by 30-minute breaks, and night-time rest from 1am-5am. Heart rate (HR), oxygen uptake (VO2), weight (kg), blood lactate (La; mmol/L-1), haemoglobin (Hb; g.DL-1), haematocrit (hct; %), glucose (G; g.l-1), and nutrition were recorded. Results: SG ran at approx. 7km/h for 17.5 hours/day, covering an average of 120km. Mean VO2 1.2 ± 0.1 L.min-1, 24.7 ± 3.2 ml.kg.min-1, RER 0.80 ± 0.03, HR 125 ± 5 b.min-1. Weight increased from 48.6 to 49.5kg. Hb decreased from 13.7 to 11 g.DL-1. Energy expenditure (EE) increased from 40% to 33%. Average G was 6.3 ± 1.6 g.l-1 (range 2.65-9.14 g.l-1), and average blood lactate was 1.0 ± 0.5 mmol.L-1 (range 0.4-3.3 mmol.L-1). Energy expenditure (EE) for each 24-hour period was 7878 kcal, and energy intake (EI) was 2701 kcal. Hourly EE was 382 kcal, with 66.6% and 33.4% of the energy coming from fat and carbohydrate oxidation, respectively. 7-day EI was 26,989 kcal and EE was 48,147 kcal, resulting in a total energy deficit (ED) of 21,156kal.

**Conclusion:** The previous record of 753.24km was extended by 79km to a new world record of 833.05km. SG exhibits an enhanced fat metabolism through which she covered the large daily ED. The increase in body weight could be the result of protein catabolism. The corresponding development of hypoproteinemic oedema, and increased plasma volume, likely lead to the reduced Hb and hct. Her success can be attributed to a combination of physiological and psychological factors, as she remained upbeat throughout the event and stated that she felt that the attempt was easy but became a bit ‘tedious’ towards the end.

**CONCLUSION**

There was high prevalence of low BMD (Z-score < -1.0) in high level male and female athletes and their respective controls. LS-BMD Z-score, RF-BMD Z-score and TB-BMD Z-score frequency count in the range of -1 to -2 and below -2 is shown in table 1.

| Table 1. Number of participants with Z-scores in the range of -1 to -2 and below -2. |
|-----------------------------------------------|----------------|---------------|
| F Athletes | M Athletes | F control | M control |
| (n=26) | (n=29) | (n=29) |
| LS-BMD Z <-2 | 7 | 5 | 6 | 7 |
| LS-BMD Z < -2 | 3 | 1 | 2 | 2 |
| RF-BMD Z <-2 | 5 | 2 | 3 | 3 |
| TB-BMD Z <-2 | 2 | 0 | 3 | 2 |
| * sample size for these values was 20; M = male, F = female |

**CONCLUSION**

There was high prevalence of low BMD (Z-score < -1) in high level male and female Kenyan distance runners and somewhat unexpectedly for control groups too; but, no statistical differences in bone health indices between female-male athletes and corresponding control groups. These findings warrant additional investigation to conducted into the energy balance, eating disorders, disordered eating and hormonal markers to further explain causality, both among Kenyan athletes and controls.

**Board #23 May 27 1:30 PM - 3:00 PM**

**Prevalence Of Low Bmd Of High-level Kenyan Male And Female Distance Runners Compared To Kenyan Controls**

Lauri Onnik1, Diresibachew Haile2, Anthony C. Hackney3, Robert Ojiambo4, Silva Suvi5, Amy R. Lane6, Martin Mooses7, 1University of Tartu, Tartu, Estonia. 2Moi University, Eldoret, Kenya. 3University of North Carolina, Chapel Hill, NC. Email: lauri.onnik@ut.ee

(No relevant relationships reported)

Kenyan male and female runners have dominated international running events for decades, however the information about their bone health to date is lacking. High training volumes and low energy availability concurrently could potentially impact greatly on bone health. Previous reports lack comparison with the proper control group.

**PURPOSE**

To determine the bone health indices of Kenyan high-level male and female distance runners.

**METHODS**

Participants were 26 female (28.7±6.3 yr; 51.8±5.0 kg; 16.1±0.7 mmol.l-1, IAAF performance score: 1029±132 pt) and 30 male (28.1±3.8 yr; 57.7±6.1 kg; 1.73±0.05 m; 19.6±1.8 kg.m-2; IAAF performance score: 1087±66 pt) high level Kenyan distance runners. Control group consisted of 29 female (25.0±5.7 yr; 61.4±9.1 kg; 1.65±0.06 m; 23.3±3.2 kg.m-2) and 29 male (24.1±3.8 yr; 62.5±1.0 kg; 1.75±0.08 m; 21.8±5.0 kg.m-2) university students of similar age. DEXA was used to measure BMD at the lumbar spine (LS-BMD), right femur (RF-BMD) and total body (TB-BMD). Low BMD was defined as Z-score between -1.0 and -2.0 and osteoporosis < -2.0.

**RESULTS**

There were no differences in LS-BMD Z-score, RF-BMD Z-score and TB-BMD Z-score between female-male athletes and their respective controls. LS-BMD Z-score, RF-BMD Z-score and TB-BMD Z-score frequency count in the range of -1 to -2 and below -2 is shown in table 1.
to quantify external loads (vertical ground reaction forces; vGRFs) during running in
ecologically valid settings. **PURPOSE:** Develop models to accurately estimate vGRF
second (“active”) peaks during running from iliac crest and sacrum accelerations.
**METHODS:** Anthropometric and sex data were collected from 40 runners. Runners
wore inertial measurement units (IMUs) (±100g, ±2000deg/s, 1000Hz) secured to their
iliae crests and sacra as they ran a 25m track with embedded force plate (1000Hz).
Speed, IMU accelerations, and force plate data were synchronously recorded for ten
stances per foot at “slow,” “typical,” and “fast” self-selected speeds. Accelerations were
transformed to a segment coordinate system. Force and acceleration signals were
50Hz low-pass filtered and divided into 0-8Hz low frequency (LoF) and ≥10Hz
high frequency (HiF) signals. Acceleration and vGRF peaks were extracted from the
original, LoF, and HiF signals. Two multiple linear regressions were created to
estimate log-transformed vGRF second peak: One used sacrum accelerations to predict
ipsilateral forces, the other used iliac crest accelerations to predict ipsilateral forces.
Each model included sex and limb lengths as fixed effects and was validated using an
eight-fold cross-over. **RESULTS:** Both models predicted observed vGRF second peaks
well (r^2 = 0.78, mean absolute error <7%). Addition of participant as a random effect
of vGRF could not be performed. **CONCLUSIONS:** The models developed here
de demonstrate a single IMU secured over the iliac crest or sacrum can estimate ipsilateral
or bilateral vGRF second peak, respectively, with high accuracy. This approach could
greatly impact our understanding of RRI by facilitating quantification of the step-by-
step external forces experienced by runners over long time periods in ecologically
valid settings. Supported by an ACSM Doctoral Student Research Grant, a Sigma Xi
Grant-in-Aid of Research, the Maury Hall Endowed Fellowship for Musculoskeletal
Biomechanics Research, and an NSERC Post-Graduate Scholarship.

Training workload (WL) has become a more common monitoring approach in runners
and is defined as the product of external and internal training loads. Although rating
of perceived exertion (RPE) is a widely accepted measure of internal load, various types
of subjective measures are also used, including heart rate (HR), respiratory
exchange ratio (RER), and session RPE (p = 0.02, d = 0.52). Literature on the efficacy of cupping therapy (CT) is limited. Potential mechanisms
of action of cupping therapy include increased localized blood and restructuring of
fascial protein conformations through mechanotransduction, which has implications
for enhanced buffering from putative increased localized blood.

**PURPOSE:** To elucidate the effects of myofascial decompression through CT on
RE and HEFP in well-trained runners. **METHODS:** Five minutes of CT or placebo
gel was applied to bilateral gluteus maximus, biceps femoris, semimembranosus,
and semitendinosus of 7 female (29.3 ± 2.1 yrs, 1.68 ± 0.06 m, 60.2 ± 3.4 kg) and
8 male (27.5 ± 6.2 yrs, 1.77 ± 0.04 m, 69.1 ± 4.0 kg) well-trained runners (female
10-km time = 41.4 ± 4.4 min, male 10-km time = 33.5 ± 1.2 min) after a 10-minute
treadmill warm-up. Maximal HEFP was measured immediately post CT or gel using
an isokinetic dynamometer. Then RE was measured using two 6-minute steady-
state treadmill runs (fixed velocity and subject 10-km velocity). Maximal oxygen
consumption (VO2 max) test followed the RE tests. All subjects performed both
conditions in randomized order separated by at least 1 week, but not more than 3
weeks. Maximal HEFP, RE, respiratory exchange ratio (RER) during steady-state,
and VO2 max after CT and gel were compared independently using paired two-sample
tests. Effect size for all variables was calculated using Cohen’s d. **RESULTS:**
Maximal HEFP was not significantly different between conditions (CT: 1.63 ± 0.47
Nm.kg^-1; 1.51 ± 0.40 Nm.kg^-1, p = 0.18, d = 0.29). There was no difference in RE
expressed as %VO2 max between CT and gel (fixed = 76.9 ± 10.6% of VO2 max,
76.6 ± 10.5% of VO2 max, p = 0.72, d = 0.02; 10-km = 84.2 ± 7.2% of VO2 max,
83.7 ± 6.9% of VO2 max, p = 0.17, d = 0.07). There was also no difference in VO2
max between CT and gel (65.1 ± 9.1 ml kg^-1 min^-1 vs. 65.0 ± 10.3 ml kg^-1 min^-1, p =
0.96, d = 0.004); however, RER was significantly increased by CT compared to gel
(fixed = 0.92 ± 0.06 vs. 0.90 ± 0.04, p = 0.04, d = 0.32; 10-km = 0.94 ± 0.04 vs. 0.92 ±
0.03, p = 0.02, d = 0.52). **CONCLUSIONS:** Acute cupping therapy increases steady-
state carbon dioxide expiration in well-trained runners without changing oxygen
consumption. This has implications for enhanced buffering from putative increased
localized blood.
understood. It is clear that physical and metabolic costs of these events are quite high; most participants take 20-35 hours to complete the distance and burn upwards of 10,000 calories. As such, many 100-mi. events are reporting 30-50% “Did Not Finish” (DNF) rates among their participants. Ultra-runners are also challenged by sleep deprivation, which may lead to the decline of cognitive skills and reaction time over the course of these events, potentially leading to exhaustion or injury. PURPOSE: To observe and assess physiological and cognitive dynamics during a 100-mile ultramarathon with relationships to flat terrain (~7500 ft. vertical gain). METHODS: Nine registered participants (age 46 ± 9.5 yrs., weight 74.0 ± 6.1 kg., height 176.4 ± 7.8 cm.) completed the 100-mile distance (Finish time 24.02 ± 3.32 hrs.). Measurements were collected pre-race, at each 20-mile interval (20, 40, 60, 80), and post-race. Measurements included lap time, foot volume, cognition, and reaction time. Foot volume was measured by making a figure-8 with cloth tape around the subjects’ bare foot and ankle. Cognitive performance was assessed using mental calculation and reaction time tests via iOS applications. The mental calculation test involved solving as many equations possible in 100 s while the reaction time required the participant to tap the screen as many times as possible in 30 s. Comparisons were made across the 20-mile intervals using repeated-measures ANOVA. RESULTS: While the duration to complete each 20-mi. lap significantly differed throughout the race (F(4,20)=7.896, p<0.001), no differences were found in foot volume (F(5,15)=2.13, p=0.118), reaction time (F(5,10)=945, p<0.493), or cognition (F(5,20)=896, p>0.503). CONCLUSIONS: A relatively flat-terrain 100-mile distance does not elicit cognitive exhaustion or significant foot swelling. More research is needed to determine if there are other physiological or metabolic variables correlated with high DNF rates, and to compare these data to those of more “challenging” courses with greater elevation gain/loss.

902 Board #28 May 27 1:30 PM - 3:00 PM
Is There A Difference In Strength, Flexibility, Range Of Motion Between Postpartum And Nulliparous Runners?
Sefalih Christopher, Hannah Janssen, Kimberly Colby, Erin Kane, Susan Chinworth, Srikant Vallabhajosula. Elon University, Elon, NC. (Sponsor: Dr. Stephen Bailey, FACSM)
Email: spchrisafter@email.com (No relevant relationships reported)

Research has shown that women are returning to sport as soon as two weeks after birth with most resuming running by two months postpartum. There are significant musculoskeletal and physiologic changes during pregnancy as well as the effects of childbirth that a postpartum runner to recover from to return to running. Research on returning to running guidelines are nonexistent in the postpartum population. Purpose: To investigate the differences in strength, range of motion (ROM), and, flexibility between postpartum runners (PP) and non-pregnant controls (NC). Methods: Healthy postpartum (up to 3 years) and nulliparous runners were recruited from local running groups. Three trials of strength, ROM and flexibility of the hip, knee and ankle were collected using a hand held dynamometer, inclinometer or goniometer respectively. Three trials of strength, ROM and flexibility between the postpartum (PP) and nulliparous (NC) were performed. Three trials of strength, ROM and flexibility were collected pre-race, at each 20-mile interval (20, 40, 60, 80), and post-race. Three trials of strength, ROM and flexibility of the hip, knee and ankle were collected using a hand held dynamometer, inclinometer or goniometer respectively and then averaged. An independent samples t-test was performed to compare groups. Results: 28 runners participated (14 PP, 14 NC) and were matched for BMI (24.2 kg/m²). There were no significant differences in strength of the hip, knee and ankle between the groups. Right and left ankle dorsiflexion was significantly greater in PP group (Right Soleus: PP, 10.33±3.3cm; NC, 6.75±2.6cm; p=0.01; Left soleus: PP, 11.32±3.3cm; NC, 7.34±2.7cm; p=0.004; Right Gastrocnemius: PP, 7.95±2.74%; NC, 4.67±1.59%; p=0.032; Left Gastrocnemius: PP, 8.48±3.39%; NC, 4.5±5.23%; p=0.026). Knee and Hip ROM were not significantly different between the groups. Conclusion: The current study shows that postpartum runners have significantly more dorsiflexion ROM than controls. When breastfeeding, hormones that influence elasticity like prolactin are still present in the body which may be allowing for the postpartum women to have significantly more ROM than nulliparous controls. Future studies should investigate the effect of breastfeeding duration on range of motion in runners as well as if while breastfeeding return to running guidelines should be different than women that cease breastfeeding at different stages.

903 Board #29 May 27 1:30 PM - 3:00 PM
Abstract Withdrawn

904 Board #30 May 27 1:30 PM - 3:00 PM
Effects Of A 4-week Supplemental Breathwork Program On Aerobic Performance Of Recreational Runners
Adrian Bilyk, Sara R. Sherman, Craig Horswill. University of Illinois at Chicago, Chicago, IL. Email: abilyk89@gmail.com (No relevant relationships reported)

PURPOSE: This study investigated the effects of a novel supplemental functional breathing program (FBP) on the aerobic performance of recreational runners. METHODS: Two groups of recreational runners participated in a 4-week aerobic endurance training program. One group supplemented the aerobic endurance training program with FBP (FBP, n=8, 34.8±5.1 yrs., 25.3±2.5 kg/m²), and one completed the same aerobic endurance training program, but not the FBP (CON, n=8, 28.8±5.4yrs, 22.7±2.3kg/m²). The 4-week running program consisted of 3 days of low intensity running (i.e. below aerobic threshold heart rate), and 1 day of high intensity interval running (i.e. above ventilatory threshold heart rate) per week. FBP consisted of daily breathing exercises completed at rest, and nasal breathing completed during low intensity running sessions. Subjects were tested before (PRE) and after (POST) 4-weeks of training. Testing included a breath holding test (BOLT) followed by a treadmill VO2max test using a progressive workload. During the VO2max test subjects were wore a secure piece of tape covering their mouth under a face mask and were instructed to perform the VO2max test to the best of their abilities using this induced nasal breathing condition. When they felt that they could no longer run with nasal breathing, the tape was removed, and the test continued under normal breathing conditions until VO2max was reached. The maximal running time using nasal breathing only (MNRT) and maximal nasal breathing oxygen uptake (MNBVVO2) were recorded and data were assessed using a two-way ANOVA (p<0.05). RESULTS: There were no significant differences in MNRT (>58.7 sec, p=0.038), MNBVVO2 (>2.34 ml/kg/min, p=0.007), and VO2max (>2.16 ml/kg/min, p=0.028), suggesting the training stimulus was adequate for the relatively short training program. CONCLUSION: This study demonstrated that the 4-week supplementary functional breathing protocol was effective in increasing breath hold time at rest, but not MNRT, MNBVVO2, and VO2max in recreational runners.

905 Board #31 May 27 1:30 PM - 3:00 PM
Should Runners Pay Less Life Insurance
Jingyuan Zhu, Zhezhao Chen, Weizhuo Zhu, FACSM. University of Illinois at Urbana, Champaign, Urbana, IL. Email: jz5@illinois.edu (No relevant relationships reported)

PURPOSE: An ad “Can You Run An 8 Minute Mile?” (so that you could qualify for lower rates on life insurance) has brought lots of public attention and discussions, and the purpose of this study was to examine the scientific basis for this claim by estimating the impact of physical fitness on modifiable health risk behaviors and related health care expenditures. METHODS: Using keywords “Physical Fitness,” “Cardiorespiratory,” “Health Risks,” “Health Care Costs,” etc., a comprehensive literature search was conducted, and identified publications were reviewed and analyzed. RESULTS: Over 45 research publications were documented, and 15 articles were included in this review, focusing mostly on 10 modifiable health risks. Over 23 components were found in influencing the future medical costs, e.g., emotional health, stress, blood glucose levels, extreme bodyweight, tobacco user, sedentary lifestyle, per metabolic equivalents (METs) increase, and so on. Amount them, the key components rising the potential health care costs are high blood glucose levels ranging from 12.5% to 111.5%, high stress ranging from 17.45% to 70%, depression ranging from 8.5% to 40%, etc. The most effective measure to reduce potential health care costs is increasing metabolic equivalents (METs) per unit by aerobic exercises ranging from 5.4% to 13.4%. CONCLUSION: A set of measures has been developed to assess the relationships between health risks and aerobic fitness, and there is a foundation to support the claim that a fit runner will likely have better aerobic fitness, less likely to have health risks, therefore spend less money in health care and medical expense. Yet, significant work is still needed to develop specific and accurate prediction equations so that the cost of life insurance can be determined based on aerobic fitness and other risk factors.

906 Board #32 May 27 1:30 PM - 3:00 PM
Abstract Withdrawn

907 Board #33 May 27 1:30 PM - 3:00 PM
Validity Of A Field-based Critical Velocity Test On Predicting 5,000 M Running Performance
Nicholas R. Yoth1, Charles M. Laurent2, Jessica E. Kiss3, Adam M. Fullenkamp1. 1St. Ambrose University, Davenport, IA. 2Tarleton State University, Stephenville, TX. 3Bowling Green State University, Bowling Green, OH. (Sponsor: Lynn Darby, FACSM) (No relevant relationships reported)

Measuring and modeling known adaptations to endurance training can be achieved through a variety of physiological parameters. A unique and emerging performance parameter receives attention is the notion of critical velocity (CV). This concept allows an athlete’s performance be to mathematically modeled based on the relationship that exists between distance and time. PURPOSE: To assess the validity

ACSM May 26 – May 30, 2020
San Francisco, California
Attemping To Acutely Manipulate Ground Contact Time Imbalances Impairs Running Economy

Dustin P. Joubert, Broderick L. Dickerson, Eric J. Jones, Dani D. Willis. Stephen F. Austin State University, Nacogdoches, TX. (Sponsor: Stephen F. Crouse, FACSM)

Email: joubertd@shsu.edu

(NO relevant relationships reported)

Running economy (RE) is a key performance determinant. Biomechanical markers have been linked to RE, including ground contact time (GCT), cadence, and vertical oscillation (VO). Recently, we showed a strong relationship between GCT imbalances and RE. Because these markers can be tracked real-time with consumer-wearable devices, runners now have access to instant feedback concerning their mechanics.

Purpose: Determine if attempting to correct GCT imbalances real-time alters mechanics and RE. Methods: 7 recreational runners (38±15 years, 24.7±2.8 kg/m², 5 male) completed 2, 10-minute running trials (9.65 km/hr) on separate days. For both trials, subjects ran with a heart rate (HR) monitor/watch that measured GCT, GCT imbalances, cadence, and VO. For the control trial, subjects were not permitted to receive feedback from the watch. During the feedback trial, the watch was set to display GCT imbalances, and subjects were prompted every 20-30 seconds to monitor/attempt to correct any imbalances. Both trials were preceded by a dynamic warmup and a 5-minute jog. For the feedback trial warmup, subjects were accelerated to the watch and allowed to experiment with manipulating their GCT imbalances. VO2 was monitored continuously throughout each 10-minute trial, and average values from 6 to 9 minutes were determined for each trial. Average values for all running biomechanical variables were calculated from 0.5 minutes to 9.5 minutes. Comparisons between trials were made with a dependent sample t-test. Results: Data are displayed in Table 1. Conclusions: Acutely attempting to correct GCT imbalances did not result in improved mechanics and actually impaired RE. Altering mechanics based on real-time feedback from consumer-wearable devices may impair performance in the short term. Given that GCT imbalances have been linked to impaired RE, future research should determine how to better correct these imbalances rather than attempting to acutely manipulate them.

<table>
<thead>
<tr>
<th>Control</th>
<th>Feedback</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VO2 (mL/kg/min)</td>
<td>33.4 (1.8)</td>
<td>35.5 (1.6)</td>
</tr>
<tr>
<td>RER</td>
<td>0.9 (0.4)</td>
<td>0.92 (0.9)</td>
</tr>
<tr>
<td>Heart Rate (beats/min)</td>
<td>159 (26)</td>
<td>163 (24)</td>
</tr>
<tr>
<td>GCT Difference (%)</td>
<td>1.69 (67)</td>
<td>1.70 (1.70)</td>
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<tr>
<td>GCT Difference (ms)</td>
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<td>GCT</td>
<td>272 (26)</td>
<td>268 (31)</td>
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<tr>
<td>Cadence (steps/min)</td>
<td>165 (9)</td>
<td>167 (9)</td>
</tr>
<tr>
<td>VO (cm)</td>
<td>9.3 (2.0)</td>
<td>9.2 (1.9)</td>
</tr>
<tr>
<td>VO ratio (cm/m)</td>
<td>9.5 (1.6)</td>
<td>9.5 (1.6)</td>
</tr>
</tbody>
</table>

Values represent mean (SD). p-values from dependent t-test. *p < .05
Purpose: In the last decade or so, a plethora of fitness tracking devices have come to market. With this, use of these devices has increased exponentially. Among these devices’ many functions is the ability to monitor heart rate (HR). The purpose of this investigation was to determine if HR measured by the Suunto Spartan Sport watch was statistically comparable to that of our criterion, the Polar H7 HR monitor.

Methods: Twenty-one participants (male n = 11, female n = 10, age = 31.2 ± 2.5 y) were divided into subgroups of 7 (mean ± SD) for T10-test and T10-retest. Speed from the T10-test and T10-retest were measured using coefficient of variation (CV), limits of agreement (LoA), and intraclass correlation (ICC). A Pearson Product Moment Correlation was determined using the Mean Absolute Percent Error (MAPE), Bland-Altman analysis with accompanying bias and Limits of Agreement (LoA), and single measures Intraclass Correlations (ICC). A Pearson Product Moment Correlation Coefficient was used to determine the relationship between the cardiovascular measures with significance accepted at p < 0.05. Results: During uphill running, the MAPE was 1.46%, and the lower and upper LoA were -11.53 and 12.34, respectively. The single measures ICC was 0.94 with a 95% CI of 0.946 to 0.951 (< 0.000). During downhill running, the MAPE was 2.18% with the lower and upper LoA at -15.76 and 14.15, respectively. The single measures ICC was 0.96 with a 95% CI of 0.946 to 0.951 (p < 0.000). Conclusions: These results demonstrate a very low percentage of error for the Suunto Spartan Sport watch in recording HR for both uphill and downhill running. This suggests that The Suunto Spartan Sport watch may be a valid and reliable option for consumers wishing to monitor HR during outdoor trail running activities.

Current methods to assess critical speed (CS) are limited by the need for subjects to perform a set number of time-to-exhaustion trials at a constant speed on a treadmill or through several maximal runs on separate days on a running track. PURPOSE: To assess the reliability and validity of a 10-minute submaximal treadmill test of critical speed (CS). METHODS: Twenty-nine recreational road runners (21 men, 8 women; age: 31.8 ± 5.7 years; VO2max: 52.5 ± 6.9 ml/kg·min−1) completed a familiarization trial consisting of running 10 minutes (T10) at a vigorous self-selected speed plus two experimental trials (T10-test and T10-retest). Speed from the T10-test and T10-retest were assessed using coefficient of variation (CV), limits of agreement (LoA) and intraclass correlation (ICC). Next the CS assessed from an additional T10-test was compared with the CS assessed through Field tests. The Field tests consisted of 3 runs on separate days on a running track over 1200, 2400 and 3600 m. Results: Reliability analysis between the T10-test and T10-retest showed a CV of 3.2% (95% CI: 2.5-4.3%), LoA of ± 32 m·s−1, and an ICC of 94% (95% CI: 87.97). Validity data showed that speed (m·s−1) (T10-test: 3.79 ± 0.47; Field-test: 3.80 ± 0.49) did not differ between trials (p = 1.0). Also, the T10-test was highly correlated with the Field-test (r = 0.90, p < .001) and presented a CV of 4% (95% CI: 3.2-5.4%) and LoA of ± 41 m·s−1. Conclusion: The submaximal 10-minute treadmill test (T10) yields reliable and valid estimates of CS providing a useful alternative for assessing CS on a treadmill.

Running economy (RE) is one of the important indicators for evaluating endurance. However, treadmill running (TR) test, seems not to be specific enough for team sport, considering their running characteristics with change of direction. PURPOSE: To investigate the RE of TR and 20m-shuttle running (SR). METHODS: 18 physically-active collegiate man (22.4 ± 4.8yrs, 177.4 ± 7.5cm, 69.3 ± 8.2kg, VO2max: 48.9 ± 6.2 ml/kg/min, training experience: 4.6 ± 1.6yrs) volunteered to participate in one incremental TR (8, 10, 12 and 14km/h) and one incremental SR (6, 8, 10 and 12km/h), with the duration of 5 min for each step, and the interval of 1 min (RM) for each 2 steps. The VO2max was also assessed in combination with the TR test. The portable gas metabolism system (Kab, Cosmed, Italy) was used to measure the breathing gas during running. The RE for each speed was calculated as the averaged VO2 of the last 1 min during each step. RESULTS: At the same running speed (8, 10 and 12km/h), the RE of the SR are lower (oxygen consumption is higher ) than the TR (34 ± 3.6 vs. 32.5 ± 4.9 ml/kg/min, 47.9 ± 5 vs. 37.9 ± 5.9 ml/kg/min, 54.9 ± 6.2 vs. 42.0 ± 7 ml/kg/min), with the difference significant at the two higher speed (p<0.05). CONCLUSIONS: At the same running speed, the RE of SR is lower than that of TR. Assessment of RE with TR might overestimate the RE in running with change of direction. Running test with change of direction (e.g. SR) is recommended for examining the RE in team sport players.

Fatigue is often considered an injury risk factor due to gait adjustments that occur during prolonged running, and 41% of physical therapists recommend roller massage (RM) for injury prevention. However, whether RM prior to running affects gait mechanics and fatigue is currently unknown.

PURPOSE: To investigate the effects of an acute bout of RM on gait mechanics and fatigue after a treadmill run.

Methods: Fourteen well-trained runners (mean VO2max: 53 ml/kg·min) completed 3 sessions each on separate days. In Baseline sessions participants sequentially ran overground at their 5k pace, performed 3 maximal countermovement jumps (CMJ), and completed a maximal oxygen consumption test. Force and motion data were measured during running and jumping. In fatigue sessions, run and CMJ protocols identical to the Baseline session were performed before (PRE) and after (POST) a 30-minute fatiguing treadmill run at a pace associated with 84% of ventilatory threshold. Before the fatiguing run, participants rested for 12 minutes (REST) in one visit, and performed a 12-minute RM protocol (ROLL) in the other visit. Two-way analysis of variance (ANOVA) compared end tidal pressure of carbon dioxide (PETCO2) every 5 minutes of the treadmill runs to assess fatigue. From the run and CMJ data, 2-way multiple analysis of variance (MANOVA) compared vertical average loading rate (VALR), free moment, tibial shock, and jump height between REST and ROLL conditions at times PRE and POST.

RESULTS: PETCO2 decreased throughout both treadmill runs, indicating general fatigue (p < 0.001). VALR, free moment, tibial shock, and jump height did not differ significantly between PRE and POST treadmill run on both REST and ROLL days (Table 1).

Conclusions: Well-trained runners exhibited fatigue in respiratory measures but not in neuromuscular performance, or gait mechanics. RM had no effect on any outcomes. We can conclude no benefits of pre-run RM on resistance to fatigue-induced changes in running mechanics.
**B-65 Free Communication/Poster - Blood Flow**

**Board #41** May 27 2:30 PM - 4:00 PM  
**Impact Of Cell-free Hemoglobin On Exercising Muscle Vascular Control In Rats**  
Scott K. Ferguson1, Trenton D. Colburn2, Jesse C. Craig3, Karen S. Hageman4, Kurt R. Stemmark5, Paul W. Bucheler6, Daniel M. Hira6, David C. Irwin7, David C. Poole, FACSM8, Timothy I. Musch, FACSM9, 1University of Hawaii, Hilo, HI. 2Kansas State University, Manhattan, KS. 3University of Utah, Salt Lake City, UT. 4University of Colorado, Aurora, CO. 5US Food and Drug Administration, Silver Spring, MD. 6Purdue University, West Lafayette, IN. 7Sponsor: Tim Musch, FACSM  
Email: scott.ferguson@hawaii.edu  
(No relevant relationships reported)

Hemolysis associated with Sickle Cell Disease (SCD) compromises nitric oxide (NO) bioavailability and results in a plethora of cardiopulmonary and skeletal muscle complications causing severe exercise intolerance. Recent evidence suggests that cell-free Hb reduces NO bioavailability and lowers the skeletal muscle microvascular PO2 during contractions, likely due to a reduction in blood flow. Despite these observations, the effects of Hb on skeletal muscle vascular control during locomotor exercise remain unknown. **Purpose:** We tested the hypothesis that acute exposure to Hb would increase mean arterial pressure (MAP) and decrease hindlimb muscle blood flow in the exercising rat. **Methods:** MAP and hindlimb skeletal muscle blood flow (fluorescent microspheres) were measured in male Sprague-Dawley rats (3-6 months, n=8) during submaximal treadmill running (20 ml/min, 5% grade) following a vehicle (0.2 ml of saline) and Hb (50 mg/kg) infusion. **Results:** Relative to control, Hb resulted in a significantly greater exercising MAP (control: 137 ± 3, Hb: 150 ± 3 mmHg, p<0.05) and blood [lactate] (control: 2.51 ± 0.25, Hb: 3.13 ± 0.42 mM, p<0.05). Total exercise hindlimb skeletal muscle blood flow (control: 179 ± 14, Hb: 111 ± 7, ml/min/100 g, p<0.05) and vascular conductance (control: 1.34 ± 0.13, Hb: 0.75 ± 0.05 ml/min/100 g/mmHg, p<0.05) were lower following Hb infusion when compared to control. **Conclusion:** These data support the hypothesis that free Hb impairs vascular control and lowers skeletal muscle O2 delivery during exercise and provides a potential mechanism by which hemolytic diseases like SCD impair exercise tolerance in humans. Support: NIH-P30DK048520 (SKF), NIH-R10HL125642-01A1 (DCI)

**Board #42** May 27 2:30 PM - 4:00 PM  
**Peripheral Revascularization Reverses The Decline In Active Muscle Oxygen Saturation In Peripheral Artery Disease**  
J. Carter Luck1, Danielle JK Kim1, Cheryl A. Blaha2, Samuel Pai2, Faisal Aziz1, John F. Radtka3, III, Kimberly S. Faszczyk, Abigail SL Stickford2, Amanda J. Miller1, Matthew D. Muller3, Lawrence I. Sinoway3, 1Penn State College of Medicine, Hershey, PA. 2Appalachian State University, Boone, NC. 3University Hospitals Cleveland Medical Center, Cleveland, OH.  
(No relevant relationships reported)

Peripheral artery disease (PAD) is a progressive atherosclerotic disease that limits blood flow to the skeletal muscles in the lower extremity. Reductions in blood flow may be more pronounced during ambulation or exercise and produce leg cramping or pain known as intermittent claudication. Recent studies have shown an exaggerated blood pressure response with lower muscle oxygen saturation (SmO2) during foot exercise in patients with PAD. However, it is unclear whether surgical and/or endovascular interventions normalize this response. **PURPOSE:** To examine whether revascularization procedures improve calf muscle SmO2 and reduce blood pressure responses in patients with foot exercise in patients with PAD. We hypothesized that revascularization would improve SmO2 responses (indicating greater tissue perfusion) and that the blood pressure response would be attenuated during exercise. **METHODS:** Patients with symptomatic PAD (n = 6) performed incremental supine plantar flexion exercise, starting at 0.5 kg and increased by 0.5 kg every minute for up to 6 minutes, pre- and one-month post peripheral revascularization procedure. SmO2 was measured continuously from the gastrocnemius muscle, while heart rate and blood pressure were measured beat-by-beat. **RESULTS:** Reductions in SmO2 from baseline to end-exercise were attenuated post-revascularization (-6.5 ± 6.2% vs. -39.8 ± 22.5%, P < .05). The change in mean arterial blood pressure was reduced post-revascularization (4 ± 4 mmHg vs. 16 ± 12 mmHg P < .05). PAD patients exercised longer post-revascularization (5.8 ± 0.4 min vs. 4.0 ± 1.5 min P <.05). **CONCLUSIONS:** These data suggest that revascularization lessens the degree and rapidity of decline in SmO2 during exercise, and lowers the exaggerated blood pressure response in patients with PAD. Supported by NIH Grant P01 HL134609

**Board #43** May 27 2:30 PM - 4:00 PM  
**Endothelial Shear Stress In The Common Carotid Artery During Boxing Training**  
Karla F. Carrillo, Francisco Morales-Acuna, Manuel Gomez, Lisa Rodriguez, Paulina Cárceco, Alvaro N. Gurovich, FACSM. The University of Texas at El Paso, El Paso, TX. (Sponsor: Alvaro N. Gurovich, FACSM)  
(No relevant relationships reported)

**PURPOSE:** Endothelial function is highly regulated by the interaction between blood flow and the endothelium. Endothelial shear stress (ESS) is defined as the dragging force generated by this interaction and it has been reported that low ESS affects nitric oxide bioavailability which in turn might increase blood pressure. Exercise programs are one of the best suited approaches to prevent high blood pressure, however, there are no studies describing changes on ESS in the common carotid artery during specific modalities of exercise, such as boxing training. Therefore, the purpose of this study was to quantify ESS in the common carotid artery during maximal and submaximal boxing training in normotensive and pre-hypertensive subjects. **METHODS:** A cohort of 5 healthy normotensive and 5 pre-hypertensive subjects matched by age, gender, height, and weight were recruited for this study. All 10 subjects performed two boxing tests. The first was a graded maximal boxing test to estimate their maximal oxygen uptake (VO2max). The second one, performed 48 hours after the first evaluation, was a 2-workload steady-state boxing test at 60%VO2max and at 95%VO2max for 3 minutes each. A high-definition Doppler ultrasound recorded common carotid artery diameters and blood flow velocities throughout each steady-state condition. ESS was estimated using Womersley’s approximation. **RESULTS:** There was a significant increase in antegrade ESS with higher workloads in both groups (p <.05 for all). No difference were found in antegrade ESS at baseline (Normotensive: 33.9±13.9 dynes/c㎡, Pre-HTA: 34.7±15.5 dynes/c㎡; p = 0.936), at 60%VO2max (Normotensive: 51.3±19.1 dynes/c㎡, Pre-HTA: 49.6±7.6 dynes/c㎡; p = 0.894, and at 95%VO2max (Normotensive: 72.9±30.9 dynes/c㎡, Pre-HTA: 85.2±12.5 dynes/c㎡; p = 0.560) between both groups. Meanwhile, no retrograde blood flow was present at baseline for either groups, but it was identified at 60%VO2max (Normotensive: 8.1±0.7 dynes/c㎡, Pre-HTA: 7.8±1.7 dynes/c㎡; p = 0.971) and 95%VO2max (Normotensive: 22.5±18.9 dynes/c㎡, Pre-HTA: 20.8±5.6 dynes/c㎡; p = 0.891). **CONCLUSIONS:** ESS increases in an exercise-intensity manner during boxing training in normotensive and prehypertensive population. Boxing training might be beneficial in high blood pressure prevention due to increments on ESS.

**Board #44** May 27 2:30 PM - 4:00 PM  
**The Effects Of A High Fat Meal On Blood Flow Regulation During Arm Exercise**  
Alexander H. Chiu, Lauren Pederson, Jeremy O. Via, Natalie J. Bohmke, Jacob Richardson, Aaron Butler, Hunter Reed, Eric Henderson, Robert L. Franco, Ryan S. Garten. Virginia Commonwealth University, Richmond, VA.  
Email: chiuas@ymail.vcu.edu  
(No relevant relationships reported)

A diet high in saturated fats results in endothelial dysfunction and can lead to atherosclerosis, a precursor to cardiovascular disease. Exercise training is a potent stimulus though to mitigate the negative effects of a high saturated fat diet; however, it is unclear how high-saturated fat meal (HSFM) consumption impacts blood flow regulation during a single exercise session. **PURPOSE:** This study sought to examine the impact of a single HSFM on peripheral vascular function during an acute upper limb exercise bout. **METHODS:** Ten young healthy individuals completed two sessions of progressive handgrip exercise. Subjects either consumed a HSFM (0.84 g of fat/kg of body weight) 4 hours prior or remained fasted before the exercise
Previous investigations on the ability of upper body exercise (UBE) to increase femoral artery blood flow (FABF) in the paraplegic population have produced a wide disparity in results. However, this could have been the result of a non-homogeneous population with a wide range of injury level and severity. The use of a non-homogeneous population, controlling for both level and severity of injury, may result in more robust data. In addition, previous reports suggest passive limb movement (PLM) could be used as a modality to increase femoral artery blood flow in this population. A combination of UBE and PLM may provide a sufficient stimulus for a robust increase in FABF in the paraplegic population. METHODS: Ten paraplegics with a clinically confirmed lesion between the 3rd and 11th thoracic vertebra participated in the study. The subjects underwent 10 minutes of UBE, 5 minutes at a low intensity (LI) and 5 minutes at a moderate intensity (MI), during which FABF was measured. After a 30 minute break, the protocol was replicated with the addition of repeated bouts of passive limb movement being conducted every other minute during the upper body exercise (CMB).

CONCLUSIONS: A single dose of dietary nitrate does not enhance exercising muscle blood flow or VO2max in a PAH rat, despite significantly increasing plasma nitrate and nitrite. This may be explained by a lack of efficacy in BRJ increasing muscle nitrite and cGMP, known mediators of the nitric oxide pathway and tissue perfusion. Future work should examine mechanisms for reduced skeletal muscle blood flow and further exploration of nitric oxide signaling in PAH patients. Funding: NIH HL121661 (MB Brown) and AG053606 (AR Coggan).

BOARD #48  May 27 2:30 PM - 4:00 PM
Racial Differences In Exercising Limb Blood Flow During Elevated Sympathetic Activity
Austin C. Hogwood1, Kevin Decker2, Ashley Darling2, Jennifer Weggen2, Alex Chiou1, Ruhi Maniyar2, Ryan Garten2. 1University of Virginia, Charlottesville, VA. 2Virginia Commonwealth University, Richmond, VA.

PURPOSE: Young, healthy African Americans (AA) exhibit lower vascular conductance during an exercise bout compared to Caucasian Americans (CA). This disparity may be due to greater sympathetic vasoconstriction and an impairment in functional sympatholysis during exercise in AA. Thus, the purpose of this study was to examine racial differences in vascular conductance during lower limb exercise in the presence of elevated sympathetic nervous system (SNS) activity.

METHODS: A total of 5 African American (AA) and 4 Caucasian (CA) young (24 ± 2 yrs), healthy males were recruited. Subjects then underwent 6 minutes of rhythmic plantar flexion (PF) exercise at 30% of their previously determine maximum voluntary contraction (MVC). Doppler ultrasonography was utilized to measure superficial femoral artery blood flow on the exercising leg while simultaneous measures of mean arterial pressure (MAP) were obtained via finger plethysmography. Subjects underwent the CPT (minutes 4-6) during which the hand was placed in cold water (4 °C) during PF exercise. Measures were obtained during steady state exercise blood flow.
RESULTS: The CPT resulted in similar increases in MAP in both AA (±24.8 ± 3 mmHg) and CA (±25.56 ± 13 mmHg) (p = 0.05) when compared to PF exercise alone. Exercising leg blood flow [AA (±38.89 ± 62 mL/min); CA (+137.97 ± 62 mL/min) (p = 0.09)] or leg vascular conductance [AA (±.00 ± 6 mL/min/mmHg); CA (-0.28 ± 4 mL/min/mmHg) (p = 0.35)] was not different between groups when evaluated during the CPT and expressed as change from PF exercise alone.

CONCLUSIONS: This study suggests that during lower limb exercise, young AA males, when compared to CA, are similarly resistant to reductions in lower limb vascular conductance in response to elevated sympathetic activity.

Sex-differences in O₂ transport include O₂ content (CₐO₂) and quantity of muscle mass. PURPOSE: To determine their consequences on exercising hemodynamics (with large, e.g., 2-leg cycling (BIKE) vs. small, e.g., 1-leg knee extension (KE)) to measure leg blood flow (Q), CₐO₂, and mean arterial pressure (MAP). Vascular conductance (VC), O₂ delivery, and leg O₂ uptake (VO₂) were calculated. Measures were normalized to the right leg (BIKE) or quadriceps (KE) lean mass. Whole body VO₂ was measured with a metabolic cart. Men and women were compared at similar and maximal work rates.

RESULTS: Body mass was greater in men (M: 80 ± 6 vs. W: 59 ± 12 kg, p=0.03). Although quadriceps mass (3.3 ± 0.2 vs. 2.0 ± 0.3 kg, p<0.001) and CₐO₂ were lower, women had a higher mass-specific Q, VC (p=0.054), O₂ delivery, and leg VO₂ uptake (VO₂) were calculated. Measures were normalized to the right leg (BIKE) or quadriceps (KE) lean mass. Whole body VO₂ was measured with a metabolic cart. Men and women were compared at similar and maximal work rates.

Table 1 - Exercising hemodynamics (*p<0.05, **p<0.01, ***p<0.001 men vs. women)

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<th></th>
<th>Similar KE</th>
<th>Maximal KE</th>
<th>Similar BIKE</th>
<th>Maximal BIKE</th>
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<tr>
<td>M</td>
<td>W</td>
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<td>W</td>
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<td>Work rate (W)</td>
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<td>O₂ (ml·min⁻¹·kg⁻¹)</td>
<td>199±213</td>
<td>2934±626 *</td>
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<td>VO₂ (mg·min⁻¹·kg⁻¹)</td>
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<td>MAP (mmHg)</td>
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<td>VO₂ (ml·min⁻¹·kg⁻¹)</td>
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<td>Leg VO₂ (ml·min⁻¹·kg⁻¹)</td>
<td>16.3±1.1</td>
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924 Board #50 May 27 2:30 PM - 4:00 PM
Sex-differences In Exercising Hemodynamics: Role Of Exercising Muscle Mass

Joshua Bovard¹, Daniele A. Cardinale², Filip J. Larsen², Emma Reiter³, Mads Jensen-Urstad⁴, Erik Rullman⁵, David Morales-Alamo⁶, Bjorn Ekblom⁴, Jose A. L. Calbet⁶, Mads Jensen-Urstad⁴, Filip J. Larsen², Emma Reiter³.

¹University of British Columbia, Vancouver, BC, Canada. ²The Swedish School of Sport and Health Sciences, Stockholm, Sweden. ³Karolinska Institute, Stockholm, Sweden. ⁴University of Las Palmas de Gran Canaria, Las Palmas de Gran Canaria, Spain. ⁵Sponsor: A. William Sheel, FACS&M (No relevant relationships reported)

Abstract Withdrawn

923 Board #49 May 27 2:30 PM - 4:00 PM
Exercising Muscle Mass

Sex-differences in O₂ transport include O₂ content (CₐO₂) and quantity of muscle mass. PURPOSE: To determine their consequences on exercising hemodynamics (with large, e.g., 2-leg cycling (BIKE)) vs. small (e.g., 1-leg knee extension (KE)) to measure leg blood flow (Q), CₐO₂, and mean arterial pressure (MAP). Vascular conductance (VC), O₂ delivery, and leg O₂ uptake (VO₂) were calculated. Measures were normalized to the right leg (BIKE) or quadriceps (KE) lean mass. Whole body VO₂ was measured with a metabolic cart. Men and women were compared at similar and maximal work rates.

RESULTS: Body mass was greater in men (M: 80 ± 6 vs. W: 59 ± 12 kg, p=0.03). Although quadriceps mass (3.3 ± 0.2 vs. 2.0 ± 0.3 kg, p<0.001) and CₐO₂ were lower, women had a higher mass-specific Q, VC (p=0.054), O₂ delivery, and leg VO₂ uptake (VO₂) were calculated. Measures were normalized to the right leg (BIKE) or quadriceps (KE) lean mass. Whole body VO₂ was measured with a metabolic cart. Men and women were compared at similar and maximal work rates.

CONCLUSIONS: This study suggests that during lower limb exercise, young AA males, when compared to CA, are similarly resistant to reductions in lower limb vascular conductance in response to elevated sympathetic activity.

925 Board #51 May 27 2:30 PM - 4:00 PM
Effects Of Dietary Sodium Intake On Blood Flow Regulation During Exercise In Salt Resistant Individuals

Kevin Decker, Morgan Kimmel, Hunter Reed, Alex Chui, Austin Hogwood, Jennifer Weggen, Ashley Darling, Ryan Garten. Virginia Commonwealth University, Richmond, VA.

PURPOSE: Dietary guidelines for sodium intake is less than 2,300 mg/day, yet 90% of Americans exceed this value. This study examined individuals resistant to salt-induced changes in blood pressure to determine the impact of a high sodium diet on blood flow regulation during upper and lower limb exercise. METHODS: Six young (25 ± 2 years) males followed recommended dietary sodium intake guidelines on two diets. Peripheral hemodynamic measurements [blood flow (BF), shear rate (SR), and flow mediated dilation (FMD)/SR] of the brachial and superficial femoral artery were taken during rhythmic (1 Hz), progressive handgrip (HG) and plantar flexion (PF) exercise, respectively. Exercise workloads were three minutes in length and increased by increments of 8 kilograms until exhaustion. RESULTS: Between each diet (LS and HS) there were no significant differences in resting MAP (82 ± 4 vs. 80 ± 5 mmHg; p = 0.3), HR (56 ± 6 vs. 59 ± 10 bpm; p = 0.4), or HRV (2.7 ± 1.9 vs. 8.3 ± 15.1 LF/HR; p = 0.4). During progressive HG and PF exercise the BF, SR, and FMD/SR were significantly increased by workload (p < 0.02 for all), but not different between diets (p > 0.05 for all). CONCLUSION: Despite previous evidence reporting a HS diet can impair resting vascular function, this study revealed that peripheral vascular function and blood flow regulation during exercise is not impacted by a HS diet in salt resistant individuals.

Effects of Dietary Sodium Intake on Blood Flow Regulation During Exercise in Salt Resistant Individuals

Kevin P. Decker, Morgan T. Kimmel, Hunter L. Reed, Alex H. Chui, Austin C. Hogwood, Jennifer B. Weggen, Ashley M. Darling, and Ryan S. Garten. Department of Kinesiology and Health Sciences Virginia Commonwealth University, Richmond, VA.

(No relevant relationships reported)
Accumulating evidence shows an exacerbated incidence of cognitive impairment after spinal cord injury (SCI); however, the physiology that underlies this apparent post-SCI cognitive decline is unknown.

**PURPOSE:** To investigate the impact of injury and 6-month full-body exercise training on neurovascular coupling in individuals with SCI.

**METHODS:** In 24 participants with SCI and 16 controls, we investigated hemodynamic (heart rate, blood pressure, CO,) and middle cerebral artery blood flow velocity responses to a working memory task (neurovascular coupling) before and after training. Neurovascular coupling was compared across groups while accounting for injury parameters. Within individuals with SCI, 6-month changes in neurovascular coupling and its relation to changes in aerobic capacity were compared via linear mixed effect model.

**RESULTS:** Reaction time tended to be higher in individuals with SCI, especially those with high-level (≥T4) injuries, possibly due to upper motor impairments. Neurovascular coupling was graded across task difficulty (p<0.01), while injury did not have a significant impact (group effect p=0.16, interaction p=0.46). Individuals with low-level injuries (≥T4) had higher aerobic capacity than those with high-level injuries (p<0.01). Aerobic capacity increased significantly with training in both groups (p=0.01). While there was no overall significant improvement in neurovascular coupling with training at the group level, the degree of improvement was closely related to that in aerobic fitness in individuals with high-level (R²=0.19, p=0.03) but not low-level (R²=0.04, p=0.46) injuries, which translated to an increase in reaction time (R²=0.16, p=0.05).

**CONCLUSIONS:** The apparent cognitive impairment after SCI is primarily due to physical deconditioning, rather than injury itself, and can be mitigated by aerobic exercise training. This has significant implications for long-term care and management for individuals with SCI.

Supported by AHA Grant 15SDG2329000 (COT), Ellen R. and Melvin J. Gordon Center for the Cure and Treatment of Paralysis (COT). EDO was in part supported by the Harvard College Research Program.

Hypertrophic cardiomyopathy (HCM) is characterized by diastolic dysfunction which contributes to exercise intolerance despite a preserved ejection fraction. This phenotype is strikingly similar to that reported in HFrEF. While disease etiologies clearly differ and HCM patients may not have heart failure, the degree of exercise intolerance is comparable and may be due to similar impairments in cardiac function.

**PURPOSE:** To compare systolic function and early diastolic relaxation during submaximal cycle exercise in HCM and HFrEF patients.

**METHODS:** Patients with HCM without heart failure (n = 12, 48 ± 7 years) were compared to HFrEF patients (n = 12, 67 ± 5 years), and old (n = 11, 70 ± 5 years) and young (n = 11, 31 ± 3 years) controls. Subjects underwent semi-recumbent echocardiography at rest and during steady state exercise at a heart rate of 100bpm. Tissue Doppler velocities of the septal and lateral mitral annulus were averaged during systole (S’) and early diastole (E’), and the difference in resting and exercise velocities were calculated.

**RESULTS:** There were no differences in resting S’ between groups, and all subjects similarly increased S’ from rest to exercise (Figure). HCM patients had significantly lower resting E’ velocities compared to HFrEF patients and young controls (P < 0.05 and P < 0.001, respectively). While all groups augmented E’ from rest to exercise (P < 0.05), the magnitude of the increase was significantly less in patients with HCM compared to young and old controls but indistinguishable from HFrEF patients. **CONCLUSION:** Patients with HCM are unable to increase E’ from rest to exercise to the same extent as healthy young and old individuals. In fact, augmentation of early diastolic relaxation was similar between HCM and HFrEF patients, despite the HCM cohort being almost 20 years younger and without heart failure. Although the disease etiologies differ, these data suggest a common phenotype explaining exercise intolerance in HCM and HFrEF.

**B-66**

**Free Communication/Poster - Disease**

**Wednesday, May 27, 2020, 1:30 PM - 4:00 PM**

**Room:** CC-Exhibit Hall

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Angiotensin Receptor Neprilysin inhibitors (ARNi) is a new class of drug approved for heart failure patients with reduced ejection fraction (HFrEF). ARNi reduces resting blood pressure (BP) in HFrEF. However, the effect of ARNi on BP response to exercise in HFrEF has not been established. PURPOSE: We hypothesized that BP response to isometric handgrip exercise (IHG) would be attenuated in HFrEF after 12 weeks of ARNi (ANOV A: P<0.048). However, the increase in MAP during IHG (ARNi: ∆ 11±8 vs. CON: 13±6 mmHg; P=0.60) and PEI (ARNi: ∆ 8±6 vs. CON: 12±3 mmHg; P=0.60) after 12 weeks was not impacted by ARNi (ANOVA time P=0.24) or different between groups. Maximal raw force and RPE ratings during IHG were similar between groups and not different following 12 weeks of ARNi (ANOVA P=0.70). CONCLUSION: These preliminary data suggest that although 12 weeks of ARNi therapy reduces resting MAP in HFrEF, there are no significant reductions on MAP response to exercise. Additional data are needed to fully understand the impact of ARNi on cardiovascular responses to exercise in HFrEF. Supported by ACSM grant 19-00934 and P20 GM 113125.

930 Board #56 May 27 2:30 PM - 4:00 PM
The Feasibility And Physiological Responses Of Single Leg Cycling In Individuals With Hemiparesis
Tyler J. Singer, John McDaniel, Cody Dulaney, Eric Heidorn, Kent State University, Kent, OH. (Sponsor: Ellen Glickman, FACSM)
Email: tsinger4@kent.edu
(No relevant relationships reported)

INTRODUCTION: The primary treatment for individuals post stroke is intensive rehabilitation focusing on improving and restoring motor control. Typically, the rehabilitation does not focus on increasing cardiovascular fitness due to the inability of these individuals to coordinate those modalities of aerobic exercise (i.e. walking and cycling). Both cycling and walking can promote increases in cardiovascular fitness in individuals’ post-stroke but most of the increases are minimal. Single leg cycling (SLC) is a modality of exercise that has never been attempted by this population. Working around their affected side while utilizing SLC may be what they need as a means to get a quality cardiovascular workout. PURPOSE: The purpose of this study aims to examine feasibility and safety of SLC in this population as well as how effective it may be at increasing oxygen consumption, heart rate, blood pressure, cognitive function, cerebral blood flow and proprioception compared to traditional double leg cycling (DLC)

METHODS: Individuals with completed a trial compared to DLC (p=0.01). There was no significant difference in RPE across the two conditions. CONCLUSION: The results suggest that single leg cycling may be more beneficial to individuals with hemiparesis. Elevated VO2, HR, and BP during SLC suggest that they were able to work around their affected side and coordinate this exercise more effectively than traditional DLC.

931 Board #57 May 27 2:30 PM - 4:00 PM
Sensory Neuron Sensitization By Pkc-induced Trpv1 Phosphorylation In Type 2 Diabetic Rats
Rie Ishizawa1, Han Kyyu Kim1, Norito Hotta1, Gary A. Iwamoto1, Wanpen Vongpatanasin1, Jere H. Mitchell, FACSM1, Scott A. Smith1, Masaki Mizuno2, University of Texas Southwestern Medical Center, Dallas, TX. 1Chubu University, Kasugai, Japan.
Email: swong@udel.edu
(No relevant relationships reported)

Skeletal muscle reflex-induced increases in blood pressure are exaggerated during exercise in type 2 diabetes mellitus (T2DM). We previously demonstrated that skeletal muscle afferent discharge in response to exercise can be decreased by a PKC-induced phosphorylation Acanthopanax senticosus root extract (PEI) to isolate the metaboreflexes. The change in mean arterial pressure (MAP) from baseline to exercise and PEI was assessed. Statistical comparisons were performed using 2x2 repeated-measures ANOVA. RESULTS: At baseline, resting MAP was similar between ARNi (96±14 mmHg) and CON (86±12 mmHg; P=0.17) and MAP increased similarly during IHG (ARNi: ∆ 10±12 vs. CON: 8±10 mmHg) and PEI (ARNi: ∆ 6±4 vs. CON: 5±10 mmHg; ANOVA P=0.60; ARNi vs. CON: P<0.05). Resting MAP was reduced after 12 weeks of ARNi (87±7 mmHg) and was unchanged in CON (91±20 mmHg; ANOVA interaction P=0.048). However, the increase in MAP during IHG (ARNi: ∆ 11±8 vs. CON: 13±6 mmHg; P=0.60) and PEI (ARNi: ∆ 8±6 vs. CON: 12±3 mmHg; P=0.60) after 12 weeks was not impacted by ARNi (ANOVA time P=0.24) or different between groups. Maximal raw force and RPE ratings during IHG were similar between groups and not different following 12 weeks of ARNi (ANOVA P=0.70). CONCLUSION: These preliminary data suggest that although 12 weeks of ARNi therapy reduces resting MAP in HFrEF, there are no significant reductions on MAP response to exercise. Additional data are needed to fully understand the impact of ARNi on cardiovascular responses to exercise in HFrEF. Supported by ACSM grant 19-00934 and P20 GM 113125.
streptozotocin (T2DM). Plasma insulin, HMGB1 and AGE were determined using ELISA. RAGE, phosphorylated PKC and TRPV1 protein levels were quantified in DRG by western blotting. RESULTS: After overnight fasting (T2DM), T2DM glycemia is a main characteristic of T2DM and is known to cause damage to both cardiovascular and nervous system structures. However, the effects of the presence of hyperglycemia on the mechanoreflex and metaboreflex are not known. PURPOSE: To determine the acute effect of hyperglycemia on the mechanoreflex and metaboreflex. METHODS: Experiments were conducted after an overnight fast in unanesthetized, deccerebrated healthy male and female Sprague-Dawley rats. The mechanoreflex was evoked by stretching the Achilles tendon for 30 s and the metaboreflex was evoked by locally injecting lactic acid (0.2 ml, 24 mM) into the hindlimb. Time and dosage for glucose infusion were selected based on a preliminary study that showed infusing 250 mg/dl of glucose solution for 15 min into the hindlimb circulation, with blood flow to and from the hindlimb restricted, would elevate local glucose concentration to the same degree as that seen in T2DM rats with an exaggerated exercise pressor reflex. To elicit an acute hyperglycemia environment while preventing an endogenous insulin response, somatostatin (3.9 ug/100 ul) was infused systemically and simultaneously with blood flow to and from the hindlimb. RESULTS: We found that the peak pressor and cardioaccelerator responses to tendon and compared before and after infusion.

METHODS: To determine the effects of physical activity on hemoglobin and health outcomes in CKD patients.

RESULTS: Across the total sample, patients were 64.7 ± 17.4 years old, 40.3% were obese, they 5.9% had a history of kidney transplant, and 4.4% died. Patients with a history of diabetes were more likely to experience mortality (4.9% vs. 2.4%, p<0.05), and were more likely to have a history of cardiovascular disease (7.9% vs. 4.7%, p<0.05). 3) Comorbidities were higher in patients with a history of diabetes (29.6% vs. 16.7%, p<0.05). 4) Patients with a history of diabetes were more likely to report PA for at least 30 minutes (89.6% vs. 81.8%, p<0.05).

CONCLUSION: Independent of diabetes and transplant status, engagement in regular physical activity elicited an increase in HB and shortened hospital stays among CKD patients. Our findings reinforce the importance of physical activity prescription as a standard component of care.

B-67 Free Communication/Poster - Renal Physiology

Chronic kidney disease (CKD) affects 13% of U.S. adults. Patients endure a disproportionate amount of cardiovascular complications with nearly 50% of dialysis patients experiencing a premature death related to cardiovascular disease. Although participation in regular physical activity can mitigate CKD complications, more than half of nephrologists fail to recommend it to their patients. PURPOSE: To investigate the effects of physical activity on hemoglobin and health outcomes in CKD patients.

METHODS: We analyzed patients admitted to a hospital in the Midwestern United States. A comprehensive metabolic panel and health history, including physical activity (PA) levels, were obtained upon admittance. Patients were assigned a status of either active (N=23) or sedentary (N=45). Independent-samples t-tests and chi-squared tests compared sedentary and active groups. Linear and negative binomial regression models tested the effect of PA on Hb and hospital length of stay (LOS).

RESULTS: Across the total sample, patients were 64.7 ± 17.4 years old, 40.3% were obese, they remained in the hospital for 6.9 ± 7.3 days, 16.2% received dialysis during treatment, 5.9% had a history of kidney transplant, and 4.4% died. Patients with a history of transplant had a reduction in Hb of 3.7 g/dL (p<0.001) and exhibited a trend for a higher rate of engagement in PA (p=0.073). Patients receiving dialysis had 2.4 g/dL lower Hb (p=0.006) and comparable rates of PA (p=0.616). All cases of mortality occurred in the sedentary group, and the Hb of patients who expired was 2.2 g/dL lower; owing to a small sample, this failed to reach significance (p=0.179). Physically active patients had 1.4 g/dL higher Hb (p=0.041). Holding constant transplant status and whether patients received dialysis, PA predicted an increase in Hb of 1.75 g/dL (p=0.007; 95% CI: 0.489 to 3.011) and a 96.4% shorter LOS (p=0.005; 95% CI of IRR: 0.033 to 0.373). In turn, HB was a trending predictor of mortality; each additional g/dL predicted a 38.3% reduction in odds (p=0.069; 95% CI of OR: 0.367 to 1.038). CONCLUSION: Independent of diabetes and transplant status, engagement in regular physical activity elicited an increase in HB and shortened hospital stays among CKD patients. Our findings reinforce the importance of physical activity prescription as a standard component of care.
Hemodialysis patients reveal a significantly reduced exercise capacity, often associated with the presence of Chronotropic Incompetence (CI). Both these conditions are well known cardiovascular risk factors. Very limited data exists on CI in Kidney Transplant Recipients (KTRs).

**PURPOSE**: To describe the prevalence of CI in a KTRs population and to analyze its potential determinants and its effects on functional capacity.

**METHODS**: Consecutively recruited KTRs 3 months after transplantation underwent a Cardiopulmonary Exercise Test with an incremental protocol. 175 KTRs were included and the test was repeated in 60 subjects after a mean period of 22 months. Laboratory and drug therapy data were collected. CI was defined by the formula: MC1 = (HRpeak/HRrest)/(HRpredicted-HRrest) / (VO2peak/VO2rest)/(VO2predicted-VO2rest) (MC1: metabolic chronotropic index, HR: heart rate, VO2: oxygen consumption). The prevalence of CI was calculated on 175 KTRs, while the multivariate regression analysis was conducted on 60 KTRs that repeated the test.

**RESULTS**: In the whole population the CI prevalence was 30.9%. The 60 reassessed KTRs (age 56.1±1.3 years, 77% men) showed significant differences between 3 and 22 months after transplantation in the hemoglobin level (123.4±16.6 vs 136.4±17.8 g/L, p < 0.01) and in the proportion of beta-blocker therapy (50 vs 23.3%, p < 0.001), but no differences in VO2/kg peak (26.5±7.9 vs 26.8±8.2 ml/kg/min, p = 0.85) nor in CI prevalence (31.7 vs 36.7, p = 0.41). KTRs with CI demonstrated no significant differences of VO2 peak nor at 3 or 22 months after transplantation, compared to KTRs without CI. The only determinant of CI at the two visits was the presence of arterial hypertension. Gender, age, BMI, the presence of diabetes, the type of immunosuppressive therapy, the duration of follow-up and beta-blocker therapy did not appear to be determinants of CI. CONCLUSIONS: KTRs are characterized by reduced functional capacity but the CI does not seem to significantly limit their functional level. In contrast to what it would be expected, beta-blocker therapy does not appear to be a CI determinant, while its only significant determinant was arterial hypertension.
followed by changes in the levels of endogenous steroids. As a later response. We showed for the first time in this model the elevation of some steroids, like aldosterone, corticosterone which identified the enzymatic pathways involved. Literature results were partially reproduced, with further changes in steroid levels revealed by our model. This research was supported by: GINOP-2.3.2-15-2016-00047, Szczeyni 2020., 20765/3/2018 F EK USTRAT projects.

939 Board #65 May 27 2:30 PM - 4:00 PM Renal And Segmental Artery Hemodynamic Response To Mild Hypercapnia Christopher L. Chapman1, Paul J. Kueck1, Wenjie Ji2, Emma L. Reed1, Morgan L. Worley1, Hannah Zazulak1, Zachary J. Schlader1, FACSM1, Blair D. Johnson, FACSM1. 1University at Buffalo, Buffalo, NY; 2Indiana University, Bloomington, IN. (Sponsor: Blair Johnson, FACSM)

Email: cc338@buffalo.edu

(No relevant relationships reported)

The risk of kidney disease is elevated in conditions associated with sustained or transient elevations in the partial pressure of carbon dioxide, such as chronic obstructive pulmonary disease or sleep apnea. Indirect evidence indicates that hypercapnia induces renal vasoconstriction, a response that differs from the vasodilatory response that occurs in most other vascular beds. Thus, one mechanism underlying an increased risk of kidney disease is that repeated hypercapnia-induced episodes of renal vasoconstriction reduce oxygen delivery and compromise renal oxygenation. However, it is unknown if hypercapnia elevates vascular resistance in vessels going to or within the kidneys.

PURPOSE: To test the hypothesis that breathing a hypercapnic gas mixture increases vascular resistance in the renal and segmental arteries.

METHODS: After 45 min of supine rest, renal hemodynamics were assessed in eleven healthy adults (27 ± 4 years, 5 females) immediately prior to breathing a hypercapnic gas mixture increases vascular resistance in the renal and segmental arteries.

RESULTS: After 45 min of supine rest, renal hemodynamics were assessed in eleven healthy adults (27 ± 4 years, 5 females) immediately prior to breathing a hypercapnic gas mixture for 5 min (CO₂ = 45 ± 3 vs. 48 ± 3 mmHg, P < 0.01). CO₂ did not change MAP (AIR: 90 ± 4; CO₂: 90 ± 5 mmHg, P = 0.83). In the renal artery, CO₂ reduced BP (33.7 ± 8 vs 31.3 ± 7.7 mmHg, P = 0.02), and increased VR (2.8 ± 0.9 vs 3.1 ± 1.0 mmHg/cm/s, P = 0.03). Similarly, in the segmental artery, CO₂ reduced BP (24.5 ± 5.9 vs 22.0 ± 4.6 mmHg, P = 0.03) and increased VR (4.0 ± 1.1 vs. 4.3 ± 1.1 mmHg/cm/s, P = 0.05).

CONCLUSION: These findings suggest that mild hypercapnia elevates vascular resistance in the renal and segmental arteries.

940 Board #66 May 27 2:30 PM - 4:00 PM Heart Rate Variability Responses To Exercise In Mid-spectrum Chronic Kidney Disease Matthew N. Peterson1, Jeffrey S. Forse1, Zacharias Papadakis2, Peter W. Grandjean, FACSM1. 1Baylor University, Waco, TX; 2University of Miami, Miami Beach, FL. (Sponsor: Peter Grandjean, FACSM)

(No relevant relationships reported)

BACKGROUND: Heart rate variability (HRV) is a measure of autonomic nervous system (ANS) activity, and decreased HRV is associated with many cardiovascular conditions. Chronic kidney disease (CKD) is characterized by a decrease in renal function and may be associated withANS imbalances in the renal vasculature. Low HRV is associated with CKD incidence. Exercise is able to alter HRV by modulating the ANS. The effect of exercise on HRV in mid-spectrum CKD patients remains understudied.

PURPOSE: To determine the effect of steady-state exercise (SSE) and high-intensity interval exercise (HIIE) on post-exercise HRV in patients with stage 3 or 4 CKD.

METHODS: Twenty participants with stage 3 or 4 CKD (n = 6 men; n = 14 women; age 62.0 ± 9.9 years; weight 80.9 ± 16.2 kg; BMI 37.3 ± 8.9 kg/m²; eGFR 51.5 ± 6.8 ml/min/1.73 m²) were included in this study.

RESULTS: VO₂max 19.4 ± 4.7 ml/kg/min, eGFR 51.5 ± 6.8 ml/min/1.73 m². During the exercise period, HRV was measured for 5 mins in the supine position using an elastic belt and Bluetooth monitor (Polar H7). CardiacMoosw technology was used to process HRV variables high frequency (HF), low frequency (LF), and standard deviation of all NN intervals (SDNN). Data were analyzed using 2 (condition) by 4 (time) repeated-measures ANOVAs. Data violated normality and were natural log (ln) transformed prior to analysis. Significant main effects were followed using pairwise comparisons using a Bonferroni adjustment for multiple comparisons. All analyses were performed using SPSS (v.26).

CONCLUSION: For ln LF/HF there were no significant main effects for exercise condition, time, or their interaction (p > 0.05). For ln HF (P = 3.507, p < 0.05, η² = 0.156), ln LF (P = 3.093, p < 0.05, η² = 0.140), and ln SDNN (P = 3.761, p < 0.05, η² = 0.165) there was a significant main effect for time. Post-hoc comparisons revealed that HF, LF, and SDNN were lower IPE than for all other time points.

941 Board #67 May 27 2:30 PM - 4:00 PM INCREASES IN PHYSICAL CAPACITY (VO2 PEAK) IMPROVES RENAL PROTECTIVE EFFECTS IN CKD AND MITOCHONDRIAL FUNCTION Wesley H. Silva, Rafael S. Luiz, Alexandre Saud, Natália Reinecke, Luciana Jorge, Samuel Trindade, Rodolfo Rampaso, Waldemar S. Almeida, Mirian Boim. University Federal de São Paulo, São Paulo, Brazil.

(No relevant relationships reported)

PURPOSE: Physical exercise improves mitochondrial function and biogenesis. It is common for CKD patients to be physically inactive having less physical and functional capacity when compared to the general population. The aim of this study was to evaluate physical capacity, renal function and mitochondrial function in rats with CKD by nephrectomy 5/6 (Nx5/6).

METHODS: Adult Wistar rats were divided into groups (n=8): SHAM; Sedentary/Nx5/6(Sedentary) (Sed), Sedentary/Nx5/6 (Exercise, SE), Exercise/Nx5/6/Sedentary (Combined) (Exe). The physical capacity was performed with ergoprotectometry test (VO2 peak) and maximal exercise test (Mtest). Exercise periods were 40-60min daily during 8 weeks, to 40% of Mtest. We evaluated proteinuria (uprot), blood urea nitrogen (BUN) and blood pressure (BP). By Western Blotting evaluated renal AMPK Pathway (AMPK and PGC1- alpha) was

RESULTS: The Physical Capacity (VO2 peak) was increased in SE and Exe vs Sed (31.6±0.7 vs 35.2±0.9 vs 23.1±1.8; p<0.05, respectively), and Mtest was improved in SE and Exe vs Sed (34.2±2.1; 37.9±1.7 vs 24.8±0.6; p<0.05, respectively). The Exercise group presented a significant reduction in proteinuria when compared to the SE and ES (61.1±20.9 vs 173.3±9.2 vs 124±14.1; p<0.05, respectively). BUN was higher in SE and ES vs Exe (57.2±7.4 vs 65.6±7.8 vs 51.1±7.4; p<0.05, respectively). There was a decrease in PF in the SE and Exe groups when compared with the Sed group (215±1 vs 219.1±2 vs 251±2; p<0.05, respectively), but the blood pressure values still remained high. The Renal AMPK Pathway was reduced in all group vs Sed in terms of protein levels (AMPK and PGC1- alpha) was

CONCLUSIONS: The Increased physical capacity VO2 peak and Mtest minimized the impact of Nx5/6 in the CKD, attenuating proteinuria, an important index of progressive loss of renal function and to improve mitochondrial function. Finally, previous exercise induced protection for CKD, especially under this experimental protocol. Thus, it is reasonable to suggest that exercise may be an additional strategy to be employed in CKD

942 Board #68 May 27 2:30 PM - 4:00 PM Overshoot Of The Respiratory Exchange Ratio During Recovery From Maximal Exercise In Kidney Transplant Recipients Alessandro Patti, Daniel Neunhaeuserer, Sara Ortolan, Francesca Battista, Lucrezia Furian, Andrea Gasperetti, Andrea Ermolao, Padua University-Hospital, Italy, Padua, Italy. (No relevant relationships reported)

PURPOSE: The overshoot of the respiratory exchange ratio (RER) during recovery from maximal cardiopulmonary exercise testing (CPET) has been found reduced in magnitude among patients with heart failure, possibly due to the slow recovery kinetics of VO₂. To investigate whether this phenomenon could be present in patients with peripheral limitations to exercise, a population of kidney transplant recipients (KTRs) was specifically studied, since these patients may present peripheral alterations at the muscularr covering muscles. METHODS: RER was retrospectively evaluated during recovery after maximal exercise (peak RER ~ 1.1) in KTRs without history of systolic dysfunction that underwent CPET for clinical purposes. Variables assessed were the maximum RER during recovery (RER-max), the RER overshoot magnitude (RER-OM) was found significantly different among sub-populations of KTRs when conversely to RER-max, it was conditioned by peak RER (ρ=0.50; P<0.01). Finally, previous exercise induction protection for CKD, especially under this experimental protocol. Thus, it is reasonable to suggest that exercise may be an additional strategy to be employed in CKD.
Sedentary behavior increases the risk for cardiovascular and cerebrovascular disease. However, little work examined the causal link between a decline in sedentary behavior and cardiovascular and cerebrovascular function, and the potential underlying mechanisms for this relation. PURPOSE: to examine the chronic (16-week) and acute (3-hour) impact of reducing sedentary behavior on vascular and cerebrovascular function in subjects with increased cardiovascular risk. METHODS: This prospective study included 24 individuals with increased cardiovascular risk (65±5 years, 29±3±3 kg/m²). Before and after 16-week reduced sitting, using a mobile-Health device with vibrotactile feedback, we examined: i) vascular function (flow-mediated dilation (FMD)), ii) cerebral blood flow (CBF, transcranial Doppler), and iii) cerebrovascular function (cerebral autoregulation (CA) and cerebral vasomotor reactivity (CVMR)). To better understand potential underlying mechanisms, before and after intervention, we evaluated the effects of 3-hour sitting with and without light-intensity physical activity breaks (every 30-minutes). RESULTS: The first wave of participants showed no change in sedentary time (Men=10.3±0.5 hours/day, P=0.87). Upon intervention optimization, the subsequent participants (n=15) decreased sedentary time (10.2±0.4 to 9.2±0.3 hours/day, P<0.01). This resulted in significant increases in FMD (3.1±0.3 to 3.8±0.4%, P=0.02) and CBFV (48.4±2.6 to 51.4±2.6 cm/s, P=0.02), without altering CA or CVMR. Before and after the 16-week intervention, 3-hour exposure to uninterrupted sitting decreased FMD and CBFV, whereas physical activity breaks prevented a decrease (both P<0.05). CA and CVMR did not change (P=0.20).

CONCLUSION: Long-term reduction in sedentary behavior in older subjects with increased cardiovascular risk improves peripheral vascular function and cerebral blood flow, and acutely prevents impaired cerebral blood flow. These results highlight the potential benefits of reducing sedentary behavior to acutely and chronically improve cardio/cerebrovascular risk. Study is registered at the Netherlands Trial Register (NTR6387) (https://www.trialregister.nl/trial/6215).
rest and during CPT before and after the assigned intervention. An analysis of variance with repeated measures was used to determine if there were differences within and between interventions and during CPT.

RESULTS: No significant changes with either intervention were observed at rest. Responses in aortic PP (9.1 ± 2.9; P = .008), AP (4.1 ± 2.1; P = .004), Aix (3.7 ± 2.1; P = .015), Axls/axs (3.4 ± 2.4; P = .024), PR (5.1 ± 2.9; P = .034), and Pb (3.4 ± 1.7; P = .027) were significantly attenuated following L-CIT supplementation compared with placebo.

CONCLUSIONS: Although L-CIT had no effect on resting aortic hemodynamics, L-CIT attenuated aortic pressure and wave reflection responses during CPT in older adults. Therefore, short-term L-CIT supplementation may elicit cardioprotection during cold exposure in older adults.

948 Board #74 May 27 2:30 PM - 4:00 PM Single Dry Cupping Treatment On Vascular Function In Healthy Young Individuals
Arturo A. Arce-Esquivel, S. Andrew Cage, Ashley N. Tulloch, Joyce E. Ballard, FACSM, 1Texas A&M University at Texas at Tyler, Tyler, TX. (Sponsor: Joyce E. Ballard, FACSM)

(No relevant relationships reported)

Cupping, part of traditional Chinese medicine, is regularly observed to bring about pain relief and to increase a patient’s general feeling of well-being. It has been suggested that cupping promotes hyperemia (i.e., increased blood flow). Flow-mediated dilatation (FMD) is a widely used method of assessment of vascular function that provides a surrogate index for arterial health. PURPOSE: To examine the effect of a single dry cupping treatment on vascular function among healthy young individuals. METHODS: Five apparently healthy young individuals (3 women and 2 men, average age: 22 ± 1.48 years) participated in this study. Dry cupping treatment was performed using two cupping caps on the brachial and femoral arteries of each participant. Before and after a 10-minute cupping treatment, brachial FMD was evaluated using a high-resolution ultrasound with a 7.5-MHz linear array transducer. RESULTS: Following the 10-minute cupping treatment, brachial FMD increased significantly after the treatment from 7.40 ± 0.65 to 8.98 ± 1.4%, p < .05. Participants did not experience complications as a result of the intervention. CONCLUSIONS: These findings demonstrated that in healthy individuals, dry cupping treatment, was capable of increasing vascular function. This study underlies the role of cupping treatment in promoting vascular function improvements. Finally, cupping is an inexpensive and low-risk alternative therapeutic modality.

949 Board #75 May 27 2:30 PM - 4:00 PM Dietary Nitrate Counteracts The Elevated Blood Pressure Response To Nitric Oxide Synthase Inhibition In Humans
Anne V. Valvano, FACSM1, Jamie Blackwell1, Stephen J. Bailey1, Lee J. Wylie1, Bert Bond1, Michael Nyberg2, Andrew M. Jones, FACSM1, 1University of Exeter, Exeter, United Kingdom.
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(No relevant relationships reported)

Decreased production of nitric oxide (NO) via the endogenous NO-synthase (NOS) pathway is a hallmark of impaired endothelial function and is associated with elevated blood pressure. Potentiation of the alternative nitrate-nitrite-NO pathway via the diet has been suggested as a possible therapeutic strategy to counteract NOS dysfunction, but proof-of-concept that exogenous nitrate treatment compensates in situations where NOS function is impaired. PURPOSE: To determine whether dietary supplementation with nitrate-rich beetroot juice attenuates the detrimental effects of acute NOS inhibition achieved by intravenous infusion of Nω-monomethyl-L-arginine (L-NMMA) on vascular function. METHODS: Seven male volunteers (age 23 ± 3 years, body mass 77.9 ± 6.8 kg) completed four conditions in a double-blind, randomised cross-over design: 1) 5-d dietary placebo supplementation with acute saline infusion (PL-CON), 2) 5-d placebo supplementation with acute L-NMMA infusion (3 mg/kg BM over 5 min followed by 55 μg/kg BM/min; PL-LNMMA), 3) 5-d dietary nitrate supplementation (12 mmol/d) with acute L-NMMA infusion (3 mg/kg BM over 5 min followed by 55 μg/kg BM/min; PL-LNMMA), 3) 5-d dietary nitrate (12 mmol/d) with acute saline infusion (BR-CON), and 4) 5-d nitrate supplementation (12 mmol/d) with acute saline infusion (BR-LNMMA). RESULTS: L-NMMA -114 ± 85, BR-LNMMA -95 ± 71 mL/min) that were greater than after saline infusion (HR: PL-CON -2 ± 5, BR-CON -1 ± 4 bpm, P = .005; FBF: 20 ± 40 and 18 ± 36 mL/min, P = .005), with no effects of dietary supplementation. MAP was elevated by 20 ± 40 mmHg (P = .005), Pb was attenuated by ~56% following BR ingestion (P < .05). CONCLUSIONS: Acute NOS blockade through systemic infusion of L-NMMA resulted in reduced HR and FBF, and elevated MAP, in healthy humans, resembling cardiovascular impairments observed in conditions of chronic NOS dysfunction. BR attenuated the elevation in MAP, highlighting the potential for exogenous nitrate to improve vascular control in situations where NOS function is impaired.

950 Board #76 May 27 2:30 PM - 4:00 PM Association Between Arterial Stiffness, Body Mass Index And Cardiorespiratory Fitness In 7-to-17 Years Old Children
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(No relevant relationships reported)

Excess adiposity is a risk factor for cardiovascular disease, however, the obesity paradox suggests the existence of a subpopulation of obese individuals that do not suffer from those cardiovascular risks. Cardiorespiratory fitness (CRF) is a strong indicator of cardiovascular health in children and adults. Both obesity and low CRF have shown to independently increase the risk of cardiovascular diseases. PURPOSE: The aim of this study was to investigate how central arterial stiffness is associated with aerobic capacity and body fat percentage and body mass index (BMI) in children aged 7-to-17-years. METHODS: Seventy healthy children, 34 boys and 36 girls (age 7-17 years; BMI 21.5 ± 5.4 kg/m; fat mass 23.4 ± 11.5%), participated in this study. Percentage of fat mass (FM%) and fat free mass (FFM) were assessed using air displacement plethysmography (Bod Pod COSMED). Arterial stiffness was assessed measuring carotid-femoral PWV (cfPWV) with the Sphygmocor XCEL (AIC Medical, Inc.). CRF was assessed through breath-by-breath gas analysis (K5, COSMED) using a 15 watts per minute graded exercise test on a cycle ergometer. The VO2 at the first ventilatory threshold (VT1) was identified using the V-slope technique and as the lowest respiratory equivalent for oxygen. Differences in cfPWV between quartiles of VO2, at VT1, %BF, and BMI were assessed using a multivariate general linear model. RESULTS: cfPWV was higher in the first VO2 quartile compared to the fourth when VO2 was normalized by FFM (4.99 ± 0.73 vs 4.24 ±0.69 m/s, p < .05). No differences in cfPWV were observed between first and fourth VO2 at VT1 quartiles when VO2 was normalized by body mass (5.05 ± 0.92 vs 4.34 ±0.71 m/s). cfPWV was higher in the fourth and third BMI quartile compared to the first (4.26 ±0.53 and 4.90 ±0.66 vs 5.09 ±0.89, p < .05) but no differences in cfPWV were observed between third and fourth BMI quartiles (5.06 ±1.04, 4.57 ±1.04, 4.61 ±0.64). CONCLUSION: Low central arterial stiffness in children is associated with high CRF expressed as VO2 at VT1, and with low BMI.

951 Board #77 May 27 2:30 PM - 4:00 PM Brachial And Aortic Blood Pressure Soon After Delivery In Women With Versus Without A Past Adverse Pregnancy Outcome
Catherine A. O’Byrne1, Abby J. Heinichen1, Chloe W. Caudell1, Paige K. Wilbanks1, William C. Tucker1, Bo Fernhall, FACSM2, Abdi D. Lane-Cordova1.1University of South Carolina, Columbia, SC. 2University of Illinois at Chicago, Chicago, IL.

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(No relevant relationships reported)

ADVERSE pregnancy outcomes (APOs), such as preterm birth, gestational diabetes, and hypertensive disorders of pregnancy, are associated with excess maternal risk of hypertension and cardiovascular disease years later. Little is known about the effect of an APO on aortic blood pressure (BP) in the first few years after delivery. Our purpose was to test the hypothesis that women with a history of APO would have higher peripheral and aortic BP in the 6 months-3 years after delivery. METHODS: We recruited 37 women aged 18-45 years (26 white/9 black/2 other), from the greater Columbia, SC area who delivered a singleton infant 6 months -3 years ago to participate in our study. Women were excluded if they were smokers, had diabetes, HIV/AIDS, or were receiving cancer therapy. Participants completed a single visit following an overnight fast during which brachial and aortic BP were measured using an oscilometric cuff and applanation tonometry, respectively. History of APO and sociodemographic information were determined via self-report. After assessing the distribution of the data with Shapiro-Wilk tests, we tested for differences in brachial and aortic systolic, diastolic, and mean BP between groups using t-tests or Kruskal-Wallis tests, as appropriate.

RESULTS: Mean age was 33±1 yrs and mean BMI was 26.6±1.0 kg/m2 with no difference between groups. Of the 37 women in the study, 12 had a history of APO with no difference in race distribution by group. Mean brachial and aortic systolic BP were measured using repeated measures ANOVA. BR tended to be higher in women with a history of APO: 116±14 versus 108±3 mmHg, p=0.07 (brachial) and 105±4 versus 97±1 mmHg, p=0.08 (aortic). There was no difference in brachial or aortic diastolic or mean BP between groups.
CONCLUSIONS: Women with a history of APO tended to have higher peripheral and aortic systolic BP 6 months–3 years after delivery. The effects of an APO on BP may be detectable soon after the pregnancy ends and might represent a target for prevention of overt cardiovascular disease in affected women.

952 Board #78 May 27 2:30 PM - 4:00 PM The Effect Of A High-fat Meal On Sympathetic Vasoconstrictor Responsiveness In Men And Women Justin J. Duong, Breanne S. Collison, S.M. Majedul Karim, Darren S. DeLorey, FACSM. University of Alberta, Edmonton, AB, Canada.

(No relevant relationships reported)

Consumption of a high-fat (HF) meal has been shown to reduce flow-mediated dilatation (FMD) in men, but not women. This decline in FMD may be a result of decreased nitric oxide (NO) bioavailability. NO inhibits sympathetic vasoconstriction and a HF meal may, therefore, heighten sympathetic vasoconstrictor responsiveness. However, the effect of a HF meal on sympathetic vasoconstriction in men and women has not been investigated. PURPOSE: The purpose of this study was to investigate the hypothesis that consumption of a HF meal would heighten sympathetic vasoconstrictor responsiveness in men, but have no effect in women. METHODS: In a randomized cross-over design, young males (n=15) and females (n=15) consumed a HF or an isocaloric low-fat (LF) meal on separate days. Two hours post-meal, subjects underwent a cold pressor test (CPT) and measurement of brachial artery FMD to determine sympathetic vasoconstrictor responsiveness and endothelial function, respectively. Beat-by-beat blood pressure was measured by Finometer and mean arterial pressure (MAP) was calculated. Forearm blood flow (FBF) was measured by Doppler ultrasound at the brachial artery and forearm vascular conductance (FVC) was calculated as FBF/MAP. Sympathetic vasoconstrictor responsiveness was calculated as the percentage decrease in FVC (%AFVC) in response to CPT. FMD was calculated as the percentage increase in brachial artery diameter from baseline and normalized for cumulative shear rate. RESULTS: Sympathetic vasoconstrictor responsiveness was not different (p>0.05) between meal conditions or between females (LF: -27±14%; HF: -30±15%) and males (LF: -29±23%; HF: -24±16%) in either meal condition. FMD was higher (main effect of sex, p<0.05) in females (LF: 8.1±2.1%; HF: 7.4±1.4%) compared to males (LF: 6.2±1.5%; HF: 5.1±1.1%) and FMD was lower (main effect of meal; p<0.05) in the HF compared to the LF condition. No interaction (p>0.05) was observed between meal condition and sex for FMD. FMD normalized for shear rate was not different (p>0.05) between meal conditions or between females and males in either meal condition. CONCLUSION: These data suggest that, despite evidence of a post-prandial decrease in endothelial function, a HF meal does not alter sympathetic vasoconstrictor responsiveness in men or women.

953 Board #79 May 27 2:30 PM - 4:00 PM The Relationship Between Estimated Pulse Wave Velocity With Cardiorespiratory Fitness In Young Adults Kashan J. Curry1, Brock Jensen2, Kevin Heffernan3, Michael Holmstrup, FACSM. 1Syracuse University, Syracuse, NY. 2Slippery Rock University, Slippery Rock, PA. (Sponsor: Michael E. Holmstrup, FACSM)

(No relevant relationships reported)

Introduction: Carotid-femoral pulse wave velocity (ePWV) is used to measure aortic stiffness and offers insight into cardiovascular disease (CVD) risk. The measurement requires specialized equipment and technical expertise to perform accurately. Estimated carotid-femoral pulse wave velocity (ePWV) is an easily calculated alternative to objectively measured cPWV that offers comparable CVD risk prediction. Whether ePWV also offers similar insight into CVD resiliency has not been investigated. PURPOSE: Whether ePWV also offers insight into CVD resiliency. METHODS: A total 80 male spontaneously hypertensive rats (SHR) (six-week-old) were randomly divided into four groups: (1) 0.86% methionine diet and sedentary lifestyle (C), (2) 0.17% methionine diet and sedentary lifestyle (MR), (3) 0.86% methionine diet and endurance exercise (EX), (4) 0.17% methionine diet and endurance exercise (MR+EX). The body weight, water intake, and food consumption were recorded once per week. In the exercise group, the rats were adapted to exercise on treadmill (10 min/min, 10 min/day) for three days. The endurance exercise protocol on the treadmill started from 15 min, and progressively enhanced to 27 min during eight weeks, and then maintain to 12 months. The rats were trained on treadmill 5 days/week, 60 min/day for 12 months. We measured the rats’ diameter of left ventricle (LVD), and left ventricular posterior wall (LVPW) during diastole and systole period by using echocardiography at beginning and after 2 and 12 month intervention. All data were presented as mean±SEM. One-way ANOVA was used to evaluate differences between the changes, while Dunnett T3 post-hoc analysis was used to compare significant differences between test conditions. Statistical significance was accepted at p<0.05. RESULTS: Comparison between C and EX, MR and MR+EX, MR and MR+EX revealed the gain of body weight during 12-months intervention (p<0.05), but there is no difference between Ex and Ex+MR. Age, Ex, and MR reduce the LVD during diastole (p<0.05). The LVPW of diastole and systole were thickened as growth, endurance training, and restricted with methionine of individual (p<0.05). Cardiomyocytes were enlarged as growth (p<0.05), but endurance training and methionine restriction decelerate the effect. Cardiac fibrosis also increased as growth, endurance training and methionine restriction limited the development of fibrosis. CONCLUSIONS: The MR diet might be used as a strategy to ameliorate the pathological effect of hypertension evidenced by reducing the cardiac fibrosis.

954 Board #80 May 27 2:30 PM - 4:00 PM Effects Of Methionine Restriction And Exercise On Cardiac Fibrosis Of Spontaneously Hypertensive Rats. Chien-Hui Chan1, Hsin-Wei Tsai2, Yi-Hung Liao2, Shiw-Chwen Tsai1, Institute of Sports Sciences, University of Taipei, Taipei City, Taiwan, Taipei, Taiwan. 1Department of Exercise and Health Science, National Taipe University of Nursing and Health Sciences, Taipei City, Taiwan, Taipei, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)

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(No relevant relationships reported)

PURPOSE: To investigate the effect of low methionine diet and endurance exercise training on cardiac function of spontaneously hypertensive rats. METHOD: A total 80 male spontaneously hypertensive rats (SHR) (six-week-old) were randomly divided into four groups: (1) 0.86% methionine diet and sedentary lifestyle (C), (2) 0.17% methionine diet and sedentary lifestyle (MR), (3) 0.86% methionine diet and endurance exercise (EX), (4) 0.17% methionine diet and endurance exercise (MR+EX). The body weight, water intake, and food consumption were recorded once per week. In the exercise group, the rats were adapted to exercise on treadmill (10 min/min, 10 min/day) for three days. The endurance exercise protocol on the treadmill started from 15 min, and progressively enhanced to 27 min during eight weeks, and then maintain to 12 months. The rats were trained on treadmill 5 days/week, 60 min/day for 12 months. We measured the rats’ diameter of left ventricle (LVD), and left ventricular posterior wall (LVPW) during diastole and systole period by using echocardiography at beginning and after 2 and 12 month intervention. All data were presented as mean±SEM. One-way ANOVA was used to evaluate differences between the changes, while Dunnett T3 post-hoc analysis was used to compare significant differences between test conditions. Statistical significance was accepted at p<0.05. RESULTS: Comparison between C and EX, MR and MR+EX, MR and MR+EX revealed the gain of body weight during 12-months intervention (p<0.05), but there is no difference between Ex and Ex+MR. Age, Ex, and MR reduce the LVD during diastole (p<0.05). The LVPW of diastole and systole were thickened as growth, endurance training, and restricted with methionine of individual (p<0.05). Cardiomyocytes were enlarged as growth (p<0.05), but endurance training and methionine restriction decelerate the effect. Cardiac fibrosis also increased as growth, endurance training and methionine restriction limited the development of fibrosis. CONCLUSIONS: The MR diet might be used as a strategy to ameliorate the pathological effect of hypertension evidenced by reducing the cardiac fibrosis.

955 Board #81 May 27 2:30 PM - 4:00 PM Sleep Variability Is A Predictor Of Peripheral Vascular Function In Apparently Healthy Undergraduate College Students Elissa K. Katulka, Felicia R. Berube, Michele N. D’Agata, Freda Patterson, David G. Edwards, William B. Farquhar, FACSM, Melissa A.H. Wittam. University of Delaware, Newark, DE.

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(No relevant relationships reported)

Experimental studies suggest that highly variable sleep-wake patterns may impair vascular function, suggesting a potential mechanism for the increased risk of cardiovascular (CV) diseases seen in shift workers and those with sleep disorders. However, it is unclear if naturalistic, day-to-day variability in sleep-wake patterns of generally healthy individuals poses a risk to vascular function. PURPOSE: To examine the association between sleep variability (SLV) and vascular function in undergraduate college students. METHODS: SLV metrics were estimated in 39 healthy undergraduate students (20±0.2 years) using wrist actigraphy for 14 days and nights. Sleep timing was defined by sleep midpoint (halfway point between sleep onset and wake onset). Sleep timing variability (STV) was then quantified as the standard deviation (SD) of sleep midpoint, and sleep duration variability (SDV) as the SD of sleep duration across 14 days. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI). Peripheral vascular function was indexed as the magnitude of hyperemia in response to passive leg movement (PLM) and was performed immediately following the end of sleep monitoring. Blood velocity and femoral artery diameter were measured via Doppler ultrasound. RESULTS: In a linear regression model adjusting for sex and body mass, SDV predicted peak leg blood flow at PLM (β=-0.49, p<0.01), change in LBF from baseline (β=-0.49, p<0.01), and LBF area under the curve (AUC) (β=-0.57, p<0.01) during PLM. Associations remained significant when the model included PSQI score (all p<0.01). Similarly, models adjusting for sex and mass found that STV predicted LBF AUC (β=-0.30, p<0.05). CONCLUSION: In adjusted models, greater SLV is associated with less optimal peripheral vascular function in healthy college students. These data support the growing body of literature suggesting that regular sleep schedules may be important for CV health, even in otherwise healthy young adults. Supported, in part, by NIH P20GM113125.
INFLUENCE OF TYPE 2 DIABETES AND CARDIOVASCULAR DISEASE FAMILY HISTORY ON METABOLIC SYNDROME SEVERITY

N.R. Stewart, E.M Heiston, S.L. Miller, A.L. Weltman (FACS), J.T. Patrice, S.K. Malin (FACS) University of Virginia, Charlottesville, VA 22904

Background: Family history of cardiovascular disease (CVD) is considered a strong predictor of developing metabolic syndrome (MetS), in part through promoting endothelial dysfunction. In addition, a family history of type 2 diabetes (TD2) relates to lower metabolic insulin sensitivity and may compound their MetS risk severity. We examined in people with MetS if a family history of CVD and TD2 (CVD+TD2) increases MetS risk severity compared to individuals with a family history of CVD only (CVD). Methods: Twenty, middle-aged obese individuals with MetS (55 ± 6.5 yrs; 32.5 ± 6.6 kg/m²) were divided into CVD (n=9; 6F) or CVD+TD2 (n=11; 9F). MetS was defined using the NCEP ATP III criteria. MetS severity Z-score was calculated from waist circumference, blood pressure, fasting blood glucose, triglycerides, and high-density lipoproteins. Metabolic insulin sensitivity (i.e. glucose infusion rate, GIR) was measured using a 2-hr hyperinsulinemic-euglycemic (40 mU/m²/min, 90 mg/dl) clamp. Insulin-stimulated brachial artery flow-mediated dilation (FMD) was also measured as the change from fasting to 2-hr during the clamp to assess endothelial function and gain tissue-specific insight into the origin of insulin action. Results: There was no difference in anthropometrics between groups. There was also no statistical difference between CVD and CVD+TD2 in MetS severity (2.62±1.12 vs. 1.65±0.56, P=0.42), GIR (2.35±1.05 mg/kg/min vs. 2.63±1.56 mg/kg/min, P=0.86), or insulin-stimulated FMD (0.53±1.57% vs. 1.62±1.19%, P=0.52). However, waist circumference was inversely correlated to GIR (r=-0.63, P<0.01). Conclusion: In adults with MetS, TD2 family history does not exacerbate MetS severity in adults with CVD family history. However, waist circumference appears to be important for lowering metabolic insulin sensitivity. Thus, targeting abdominal fat may contribute to improved metabolic health independent of CVD and/or CVD family history.

Funding was supported by the National Institutes of Health RO1-HL130296.
Cardiovascular diseases (CVD) are the leading cause of death worldwide, and compelling evidence indicates that exercise prevents and attenuates CVD. Resistance training (RT) exerts positive health effects; however, there is a lack of evidence regarding the RT intensities that could be prescribed to improve vascular endothelial function. PURPOSE: To compare the effects of two RT intensities during eight weeks on vascular endothelial function in sedentary young males. METHODS: Thirty-four sedentary males were recruited (age = 20.6 ± 1.8 yr, height = 171.3 ± 5.2 cm, weight = 65.2 ± 10.6 kg, DXA fat mass = 22.3 ± 7.4 %), and randomly assigned to a control group (CTRL, no exercise), RT at 50% of a maximum repetition [1-RM] and RT at 80% 1-RM. The RT program was performed twice a week for eight weeks, and except for the CTRL group, participants performed the same RT exercises at similar total workloads (2010 arbitrary units [AU] for the 80% RM and 1950 AU for the 50% RM). Vascular endothelial function was measured between (pre) and after (post) eight weeks by ultrasound and determined by the percentage of flow-mediated dilatation (%FMD). Mixed factorial ANOVA (3 groups x 2 measurements x 2 occlusions), effect size (ES) and 95% confidence interval (CI95%) were computed for %FMD. RESULTS: A significant triple interaction was found on %FMD (p = 0.021). The eight-week post-intervention follow-up analyses showed a significant increase (%FMD >10%) in the 80% RM (Mean = 9.93 ± 3.73%, ES = 3.70, CI95% = 1.59 to 5.79) compared to the control group (Mean = 5.72 ± 1.71%, ES = 1.67, CI95% = -0.21 to 3.55), and no significant differences between 50% RM and 80% RM (Mean = 7.90 ± 2.51%, ES = 2.18, CI95% = 0.27 to 4.10), and between 80% RM and control groups. CONCLUSION: A 50% RM intensity RT program elicited a positive vascular endothelial function adaptation following eight-weeks of training. It seems unnecessary to perform high-intensity RT to obtain arterial health benefits.
PURPOSE: Isometric exercise training (IET) is an effective adjunct for the management of resting blood pressure (RBP) but responsible mechanisms have not yet fully been identified. Isometric contractions reduce blood flow as a result of vascular compression altering intramuscular metabolism. In response, active muscle could increase the production and circulation of vasoactive molecules (e.g., VEGF) and alter inflammatory biomarkers (e.g., IL-6 and TNF-α), which may lead to adaptations in resistance vessels. We studied the influence of bilateral arm or leg IET on blood pressure and plasma VEGF, IL-6, and TNF-α over the course of 6-weeks.

METHODS: The study was approved by the UNC Charlotte IRB. Twenty-eight healthy and recreationally active normotensive males (19-25 years) gave written informed consent and were randomized to one of three conditions; double bicep curl IET (IBC), double leg extension IET (ILE), or control (CON). IET groups completed exercise sessions at 15% maximal voluntary contraction (6 x 2-minute contractions) 3 days per week for 6-weeks with RBP assessed at each visit. For a subsample (n=17), 3 blood samples (pre-, 1 hour post-, 24 hours post-training) were collected at the first and last training visits. The CON group performed all study procedures except IET.

RESULTS: Using a repeated-measures ANCOVA (controlling for acclimation RBP and cohort), a significant time by condition interaction was observed for RBP (P < 0.05). Specifically, IET resulted in a lower systolic RBP, but did not differ by IET group: IBC: 144.4 ± 4.0 mmHg; ILE: 143.5 ± 7.6 mmHg; CON 23.2 ± 4.0 mmHg. Diastolic RBP did not significantly change for any group. Currently, there are no acute or chronic IET effects on the systemic biomarker levels.

CONCLUSIONS: 6-weeks of bilateral arm or leg IET resulted in significant reductions in systolic RBP to the small sample size (n=17), power may have limited the ability to detect significant effects on circulating VEGF, TNF-α and IL-6. Research should continue to examine how IET alters RBP. The research was funded by Faculty Research Grant (JMB & HR) and the Thomas L. Reynolds Graduate Student Research Award (B.D.H.G).

Oscillometric Ambulatory Blood Pressure Monitors Are Prone To Errors In A Controlled Laboratory Setting


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We developed a dual monitor protocol for testing the accuracy and reliability of 24-hr ambulatory blood pressure monitors (ABPMs) and determined in normotensive (n=15), hypertensives (n=14) and alcohol-dependents (n=11) that a popular oscillometric ABPM was highly variable, misclassifying up to 70% of patients.

Purpose: To determine the accuracy and reliability of two widely used oscillometric ABPMs, the Oscar 2 (Suntech Medical, Morrisville, NC) and the Spacelabs 90207 (Spacelabs Healthcare, Snoqualmie, WA) under controlled lab conditions. Hypothesis: Oscillometric proprietary algorithms were developed from auscultatory reference BPs, thus ABPMs would differ from each other and from observers (O1, O2) using a Hg column and Thinklabs digital stethoscope. Methods: BPs were measured in triplicate on both arms in 17 seated subjects (10 ♀, 7 ♂) with simultaneously arm BPs by O1 & O2 alternating with simultaneous opposite arm BPs by ABPMs. Results: The average (± SE) systolic (SBP) and diastolic (DBP) BPs for O1, O2, Oscar & Spacelabs ABPMs were 114.2±6.7 ± 2.0±1.8 mm Hg, 144.1±6.7± 2.0±1.8 mm Hg, 120.4±6.7± 2.1±1.4 mm Hg, and 119.3±6.7± 1.9±1.3 mm Hg, respectively. Compared to O1O2, the Oscar overestimated SBP by 9.8 ± 0.9 mm Hg (P <0.001), while the Spacelabs overestimated SBP by 5.2 ± 0.8 mm Hg (P <0.001), SBP was significantly between ABPMs (P <0.001). Though the DBP difference was small between observers and ABPMs, O1O2 - Oscar = 4.6 mm Hg; O1O2 - Spacelabs = -0.7 mm Hg, there was a high degree of variability with the Oscar ranging from 23 mm Hg above to 20 mm Hg below and the Spacelabs 23 mm Hg above to 26 mm Hg below the observers. Compared to O1O2, Oscar SBP and DBP differed by > 5 mm Hg in 15/17 (88%) and 7/17 (41%), while the Spacelabs SBP and DBP differed by > 5 mm Hg in 11/17 (65%) and 8/17 (47%) of subjects, respectively. Conclusions: Controlled lab testing revealed significant measurement errors in widely used oscillometric ABPMs. Given light exercise during 24-hr ambulatory monitoring, the outlook for accuracy and reliability appears worse. Oscilometric nomogram-like equations are population-specific and indirect 2nd generation estimations and cannot account for individual variations making them highly susceptible to errors, though more testing is required in a greater number of hypertensives.
Near-Infrared spectroscopy (NIRS) is a non-invasive tool used to measure blood flow in peripheral tissues. More information on test-retest reliability and inter-rater agreement of NIRS-based reperfusion assessments is needed. PURPOSE: To assess inter-rater agreement for NIRS based data analysis, and evaluate the measurement’s reliability across days. METHODS: On three separate days, participants’ (N=15 males, 22±2 yr) reactive hyperemia was measured in the left gastrocnemius muscle using Continuous-Wave NIRS. A blood pressure cuff was placed proximal to the knee and inflated to occlude lower leg blood flow for 5 minutes. The cuff was rapidly deflated, and the blood flow responses were measured until values returned to baseline. Raw NIRS data were exported and analyzed in a custom-written routine in MATLAB by two individuals. The following NIRS parameters were selected: (1) the time for the O2Hb signal to reach 50% peak post-occlusion hyperemia (T1/2), (2) The O2Hb range used to normalize the NIRS signal; (3) the post peak-hyperemic O2Hb recovery slope, taken as an index of sustained microvascular dilation. Inter-rater agreement was assessed using Intraclass Correlation Coefficients (ICC), calculated using an absolute agreement two-way mixed effects model. 95% confidence intervals (CI) of ICCs are reported. Cronbach’s alpha was used to assess day to day reliability for each of the measures. RESULTS: The ICC data indicate that there is “good” to “excellent” agreement between NIRS analyzers as shown in table 1.

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<th>Table 1. Intraclass Correlation Coefficients for Reperfusion Measures</th>
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Cronbach’s alpha for raters 1 and 2 were: T1/2 (α = 0.95, α = 0.91), O2Hb (α = 0.95, α = 0.91), and post peak-hyperemic O2Hb recovery slope (α = 0.74, α = 0.83). CONCLUSION: Our data indicate multiple raters can be used to analyze NIRS based reperfusion measures with good agreement and that the method has sufficient test-retest reliability to use in experimental designs involving multiple laboratory visits.

Loss of ideal cardiovascular health can begin in childhood with the development of cardiovascular disease (CVD) risk factors occurring on a continuum. Central blood pressure (BP) values may be more reflective of CVD risk than peripheral BP but are rarely measured in children. Additionally, in adults, poor sleep quality is associated with higher BP and incidence of CVD, however these relations are not as well elucidated in children. PURPOSE: To evaluate the role of sleep duration, sleep quality, and sleep variability (SLV) on resting central and peripheral BP in apparently healthy 7-12 yr old children. METHODS: Sleep duration, total time in bed (TTIB), sleep quality (assessed by sleep efficiency (SE) and wake after sleep onset (WASSO)), and SLV (assessed by sleep midpoint standard deviation (SMDSD)) were recorded in 20 healthy children (10 ± 0.5 yrs, 10 boys, 10 girls) for 7 consecutive nights outside of the laboratory via wrist accelerate monitoring. Following sleep monitoring, peripheral BP was measured and using pulse wave analysis (PWA) central BP was estimated. Central and peripheral BP were measured and averaged over 3 trials. Pearson’s r correlations were used to assess relations between sleep metrics and BP values. Independent samples t-tests were used to determine group (low vs. high SE) differences. RESULTS: Sleep duration averaged 7.9 ± 0.2 hrs per night, while TTIB was averaged 8.2 ± 2%. WASO was 89 ± 9 mins, and SMDSD was 48 ± 6 mins. Sleep duration, TTIB, SE, WASO, and SMDSD were not significantly associated with central or peripheral BP values. When using an 85% cutoff for SE, central and peripheral BP were not significantly different between groups. Additionally, using the same cutoff for SE, TTIB was not significantly different between groups, however sleep duration was significantly different (7.4 hrs < 85% vs 8.4 hrs > 85%). CONCLUSION: Preliminary data suggest that children age 7-12 are not getting the recommended amount of sleep (9-11 hrs/night) despite adequate time in bed. Thus far, there seems to be no effect of shortness, poor-quality, and more variable sleep on BP in healthy children age 7-12, but further research is needed.
as the percent rise of the peak diameter from baseline diameter. Doppler ultrasound was employed to measure the carotid diameter, and blood velocity during exercise, and hyperemia. Conductance and shear rate (SR) of the ICA at 25 min of exercise was calculated based on the Doppler variables and mean blood pressure. 

**RESULTS:** Neither type of exercise altered the SR of the ICA (Interaction effect; P = 0.93, main effect of time; P = 0.14). Conductance decreased during high-intensity exercise (Pre to 25 min; 5.1 ± 3.3 to 3.2±1.0 ml/min/mmHg, P < 0.01) but not during moderate-intensity exercise (5.0 ± 3.3 to 4.0 ± 0.8 ml/min/mmHg, P = 0.11). Shear-mediated dilation immediately declined after high-intensity exercise (Pre to Post5; 6.9 ± 1.7 to 4.0 ± 1.4%, P < 0.01), but not after moderate-intensity exercise (7.2 ± 2.1 to 7.3 ± 1.8%, P = 1.00). Shear-mediated dilation did not show significant changes at Post60 in either exercise intensity (Post 60; Moderate; 8.0 ± 3.1, High; 6.4 ± 2.9%).  

**CONCLUSIONS:** The acute decline of shear-mediated dilation in the ICA following high-intensity exercise may have been due to changes in blood sympathetic activity and hemodynamics rather than in the SR. Current findings suggest that moderate-intensity exercise is more suitable for promoting cerebrovascular health than high-intensity exercise.

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### Board #98 May 27 2:30 PM - 4:00 PM

**Concurrent Vibration During Muscle Contractions Acutely Reduces Following Central Arterial Stiffness**

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(No relevant relationships reported)

Whole body vibration has been shown to elicit vasodilation after intervention.  

**PURPOSE:** To test the hypothesis that concurrent local vibration while muscle contraction would reduce the vasoconstrictive response induced by exhaustive resistance exercise.  

**METHODS:** A total of 18 apparently young healthy males (age=22±1 y; BMI=23 ±1 kg/m²) were recruited. Following the maximal isometric voluntary contraction determination (MVC), participants were randomly assigned to perform 2 trials of isometric knee extensor (40%MVC×3 sets, 8 reps for the first 2 sets, exercise to exhaustion in the 3rd set, 1 min rest interval) with (KE-V) and without (KE) concurrent vibration (20Hz, 2.4mm in magnitude) on the customized motor-driven knee extensor device. Brachial blood pressure measured by sphygmomanometer, central and peripheral pulse wave velocity determined by photoplethysmography, and heart rate variability (HRV) were measured before and after 5 mins of exercise.  

**RESULTS:** Heart rate, brachial blood pressure parameters significantly increased from baseline during exercise, and there was no difference between treatments. KE-V trial significantly reduced central pulse wave velocity exercise after exercise, whereas KE did not elicit any changes on pulse wave velocity measures compared with the baseline.  

**CONCLUSIONS:** These results demonstrate that concurrent vibration with muscle contraction also exerts vasodilatory responses after exercise, which may be associated with relatively higher parasympathetic dominance induced by vibration.

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### Board #99 May 27 2:30 PM - 4:00 PM

**Distribution Of Passive Leg Movement-induced Hyperemia In Old And Impact Of Occluding The Lower Leg**

Katherine L. Shields, Catherine L. Jarrett, Angela V. Bisconti, Soung Hun Park, Jesse C. Craig, Ryan M. Broxterman, Russell S. Richardson. University of Utah, Salt Lake City, UT.  

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(No relevant relationships reported)

**PURPOSE:** With passive leg movement (PLM), a vascular function assessment, in the young, of the total blood flow (BF) that passes through the common femoral artery (CFA), ~70% is directed to the deep femoral artery (DFA), while only ~30% passes through the superficial femoral artery (SFA). With lower leg cuff-induced BF occlusion, a common practice with drug infusions during PLM, there is an attenuated response in the SFA, which is reflected by a fall in BF in the CFA, but not in the DFA. Interestingly, the proportion of blood passing through the DFA and SFA is unchanged. Therefore, PLM was performed with and without cuff-induced lower leg BF occlusion in 6 healthy old subjects, with BF assessed by Doppler ultrasound. RESULTS: In terms of BF distribution during PLM, like the young, of the 80±27 ml of blood that passed through the CFA, 69±22% was directed to the DFA, while only 31±22% passed through the SFA. However, unlike the young, the cuff resulted in the isometric handgrip (IHG) and the fall in BF did not achieve statistical significance. As with the young, DFA BF was unaltered by the cuff.  

**CONCLUSIONS:** Thus, in the old, as with young, the PLM-induced hyperemia predominantly passes through the DFA. Cuffing appears to impact the SFA BF in the old to a greater extent than the young, but, again, in this population there is no effect on PLM-induced DFA BF.

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### Board #100 May 27 2:30 PM - 4:00 PM

**Decreased Pulse Wave Reflections Associated With Isometric Handgrip Training Improves Cognitive Function In Older Adults**

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(No relevant relationships reported)

**PURPOSE:** The purpose of this study was to investigate whether the decrease in pulse wave reflection and central systolic blood pressure (SBP) as a result of isometric handgrip (IHG) training improves cognitive function in older adults.

**METHODS:** Twenty-two men and women (age 75±7 years, mean±standard deviation) who were not actively involved in regular resistance or endurance training were randomly assigned to either the group that performed IHG training (IHG group, n=11) or the sedentary control group (CON group, n=11). The IHG exercise comprised four unilateral 2-min isometric contractions at 30% of maximal voluntary contraction using a programmed handgrip dynamometer with 1-min rest periods for 5 days per week for 8 weeks. Carotid augmentation index (AIx), an index of the magnitude of pulse wave reflections, and carotid SBP were non-invasively measured after resting in the supine position for at least 5 min in both groups before (baseline) and after 8 weeks of training using an arterial applanation tonometry system. Trail making test (TMT) Part A, which measures processing speed, and Part B, which assesses task shifting, were used to determine processing speed and flexibility in task switching and cognition.

**RESULTS:** Carotid AIx and carotid SBP in the IHG group after training were significantly lower than baseline values, decreasing from 52±4 to 39±3 ml/mmHg and from 148±5 to 137±5 mmHg, respectively (p<0.05 for both). TMT-A and TMT-B in the IHG group after training were significantly lower than baseline values, decreasing from 34.7±3.04 to 26.41±2.33 and from 60.52±5.25 to 49.39±4.51 s, respectively (p<0.05 for both). The carotid AIx, carotid SBP, TMT-A and TMT-B did not significantly change before and after training in the CON group. A significant positive correlation was observed between the amount of change in carotid AIx and the amount of change in TMT-A (r=0.603, p<0.05) and TMT-B (r=0.591, p<0.05). In addition, a significant positive correlation was observed between the amount of change in carotid SBP and the amount of change in TMT-A (r=0.736, p<0.01) and TMT-B (r=0.582, p<0.05).

**CONCLUSIONS:** These results demonstrate that isometric handgrip exercises reduce carotid AIx and carotid SBP, which is associated with improving cognitive function.

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### Board #101 May 27 2:30 PM - 4:00 PM

**Abstract Withdrawn**

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### Board #102 May 27 2:30 PM - 4:00 PM

**Abstract Withdrawn**

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### Board #103 May 27 2:30 PM - 4:00 PM

**A Cross-sectional Comparison Of Vascular Health Between Physically Active Pre- And Post-Menopausal Women.**

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(No relevant relationships reported)

Following menopause, the risk of developing cardiovascular diseases increases significantly in women. The hormonal changes observed during the menopause transition, including the cessation of estrogen production by the ovaries, seems to accelerate arterial aging by decreasing vasoreactivity and increasing arterial stiffness. Physical activity is considered the most effective strategy to maintain optimal vascular health for older men, whereas it was demonstrated a positive influence of physical activity on markers of vascular health. However, in older women, the benefits of physical activity on vascular health are still unclear. **PURPOSE:** To determine if physically active post-menopausal women demonstrate preserved vascular health compared to physically active pre-menopausal women. **METHODS:** Five pre- (49 ± 3 years) and five post- (54 ± 2 years) menopausal healthy and active women were recruited. Blood pressure (24Hz, 24-hour blood pressure monitoring), physical activity levels (7-day accelerometer), vasoreactivity (brachial artery flow-mediated dilation) and central arterial stiffness (carotid-femoral pulse wave velocity) were compared between groups. **RESULTS:** Despite both groups being physically active
CONCLUSIONS: In conclusion, the present study revealed that sitting-induced leg endothelial dysfunction is prevented in endurance-trained individuals. Sitting-induced leg endothelial dysfunction remains largely unknown. Herein, we tested the hypothesis that sitting-induced leg endothelial dysfunction is prevented in high endurance-trained individuals. Moreover, siting-induced leg endothelial dysfunction is associated with a sustained reduction in blood flow-induced shear stress. However, whether regular endurance training is effective in preventing sitting-induced leg endothelial dysfunction remains largely unknown. Herein, we tested the hypothesis that sitting-induced leg endothelial dysfunction is prevented in high endurance-trained individuals.

METHODS: The endurance-trained group comprised 11 male collegiate cyclists (age, 21.1 ± 1.8 years; height, 170.1 ± 6.6 cm; weight, 72.2 ± 8.1 kg; body mass index, 24.8 ± 1.5 kg/m²). Peak oxygen uptake (VO₂peak) was initially determined in all participants using incremental exercise test (37.9 ± 4.7 mL/min/kg). During the testing period, the popliteal artery flow-mediated dilation (%FMD) was assessed before the 30-minute sitting period in both groups (the untrained group and the endurance-trained group: 51.9 ± 19.2 sec at post-sit, 19.4 ± 7.4 sec at 1h during sitting period, 29.4 ± 13.9 sec at 3h during sitting period, 29.4 ± 13.9 sec at post-sit, 4.5 ± 0.6 sec at rest). During the 30-minute sitting period, the popliteal artery diameter and blood velocity were measured every hour.

RESULTS: The popliteal artery shear rate was significantly and similarly reduced during the sitting period in both groups (the untrained group and the endurance-trained group: 51.9 ± 19.2 sec vs. 58.3 ± 23.5 sec at pre-sit, 25.5 ± 10.9 sec vs. 25.5 ± 15.2 sec at 1h during sitting period, 19.4 ± 7.4 sec vs. 27.5 ± 12.3 sec at 2h during sitting period, 21.4 ± 8.1 sec vs. 20.8 ± 8.3 sec at 3h during sitting period, 29.4 ± 13.9 sec vs. 29.7 ± 15.8 sec at post-sit, P < 0.001). In a 3-h sitting, a significant impairment in popliteal artery %FMD was observed in the untrained group (4.5 ± 0.6 % vs. 1.6 ± 0.2 %, P < 0.003), but it was prevented in the endurance-trained group (6.9 ± 0.7 % vs. 6.2 ± 1.3 %, P < 0.431).

CONCLUSIONS: In conclusion, the present study revealed that sitting-induced leg endothelial dysfunction is prevented in endurance-trained individuals.

Purpose: To determine the associations between Functional Movement Screen (FMS) scores and the International Knee Documentation Committee (IKDC) questionnaire score, Knee Injury and Osteoarthritis Outcome Score (KOOS) subscales scores, gait biomechanics, and drop vertical jump (DVJ) biomechanics in individuals with ACL reconstruction (ACL-R).

Methods: 30 individuals with ACL-R (53% female; 71.0±46.4 months post-ACL-R; 22.6±1.8 years old; 11 patellar tendon graft, 12 hamstring tendon graft, 7 allograft) completed the IKDC and KOOS. Bilateral gait biomechanics were obtained from 5 trials on a 10m runway over 2 force plates. DVJ biomechanics were obtained using a 30cm box placed half their height from the force plates. FMS tasks were scored from 0-3 and summed for analysis. Bilateral gait biomechanics included the knee flexion angle (KFA) at heel contact, peak KFA, and vertical ground reaction force (vGRF) in the first 50% of stance. Bilateral DVJ biomechanics included the peak knee abduction angle, KFA at heel contact, peak KFA, and peak vGRF. A limb symmetry index (LSI) was calculated for peak KFA and peak vGRF during gait and DVJ. Involved limb values and LSI from gait and DVJ were used for analysis. Separate stepwise linear regression examined the association between the FMS and the IKDC, KOOS subscales, and DVJ biomechanics after accounting for sex and time since ACL-R.

Results: No associations were found between FMS score (Mean: 10.9±2.0) and the IKDC (Mean: 84.3±10.6) and KOOS (Mean: 72.0 – 95.6±1.8 – 21.3) after accounting for sex and time since ACL-R (AR=0.01 – 0.05, ΔP=0.23 – 0.95). No associations were found between FMS score and involved limb biomechanical variables or their LSI’s for gait (AR=0.01 – 0.07, ΔP=0.17 – 0.79) and DVJ (AR=0.01 – 0.11, ΔP=0.08 – 0.99) after accounting for sex and time since ACL-R.

Conclusion: The IKDC and KOOS indicated that participants reported some knee-related disability. Conversely, the average FMS score was above the clinical threshold for dysfunctional movement patterns. Therefore, the FMS may not identify knee-related disability in individuals with ACL-R. Moreover, FMS score was not associated with gait or DVJ biomechanics, and thus the FMS may not identify hazardous knee movement patterns in individuals with ACL-R.
Matrix metalloproteinase-3 (MMP-3) is a degenerative enzyme associated with joint tissue breakdown and has been shown to be a potential biomarker of osteoarthritis. It remains unknown if synovial fluid (SF) MMP-3 concentrations following ACL injury influence gait mechanics. PURPOSE: To compare knee flexion angle (KFA) and internal knee extension moment (KEM) during gait 6 months post-ACLR in individuals with the highest concentrations of SF MMP-3 compared to those with the lowest concentrations of SF MMP-3 collected within the first 14 days of injury. METHODS: Thirty-seven individuals with ACL injury scheduled for primary patellar tendon autograft ACLR (57% females, 21±4 yrs, 23.7±2.8 BMI) participated. Individuals were grouped into highest (HQ; n=9) and lowest (LQ; n=10) quartiles based on MMP-3 knee joint SF concentrations sampled 6±4 days after ACL injury. At 6 months post-ACLR, biomechanics were collected using 3-dimensional motion capture during gait performed at a self-selected speed. Functional analyses of variance were conducted to compare KFA and KEM between HQ and LQ groups throughout stance. Groups were considered different at any percentage of stance where the 95% confidence intervals of the mean differences did not cross zero. Peak differences (PD) and corresponding effect sizes (Cohen’s d) within portions of stance demonstrating differences were also calculated. RESULTS: HQ exhibited lesser knee flexion excursion; KFA was lower during 17-24% of stance (PD: 2.1°, d=0.44) and greater during 48-100% of stance (PD: 4.5°, d=0.93). HQ also exhibited lower KEM during 14-30% and 91-100% of stance (PD: 0.72 BW, d=0.07; PD: 0.33 BW, d=1.42) and greater KEM during 45-72% of stance (PD: 0.44, d=0.76). CONCLUSION: Compared to individuals in the lowest quartile of SF MMP-3, those in the highest exhibited a stiffened knee gait strategy. Pre-surgery levels of MMP-3 following ACL injury may serve as a biomarker predicting worse gait mechanics 6 months post-ACLR.

Figure 1: Torque complexity of knee extensor maximal contraction compared between limbs and groups. The involved limb of the ACLR individuals demonstrated significantly higher torque complexity compared to the uninvolved limb (denoted by *) and the healthy individual trials (denoted by #).
resistance trained according to the American College of Sports Medicine guidelines consistently after completion of physical therapy. The NRT group included individuals who did not resistance train at all. Independent samples T-tests were used to compare peak hip and knee extensor strength (Nm/kg stature), peak pGRF (N/kg stature), and pGRF impulse (Nw/kg stature) between the RT and NRT groups. Bi variate correlations were used to identify if hip and knee extensor strength were related to pGRF and pGRF impulse.

**Results:** The RT group had greater peak knee extensor torque at 60°/sec (KE60) and 180°/sec (KE180) than the NRT group. Differences were observed between groups in peak hip torque, pGRF, or pGRF impulse. There was a negative correlation between KE60 and pGRF during walking (r = -0.451, p = 0.034). No correlations were found between pGRF impulse and hip or knee torque. **Conclusion:** Results confirm our hypothesis that in ACLR, individuals in the RT group exhibited greater knee extensor torque than the NRT group. Additionally, greater KE60 was related to less pGRF during walking. An exploratory analysis found no differences in walking or running velocities, indicating the RT group accomplishes the same goal with less force. This may demonstrate greater movement efficiency resulting from resistance training above the improvements in strength alone.

### Appropriate knee loading during walking is essential for optimal health of mechanosensitive joint tissues and is largely governed by quadriceps muscle forces. However, individuals with anterior cruciate ligament reconstruction (ACLR) often exhibit quadriceps muscle dysfunction conventionally measured via reduced peak knee extensor moments (pKEM). Recent advances in ultrasound imaging provide a unique opportunity to determine if quadriceps dysfunction also manifests as altered contractile behavior between those with ACLR and uninjured controls. **PURPOSE:** Determine differences in quadriceps contractile behavior during weight acceptance in walking between ACLR, contralateral, and control limbs. **METHODS:** Six individuals to date with unilateral ACLR (4 females, 20±2 yrs, BMI: 25.3±1.8, months post-surgery: 7.1±0.7) and 11 uninjured controls (6 females; 24±3 yrs, BMI: 22.0±2.0) walked for 2 min on an instrumented treadmill. We collected motion capture and ground reaction force data and recorded cine B-mode ultrasound images of the vastus lateralis (VL). We quantified pKEM, knee flexion excursion (KFE), and VL fascicle length change during weight acceptance (i.e., heel-strike to the instant of pKEM). We report effect sizes (ES) for all comparisons. **RESULTS:** pKEM was 25% lower in the ACLR limb (0.18±0.21 Nm/kg) than the contralateral limb (0.24±0.14 Nm/kg, ES = 0.40) and 75% lower than for uninjured controls (0.74±0.19 Nm/kg, ES = 3.03). Similarly, the KFE limb exhibited 21% less KFE (11.4±3.4°) than the contralateral limb (14.5±2.2°, ES = 1.08) and 32% less KFE than in uninjured controls (16.8±3.5°, ES = 1.57). In uninjured controls, VL fascicles shortened by 0.13±0.23 mm during weight acceptance despite 1.21±0.26 cm of muscle-tendon-unit lengthening, alluding to a predominant role of tendon elongation. VL fascicles in the contralateral limb of ACLR subjects also exhibited shortening during weight acceptance (0.07±0.33 mm). Conversely, we observed fundamentally different behavior in the ACLR limb, for which VL fascicles lengthened by 0.10±0.14 mm (vs controls, ES = 1.21). **CONCLUSION:** ACLR alters quadriceps contractile behavior during weight acceptance in fascicles lengthening unique to the ACLR limb may be a functional consequence of quadriceps dysfunction relevant to altered knee loading.

### Appropriate knee loading during walking is essential for optimal health of mechanosensitive joint tissues and is largely governed by quadriceps muscle forces. However, individuals with anterior cruciate ligament reconstruction (ACLR) often exhibit quadriceps muscle dysfunction conventionally measured via reduced peak knee extensor moments (pKEM). Recent advances in ultrasound imaging provide a unique opportunity to determine if quadriceps dysfunction also manifests as altered contractile behavior between those with ACLR and uninjured controls. **PURPOSE:** Determine differences in quadriceps contractile behavior during weight acceptance in walking between ACLR, contralateral, and control limbs. **METHODS:** Six individuals to date with unilateral ACLR (4 females, 20±2 yrs, BMI: 25.3±1.8, months post-surgery: 7.1±0.7) and 11 uninjured controls (6 females; 24±3 yrs, BMI: 22.0±2.0) walked for 2 min on an instrumented treadmill. We collected motion capture and ground reaction force data and recorded cine B-mode ultrasound images of the vastus lateralis (VL). We quantified pKEM, knee flexion excursion (KFE), and VL fascicle length change during weight acceptance (i.e., heel-strike to the instant of pKEM). We report effect sizes (ES) for all comparisons. **RESULTS:** pKEM was 25% lower in the ACLR limb (0.18±0.21 Nm/kg) than the contralateral limb (0.24±0.14 Nm/kg, ES = 0.40) and 75% lower than for uninjured controls (0.74±0.19 Nm/kg, ES = 3.03). Similarly, the KFE limb exhibited 21% less KFE (11.4±3.4°) than the contralateral limb (14.5±2.2°, ES = 1.08) and 32% less KFE than in uninjured controls (16.8±3.5°, ES = 1.57). In uninjured controls, VL fascicles shortened by 0.13±0.23 mm during weight acceptance despite 1.21±0.26 cm of muscle-tendon-unit lengthening, alluding to a predominant role of tendon elongation. VL fascicles in the contralateral limb of ACLR subjects also exhibited shortening during weight acceptance (0.07±0.33 mm). Conversely, we observed fundamentally different behavior in the ACLR limb, for which VL fascicles lengthened by 0.10±0.14 mm (vs controls, ES = 1.21). **CONCLUSION:** ACLR alters quadriceps contractile behavior during weight acceptance in fascicles lengthening unique to the ACLR limb may be a functional consequence of quadriceps dysfunction relevant to altered knee loading.
### S92 Vol. 52 No. 5 Supplement

**MEDICINE & SCIENCE IN SPORTS & EXERCISE®**

#### S98 Board #114 May 27 1:30 PM - 3:00 PM Preventing ACL Injuries With Martial Arts Training

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(No relevant relationships reported)

### Purpose:
ACL injuries have remained prevalent despite numerous prevention attempts. Most prevention has focused on traditional approaches. We propose a novel approach to injury prevention by implementing martial arts falling techniques. This training uses proprioceptive and kinesthetic conditioning to reinforce the athlete’s ability to mitigate at-risk postures. This study aims to evaluate the proprioceptive function and risk factors in soccer athletes that undergo fall training.

### METHODS:
Members of a premier soccer club, ages 9 to 16, were recruited to all subjects continued usual training. Subjects partook in the interventional training of martial arts fall training, taught by a 3rd degree black belt master in karate and aikido, twice weekly for ten weeks. Baseline and post-intervention, proprioceptive testing was performed using the Neurocom Balance Master. A linear mixed model was used to determine the effect of the intervention on variables of interest. The fixed effect was time point, used to compare pre to post intervention measures, and random effects included intercepts for subjects and trials within subjects. The level of significance was 0.05.

### RESULTS:
A significant increase in movement time from pre to post (P<0.01, Postmean=1.14, P<0.02), no significant change in turn time, turn sway, or sway energy. There was a non-significant decrease in impact index (P<0.01, Postmean=6.9, P=0.06). A significant decrease in the mean impact index for the right lower extremity. While not statistically significant, downward trends were observed in right lower extremity for mean turn time, mean turn sway, and mean sway energy. Additionally, no change noted for mean equilibrium and mean strategy.

### CONCLUSIONS:
Results of the mean impact index test highlight the efficacy of martial arts fall training in the dominant lower extremity. Furthermore, the trend of improvement in the dominant leg in a variety of proprioceptive metrics is noteworthy, suggesting the intervention reinforced the more honed neural pathways of the dominant side quicker than the non-dominant. Future research is needed to elucidate whether the non-dominant side can demonstrate the plasticity seen in the dominant side. Finally, the overall increase seen in mean equilibrium and mean strategy is promising.

#### S987 Board #113 May 27 1:30 PM - 3:00 PM Revisiting Central And Peripheral Contributions To Muscle Weakness After ACL-Reconstruction

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(No relevant relationships reported)

### Purpose:
Alterations in quadriceps muscle morphology (i.e. cross-sectional area [CSA]) and volitional activation (VA) contribute to muscle weakness following anterior cruciate ligament reconstruction (ACLR). Research on the relative contributions of each factor and quadriceps weakness remain inconclusive as few studies have concurrently evaluated VA and muscle morphology in the same cohort of ACLR patients. Further, the magnitude of contribution of morphology and activation may vary depending on whether data are considered for the ACLR limb alone or if data are reported as a limb symmetry index (LSI), taking into account the uninvolved leg.

### METHODS:
Two separate stepwise linear regressions were performed to examine the contribution of VA and CSA on quadriceps peak torque (PT) where legs (Bonferroni-adjusted α’s = 0.025). Paired t-tests were used to compare outcomes between limbs (Bonferroni-adjusted α = 0.017). Two separate stepwise linear regressions were calculated for all outcome variables by expressing values of the involved leg as a percent of the uninvolved leg. Ultrasound images were acquired to assess vastus lateralis CSA in both legs. LSI’s were calculated for all outcome variables by expressing values of the involved leg as a percent of the uninvolved leg.

### RESULTS:
A significant decrease in mean PT was observed for M RP (F2,26=6.9, P=0.01, Postmean=1.94, p=.032), no significant change in turn time, turn sway, or sway energy. There was a non-significant decrease in impact index (P<0.01, Postmean=6.9, P=0.06). A significant decrease in the mean impact index for the right lower extremity. While not statistically significant, downward trends were observed in right lower extremity for mean turn time, mean turn sway, and mean sway energy. Additionally, no change noted for mean equilibrium and mean strategy.

### CONCLUSIONS:
Results of the mean impact index test highlight the efficacy of martial arts training in the dominant lower extremity. Furthermore, the trend of improvement in the dominant leg in a variety of proprioceptive metrics is noteworthy, suggesting the intervention reinforced the more honed neural pathways of the dominant side quicker than the non-dominant. Future research is needed to elucidate whether the non-dominant side can demonstrate the plasticity seen in the dominant side. Finally, the overall increase seen in mean equilibrium and mean strategy is promising.

### TABLE 1

<table>
<thead>
<tr>
<th>Deceleration</th>
<th>Lateral Shuffle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Contact</td>
<td>Contact P-value</td>
</tr>
<tr>
<td><strong>SHOCK ABSORPTION</strong></td>
<td></td>
</tr>
<tr>
<td>Max hip flexion</td>
<td>75.3 (15.2)</td>
</tr>
<tr>
<td>Max knee flexion</td>
<td>65.2 (14.1)</td>
</tr>
<tr>
<td>Max ankle dorsiflexion</td>
<td>-5.5 (7.3)</td>
</tr>
<tr>
<td>Max hip flexion moment</td>
<td>2.8 (1.5)</td>
</tr>
<tr>
<td>Max knee flexion moment</td>
<td>1.3 (0.5)</td>
</tr>
<tr>
<td>Max ankle dorsiflexion moment</td>
<td>0.84 (0.22)</td>
</tr>
<tr>
<td>Energy absorption at hip</td>
<td>0.66 (0.48)</td>
</tr>
<tr>
<td>Energy absorption at knee</td>
<td>0.50 (0.38)</td>
</tr>
<tr>
<td>Energy absorption at ankle</td>
<td>0.17 (0.11)</td>
</tr>
<tr>
<td><strong>DYNAMIC LIMB VALGUS</strong></td>
<td></td>
</tr>
<tr>
<td>Max hip internal rotation</td>
<td>7.8 (7.4)</td>
</tr>
<tr>
<td>Max hip adduction</td>
<td>1.9 (6.4)</td>
</tr>
<tr>
<td>Min knee varus</td>
<td>1.1 (4.8)</td>
</tr>
<tr>
<td>Min knee varus moment</td>
<td>-0.34 (0.34)</td>
</tr>
</tbody>
</table>

External moments are reported. Angles are expressed in degrees, moments in Nkg, energy absorption in J/kg.

Aberrent lower extremity loading following anterior cruciate ligament reconstruction (ACLR) is theorized to play a role in posttraumatic osteoarthritis (PTOA) development. Cueing an increase or decrease in loading could potentially optimize gait biomechanics and slow progression to PTOA. Stable coordination is fundamental for functional gait as a mediating process for the distribution of joint loads. Accordingly, examining how joint loading impacts coordination during gait may elucidate compensatory movement strategies following ACLR. PURPOSE: Determine the effect of cueing an increase or decrease in lower extremity loading on intralimb coordination between the knee-hip joints in ACLR participants. METHODS: Coordination was assessed in 10 individuals (age: 21±4 years; 91±7 months post-surgery; 4F) with unilateral ACLR during three separate loading conditions. Loading was manipulated via real-time feedback using a force measuring treadmill that cued a change in peak vertical ground reaction force (vGRF). Three conditions were conducted on separate days in a random order: 1) preferred (no feedback), 2) overload (cue 5% body weight [BW] increase in vGRF), and 3) underload (cue 5% BW decrease in vGRF). The intralimb coordination between sagittal plane knee-hip angles was assessed via measures of coordination dynamics (mean [M] and standard deviation [SD] of relative phase [RP] and percent determinism [%DET] from cross-recurrence quantification analysis) for each condition. One-way repeated-measures analyses of variance were used to determine differences between conditions. RESULTS: A main effect of loading was observed for M RP (F2,26=6.9, P<0.05) and SD RP (F2,26=9.5, P<0.05). The underloaded condition exhibited significantly different coordination stability (lower M and higher SD of RP) compared to the preferred and overloaded conditions (p<0.05).
A significant effect of loading on %DET (F2,26=2.7 p<.05) was also observed; the unloaded condition led to tighter coupling than the preferred condition. (p<.05).

CONCLUSIONS: Overall, unloading changed the pattern and multi-scale stability of knee-hip coordination. These findings indicate manipulations in joint loading result in altered movement strategies that concern the development of PTOA.

RESULTS: Fewer steps/day (mean±SD: 9.62±2.452) associated with greater ΔCOMP (+11.5±16.4%: R2=0.152, β=0.003, p=0.030).

CONCLUSIONS: Individuals after ACLR who habitually engage in fewer steps/day demonstrated greater ΔCOMP during a walking protocol. We postulate fewer steps/day in individuals with a history of ACLR may result in delayed changes in articular homeostasis due to inadequate mechanical stimulation of joint tissues. Future studies should determine if increasing steps/day improves knee cartilage outcomes following ACLR.

CONCLUSIONS: Downhill walking necessitates a larger internal extension moment and knee flexion angle compared to level walking. Changes in joint dominance are partly due to increased loading during downhill walking. Therefore, the purpose was to determine the association between steps/day and change in COMP (ΔCOMP) following walking in individuals with an ACLR.

METHODS: Steps/day was assessed over 7 days using ActiGraph accelerometers worn on the right hip in 31 participants (age=22±4 years, BMI=23±3 kg/m2) and 24 healthy controls (79% female, age=21±1 yr, BMI=24±3 kg/m2). Dependent variables were compared across groups and conditions via two-way repeated measures ANCOVA controlling for gait speed.

RESULTS: There were no significant condition*group interaction effects nor group main effects for any outcomes. However, there were significant condition main effects for peak internal knee extension moment (p = 0.020, level to downhill mean increase of 0.042 %BW*Ht) and peak knee flexion angle (p = 0.018, level to downhill mean increase of 3.2°).

CONCLUSIONS: Downhill walking necessitates a larger internal extension moment and knee flexion angle compared to level walking. Our results suggest that changes in gait biomechanics between level and downhill conditions do not differ between individuals with ACLR + 1 year post reconstruction and controls. These results suggest that aberrant gait biomechanics may be mitigated over time in those with ACLR.

Changes in limb dominance, the limb to kick a ball or recover a fall, after an anterior cruciate ligament reconstruction (ACLR) could occur if the limb has not fully recovered. Due to the impact of an ACLR on the quadriceps, a poor quadriceps limb symmetry index (Q-LSI) could influence change in limb dominance. The difference in the leg used during a quick regain of balance (step- limb) from the subjects’ self-reported limb dominance, could identify poor motor planning required to use the limb. PURPOSE: Evaluate if patients reporting tearing their dominant, defined as the leg to kick a ball, (DOM group) or non-dominant (N-DOM group) limb is the same as the step- limb used during a reactive balance test. For the DOM group, Q-LSI was compared between subjects who switched dominance and those that did not.

METHODS: 36 ACLR (15M, 18±5 years) reported their dominant leg 6-months after ACLR. A reactive balance test was performed where subjects were passively leaned forward 10 degrees. In 5 out of 10 trials they were released and had to step to regain their balance. The most frequently used (3 out of the 5 trials) step- limb was recorded. Q-LSI were calculated through the maximum voluntary isometric contractions at 90 degrees of knee flexion. A Fisher’s exact evaluated if the step-limb was similar to the reported dominant limb, comparing the DOM and N-DOM groups. For the DOM group, a Student’s t-test compared the differences in Q-LSI between switchers and non-switchers.

RESULTS: 75% (27 DOM: 9 N-DOM) of the subjects tore their dominant limb. When a loss of balance occurred, 48% of the DOM group (13:14) switched dominance. This was significantly greater than the N-DOM group (11%, 1:8, p=0.02). The DOM group who did not switch limbs had higher Q-LSI (switchers: 57% Q-LSI, non-switchers: 78% Q-LSI, p=0.04).

CONCLUSIONS: Almost half of the subjects who tore their dominant limb stepped with their uninjured/non-dominant limb 6-months after an ACLR and had a lower Q-LSI than those who stepped with their dominant limb. These results suggest that with lower Q-LSI, subjects’ preplanning of initial movements is altered. Switching limb dominance to the non-dominant/uninjured limb may affect performance during tasks that require quick movements. Future studies should evaluate the effects of changes in limb dominance on subsequent injuries after ACLR.
The hemisphere of the ACLR injured limb demonstrated lower volume (567.1 ± 75.3 voxels; p = 0.005), lower FA (0.49 ± 0.01; p = 0.02), higher MD (7.58 x10^-4 ± 0.35 x10^-4; p = 0.01), and smaller MREPs (0.013 ± 0.007; p = 0.04) relative to the hemisphere of the non-injured limb (659.7 ± 64.3 voxels; 0.53 ± 0.02; 7.23 x10^-4 ± 0.10 x10^-4; 0.028 ± 0.020), indicating disrupted white matter structure and a reduction in excitability of the corticospinal tract. Correlation analyses revealed a strong, positive correlation between corticospinal tract volume and MEP of the ACLR injured limb (r=0.890; p=0.001).

CONCLUSIONS: ACLR patients demonstrated asymmetry in structural properties of the corticospinal tract that may influence the recovery of motor function following surgical reconstruction. More research is warranted to establish the influence of neurostructural measures on patient outcomes and response to treatment in ACLR populations.

**994 Board #120**
**May 27 1:30 PM - 3:00 PM**
**Gait Biomechanics Linked To Post-traumatic Osteoarthritis Following Anterior Cruciate Ligament Reconstruction Are Improved With Vibration**
TROY BLACKBURN1, Brian Pietrosiocene, FACSM2, Darin Padua1, Derek Dewig1, Jonathan Goodwin1, Chris Johnston2. 1University of North Carolina at Chapel Hill, CHAPEL HILL, NC. 2Elon University, Elon, NC. (Sponsor: Brian Pietrosiocene, FACSM)
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(NO relevant relationships reported)

**PURPOSE:** Anterior cruciate ligament reconstruction (ACLR) incurs a high risk of post-traumatic knee osteoarthritis (PTOA). Ablent gait biomechanics contribute to PTOA and are attributable in part to quadriceps dysfunction. Vibration improves quadriceps function following ACLR, but its effects on gait biomechanics are unknown. The purpose of this study was to evaluate the effects of whole body vibration (WBV) and local muscle vibration (LMV) on gait biomechanics in individuals with ACLR.

**METHODS:** 75 volunteers with primary unilateral ACLR (72% females; age 21 ± 3 yr; time since ACLR 27 ± 16 mo) were randomized to WBV, LMV, or control interventions. WBV and LMV were applied 6 x 1 minute (30Hz, 2g). Walking biomechanics were assessed prior to and following the interventions. Outcomes included the peak vertical ground reaction force (vGRF) and its loading rate, peak internal knee extension and valgus moments, and peak knee flexion and varus angles during the first 50% of stance. vGRF magnitude and rate were normalized to body weight (BW) and moments were normalized as % body weight*height (%BW*Ht). ACLR limb change scores (post-pre) for each outcome were compared across groups via one-way ANCOVA controlling for gait speed, time since ACLR, and baseline values.

**RESULTS:** Change scores did not differ across groups for peak knee flexion (p = 0.374) or varus (p = 0.801) angles, vGRF (p = 0.656), or internal valgus moment (p = 0.866). However, changes in vGRF loading rate differed across groups (p = 0.024), with a significant decrease in the LMV group (-3.6 BW/s; p = 0.005) and Control (0.5 BW/s; p = 0.010) groups. Additionally, the change in peak internal extension moment differed across groups (p = 0.016), with a significant increase in the WBV group (0.27 BW*Ht; p = 0.010) that was greater than the change in the Control group (-0.17 BW*Ht; p = 0.005) but not the LMV group (0.01 BW*Ht; p = 0.101).

**CONCLUSIONS:** Lower knee extension moments and greater loading rates during gait have been linked to declines in joint health following ACLR. WBV acutely increased the peak knee extension moment and LMV decreased loading rates. These data suggest that vibration has the potential to mitigate aberrant gait biomechanics, and may represent an effective approach for mitigating PTOA risk following ACLR.

**995 Board #121**
**May 27 1:30 PM - 3:00 PM**
**Can Increased Gait Speed Improve Knee Loading Mechanics Following Anterior Cruciate Ligament Reconstruction?**
Sara Almansouri, William Barclay, Anushree Dighe, Carole Gong, Meagan Chow, Susan Sigward. University of Southern California, Los Angeles, CA. Email: s.almansouri@usc.edu

(NO relevant relationships reported)

Knee extensor moments (KEM) deficits during gait persist long term following anterior cruciate ligament reconstruction (ACLR) and are attributed to progression of osteoarthritis. KEM are reduced in surgical limb through modulation of heel rocker mechanics (HRM); reduced knee flexion excursion (KFE), shank anterior angular velocity (SAV) and posterior ground reaction force (pGRF). Improved KEM are more therapeutically desirable if accomplished by improving underlying HRM. Increased gait speed increases knee loading in healthy individuals but it is not known if those with long term deficits post-ACLR respond to gait speed with improved KEM or if these improvements are accomplished by improving underlying HRM.

**PURPOSE:** To determine if individuals with long term KEM deficits post-ACLR respond to increase treadmill gait speed with increased KEM and HRM and if improved KEM is related to improved knee function following surgical reconstruction. More research is warranted to establish the influence of neurostructural measures on patient outcomes and response to treatment in ACLR populations.

**METHODS:** Individuals > 1 year post-ACLR with KEM deficits >10% are recruited; data collection on-going. Participants (N=4, 61±29.8 months post-ACLR) walked on a treadmill at self-selected (SS) and 50% faster than SS (FAST) speeds (3 minutes/speed). 3D kinematics (Qualysis) and kinetics (Bertec) were collected in last 30 seconds (6-steps/limb). KEM (inverse dynamics), SAV, pGRF and KFE during landing response (surgical limb) were compared between speeds; strength of difference indicated by effect size (ES). Pearson correlations used to determine association between percent increase (SS to FAST speed) in peak KEM and increase in HRM (peak SAV, peak pGRF and KFE).

**RESULTS:** KEM (97.1±74.8%, ES =1.1), SAV (44.9±4.4%, ES =1.5), pGRF (62.9±3.5%, ES =1.6) and KFE (41±19 degrees, ES =1.3) increased with speed. Increased KEM correlated with increases in KFE (r= 0.92, p<0.08), and SAV (r=0.99, p<0.01) but not pGRF (r =-0.18, p = 0.2).

**CONCLUSIONS:** This preliminary analyses suggest that increased gait speed improves KEM and all features of HRM. A 97% increase in KEM was strongly related to improved HRM in KFE and SAV. Sample size calculations suggests these results will hold up in our full study sample (expected for May presentation). If results hold, it will suggest that increasing treadmill gait speed may be an effective stimulus for retraining kinematic features of HRM and KEM in those who have persistent KEM deficits during gait following ACLR.
added constraint of footwear and its role in guiding the development of children’s gait. **Purpose:** To determine the affect different footwear types have on children’s gait variability at different stages in development.

**Methods:** 28 healthy children were divided into four groups by ages 2-3, 4-5, 6-7, and 8-10 years old respectively. Gait variability (coefficient of variation (CV)) measures of stride length (SL) and stride time (ST) parameters were collected for three minutes of treadmill walking in barefoot (BF), mocassin (MO), athletic (AT), and rigid shoes (RS) conditions. A mixed factorial ANOVA (4 age x 4 shoe) was performed to determine significant differences. Tukey post-hoc tests were conducted where applicable. **Results:** There was a significant age x shoe interaction for SL CV (p = .003). Specifically, MO decreased from youngest to oldest while BF, AT, and RS increased from 2-3 to 4-5 before decreasing to 6-7 and 8-10. There was a significant age x shoe interaction for SL CV (p = .007). There was a linear decrease for the MO condition from youngest group to oldest group for SL CV while SL CV increased from 2-3 to 4-5 old before decreasing for the 6-7 and decreasing again for the 8-10 for the BF, AT, and RS conditions. **Conclusion:** Younger children were more sensitive to the varying types of footwear conditions than older children. Concerning footwear, MO most closely resembles BF gait compared to AT and RS. It is important to note the increased sensitivity to footwear differences for younger children. The results of this study raise the concern of what types of footwear should be most appropriate for a developing child, recommending mocassin type shoes and not typical athletic or rigid shoes.

**Figure:** Bar charts showing the mean and standard deviation for CV Stride time and CV stride length spatiotemporal time series. Data are reported for main effect of age group and footwear condition as well as pairwise comparisons.

**INTRODUCTION:** During childhood mechanical loading is important for developing a resilient skeleton. High impact activity interventions cause improvements in bone mineral density in youth and can promote long term bone health. When designing interventions, it is important to know if sex and height play a role in loading magnitudes experienced during various jumping activities. **Purpose:** Examine if sex and height impact the magnitude of peak ground reaction forces (pGRF) during different jump tasks. **Methods:** Four males (Age: 9.1±1 years; Height: 1.36±0.11 m; Mass: 31±5 kg) and four females (Age: 11.1±1 years; Height: 1.46±0.05 m; Mass: 36.6±5 kg) performed five trials for each jump condition. Each subject performed a broad jump (BJ), countermovement jump (CMJ), jumping jack (JJ), leap jump (LJ), and a drop jump (DJ). Data were collected on a force plate (1000 Hz), and pGRF in units of body weight (BW) was determined during the landing phase. A mixed ANOVA was employed to assess sex differences across conditions. Correlation analysis assessed the relationship between height and pGRF for each condition. **Results:** No differences in pGRF were observed between males (m) and females (f) across conditions [BJ (m: 2.14±0.09, f: 2.33±0.18 BW), CMJ (m: 2.42±0.2, f: 2.44±0.25 BW), JJ (m: 2.55±0.16, f: 2.53±0.25 BW), LJ (m: 1.98±0.02, f: 2.02±0.15 BW), and DJ (m: 2.38±0.31, f: 2.35±0.48 BW)]. There was a moderate correlation between height and pGRF for DJ (r = 0.59). **Conclusion:** Larger pGRF exhibited with taller subjects during the DJ condition can be explained by considering a higher center of mass contains more gravitational potential energy converted to kinetic energy during the DJ, and thus requires a larger pGRF to slow the participant’s center of mass during landing. Height differences should be considered when designing interventions involving drop jumps to elicit bone adaptations in youth.

**RESULTS:** No significant group differences in DTC were observed between groups (CG: -14.1%; AG: -11.3%). CG exhibited greater DTCs of foot strike (p = 0.008; CG: -12.9%; AG: -7.9%) as well as toe-off (p = 0.023; CG: -6.0%; AG: -2.9%) angle showing the more leveled foot angle control. There was a greater reduction of foot elevation at mid-swing in CG than AG (p = 0.007; CG: -11.1%; AG: -8.6%). Lower lateral step variability (p = 0.021; CG: 5.2%; AG: 34.5%) and greater reduction of lumbar motion in transverse plane (p = 0.030; CG: -27.7%; AG: -9.4%) were also exhibited in CG. **Conclusion:** The study highlights that to attain a comparable secondary task performance with adults, children group adopted more cautious gait patterns when walking and texting. The observed changes, therefore, may suggest that a greater compromise in motor-domain seems necessary in younger age smartphone users under dual-tasking conditions.

**INTRODUCTION:** While well-known for the potential benefits of the cardiovascular and metabolic health improvements, the underlying mechanisms and association with bone health are less clear. **Purpose:** To examine the role of different exercise conditions (traditional carpeted exercises versus an overhead video game) on bone mineral density (BMD) in children. **Methods:** 28 healthy children were divided into four groups by ages 2-3, 4-5, 6-7, and 8-10 years old respectively. Gait parameters including spatial and temporal step characteristics were employed (No-texting and Texting). In each condition, subject performed two trials of walking, each with a 3-minute prolonged walk. Participants were asked to walk while matching a preferred foot strike to the beat of a music-based video game. **Results:** Children demonstrated a significant reduction of lumbar motion in transverse plane (p = 0.030; CG: -27.7%; AG: -9.4%) were also exhibited in CG. **Conclusion:** The study highlights that to attain a comparable secondary task performance with adults, children group adopted more cautious gait patterns when walking and texting. The observed changes, therefore, may suggest that a greater compromise in motor-domain seems necessary in younger age smartphone users under dual-tasking conditions.

**RESULTS:** There was a significant age x shoe interaction for ST CV (p = .003). Specifically, MO decreased from youngest to oldest while BF, AT, and RS increased from 2-3 to 4-5 before decreasing to 6-7 and decreasing again for the 8-10 for the BF, AT, and RS conditions. **Conclusion:** Younger children were more sensitive to the varying types of footwear conditions than older children. Concerning footwear, MO most closely resembles BF gait compared to AT and RS. It is important to note the increased sensitivity to footwear differences for younger children. The results of this study raise the concern of what types of footwear should be most appropriate for a developing child, recommending mocassin type shoes and not typical athletic or rigid shoes.

**Figure:** Bar charts showing the mean and standard deviation for CV Stride time and CV stride length spatiotemporal time series. Data are reported for main effect of age group and footwear condition as well as pairwise comparisons.
children. All conditions except DJ exhibited loading below three BW, suggesting these activities may not sufficiently stimulate bone remodeling to influence bone mineral density.

**RESULTS:**

*Height, body mass, fat-free mass, and quadriceps femoris muscle cross-sectional area.**

Test, and Pearson's product-moment correlations were used to determine relationship between height, body mass, fat-free mass, and quadriceps femoris muscle cross-sectional area. Patterns of responses for PT and MP across angular velocity were fit with quadratic equations for each subject with R² values ranging from 0.803-0.934 for PT and 0.908-0.996 for MP, respectively. Derivatives of each quadratic formula quantified velocity-related changes in PT and MP. Each quadratic formula predicted the peak velocity at which torque could be generated (Vₚₑₚ) or the velocity at which the greatest MP would occur (Vₚₑₚ). The percent of fast-twitch fibers (FTFs) was estimated from the fatigue index of the 50-repetition test. Measurements of growth included age, maturity offset, height, body mass, fat-free mass, and quadriceps femoris muscle cross-sectional area.

**RESULTS:**

All measurements of growth, PT, and MP were greater for adolescents than children (p ≤ 0.003). As expected, PT decreased quadratically (p < 0.001) while MP increased quadratically (p < 0.001). Vₚₑₚ was 216 ± 11 W for children and 268 ± 11 W for adolescents (p < 0.016). FT% was 39 ± 4% for children and 46 ± 4% for adolescents (p < 0.016). Derivatives indicated that PT decreased while MP increased across velocity more rapidly in adolescents than children (p ≤ 0.016). Derivatives of PT vs. velocity exhibited a high relationship with age in children and adolescents (r = 0.884). CONCLUSION: Isometric and isokinetic muscle actions in children and adolescents indirectly demonstrate growth-related increases in fast-twitch fiber contributions to maximal, voluntary muscle strength and power across the velocity spectrum.

**Stability of the lumbopelvic “core” is essential for the control and movement of the lower extremity particularly in the prevention and treatment of running injuries.** In adult runners, core stability is related to increased running injury risk and decreasing core stability results in negative effects on mechanical variables associated with running injuries. It is currently unknown if relationships between core stability and running mechanics exist in adolescent populations. PURPOSE: Evaluate the relationship between core stability and mechanical variables associated with running injuries in adolescent runners. METHODS: 20 adolescent runners (11 M/9 F; age: 12.38 ± 0.79 years; easy training run pace: 3.25 ± 0.37 m/s). Participants ran for five minutes on an instrumented treadmill after which 10 SLSD trials were performed bilaterally from a 15 cm box. Running and SLSD kinematics were recorded using motion capture. Peak frontal plane hip, knee, and ankle, and transverse plane hip and knee angles were calculated during both SLSD and running. The sum of the frontal plane angles was calculated to indicate total medial collapse (TMC). Five additional kinetic variables previous linked to running injuries were calculated for the running trials. Linear regressions were used to determine whether performance on the SLSD predicted kinematics or kinetics during running, with left and right limbs analyzed separately. RESULTS: Kinematics on the SLSD predicted kinematics during running (Figure 1). However, TMC during SLSD did not predict vertical loading rates (R²=0.008, p=.568), peak hip adductor moments (R²=0.021, p=.363) or impulses (R²=0.007, p=.602), or peak knee adductor moments (R²=0.014, p=.446) or impulses (R²=0.039, p=.209) during running. CONCLUSIONS: The SLSD can predict kinematics during running in adolescent runners. However, performance on the SLSD does not provide information regarding kinetic factors associated with running injuries. Additional research is required to confirm the suitability of the SLSD for identifying adolescent runners at risk of injury.

**The single limb step down (SLSD) is a movement screen commonly used to assess neuromuscular control of the lower extremity.** In adult runners, performance on the SLSD is predictive of running mechanics. However, it is unknown whether this is also the case for adolescent populations. PURPOSE: To determine whether performance on the SLSD predicts running mechanics in adolescent runners. METHODS: 21 runners participated in this study (12 M/9 F; age: 12.38 ± 0.79 years; weekly mileage: 23.2 ± 6.4 miles; easy training run pace: 3.25 ± 0.17 m/s) Participants ran for five minutes on an instrumented treadmill after which 10 SLSD trials were performed bilaterally from a 15 cm box. Running and SLSD kinematics were recorded using motion capture. Peak frontal plane hip, knee, and ankle, and transverse plane hip and knee angles were calculated during both SLSD and running. The sum of the frontal plane angles was calculated to indicate total medial collapse (TMC). Five additional kinetic variables previous linked to running injuries were calculated for the running trials. Linear regressions were used to determine whether performance on the SLSD predicted kinematics or kinetics during running, with left and right limbs analyzed separately. RESULTS: Kinematics on the SLSD predicted kinematics during running (Figure 1). However, TMC during SLSD did not predict vertical loading rates (R²=0.008, p=.568), peak hip adductor moments (R²=0.021, p=.363) or impulses (R²=0.007, p=.602), or peak knee adductor moments (R²=0.014, p=.446) or impulses (R²=0.039, p=.209) during running. CONCLUSIONS: The SLSD can predict kinematics during running in adolescent runners. However, performance on the SLSD does not provide information regarding kinetic factors associated with running injuries. Additional research is required to confirm the suitability of the SLSD for identifying adolescent runners at risk of injury.

**Stability of the lumbopelvic “core” is essential for the control and movement of the lower extremity particularly in the prevention and treatment of running injuries.** In adult runners, core stability is related to increased running injury risk and decreasing core stability results in negative effects on mechanical variables associated with running injuries. It is currently unknown if relationships between core stability and running mechanics exist in adolescent populations. PURPOSE: Evaluate the relationship between core stability and mechanical variables associated with running injuries in adolescent runners. METHODS: 20 adolescent runners (11 M/9 F; age: 12.38 ± 0.79 years; easy training run pace: 3.25 ± 0.37 m/s). Participants ran for five minutes on an instrumented treadmill after which 10 SLSD trials were performed bilaterally from a 15 cm box. Running and SLSD kinematics were recorded using motion capture. Peak frontal plane hip, knee, and ankle, and transverse plane hip and knee angles were calculated during both SLSD and running. The sum of the frontal plane angles was calculated to indicate total medial collapse (TMC). Five additional kinetic variables previous linked to running injuries were calculated for the running trials. Linear regressions were used to determine whether performance on the SLSD predicted kinematics or kinetics during running, with left and right limbs analyzed separately. RESULTS: Kinematics on the SLSD predicted kinematics during running (Figure 1). However, TMC during SLSD did not predict vertical loading rates (R²=0.008, p=.568), peak hip adductor moments (R²=0.021, p=.363) or impulses (R²=0.007, p=.602), or peak knee adductor moments (R²=0.014, p=.446) or impulses (R²=0.039, p=.209) during running. CONCLUSIONS: The SLSD can predict kinematics during running in adolescent runners. However, performance on the SLSD does not provide information regarding kinetic factors associated with running injuries. Additional research is required to confirm the suitability of the SLSD for identifying adolescent runners at risk of injury.

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for adolescent scoliosis. METHODS: Adolescent scoliosis patients with Cobb angle between 10-40° were screened. Patients with other predisposing spinal and neurological abnormalities were excluded. 19 girls (age 14.18 ± 2.58) were recruited into experimental group, including 9 patients with thoracic right protrusion (TRP), 7 patients with lumbar left protrusion (LLP) and 3 patients with S-shaped curvature of spine (SSC). 20 healthy subjects (age 14.91 ± 1.23) were randomly selected. The experimental group was given rehabilitation exercises of 60 minutes for twice. sEMG was used to test the muscles at T2, T7, T10 and L4 level. Basic movements were tested in relax mode (RM) and spine correction mode (SCM). RESULTS: 1. For patients with TRP, when sitting, sEMG of muscle groups at T2 level (left: -4.53±3.58, p<0.05, right: -2.59±0.96, p<0.01), T7 (left: -3.19±1.94, p<0.05, right: -1.27±1.16, p<0.05) and right muscle group at T10 level (3.78±2.19, p<0.01) were lower in SCM than in RM; when walking, sEMG of left muscle group at T7 level (-2.07±1.61, p<0.05) was lower in SCM than in RM. Compared to control group, for SCM of this sub-group, when sitting, activation of the left muscle group at T2 level was increased (2.32±1.58, p<0.05). 2. For patients with LLP, compared to control group, when sitting, activation level of right muscle group at L4 level was increased (0.33±0.69, p<0.05). 3. For patients with SSC, when sitting, the iEMG of right muscle group of T2 level was lower in SCM than that in RM (-1.39±0.45, p<0.05). In SCM of standing with balanced legs, compared to control group, this sub-group has higher activation level of the right muscle group (2.71±1.20, p<0.05). CONCLUSION: 1. The asymmetry between convex and concave sides of paraspinal muscles in adolescents with scoliosis was not obvious. 2. The muscle activation of the thoracic spine-related muscle group was more important for the adjustment of adolescent scoliosis. 3. Posture corrective exercises for adolescent scoliosis had good acute rehabilitation effects and contributed to the maintenance of good postures in daily life.

1005 Board #131 May 27 1:30 PM - 3:00 PM Effects Of Eccentric Pre-loading On Vertical Jump Performance In 9-17-year-old Female Athletes
Nicholas A. Bohannon, Zachary M. Gillen, Marni E. Shoemaker, Sydney M. Gibson, Joel T. Cramer, FACSM. University of Nebraska-Lincoln, Lincoln, NE. (Sponsor: Joel Cramer, FACSM)
(No relevant relationships reported)

PURPOSE: Examine peak force (PF), rate of force development (RFD), peak power (PP), eccentric impulse (ECC), concentric impulse (CON), and jump height (JH) during static (SJ), counter movement (CMJ), and drop (DJ) jumps in young female athletes.

METHODS: Twenty females ranging from 9-17-years old performed SJs, CMJs, and DJs from drop heights of 20, 30, and 40 cm (DJ20, DJ30, and DJ40, respectively) in random order. Measurements included PF, RFD, PP, ECC, CON, and JH for each vertical jump condition. Measurements of growth included age, maturity offset, height, body mass, fat-free mass (FFM), and thigh muscle cross-sectional area (CSA).

RESULTS: As an indicator of eccentric pre-loading, ECC increased systematically from SJ to CMJ to DJ20 to DJ30 to DJ40 (p < 0.001-0.038) (Figure 1); however, CON: As an indicator of eccentric pre-loading, ECC increased systematically.

CONCLUSIONS: 1. The asymmetry between the convex and concave sides of paraspinal muscles in adolescents with scoliosis was not obvious. 2. The muscle activation of the thoracic spine-related muscle group was more important for the adjustment of adolescent scoliosis. 3. Posture corrective exercises for adolescent scoliosis had good acute rehabilitation effects and contributed to the maintenance of good postures in daily life.
muscle forces of each length conditions were pooled, p-values > 0.05). The total forces of the step and speed on the forces of hamstring and quadriceps muscles. Individual muscles of the lower extremities including four muscles of the hamstrings (semitendinosus, semimembranosus, semitrochantericus) and four muscles of the quadriceps (rectus femoris, vastus medialis, vastus lateralis) were analyzed. Total forces of the step and speed on the forces of hamstring and quadriceps muscles.

RESULTS: Three healthy adults performed (1 male, 2 females 35 ± 8 years) forward lunges with the change of step length and speed. Individual muscle forces during forward lunges with the change of step length and speed. The purpose of this study was to compare the force of individual muscles of the lower limb during the forward lunges with the change of length and speed. METHODS: Five recreationally active males cycled on a stationary ergometer at a workrate of 80 Watts and a cadence of 80 rotations per minute at two QF: original QF (150mm), and wide QF (276mm). Wide QF was increased using pedal extenders. Three-dimensional kinematic data (240 Hz, Vicon) and pedal reaction forces using two custom instrumented bike pedals (1200 Hz, Kistler) were collected. A modified gait2392 model with a knee that includes hinge joints for the medial and lateral compartments was used to estimate muscle forces with static optimization and TCF and MCF with joint reaction analysis (3.3 OpenSim, SimTK, Stanford University). Paired t-tests and Cohen’s d were used to detect differences between conditions.

RESULTS: Peak TCF increased from original to wide QF (960.2 ± 258.2 N to 1117.3 ± 202.1 N; p = 0.299; d = 0.54) and MCF increased from original to wide QF (792.2 ± 98.4 N to 1029.2 ± 315.5 N; p = 0.116; d = 0.89). CONCLUSION: Large standard deviations and small sample size may account for the lack of statistical significance, yet medium and large effect sizes may allude TCF and MCF increases with greater QF (Figure 1). It appears the majority of TCF is born by the medial compartment; TCF and MCF ranged from 1.46 and 1.14 BW for original and 1.75 to 1.42 BW for respective, these loads are much smaller than 2.0-2.5 BW found in walking and 4.0 BW in jogging.

CONCLUSIONS: Our preliminary results suggest that the changes in the step length and the speed used in this study did not affect the kinetics of hamstring and quadriceps muscles and the speed used in this study did not affect the kinetics of hamstring and quadriceps muscles. This might be due to the limited number of subjects. Further studies are needed.

As Q-Factor (QF: inter-pedal width) is increased, the knee abduction moment also increases. Though the knee abduction moment has been associated with knee medial compartment joint load, it is not a direct measure of joint contact forces. In the absence of in vivo measurement using an instrumented knee implant, musculoskeletal modeling simulations may provide a viable option for estimation of knee joint contact forces. 

METHODOLOGY: To estimate the total knee joint compressive force (TCF) and knee medial compartment joint compressive force (MCF) in stationary cycling with increasing QF using musculoskeletal simulation.

RESULTS: Peak TCF increased from original to wide QF (960.2 ± 258.2 N to 1117.3 ± 202.1 N; p = 0.299; d = 0.54) and MCF increased from original to wide QF (792.2 ± 98.4 N to 1029.2 ± 315.5 N; p = 0.116; d = 0.89).

CONCLUSION: The total knee joint compressive force (TCF), medial compartment compressive force (MCF), and lateral compartment compressive force (LCF) during stationary cycling.

As Q-Factor (QF: inter-pedal width) is increased, the knee abduction moment also increases. Though the knee abduction moment has been associated with knee medial compartment joint load, it is not a direct measure of joint contact forces. In the absence of in vivo measurement using an instrumented knee implant, musculoskeletal modeling simulations may provide a viable option for estimation of knee joint contact forces.

METHODOLOGY: To estimate the total knee joint compressive force (TCF) and knee medial compartment joint compressive force (MCF) in stationary cycling with increasing QF using musculoskeletal simulation.

RESULTS: Peak TCF increased from original to wide QF (960.2 ± 258.2 N to 1117.3 ± 202.1 N; p = 0.299; d = 0.54) and MCF increased from original to wide QF (792.2 ± 98.4 N to 1029.2 ± 315.5 N; p = 0.116; d = 0.89).

CONCLUSION: The total knee joint compressive force (TCF), medial compartment compressive force (MCF), and lateral compartment compressive force (LCF) during stationary cycling.

Figure 1: Ensemble curves of the total knee contact force (TCF), medial compartment compressive force (MCF), and lateral compartment compressive force (LCF) during stationary cycling.

Lunge technique variations can affect the biomechanics of lower extremity. However, only a few studies have examined the force distribution through the forward lunges. PURPOSE: The purpose of this study was to compare the force of individual muscles of the lower limb during the forward lunges with the change of length and speed. METHODS: Three healthy adults performed (1 male, 2 females 35 ± 8 years) forward lunges with different step lengths and speeds. The step lengths were set at 70% and 100% of the leg length (from the greater trochanter to the lateral malleolus); the speeds were set to slow, normal, and fast (30, 40 and 50 lunges/min, respectively). Kinematic and kinetic data were sampled using a three-dimensional motion analysis system and force plate, respectively. Individual muscles of the lower extremities including four muscles of the quadriceps (rectus femoris, vastus medialis, vastus intermedius, vastus lateralis) and four muscles of the hamstrings (semimembranosus, semitendinosus, biceps femoris long head, and biceps femoris short head) were analyzed. Tests of active/passive force were calculated using the musculoskeletal modeling technique (Seth et al., 2018). Two-way repeated measure ANOVAs were used to find the effects of the step and speed on the forces of hamstring and quadriceps muscles.

RESULTS: The total forces of the four hamstring muscles were similar between two-length conditions (3.16±2.90 vs. 3.34±3.53 N/kg; 70% vs. 100%; all muscle forces of each speed conditions were pooled, p-values > 0.05) and three-speed conditions (4.26±4.08 vs. 2.60±2.36 vs. 2.89±2.81 N/kg; Slow vs. Normal vs. Fast; all muscle forces of each length conditions were pooled, p-values > 0.05). The total forces of the four quadriceps muscles were similar between two-length conditions (2.23±0.81 vs. 2.29±1.15 N/kg; all muscle forces of each speed conditions were pooled, p-values > 0.05) and three-speed conditions (2.71±1.10 vs. 1.89±0.71 vs. 2.18±0.96 N/kg; all muscle forces of each length conditions were pooled, p-values > 0.05).
PURPOSE: The experiment aims to research the kinetics and kinematics differences between bilateral lower limbs of athletes who have the asymmetric myodynamics on bilateral lower limbs and provide some basis for avoiding sports injury.

METHODS: The experiment test subjects’ Peak Torque of their extensor kinematic chain of bilateral lower limbs. Define subjects whose difference value of peak torque is greater than 10% as the experimental group, the rest is the control group. Each group has 10 subjects. Two groups will finish 3 kinematics tests items including running with full power, triple jump by left leg and triple jump by right leg. And also every subject will finish 4 kinetics test items including drop jump, vertical jump by two legs, vertical jump by left leg and vertical jump by right leg on the force platform.

RESULTS: In the intra-group testing, the peak force and impulse in the takeoff phase of vertical jump by two legs (the dominant side peak force is 1000.81±149.59N, the non-dominant-side peak force is 852.346±198.23N; the dominant side impulse is 315.88±70.87N·s, the non-dominant side impulse is 255.82±72.00 N·s), the impulse in the takeoff phase of vertical jump by single leg (the dominant side impulse is 611.12±182.10 N·s, the non-dominant side impulse is 430.84±106.76 N·s) and the peak force in the takeoff phase of drop jump (the dominant side peak force is 916.30±272.47N, the non-dominant side peak force is 772.17±159.04N), these four indices of dominant-side is much higher than the opposite side in the experimental group (p<0.05). But there is no significant difference in control group. There was neither significant difference in the two groups of dominant side nor in the two groups of non-dominant side.

CONCLUSIONS: There are no significant influence on the sports performance of running, vertical jumping and drop-jumping caused by asymmetry of myodynamics of bilateral lower limbs when the PeakTorque of their extensor kinematic chain of bilateral lower limbs is lower than 27%, but it will have a great significant influence on sports performance and sports ability of some relative movements like long jump with single leg and vertical jump with single leg.

M-mode or motion mode allows for non-invasive assessment of contractile tissue movement from echogenicity changes. This method has been used in muscles surrounding the lumbopelvic-hip complex, including the gluteals, however this measurement has not been explored to our knowledge in the rectus abdominis, external oblique, or erector spinae. A normalization technique has not been utilized for M-mode to ensure proper comparison within and between groups as normalization strategies have been applied with other musculoskeletal ultrasound techniques, such as B-mode imaging.

PURPOSE: To determine activity ratio and timing of rectus abdominis (RA), external oblique (EO), erector spinae (ES), glutus maximus (Gmax), and glutus medius (Gmed) with a body mass normalization technique.

METHODS: Ten healthy, physically active individuals with no history of low back or lower extremity injury (21.1±0.7yrs, 67.1±14.8kg, 168.1±6.9cm, 5F) participated in this study. B-mode ultrasound images were collected at rest and during contraction: supine, hook-lying for RA and EO; prone for ES; and side-lying for Gmax and Gmed. Thickness from skin to muscle (mm) was measured at 3 locations (21.12±8.12 Ns, the non-dominant side thickness is 430.84±106.76 Ns) and the peak force in the takeoff phase of drop jump (the dominant side peak force is 916.30±272.47N, the non-dominant-side peak force is 772.17±159.04N), these four indices of dominant-side is much higher than the opposite side in the experimental group (p<0.05). But there is no significant difference in control group. There was neither significant difference in the two groups of dominant side nor in the two groups of non-dominant side.

CONCLUSIONS: There are no significant difference between activity ratios, contraction timing (cm-s/kg) between muscles. There were no significant differences (p>.05) between activity ratios, contraction timing (cm-s/kg) between muscles. The RA followed with the second highest activity ratio (1.48±0.38), then ES (1.34±0.43), Gmed (1.30±0.51), and finally EO had the largest activity (1.66±0.72). The EO had the largest activity ratio (1.48±0.38), then ES (1.34±0.43), Gmed (1.30±0.51), and finally RA followed with the second highest activity ratio (1.48±0.38). Although the EO had the largest activity (1.66±0.72), the RA had the second highest activity ratio (1.48±0.38). The EO had the largest activity (1.66±0.72). The RA followed with the second highest activity ratio (1.48±0.38), then ES (1.34±0.43), Gmed (1.30±0.51), and finally RA followed with the second highest activity ratio (1.48±0.38). Although the EO had the largest activity (1.66±0.72), the RA had the second highest activity ratio (1.48±0.38). The EO had the largest activity (1.66±0.72). The RA followed with the second highest activity ratio (1.48±0.38), then ES (1.34±0.43), Gmed (1.30±0.51), and finally RA followed with the second highest activity ratio (1.48±0.38). Although the EO had the largest activity (1.66±0.72), the RA had the second highest activity ratio (1.48±0.38). The EO had the largest activity (1.66±0.72). The RA followed with the second highest activity ratio (1.48±0.38), then ES (1.34±0.43), Gmed (1.30±0.51), and finally RA followed with the second highest activity ratio (1.48±0.38). Although the EO had the largest activity (1.66±0.72), the RA had the second highest activity ratio (1.48±0.38).

M-mode ultrasound detects changes in lumbopelvic-hip muscle activity using body mass normalization technique. Courtney Caputo, Sarah Akbarpour, L. Colby Mangum. University of Central Florida, Orlando, FL. (No relevant relationships reported)

Cardan/Euler angles (EAs) are commonly used to quantify knee valgus. Although EAs precisely describe the orientation of segments, their geometrical interpretation may not relate well to the underlying joint kinetics and can be difficult for practitioners to interpret. Having a metric that is both better related to the knee joint kinetics (e.g. knee abduction moment (KAM) and tibial external rotation moment (TRM)) and easier to interpret would be advantageous for researchers and practitioners.

PURPOSE: Assess the relationship between (1) EAs and a novel kinematic descriptor of knee valgus - the orthogonal distance of the knee joint center from the hip-foot plane (OD), and (2) EAs and OD with KAM and TRM.

METHODS: Two datasets were used; in the first, 26 volunteers performed 10 drop-jump tasks on a height-squares and a jump-squares. In the second, 13 participants performed 4-5 drop jump tasks. EAs were used to decompose orientation matrices between the shank and thigh. OD was computed by first creating a plane using the midpoint between the 1st and 5th metatarsals, the ankle joint center, and the hip joint center. Then, the scalar projection of the knee joint center and a vector normal to this plane was computed. Newton-Euler equations of motion were used to calculate the knee joint center.

RESULTS: There were no significant differences (p>.05) between activity ratios, although the EO had the largest activity ratio (1.48±0.38). The RA followed with the second highest activity ratio (1.48±0.38), then ES (1.34±0.43), Gmed (1.30±0.51), and finally Gmax (1.06±0.27). ES exhibited the greatest output from the M-mode normalization technique (0.019: 0.004cm/kg) and EO had the least at 0.0053±0.002cm/kg (p<0.001). CONCLUSIONS: The anterior musculature assessed, EO and RA, generated the largest activity ratios, while ES and EO had the greatest disparity detected during motion. The anterior musculature, however this measurement has not been explored to our knowledge in the rectus abdominis, external oblique, or erector spinae. A normalization technique has not been utilized for M-mode to ensure proper comparison within and between groups as normalization strategies have been applied with other musculoskeletal ultrasound techniques, such as B-mode imaging.
Resistance eccentric training triggers adaptations in both active and passive elements of the muscle-tendon unit (MTU). Previous research highlights the buffering role that tendinous tissues may play in mitigating muscle strain and optimizing operating fascicle length. However, the effects of eccentric training on the muscle-tendon interactions of the biceps femoris remain unexplored. PURPOSE: To evaluate the effects of eccentric training on torque and muscle-tendon interactions of the biceps femoris muscle during lengthening contractions. METHODS: Eighteen participants completed an 8-wk standardized eccentric training intervention comprising 15 sessions of Nordic hamstring (NH) or isokinetic leg curl (IK; n=10) exercise. Pre and post training, muscle behavior during lengthening contractions. A 15-session eccentric training program comprising NH or IK exercise does not seem to affect muscle-tendon interactions.

CONCLUSION: We provide novel findings on the muscle-tendon interactions of the biceps femoris muscle during lengthening contractions. A 15-session eccentric training program comprising NH or IK exercise does not seem to affect muscle-tendon interactions.

Table 1.

<table>
<thead>
<tr>
<th></th>
<th>KAM</th>
<th>TRM</th>
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<tbody>
<tr>
<td>OD</td>
<td>-0.39 - 0.13</td>
<td>67.74 - 95.16%</td>
</tr>
<tr>
<td></td>
<td>0.21 - 0.51</td>
<td>48.39 - 96.77%</td>
</tr>
<tr>
<td>EA</td>
<td>-0.71 - 0.28</td>
<td>24.19 - 38.71%</td>
</tr>
<tr>
<td></td>
<td>-0.48 - 0.10</td>
<td>33.87 - 70.78%</td>
</tr>
</tbody>
</table>

The anterolateral abdominal wall, rectus abdominis (RA), external oblique (EO), and internal oblique (IO), contributes to lumbopelvic-hip strength; and its role in injured populations such as low back pain has been well explored. However, it is important to establish the association between a body mass normalized measure of muscle size with overall physical activity in a healthy population due to their utility as a frequently used control group and for the potential of this measurement technique in aging, resistance training, and abdominal fat assessment.

PURPOSE: To determine relationships between muscle thickness (at rest and during contraction) of RA, EO, IO and patient-reported outcome measures on physical activity and health. METHODS: Eight active participants with no history of low back or lower extremity injury (23.1±5.4yrs, 171.1±11.3cm, 70.6±15.1kg, 4F) completed a single imaging session of RA, EO, and IO. Before imaging, participants completed the PROMIS Global Health (GH), PROMIS Physical Function (PF), and International Physical Activity Questionnaire Short Form (IPAQ). Ultrasound images were collected at rest while supine, hook-lying and during contraction with participants instructed to perform an abdominal crunch for RA, and crunches toward either knee for EO and IO. Thickness measures were normalized to body mass (kg). Pearson’s r correlation coefficients were used to determine relationships. RESULTS: Six of the 8 participants scored high on the IPAQ (≥3000 METmin/week) and the rest were moderate (≥600 METmin/week). The average hrs/day participants spent sitting was 4.6±2.3hrs. The PROMIS GH (78.1±17.4) and PROMIS PF (98.9±2.4) both confirmed overall health and activity levels. Right side EO at rest (r=.74, p<.04) and during contraction (r=.84, p<.01) were strongly related to hours spent sitting per day. CONCLUSIONS: Normalized EO muscle thickness was found to increase, at rest and during contraction, as health, active individuals sat longer. Although this was the only significant correlation, this controversial finding may be explained due to the relative 17.4% decrease in EO activity on the right side, compared to the left. The connection between the abdominal wall and self-reported physical activity is important to distinguish, especially with a body mass normalization technique.

Purpose: Adults with Autism Spectrum Disorder (ASD) may be predisposed to deficient biomechanics or neuromuscular control. This study compared the biomechanics of adults with and without ASD completing a single-leg hopping task. We hypothesized that adults with ASD would demonstrate deficient biomechanics (i.e., decreased pelvic control and greater dynamic limb valgus) compared to adults without ASD. METHODS: 10 participants with ASD (8 male; mean age 23.3, SD ± 3.8) and 10 without ASD (8 male; mean age 21.5, SD ± 2.5) were included in this analysis. 3D motion capture data were collected while participants performed five consecutive single-leg hops. Two of the middle hops were analyzed and kinematic values were averaged across hops. Dynamic limb valgus and frontal plane pelvic range of motion were compared between groups using independent samples t-tests. RESULTS: No statistically significant differences were observed between the individuals with and without ASD (Table). Conclusion: Our hypothesis was not supported. Individuals with ASD did not demonstrate deficient biomechanics during the single-leg hopping task when compared to individuals without ASD. The high-level of function of the adults with ASD in the present study may be related to their proficient hop performance. It is also possible other biomechanical variables not presently measured may highlight differences in performance between populations. The present results suggest adults with ASD have similar biomechanics as adults without ASD, though further study is needed. Table: Comparison of Kinematic Variables Between Groups.
INTRODUCTION: The Kinematic Sequence (KS) refers to the order of peak angular velocities of connected body segments during a specific movement. There are many possible KS patterns. The proximal-to-distal (PDS) KS ordered: pelvis-> arm-> forearm-> hand is reported as the most efficient pattern for overhead throwing. Simulation studies report that the PDS KS results in reduced torques across trunk-> arm-> forearm-> hand is reported as the most efficient pattern for overhead throwing. While the PDS KS concept is instructed in fastpitch CORE, demonstrates delayed peak velocity of the trunk: pelvis-> hand -> trunk-> throwing. Simulation studies report that the PDS KS results in reduced torques across trunk-> arm-> forearm-> hand is reported as the most efficient pattern for overhead throwing. Several training strategies have been suggested and evaluated for their effects on baseball pitching performance and injury risk. There is some data in the current literature which indicates that plyometric based weighted-ball training is effective at altering the kinematics and kinetics of the throwing motion. However, it is unclear whether weighted-ball trained pitchers throw faster with lower joint kinetics than those trained otherwise. PURPOSE: To compare throwing velocity and maximum elbow valgus torque (MEV) between collegiate male baseball pitchers trained with weighted-ball exercises and those without. It was hypothesized that weighted-ball trained pitchers exhibit higher throwing velocity and MEV than pitchers trained without weighted-ball exercises. METHODS: Twenty-one collegiate baseball pitchers participated in this study, 13 of whom were trained using weighted balls and 9 of whom trained without weighted bases as part of their in-season training regimen. After providing written informed consent, each participant threw 15 fastballs while ball speed and MEV were measured using a radar gun and a wearable inertial measuring unit (IMU), respectively. RESULTS: There was no significant difference in ball speed between weighted-ball trained pitchers (36 ± 1 m/s) and non-weighted-ball trained pitchers (35 ± 3 m/s, p = .108). Conversely, weighted-ball pitchers threw with greater MEV (110 ± 28 N m) than non-weighted-ball trained pitchers (52 ± 6 N m, p < .001). CONCLUSION: These findings suggest that pitchers who train using weighted-ball exercises throw at ball speeds comparable to those who do not but may do so at a higher risk of a pitching-related elbow injury.

<table>
<thead>
<tr>
<th></th>
<th>ASD</th>
<th>Non-ASD</th>
<th>Between-Group Differences</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pelvis ROM</td>
<td>-8.3±2.81</td>
<td>-6.7±2.35</td>
<td>-1.6</td>
<td>0.194</td>
</tr>
<tr>
<td>Hip flexion</td>
<td>45.7±8.69</td>
<td>45.9±11.03</td>
<td>0.2</td>
<td>0.965</td>
</tr>
<tr>
<td>Hip adduction</td>
<td>8.1±3.99</td>
<td>4.4±4.81</td>
<td>-3.7</td>
<td>0.077</td>
</tr>
<tr>
<td>Hip internal rotation</td>
<td>6.6±6.16</td>
<td>9.3±5.6</td>
<td>2.7</td>
<td>0.321</td>
</tr>
<tr>
<td>Knee abduction</td>
<td>7.1±4.81</td>
<td>3.6±3.94</td>
<td>3.5</td>
<td>0.100</td>
</tr>
<tr>
<td>Knee flexion</td>
<td>50.1±8.77</td>
<td>49.9±5.78</td>
<td>0.2</td>
<td>0.888</td>
</tr>
<tr>
<td>Ankle dorsiflexion</td>
<td>24.4±2.98</td>
<td>22.0±6.52</td>
<td>2.4</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Abbreviations: ASD = Autism Spectrum Disorder, ROM = range of motion.

*Values are mean±SD.
It is known that high elbow valgus torque in the pitching motion can contribute to the occurrence of elbow injury. Lately, studies have shown pitchers with UCL tears had significantly lower balance measures than healthy players when tested after injury occurred. There is a paucity of research on the effect of balance-specific training on the joint loading of the elbow and player performance in baseball pitching. PURPOSE To investigate the effect of a balance training intervention on the biomechanical factors that can contribute to a pitcher’s increased risk of elbow injury. METHODS Thirteen collegiate baseball pitchers were randomly assigned to a training group: control or intervention. The control group did only the team training and the intervention group did the team training and a specific balance training program. The intervention was performed 3 times a week for 6 weeks. Measurements of balance (Y-Balance), limits of stability (center of pressure excursion), ball speed, and joint kinematics and kinetics, specifically maximum elbow valgus torque (MEV), through motion capture were collected before and after the 6-week training program. RESULTS None of the outcome measures showed a significant difference between training type (Y-Balance p=.405; COP excursion p=.537, ball speed p=.150; MEV p=.945). Three outcome measures, COP excursion (p=.003), ball speed (p=.003), and MEV (p=.001) showed significant decreases over time regardless of training type. A Pearson Correlation was run for the entire study population (n=13) between ball speed and MEV for initial (p=.409) and final (p=.300) testing and showed no significant correlation between the variables. CONCLUSION The balance training program had no observable effect on a pitchers’ pitching performance or elbow kinetics. There was no significant difference between groups in pre or post measures, therefore, any change in balance measures can be attributed to normal in-season training strength development.

<table>
<thead>
<tr>
<th>Joint Angle</th>
<th>Average (%)</th>
<th>Correlation Coefficient</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ankle Eversion</td>
<td>-22.7 ± 10.29</td>
<td>.265</td>
<td>.018*</td>
</tr>
<tr>
<td>Knee Valgus</td>
<td>-10.8 ± 5.06</td>
<td>-.320</td>
<td>.004**</td>
</tr>
<tr>
<td>Hip Flexion</td>
<td>40.90 ± 11.21</td>
<td>499</td>
<td>.940</td>
</tr>
<tr>
<td>Adduction</td>
<td>-17.99 ± 8.74</td>
<td>-.602</td>
<td>.001**</td>
</tr>
<tr>
<td>Internal Rotation</td>
<td>-9.44 ± 9.81</td>
<td>-207</td>
<td>.002</td>
</tr>
<tr>
<td>Pelvis Abduction</td>
<td>-10.18 ± 11.32</td>
<td>-.001</td>
<td>.996</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measurment</th>
<th>Pre-Intervention</th>
<th>Post-Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y-Balance</td>
<td>123.1 ± 9.7 cm</td>
<td>124.5 ± 11.9 cm</td>
</tr>
<tr>
<td>COP Excursion</td>
<td>119.0 ± 7.7 cm</td>
<td>122.0 ± 9.6 cm</td>
</tr>
<tr>
<td>Ball Speed</td>
<td>81.2 ± 3.2 mph</td>
<td>77.9 ± 3.8 mph</td>
</tr>
<tr>
<td>Maximum Elbow Valgus</td>
<td>103.6 ± 28.6 Nm</td>
<td>64.5 ± 8.7 Nm</td>
</tr>
<tr>
<td>Intervention</td>
<td>117.0 ± 27.2 Nm</td>
<td>77.0 ± 13.7 Nm</td>
</tr>
</tbody>
</table>

Because of its relationship to pitching-related elbow injuries, the valgus torque at the elbow during baseball pitching has been a measure of interest that has clinical implications for the assessment and treatment of ulnar collateral ligament (UCL) injuries in pitchers. However, there currently is no feasible method to quantify elbow valgus torque in game-like settings. PURPOSE: To estimate the concurrent validity of a wearable sensor in measuring valgus torque at the throwing elbow during the pitching motion. METHODS: After providing informed consents, thirty-four adolescent pitchers threw 10 fastballs from a regulated mound while the joint kinematics and kinetics were simultaneously being measured with a 3D motion capture system and an inertial measurement unit (IMU) sensor, which was used to specifically estimate elbow valgus torque during baseball pitching. The Pearson correlation and Bland-Altman charts were used to estimate the concurrent validity and degree of accuracy of the IMU using the 3D motion capture system as the criterion method. RESULTS: The concurrent validity of the IMU in measuring elbow valgus torque was moderate (r = 0.686, p < 0.01) with a mean error of -3.48 Nm (Fig. 1). CONCLUSION: The wearable sensor was found to have moderate concurrent validity in estimating elbow valgus torque, the magnitude of which was underestimated by the sensor.
various variables that related to higher velocity included decreased elbow flexion at the end of acceleration phase. Strength parameters including hip internal and external rotation strength were found to be related to higher velocities. These findings highlight the potential influence of lower extremity kinematic variables and strength on performance as measured by velocity. These results can benefit players or coaches who are teaching or learning how to do the overhand throw.

1023 Board #149 May 27 1:30 PM - 3:00 PM Effects Of Weighted Baseball Throwing On Youth Glenohumeral Joint Reaction Force
Hiroshi Sagawa1, Michael R. Torry1, Adam E. Jagodinsky1, Sean Higinbotham2, Michelle Sabick1. 1Illinois State University, Bloomington, IL; 2University of Denver, Denver, CO. 3Saint Louis University, St Louis, MO. (No relevant relationships reported)

INTRODUCTION: Weighted baseball throwing programs are often used to increase pitch velocity. However, increased injury risk has been reported and questions regarding possible mechanism of injury exist. Kinematics and kinetics have been investigated with inverse dynamics approach, but the effects of individual muscle forces have rarely been taken into account by these models and in consideration of pitch mechanics. Analysis of shoulder joint reaction force with a musculoskeletal model including individual muscle forces may provide new insight on injury mechanism.

PURPOSE: To compare the effects of varied weighted baseballs on glenohumeral (GH) joint reaction forces during youth pitching.

METHODS: 7 baseball pitchers (Age 15.7 ± 2.4) participated in the study. Participants performed 5 pitches for each with 5oz, 7oz, and 9oz baseballs. Full body, 3D segment position data were collected using a motion capture system (200 Hz) and ball velocities were measured via radar gun. Highest velocities of 3 pitches were selected and 3D marker trajectories input into a 19 DOF musculoskeletal model utilizing a standard inverse dynamics and static optimization routine to produce individual muscle forces to yield GH joint reaction forces. Mean distraction force, anterior shear force, and superior shear force on GH joint were calculated and compared with RAMANOVA (alpha = .05) during the acceleration phase of the pitch with Bonferroni post-hocs.

RESULTS: Differences were noted between the ball weights on ball velocity (5oz 66.9 ± 9.4, 7oz 75.1 ± 10.3, 9oz 81.1 ± 9.4 mph, p<0.001) during the acceleration phase of the pitch with Bonferroni post-hocs. Also, throwing higher baseballs exhibited increased distraction forces (5oz 1987±472.5N, 7oz 2386±544.1N, 9oz 2581±625.7N, p<0.001) while anterior shear force and superior shear force did not present distinct differences.

CONCLUSIONS: Distraction force pulls humeral head out of the glenoid fossa, and weighted baseball throwing program may cause more stresses on biceps brachii, rotator cuff, and surrounding structures by the increased distraction force.

B-73 Free Communication/Poster - Sports Biomechanics

1025 Board #151 May 27 1:30 PM - 3:00 PM The Measurement Of Thrust In Competitive Swimming: The Association Between Different Thrust Variables
Tiago M. Barbosa1, Jia Wen Yam2,2, Giovindasamy Balasakaran, FACSM2, Daniel A. Marinho1,1. 1Politechnic Institute of Bragança, Bragança, Portugal; Research Centre in Sports, Health and Human Development, Vila Real, Portugal; 2Nanyang Technological University, Singapore, Singapore. 3Nanyang Technological University, Singapore, Singapore. 4Research Centre in Sports, Health and Human Development, Vila Real, Portugal; University of Beira Interior; Covilhã, Portugal. (No relevant relationships reported)

Swimming acceleration and velocity are the net balance between Drag Force and Thrust. It is a standard procedure to do the decomposition of the Thrust-Time curve, assessing the swimmer’s thrust. However, there is not a convention or standard procedure on the variables to be selected. Researchers report on regular basis either the Peak Thrust, Mean Thrust or Thrust-Time Integral. It is yet unclear to which extend these variables can be used, reported and interpreted interchangeably.

PURPOSE: To analyze the association between different thrust variables performing arm-pull in competitive swimming. METHODS: 671 front-crawl arm-pull cycles of 14 competitive swimmers were analyzed. Thrust was collected by an in-house built system composed by differential pressure sensors and underwater camera (Aquaneex, Swimming Technologies, USA). A customised software (LabVIEW®, v.2017) was used to acquire (=50Hz) and streaming time-series and video signal. Data was transferred to interface by a 14-bit resolution acquisition card (NI-6001, National Instruments, Austin, USA). Then, it was imported into a signal processing software (AcqKnowledge v.3.9.1, Biopac Systems, USA). It was extracted the Peak Thrust, Mean Thrust and Thrust-Time Integral of each arm-pull. Coefficients of Determination were computed between the three thrust variables. RESULTS: All Coefficients of Determination were significant (R²=0.001). Peak Thrust vs. Mean Thrust was R²=0.49, Peak Thrust vs. Force-time Integral R²=0.51, and Force-time Integral vs. Peak Thrust R²=0.61. Intersection on Y-axis at the origin of the pairwise variables noted in the same SI unit (i.e. Newton) were very close to zero (-1.694<8<1.592) and standard error of estimate acceptable (6.54<8<12.14). CONCLUSIONS: There is a strong association between different thrust variables, even though the proportion of the variance is about 50-60%. Supported by: NIE AcRF Grant (R1/6/17 TB); Portuguese Foundation for Science and Technology (UID/DTP/04045/2019); European Fund for regional development (FEDER)-COMPETE 2020 (POCI-01-0145-FEDER-006969).

1026 Board #152 May 27 1:30 PM - 3:00 PM Power Parameters Appear Less Important To Water Polo Success Than Motor Control
Cameron A. Williams, William P. Lydon, Cynthia Villalobos, Christopher B. Perry, Alexia E. Amo, J. Mark VanNess, Courtney D. Jensen. 1University of California, Santa Barbara; 2Nanjing University of Science and Technology; 3University of California, Santa Barbara. (No relevant relationships reported)

Conditioning programs for water polo players typically focus on muscular power to enhance the wrestling and shooting components of play. While improvements in strength training are easily quantifiable, the relationship between upper limb power and in-game performance has yet to be established. PURPOSE: To test the effect of upper limb force parameters on offensive performance in women’s water polo players. METHODS: We conducted biomechanical testing on 12 D1 women’s water polo players using Proteus (Proteus Motion, USA). After completing a familiarization and warm-up protocol, subjects performed a single set of 10 repetitions at 3/5 of their 1RM. RESULTS: Significant differences were found between the 3 KS groups (F(2,27)=4.95, n=0.21, p=0.012) with lower values for PDS (P<0.05). CONCLUSIONS: This foundational study is the first to apply a KS classification system to the baseball swing. Lower elbow extension torques for the PDS group are consistent with the idea that a PDS KS may result in decreased joint stress. KS analyses could potentially guide clinicians and hitting instruction to minimize biomechanical risk factors during batting.
Majority of factors that occur in the sport of triathlon happen during the swim portion of the race (Harris et al., 2010, JAMA). The potential risk of death while swimming has raised safety concerns. The governing body, USA Triathlon (USAT), has implemented guidelines related to water temperatures and the use of wetsuits. Using a wetsuit while swimming in warm water may increase body heat storage which could increase core temperature. Currently, there are only limited data on the influence of triathlon wetsuits on core temperature when swimming in warm water while swimming a short distance at a somewhat hard swim pace (Aura et al., 2019, MSSE). PURPOSE: The purpose of this study was to examine core temperature while swimming a long distance at a somewhat hard swim pace (Aura et al., 2019, MSSE).

RESULTS: The average core temperatures (°C) while wearing a wetsuit.

CONCLUSIONS: These data provide preliminary evidence that skill-based fine motor coordination may be more valuable than power development in offensive performance in women’s water polo.

PURPOSE: The vertical ground reaction force (VGRF) during a countermovement jump (CMJ) is the most commonly used method for assessing neuromuscular performance. The optimal VGRF profile appeared to be peak force occurring at low position regardless of whether there was a single or double peak. The worst VGRF profile appeared to be jumps with two peaks where the 2nd peak was greater than the 1stpeak, or the 1st and 2nd peaks were equal, but the 1st peak occurred after low position. In conclusion, achieving peak VGRF at the low position of a CMJ appears to be optimal.

PURPOSE: The purpose of this study was to examine kinematic, kinetic and muscle activation metrics during countermovement jumps (CMJs) with varying countermovement depth. The hypothesis was that a shallow countermovement depth would compromise jump height by disrupting neuromechanical control.

METHODS: Ten healthy men (age 26.6±1 yr, height 1.81±0.08 m, mass 83.5±9.0 kg) performed maximal CMJs at self-selected countermovement depth (self-selected CMJ), at reduced countermovement depth (shallow CMJ) and at increased countermovement depth (deep CMJ). Three jumps were performed in each condition on force plates with ankle, knee and hip motion recorded and electromyograms (EMG) recorded from the gluteus maximus (GM), vastus lateralis (VL) and medial gastrocnemius (MG) muscles. During CMJs flexion angle was recorded with an electrogoniometer. Jumps were instructed to flex 15% less (shallow CMJ) and 15% more (deep CMJ) than the self-selected CMJs. Kinematic, kinetic and EMG metrics were compared between the different CMJ depths using repeated measures ANOVA.

RESULTS:Ten healthy men (age 26.6±1 yr, height 1.81±0.08 m, mass 83.5±9.0 kg) performed maximal CMJs at self-selected countermovement depth (self-selected CMJ), at reduced countermovement depth (shallow CMJ) and at increased countermovement depth (deep CMJ). Three jumps were performed in each condition on force plates with ankle, knee and hip motion recorded and electromyograms (EMG) recorded from the gluteus maximus (GM), vastus lateralis (VL) and medial gastrocnemius (MG) muscles. During CMJs flexion angle was recorded with an electrogoniometer. Jumps were instructed to flex 15% less (shallow CMJ) and 15% more (deep CMJ) than the self-selected CMJs. Kinematic, kinetic and EMG metrics were compared between the different CMJ depths using repeated measures ANOVA.

CONCLUSIONS: These data provide preliminary evidence that skill-based fine motor coordination may be more valuable than power development in offensive performance in women’s water polo.

ACSM May 26 – May 30, 2020
San Francisco, California
task intensity affects the influences of AKP on frontal-plane hip biomechanics during landing and jumping. METHODS: 13 healthy adults (6 females, 7 males; 70 ± 15 kg; 1.7 ± 0.1 m; 22 ± 2 years) performed three land and jump trials under three conditions: pre-pain, pain (1-mL hypertonic saline (3% NaCl) injection into the right infrapatellar fat pad), and post-pain. Subjects jumped over an obstacle, landed on a force plate, then jumped over a second obstacle. Obstacle heights of 80 and 50% of maximal vertical jump height defined high and low task intensities. Frontal plane hip angles and internal moments were calculated for the right leg. A functional analysis (α = .01) was used to evaluate differences between conditions for each intensity, across the duration of foot contact with the force platform (ground contact). RESULTS: For the high intensity task, AKP resulted in increased hip adduction angle, as much as 2° between 1-20% and 75-95% of ground contact, and increased hip abduction moment, up to 6 Nm between 10-30% of ground contact (Figures 1E-F). For the low intensity task, AKP resulted in decreased hip abduction angle, as much 1.3° between 25-75% of ground contact, and decreased in hip abduction moment, as much as 15 Nm between 25-60% of ground contact (Figure 1G-H). Changes due to AKP persisted after pain abatement (Figures 1I-L). CONCLUSIONS: Experimental AKP effects frontal plane hip biomechanics and these effects differ between task intensity. Especially during the high-intensity task, the AKP resulted in increased hip adduction angle and internal abduction moment. More data are needed to determine how if the present changes influence the risk of chronic knee injury/disease.

Females have a greater rate of traumatic knee injuries than male athletes. Trunk position has been shown to affect knee joint biomechanics during a landing task. Given the position of breast tissue, insufficiently supported breasts may also alter knee joint biomechanics. However, no previous research has investigated the effect of breast tissue or support on knee joint biomechanics during landing. PURPOSE: to determine the effect of breast support on knee and hip joint kinematics during a landing task. METHODS: Fifteen female athletes performed five step-off landings from a height of 40 cm in each of three bra support conditions: control (CON), low support (LOW) and high support (HIGH). 3D kinematics and ground reaction forces (GRFs) were simultaneously recorded using a 9-camera motion capture system (240 Hz) and pair of force platforms (1200 Hz). Custom software (was used to determine peak joint angles and moments. ANOV A was used to compare mean knee and hip joint kinematics. RESULTS: No differences in peak knee abduction moments were observed, though peak knee external rotation moments were smaller in the LOW compared to CON (p = .007) and HIGH conditions (p = .013). No differences were observed between CON and HIGH (p = .423). No differences were observed in peak hip abduction moment or peak hip external rotation moment. CONCLUSIONS: These findings indicate that knee joint biomechanics during a landing task are affected by breast support. The current study did not address the role of trunk orientation or differences in breast size amongst participants. Future research should address the role of breast motion on trunk kinematics and kinetics.

<table>
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<tr>
<th>Variable (Moments)</th>
<th>CON</th>
<th>LOW</th>
<th>HIGH</th>
<th>p-value</th>
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<tr>
<td>Knee Abduction</td>
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<td>0.44 (0.30)</td>
<td>0.42 (0.21)</td>
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<td>-0.24 (0.25)</td>
<td>-0.23 (0.22)</td>
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<td>Hip Abduction</td>
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<td>-0.66 (0.26)</td>
<td>-0.57 (0.27)</td>
<td>0.216</td>
</tr>
<tr>
<td>Hip External Rotation</td>
<td>-0.57 (0.18)</td>
<td>-0.60 (0.16)</td>
<td>-0.58 (0.19)</td>
<td>0.353</td>
</tr>
</tbody>
</table>

Whole Body Vibration (WBV) is the exposure of oscillating vibration to the body, which may result in an increase of the rate of motor unit activation. Fatigue of knee extensor muscles has been shown to hinder vertical jump (VJ) performance. PURPOSE: The purpose of this study is to investigate the effects of WBV and fatigue on vertical jump (VJ) performance. METHODS: Sixteen active males and females (age, 23.19 ± 2.56; weight, 79.05 ± 16.97; height, 174.36 ± 12.11) volunteered for five-day study. On day 1 familiarization, after completing an IRB approved informed consent and health screening questionnaires participants were prepped on testing protocols. Following a dynamic warm up, testing sessions 2-5 will include one of four conditions: No WBV and No Fatigue (C1), WBV and Fatigue (C2), WBV and No Fatigue (C3), and No WBV and Fatigue (C4). WBV was performed using a frequency of 50Hz and a low amplitude while performing quarter squats for a total of 4min with a 30s rest or work ratio. Lower-body fatigue induced using Bosco fatigue test, performing 60s of jump squats. VJ was performed using an AMTI force plate and peak force, velocity, and power were calculated and a Vertec was used to measure vertical jump height (VJH). VJ data was collected pre and post conditions each day. Percent change scores (%) were calculated between pre and post conditions and used for analysis. SPSS was used to perform a Repeated Measures ANOVA. RESULTS: There was significant differences between C1 and C2 (p = .005; C1 = -1.21 ± 5.91; C2 = -7.83 ± 6.17 %Δ), C1 and C4 (p = .002; C1 = -1.21 ± 5.91; C4 = -8.94 ± 6.90 %Δ), C2 and C3 (p < .001; C2 = -7.83 ± 6.17; C3 = 0.97 ± 4.63 %Δ), C3 and C4 (p < .001; C3 = 0.97 ± 4.63; C4 = -8.94 ± 6.90 %Δ) in VJH. There were significant differences between C1 and C4 (p = .011) and between C3 and C4 (p = .017) in peak force. There were significant differences between C1 and C2 (p = .01), C1 and C4 (p = .02), C2 and C3 (p = .001), and C3 and C4 (p = .001) in peak velocity. There were significant differences between was between C1 and C2 (p = .05), C1 and C4 (p = .03), C2 and C3 (p = .004), and C3 and C4 (p = .008) in peak power. There were no significant (p > .05) differences between other variables. CONCLUSIONS: WBV did not show to change the detrimental effects of lower-body fatigue, however this study did show lower-body fatigue decreases vertical jump performance.

The torque-velocity (T-v) curve has been used to study the effects of energy expenditure on contractile muscle activity and work done relative to VO2max. PURPOSE: The purpose of this study was to further quantify changes to the T-v curve, but based on anaerobic energy (W') expenditure at powers above Critical Power (CP). METHODS: A group of 10 subjects (37.8 ± 11.6 y, 72.8 ± 16.2 kg, 1.75 ± 0.1 m) performed a Time to Exhaustion Test (TTE) interspersed with 6-second sprints to generate their T-v curve at 3 stages of W' expenditure after initial warmup (FRESH), fatigued (after 2 minutes at CP), and TTE. RESULTS: ANOVA results indicated a statistically significant decrease in normalized Maximal Power (Pmax/ body) from FRESH to 2MIN (16.88%, p < .0005), 2MIN to TTE (24.71%, p < .0004), and from FRESH to TTE (41.6%, p < .004). Statistically significant decreases in normalized Maximal Velocity (Vmax/ body) were seen from FRESH to 2MIN (14.1%, p < .0005), from 2MIN to TTE (11.9%, p = .001), and FRESH to TTE (25.9%, p < .0005). No significant changes occurred in Maximal Torque (Tmax). Linear regression

Abstracts were prepared by the authors and printed as submitted.
models were run using W’ expended to explain variations in P – ω and T. There were significant negative correlations for T (P < 0.020) and significant strong negative correlations for P (P < 0.005), and ω (P < 0.005).

CONCLUSIONS: This suggests W’ expenditure can be used to predict the performance parameters Torque (T), Shortening velocity (ω), and Maximal Power (Pmax) during continuous cycling above Critical Power.

### 1034 Board #160 May 27 1:30 PM - 3:00 PM

**Effects Of Bicycle Crank Length On Hip And Knee Joint Kinematics And Compressive Forces**

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(No relevant relationships reported)

**PURPOSE:** Crank length (CL) on a bicycle may affect knee and hip joint compressive forces and range of motion (ROM). The relationship between knee/hip joint moments, forces, and ROM can have an influence on hip and knee joint health (i.e. osteoarthritis, patellofemoral disorder, ligament damage, etc.). The purpose of this study was to examine the effects of four different CL (155, 165, 175, and 185 mm) on ROM and resultant compressive forces on the hip and knee. **METHODS:** 12 non-cyclists (4M, 8F, aged 18-55) participated in a single blind randomized cross-over experiment with four CL. An Enhanced Helen Hayes marker protocol was used to place 32 retroreflective markers on anatomical landmarks to track kinematic data using a 12-camera 3D motion analysis system with Cortex software (Motion Analysis Corp., CA, USA). Kinetic data were collected using a stationary bike (SRM IndoorTrainer, Germany) retrofitted with custom pedals containing 6-axis load cells (AMTI, MA, USA). A 3 minute warm-up for each CL was performed at 1.5 W/kg and 70 rpm. 4x1 minute trials were conducted at 2.0 kg. The first two trials were at a constant cadence of 70 rpm and the second two trials were at a constant pedal speed (PS) of 1.47 m/s.

There were 10 seconds of rest between trials and 5 minutes of recovery between each condition. Kinematic data was processed using Cortex software and filtered (4th order Butterworth, cutoff 6 Hz). Kinetic data was filtered using MATLAB (MathWorks, USA). All data was averaged from 30 seconds of each trial. **RESULTS:** During submax cycling, the 155 mm CL had a significantly smaller hip ROM (42 deg vs. 49 deg; p<0.05) and a significantly smaller knee ROM compared to the 185 mm CL (72 deg vs. 80 deg; p<0.05). No significant differences were found at a cadence of 70 rpm: 155 mm CL peak hip compressive force (1.3 N/kg) vs. 185 mm CL (0.9 N/kg); 155 mm CL peak knee compressive force (2.8 N/kg) vs. 185 mm CL (2.6 N/kg). No significant differences were found at a PS of 1.47 m/s: 155 mm CL peak hip compressive force (2.8 N/kg) vs. 185 mm CL (2.5 N/kg). No significant differences were found at a PS of 1.47 m/s: 155 mm CL peak hip compressive force (2.8 N/kg) vs. 185 mm CL (2.5 N/kg). No significant differences were found at a PS of 1.47 m/s: 155 mm CL peak hip compressive force (2.8 N/kg) vs. 185 mm CL (2.5 N/kg). No significant differences were found at a PS of 1.47 m/s: 155 mm CL peak hip compressive force (2.8 N/kg) vs. 185 mm CL (2.5 N/kg).

### 1035 Board #161 May 27 1:30 PM - 3:00 PM

**Effects Of Workrate And Seat Position On Knee Biomechanics In Recumbent Cycling**

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Cycling is one of the most popular rehabilitation tools for knee osteoarthritis (OA) patients. In recent years, recumbent bicycle has become a popular trend over upright bikes in exercise and rehabilitation. Previous literature has largely focused on upright cycling with few examining knee biomechanics in recumbent biking in the surgical limb. Little is known on the effects of workrate and seat position on knee biomechanics in recumbent bike. **PURPOSE:** To examine the effects of different workrates and seat positions on knee biomechanics during stationary recumbent cycling. **METHODS:** Fifteen healthy participants (55.3±3.7 years, 1.75±0.09 m, 84.3±15.7 kg) cycled on a recumbent ergometer in six test conditions of three seat positions at two workrates. Seat positions were “far” (230-30 of peak knee flexion angle), “medium” (30-40) and “close” (40-50), and the workrates were set at 60 and 100 Watts (W). A 3D motion analysis system (240 Hz, Vicon) and a pair of custom-made instrumented pedals were used to collect kinematic and kinetic data in each condition. A 3. 2 (seat position x workrate) repeated measures ANOVA was used to determine if differences existed between conditions (p<0.05). **RESULTS:** Peak knee extension moment, peak knee abduction moment (KAbM), peak knee extension angle and peak knee extension ROM were significantly higher at 100 W compared to 60 W (all p < 0.008). There was a significant main effect of seat position for peak knee flexion moment. Pairwise comparisons showed that peak knee flexion moment was significantly higher in the far seat position (-18.9±6.3 Nm) compared to medium (-13.1±6.5 Nm) and close seat position (7.2±7.33 Nm). In addition, the peak flexion moment was significantly higher in the medium seat position (-13.1±6.5 Nm) than close position (-7.2±7.33 Nm). **CONCLUSION:** Increased workrates significantly increased peak KAbM and knee extension moment. Different seat positions did not change either peak KAbM or knee extension moment. For patients with knee OA, a low workrate may be considered in recumbent cycling exercises, while the seat position could be chosen based on personal preferences.
Biomechanics Metrics Associated With Golfing Prowess
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**PURPOSE:** The biomechanics of the golf swing have been studied extensively but specific metrics related to golfing proficiency have not been identified. The purpose of this study was to compare golf swing biomechanics between proficient and average golfers and thereby identify specific metrics associated with golfing proficiency.

**METHODS:** Twenty-two male golfers were categorized as proficient (golf index <6, n=10) or average (golf index 10-24, n=12). Three-dimensional kinematics and ground reaction forces (GRF) were recorded as subjects hit standard golf balls into a net using a driver. Angular velocities of the pelvis, trunk, lead arm and golf club, as well as X-factor, were calculated from the kinematic data. GRF under the lead and back legs are expressed as a % of bodyweight. The effect of golf proficiency on golf swing biomechanics was assessed using independent samples t-tests.

**RESULTS:** Proficient golfers were younger (26.6±6 yr vs. 48±16 yr, P=0.001) but did not differ in height (P=0.114) or weight (P=0.330). Peak pelvis and trunk velocities were higher (P=0.004) in proficient golfers (52.2±1.91 deg/s and 62.1±8.99 deg/s, respectively) versus average golfers (41.4±3.67 deg/s and 52.1±7.55 deg/s, respectively) but peak club velocity was not different (2509.8±226.1 deg/s vs. 2446.6±420.3 deg/s, P=0.675). Proficient golfers had greater X-factor at the top of the backswing (56.0±6.0 degrees vs. 44.1±11.4 degrees, P=0.008), greater peak X-factor (61.4±5.7 degrees vs. 49.3±11.8 degrees, P=0.008) and greater X-factor at ball impact (34.2±5.8 degrees vs. 22.5±6.5 degrees, P=0.001). Proficient golfers had a higher peak GRF on the lead leg compared with average golfers (142±17 %BW vs. 122±18 %BW, P=0.018), while paradoxically having a lower lead leg GRF at ball impact (56.18 %BW vs. 89±17 %BW, P<0.001).

**CONCLUSIONS:** The higher X-factor in proficient golfers is indicative of a more effective use of elastic energy in the trunk that is sustained through ball impact. The GRF data indicate that proficient golfers more effectively loaded the lead leg during the initiation of the downswing and more effectively unloaded the lead leg prior to ball impact. In conclusion, golf swing proficiency appears to be a function of a more effective transfer of power from the ground and a more effective use of elastic energy in the trunk.
PURPOSE: A unique feature of lacrosse is the use of a crosse to move the ball during complex running and jumping movements. It is unclear whether there is a differential biomechanical effect of holding the crosse due to key sport-specific motions in female and male youth and high-school/collegiate players. The purpose of the study was to determine the motion differences of running and drop jumps when holding a short stick or a defensive pole in youth (11.8±1.4 yrs; 21% female) and high-school/collegiate players (18.4±4.9 yrs; 35% female).

METHODS: Players (N=70) performed drop jumps and running at near sprint speed. Drop jumps were completed under three conditions: bare hands, short stick and defensive long pole. Running was performed under three conditions: bare hands, and dominant and side one-handed and two-handed holds while dribbling. A 3D motion tracking system and floor embedded force plates captured motion about the ankle, knee, hip, pelvic and trunk during three trials of each condition for each motion. Sex and age group differences were tested using univariate analyses of variance.

RESULTS: For drop jumps, foot landings (heel, mid or toe) differed more often when holding a crosse versus bare hands for all players (31.4%-34.2% vs 27.1%). Irrespective of age, female players demonstrated more ankle 7°-9° dorsiflexion than males in all conditions (p<0.05). Youth demonstrated 28% more knee adduction in all jump conditions than high-school/collegiate players (p<0.05). Compared to males, females had 5.2°-6.5° less anterior trunk flexion at initial ground contact when holding a short or long stick and 9.8%-20% less anterior flexion after landing versus bare hands (p<0.05). During running, females had 12.7% more hip adduction and 43% more trunk lateral lean than males with one or two-hand holds compared to bare hands irrespective of age (p<0.05). A two-handed hold produced greater trunk transverse rotation than other conditions compared to males and across conditions (p<0.001). Sex and age differences provided a unique advantage for females to improve performance on shuttle run, hand grip strength and vertical jump performance in elite volleyball athletes.

CONCLUSIONS: The relationship between ratings of perceived exertion (RPE) and objective accelerometer-derived variables were: total playerload (PL), total change of direction accelerations, and RHIE (0.52, 0.52).

Correlations with RPE during games and practices were: PL (0.79, 0.57), and RHIE (0.52, 0.52).

PURPOSE: This study aimed to determine whether a hip thrust and resistance training could improve performance on shuttle run, hand grip strength and countermovement jump in elite volleyball athletes.

METHODS: eleven elite male volleyball players (23.9± 2.87 years), body weight (94.9±19.15 kg), average single leg jump (40.18± 3.07), body fat (18.16± 5.45%) completed 2 training sessions per week, which included hip thrust exercise and upper resistance training. Over the 10 week season, the athletes performed 3-4 sets of 6-10 repetitions for resistance exercises during each training session. All sessions were supervised by one of the investigators as well as by the Colombian team coach. Shuttle run, hand grip strength and countermovement jump were assessed before and after the 10 week training program. A total of 12 variables was analyzed through CMJ (peak flight time (PFT), peak contact time (PCT), Peak eccentric duration (PDE), peak concentric duration (PDC), Peak eccentric work (PEW), Peak Concentric work (PWC), Peak jump height (PMH), Peak maximum velocity (PMV), Peak maximum power (PMP), Peak maximum force (PMF), Rate of force development (PRFD) and Peak time to maximum force (PTFM) were simultaneously quantified with the Gyko inertial sensor system (Microgate, Bolzano, Italy).

RESULTS: Non parametric data were analysed by Wilcoxon and Spearman test. Significant correlations (r) were found next to the p value and the effect size (ES) (shuttle run, hand grip strength, and those of countermovement jump respectively. Shuttle run (SR, p<0.001, r= 0.96, ES=0.23), Right hand grip strength (HGS R, p<0.001, r=0.90, ES=0.18), Left hand grip strength (HGS L, p<0.001, r=0.91; ES=0.22), CMJ performance variables: Peak concentric duration (PDC, p<0.001, r= 0.68, ES=0.44), Peak Jump Height (PMH, p<0.2, r= 0.88, ES=1.1), Maximum velocity (PMV, p<0.001=0.86, ES=0.61).

CONCLUSIONS: The findings suggest that elite male volleyball players can improve speed, agility, hand grip strength and vertical jump performance during the pre competition season by implementing a well designed training program that includes both hip thrust and resistance training exercises.
The triple hop for distance (THD) involves three consecutive single leg hops for maximal horizontal displacement. This task imposes variable mechanical demands challenging balance, coordination and leg strength. While THD is common during late-stage rehabilitation, these demands may also qualify THD as appropriate for healthy athletes. While THD requires that energy absorption strategies vary between landing styles, genders and heights, a limitation is the use of a single contact for analysis or training. As a result, changes in landing strategy over repeated landings are not well understood. PURPOSE: To determine changes in sagittal plane joint energetic landing strategy during each contact of THD. METHODS: Nine female college soccer players performed THD on the dominant limb. Ground reaction forces and lower extremity kinematics were measured using a force platform (1200Hz) and 9-camera motion capture system (240Hz). Three trials were collected of each contact in the THD sequence. Negative joint work was calculated as negative joint power integrated with respect to time. Total negative joint work (TJW) is the sum of eccentric work done on the hip, knee, and ankle. Relative negative joint work (RJW) was the proportion of TJW done on each joint with respect to time. Total negative joint work (TJW) is the sum of eccentric work done on the hip, knee, and ankle, and the proportion of TJW done on each joint was defined as relative negative joint work (RJW).

RESULTS: TJW increased from the first (-80.5 ± 26.3J) to the second (-95.5 ± 33.7J), and third (-145.2 ± 42.5J) landings. From the first to second contacts, RJW done on the ankle (33.5% vs 34.7%, d = 0.10), knee (53.9% vs 52.1%, d = 0.20), and hip (12.6% vs 13.1%, d = 0.08) was unchanged. From the second to third contacts, RJW done on the ankle was substantially decreased (34.7% vs 19.4%, d = 1.67), while RJW done on the hip was substantially increased (13.1% vs 25.4%, d = 1.68). RJW done on the knee was modestly greater (52.1% vs 56.3%, d = 0.54) in the second compared to thirds contacts in THD sequence. CONCLUSION: The serial nature of THD requires athletes to adapt to different demands in each ground contact. This includes progressively greater braking forces and landing strategy modulation during each contact. This represents a task which exposes athletes to variable demands of both ground reaction forces and joint work in a controlled manner. THD may therefore address multiple athletic performance qualities during performance enhancement and rehabilitation.

Musculature exposed to continuous stress overtime will begin to decrease performance as a result of fatigue. However, past research has shown that Whole Body Vibration (WBV) can have a positive effect on performance by increasing motor unit recruitment.

PURPOSE: The purpose of this study is to analyze the effects of WBV and Fatigue on Isometric Mid-thigh Pull (IMTP). METHODS: Sixteen active males and females (age: 23.19 ± 2.56yr, weight: 79.05 ± 16.97kg, height: 174.36 ± 12.11cm) volunteered to participate in a 5-day study. Day 1 consisted of familiarization where participants completed an IRB approved informed consent, Health History Questionnaire, and a PAQ. Following anthropometrics measurements, participants were familiarized with all the testing protocols and interventions. Day 2-5 testing sessions consisted of a dynamic warm-up followed by pre-testing of IMTP’s. Post-tests for IMTP were taken following the completion of one of 4 conditions, each performed on separate days. Conditions consisted of C1 (No WBV-No Fatigue), C2 (WBV-WBV-Fatigue), C3 (WBV-No Fatigue), and C4 (No WBV- Fatigue) in a randomized order. Peak Force for the IMTP was measured using an AMTI Portable Force Plate. WBV was administered while performing quarter squats at a frequency of 50Hz and low amplitude on for a total of 4min with a work to rest ratio of 30s/30s. The Bosco fatigue protocol was administered to induced lower-body fatigue by having participants perform 60s of jump squats. Percent change scores were calculated between pre- and post-tests for each condition and analyzed for statistical differences between conditions. SPSS was used to run a Repeated Measures ANOVA to compare condition differences of percent change scores (%). An alpha level was set at p < 0.05 to determine significance.

RESULTS: There were no significant (p=0.84) differences found between conditions (C1 1.25 ± 0.98%; C2 = -0.79 ± 7.77%; C3 = 1.53 ± 5.95%; C4 = 1.32 ± 10.69%) for peak force. CONCLUSIONS: Although no significant differences were found for peak force between pre- and post-tests for IMTP, further studies need to investigate alternative ways to evaluate the effects WBV on lower-body muscular performance.
CONCLUSIONS: The decrease found in hamstring peak vertical force corresponds to the fatigue that athletes present and accumulate during the tournament and predispose to be a risk factor for knee joint ligament injury due to changes in direction and unipodal landings. They are frequent in this sport. Likewise, the predisposition of the right leg as the dominant leg increases the incidence of injuries in the knee joint compromising dynamic stability.

1049 Board #175 May 27 1:30 PM - 3:00 PM Effect Of Moxibustion On Knee Joint Stiffness Characteristics In Recreational Athletes Pre And Post Fatigue Dan Wang1, Peng Yuan2, Yilin Xu3, Yufeng Zhang4, Zhiye Zhang5, Zirong Bai6, Zun Wang7, Eamonn Delahunt8,1, Shanghai University of Sport, Shanghai, China. 2Jiangsu Research Institute of Sports Science, Nanjing, China. 3Nanjing University of Chinese Medicine, Nanjing, China. 4University College Dublin, Dublin, Ireland.

Stiffness is the coupling of nervous system and joint mechanics, and thus the comprehensive representative of joint stability. It has been reported that moxibustion can improve weakness and alleviate fatigue symptoms.

PURPOSE: To investigate whether moxibustion could enhance knee joint stiffness characteristics in recreational athletes pre- and post fatigue. METHODS: Twenty-four participants were partially randomized into intervention (9 males: 20.2 ± 1.5 yr; 6 females: 20.7 ± 1.2 yr) and control group (5 males: 19.4 ± 0.9 yr; 4 females: 20.5 ± 0.6 yr). Intervention group: Acupoints ST36 (bilateral) and CV4 for indirect moxibustion 30 min every other day for 4 consecutive weeks; control group: no moxibustion intervention. Peak torque (PT) of right knee extensors, relaxed and contracted muscle stiffness (MS) of vastus lateralis, knee extensors muscular articulotorsional stiffness (MAS) were assessed by isokinetic dynamometer Isomed 2000, Myometer and free oscillation technique respectively, at three time points: pre-intervention (time-point 1), post-intervention (time-point 2), and after a treadmill fatigue protocol (time-point 3).

RESULTS: Two-way repeated measures ANOVA found a significant interaction between time and group in MAS (p = 0.001) and normalized PT (p = 0.004). Post-hoc tests with the Bonferroni adjusted were used and indicated that MAS in intervention group (time-point 1: 521.8±201.3 N.m, time-point 2: 637.7±181.2 N/m) increased more from pre to post intervention when compared to the control group (time-point 1: 615.4±196.6 N.m, time-point 2: 597.1±190.4 N.m, p = 0.022). There was a tendency that after fatigue MAS increased more in intervention group (time-point 2: 637.7±181.2 N/m, time-point 3: 712.1±156.9 N/m) than in control group (time-point 2: 597.1±190.4 N/m, time-point 3: 629.8±172.7 N/m, p = 0.020); and the tendency that normalized PT (PT/body mass) increased in intervention group (time-point 2: 1.49 ± 0.20 Nm/kg, time-point 3: 1.53 ± 0.17 Nm/kg) whilst it decreased in control group (time-point 2: 1.41 ± 0.21 Nm/kg, time-point 3: 1.34 ± 0.21 Nm/kg) (p = 0.033). CONCLUSION: Moxibustion enhanced the knee MAS, may benefit the ability of fatigue resistance in young recreational athletes, and thus could be utilized in injury prevention.

Supported by Jiangsu Education Department

1050 Board #176 May 27 1:30 PM - 3:00 PM Acute Effects Of Practical Blood Flow Restriction On Knee Proprioception During Low Intensity Aerobic Exercise Yujiro Yamada1, Ryan Kasprzak2, Alec Mathew2, Shelby Shotton3, Addyson Miller-Brown1, Trent Cayot1, John Thistlerwaith3,1, University of Mississippi, University, MS. 2Ohio University, Athens, OH. 3Ohio Dominican University, Columbus, OH. 4University of Indianapolis, Indianapolis, IN. 5Wittenberg University, Springfield, OH.

Practical blood flow restriction (pBFR) exercise techniques decreases blood flow to targeted muscles while increasing local metabolic accumulation, both of which could impair joint proprioception post-exercise. The impaired proprioception which typically occurs after high intensity aerobic exercise can provide faulty sensory feedback to the brain during movement, resulting in increased risk of injury. Currently, there have been no studies investigating whether pBFR low intensity aerobic exercise has an effect on joint proprioception.

PURPOSE: To investigate the effect of low intensity aerobic exercise with pBFR affecting knee joint proprioception. METHODS: Fourteen participants (8 males and 6 females) completed 3 sessions. On the first session, participants walked at 5.6 km/h at a 0% grade for two minutes followed by a 2% increase in the incline each minute until 40% of their heart rate reserve was achieved. Participants were familiarized with a “7/10” (moderate tightness) on the perceived tightness scale using elastic knee wraps as well as the position sense and countermovement jumps.

On session 2 or 3, participants walked on a treadmill for 15 minutes with or without elastic wraps at 5.6 km/h at the grade determined on the first session. Absolute angular error (AAE) was measured before and immediately after each treadmill walking protocol. Muscle fatigue was determined by changes in average power and peak power measured during countermovement jumps. Change scores were computed for each condition and paired sample t-tests were used to determine differences between pBFR and Control. RESULTS: The change in AAE was not different between pBFR: -1.5 vs. Control: -1.2 (p=0.171). However, between practice exercise with and without pBFR [mean difference of -1.73 (-4.3, 0.85) degrees]. The change in peak power was also similar (pBFR: -34.5 vs. Control: 150.1 W, p=0.739) between exercise with and without pBFR [mean difference of -185 (-1358, 988) W]. Similarly, the change in average power (pBFR: -9.1 vs. Control: -3.4 W, p=0.544) was also not different [mean difference of 12.6 (-31.1, 56.2) W]. CONCLUSION: The walking exercise with pBFR did not affect joint proprioception in young adults, suggesting that walking exercise with pBFR might be safely applied without increasing the risk of injury.

1051 Board #177 May 27 1:30 PM - 3:00 PM Flight Stability Control Mechanism Of Ski Jumping In Lateral Wind Environment Qi Hu1, Yu Liu2.1, Chiina Institute of Sport Science, Beijing, China. 2Shanghai University of Sport, Shanghai, China. Email: huqi@ciss.cn

Wind is not only closely associated with the discussion of fairness in skiing jumping, but also very important to flight safety. Flight stability is essential for performance and safety in ski jumping, and mainly involved several factors, such as environmental wind and flight posture. However, the flight stability control mechanism of ski jumping in lateral wind environment remains unclear.

PURPOSE: To determine the flight stability control mechanism of ski jumping in lateral wind environment.

METHODS: The aerodynamic characteristics of ski jumping during flight under different lateral wind and yaw angles are predicted by numerical simulation of computational fluid dynamics, and the effects of the above two elements on flight stability are compared and analyzed. The jumper and skis were regarded as a multi-body system, and partially averaged Navier-Stokes turbulence model was used to simulate aerodynamic characteristics of the system based on a general flight attitude and then the forces and torques were obtained. The lateral wind speed involved in the numerical prediction includes 1.5 m/s, 3 m/s, 4.5 m/s and 7.5 m/s, and the flight yaw angle involved includes 2.5°, 5° and 7.5°.

RESULTS: When lateral wind speed is small (less than 3 m/s), yaw force, yaw torque and rolling torque are small and almost negligible, and when lateral wind speed is larger than 4.5 m/s, yaw force, yaw torque and rolling torque are more obvious. When wind speed is 4.5 m/s and 7.5 m/s, yaw force, yaw torque and rolling torque are 9.5 N and 26.3 N, 2.3 Nm and 6.3 Nm, 2.8 Nm and 7.8 Nm, respectively. When yaw angles are 2.5°, 5° and 7.5°, yaw force, yaw torque and rolling torque are 6.8 N, 12.9 N and 21.9 N, 5.0 Nm and 6.8 Nm, 2.7 Nm, 5.7 Nm and 8.3 Nm, respectively. When wind speed is 4.5 m/s and yaw angle is 2.5°, yaw force, yaw torque and rolling torque results of these two conditions are close to each other. Similarly, When wind speed is 7.5 m/s and yaw angle is 7.5°, yaw force, yaw torque and rolling torque results of these two conditions are close to each other.

CONCLUSION: The larger lateral wind can have a significant adverse effect on flight stability control of ski jumping, but it is possible to compensate or even eliminate this adverse effect by taking the appropriate flight yaw angle. Supported by the National Natural Science Foundation of China (Grant No. 11802068).

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The vertical GRF. The variables used for the statistical analysis of the FW effect were extracted from 10 consecutive hops, and were analyzed using two-way ANOVA (p < 0.05). RESULTS: Significant interaction was observed in all conditions, both in absolute (BF: 32.7 ± 8.5 kN/m, FW: 36.9±18.3 kN/m, p = 0.014), as well as in relative to body mass values (BF: 0.478 ± 0.101 kN/kg, FW: 0.520 ± 0.110 kN/kg (p = 0.017). Also, despite the instruction to follow the same hopping frequency as set by the digital metronome in both the BF and the FW, hopping duration was shortened (BF: 0.469 ± 0.022 s, p = 0.001) and the propulsive vertical GRF was increased (BF: 32.4 ± 4.7 N/kg; FW: 33.7 ± 5.6 N/kg, p = 0.048) in the FW condition. CONCLUSIONS: FW appears to increase leg stiffness, which may favor the myotendinous force transfer and contribute to a more effective lower limb spring pattern. The aesthetics in Irish dance have evolved to create greater physical demands on dancer’s bodies. Irish dancers must land from difficult movements without letting their knees bend or heels touch the ground, causing large forces to be absorbed by the body. The majority of injuries incurred by Irish dancers are due to overuse (79.6%).

PURPOSE: The purpose of this study was to determine loads on the body in female Irish dancers, including peak force, rise rate of force, and impulse in selected Irish hard shoe and soft shoe dance movements. It was hypothesized that the 8 movements would produce different GRF characteristics.

METHODS: Sixteen female Irish dancers were recruited from the three highest competitive levels. Each performed a warm-up, reviewed 8 common Irish dance movements, and then performed each movement three times upon a force plate. Of the 8 movements, 4 were performed in soft shoes and 4 were performed in hard shoes. Ground reaction forces (GRFs) were measured using a three-dimensional force plate recording at 1000 Hz. Peak force, rise rate, and vertical impulse were calculated. GRFs were normalized by each dancer’s body weight.

RESULTS: Peak forces, rise rates, and impulses were significantly different across movements (F = 65.4, p < 0.01; F = 65.0, p < 0.01; and F = 67.4, p < 0.01 respectively). The movement with the highest peak force was the stomp. The movement with the highest rise rate was the double-tee. The movement with the highest impulse was the leap. The skip had the lowest values for all GRFs measured. Individual peak forces ranged from 0.67-9.86 times body weight. Individual rise rates ranged from 10-147 body weights per second. Individual impulses ranged from -0.12 to 0.32 body weight seconds. Years of experience was not correlated with peak force, rise rate, or impulse (p > 0.40).

CONCLUSIONS: There is a large range in GFR characteristics created by Irish dancers. Dance movements that have high average peak forces may be associated with higher risk of overuse injury. Irish dancers should use appropriate training methods to strengthen the tissues at greatest risk of overuse injury.

Skating treadmills are used by ice hockey players to develop stride efficiency, power, and endurance. PURPOSE: Evaluate the effect of treadmill speed and grade on biomechanics. It was hypothesized that greater speeds and grades would elicit larger biomechanics. It was hypothesized that greater speeds and grades would elicit larger

RESULTS: Arm motion ranged from 10-147 body weights per second. Individual impulses ranged from −0.12 to 0.32 body weight seconds. Years of experience was not correlated with peak force, rise rate, or impulse (p > 0.40).

CONCLUSIONS: There is a large range in GFR characteristics created by Irish dancers. Dance movements that have high average peak forces may be associated with higher risk of overuse injury. Irish dancers should use appropriate training methods to strengthen the tissues at greatest risk of overuse injury.

Compression garment (CG) has been now viewed as a potential tool for enhancing performance and recovery. CG may boost lactate removal and enhance oxygen supply. However, there are only a small amount of research reporting usefulness of CG. PURPOSE: To determine the effect of different pressure CG on oxygen uptake during running and lactate removal after exercise. METHODS: 12 recreational male long-distance runners (age 22.5±1.9 y, height 1.78±0.04 m, mass 70.7±4.9 kg) participated in this study. Subjects performed 3 maximal incremental exercise test (Bruce protocol) on a treadmill with 3 different garments. The subject was subjected to experimental trials with a high pressure CG (HCG, 17.5 mmHg at the middle of thigh), low pressure CG (LCG, 8.0 mmHg at the thigh), or without a CG (CON condition). The 3 tests were assigned in a random order under a cross-over design, and were conducted at the same time of the day, 3-5 day apart. Oxygen uptake were continuously measured using the METAMAX 3 system. Fingertip blood samples of 20 μL were taken at 1, 4, 7 and 10 min after exercise. The lactate concentration was determined by EKF Biosen C-Line Clinic system. An ANOVA with repeated measures followed by Bonferroni pairwise comparisons were used to analyze the differences in 3 conditions. All tests were two-tailed and a .05 probability level was considered.
significant. RESULTS: The Oxygen uptakes were significantly lower with CG at 6 min time point (P < .05, HCG 22.0±1.5 vs LCG 21.3±2.0 vs CON 23.2±2.7 mL/min/1kg), and there were no significant differences on VO2 between 3 conditions at any other time point. There were no significant differences on the maximum lactate and lactate elimination rates between 3 conditions at any time point. CONCLUSIONS: Different pressure CGs have no significant effect on the maximum oxygen uptake during running, but it is possible to reduce oxygen consumption during exercise at low intensity. CGs have no significant effect on the removal of blood lactate after running.

<table>
<thead>
<tr>
<th align="left">TABLE 1 Oxygen uptake (ml/min/kg) during maximal incremental exercise</th>
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<tr>
<td align="left">TIME</td>
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<td align="left">3min</td>
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Note. *Significantly (P < 0.05) different from Control

<table>
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<tr>
<th align="left">TABLE 2 Blood lactate concentration (mmol/L) measured during recovery</th>
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<tr>
<td align="left">Post exercise</td>
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<tr>
<td align="left">1min</td>
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Most of the injuries in the military parachuting course (MPC) occur during the landing phase because of intrinsic or extrinsic variables. It is important to assess the lower limbs neuromuscular (NM) impact of the MPC to understand the muscular adaptations and the eccentric work, because via the reflex activated by the eccentric phase, it can strengthen the elastic characteristics of the muscle-tendon complex (MTC). Besides, the evaluation of the ground reaction forces (GRF) allow to evaluate muscles function in eccentric-concentric conditions, elastic and reflex components of the MTC through jumping tests that report NM changes due to a training. PURPOSE: Assess the lower limbs neuromuscular impact of the MPC in Colombian militaries. METHODS: A prospective study was performed in 43 male cadets from the military school who went to the MPC (4 weeks). Each cadet performed 5 drop jump (DJ) test before and after the course, and landed in uniaxial force platforms. For the statistical analysis a paired t-student was performed to determine the changes in the variables that described the DJ, due to the MPC. RESULTS: Positive changes were found in the reduction of contact time (0.43±0.1 vs 0.38±0.1 s, p < 0.01) and the increase of the eccentric mean force (1513.5±281.4 vs 1642.9±289.1 N, p < 0.01). However, negative changes were observed in the reduction of the jump height (27.7±3.9 vs. 24±3.6 cm, p < 0.01), concentric impulse (165.7±26 vs. 151.3±23.7 Ns, p < 0.01) and vertical velocity at takeoff (2.3±0.18 vs. 2.17±0.16 m/s, p < 0.01) and an increase in the peak landing force (3836.4±825.1 vs. 4461.5±1032.2 N, p < 0.01). CONCLUSION: There is an improvement in the myotatic reflex related to the adaptations of the lower limb extensor in response to the eccentric force. However, the variables that defined the power and the GRF shown a negative effect over NM characteristics of LL performance, increasing their risk of injury because of high impacts that are not transfer properly to other soft tissues.

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Athletes and coaches have traditionally relied on isokinetic devices to compare dominant and non-dominant strength ratios; the information provided is limited in its application. Recent technology permits strength and power comparisons in an isotonic, three-dimensional environment that is more compatible with the load profiles experienced during sport performance. PURPOSE: To determine the difference in power between dominant and non-dominant arms across various loads, motions, and planes. METHODS: 206 subjects performed 3,727 unilateral sets of 10 repetitions in upper-extremity movements on Proteus (Proteus Motion, USA). Loads were applied through magnetic resistance and ranged from 5-25 lbs; they were divided between dominant (n=1,975) and non-dominant (n=1,747) arms. The performance variables were explosiveness (peak force development rate), peak power, and braking (rate of deceleration). Descriptive statistics characterized mean performances. Linear regression models predicted the effect of arm dominance on performance parameters, holding the load and exercise constant. RESULTS: Across all sets, explosiveness was 852.61 ± 629.46 watts/sec, peak power was 206.40 ± 112.42 watts, and braking was 1,059.90 ± 766.63 watts/sec. Dominant and non-dominant strength ratios were different in explosiveness (p<0.005), peak power (p<0.001), and braking (p<0.035). With confounding variables held constant, linear regression found use of the non-dominant arm to predict a 10-watt decrease in peak power (R²=0.691; p<0.001), a 46-watt/sec decrease in mean explosiveness (R²=0.553; p<0.001), and a 65-watt/sec decrease in braking (R²=0.668; p<0.001). CONCLUSIONS: In an athletic population, the independent use of dominant and non-dominant limbs is often critical to success. It is important to know the non-dominant performance deficit in a setting applicable to sport performance. This information can contribute to optimal training protocols and return-to-play testing batteries.

**B-74**

Free Communication/Poster - Upper Extremity

**B-74**

**1059 Board #185 May 27 1:30 PM - 3:00 PM**

Three-dimensional, Isotonic Comparison Of Dominant And Non-dominant Upper Limb Force Production


(No relevant relationships reported)

**1060 Board #186 May 27 1:30 PM - 3:00 PM**

Muscle Activity In Upper Extremity Is Modulated After Arm Cycling Exercises After Cervical Spinal Cord Injuries

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(No relevant relationships reported)

Regaining upper extremity function following spinal cord injury (SCI) is one of the most important outcomes for quadruplegics with regards to enhancing quality of life. To facilitate locomotor recovery through increased activation of the lower limb muscles, ground reaction forces are commonly manipulated to optimal levels. Using similar mechanisms, manipulating power production during arm cycling exercises could facilitate activation of the upper limb muscles after SCI. PURPOSE: To determine if upper limb muscles activation is modulated during arm cycling exercises after SCI.

METHODS: Five participants with chronic SCI at C4; classified as AIS A (1), B (2), C (1) and D (1) according to the American Spinal Injury Association Impairment Scale performed arm cycling exercises at four power levels (0, 5, 10, 15W) with their hands securely attached to the handles. Surface EMG signals were recorded during a series of 10 consecutive cycles from one muscle above the lesion: medial trapezius (C2-C4), and six muscles below the lesion: deltoid posterior (C5-C6), biceps brachialis (C5-C6), triceps brachialis (C6-C8), extensor digitorum (C6-C8), flexor carpi radialis (C6-C8) and extensor carpi radialis (C6-C8).

RESULTS: Arm cycling exercises were successfully performed at cadences ranging from 30 to 50 rpm. EMG signals were detected in all muscles for both participants.

Modulation of EMG signals within the cycle was seen in most exercise conditions and participants, while modulation was most identifiable when participants produced larger levels of power. Increasing power production from 0 to 15 W led to an increase in the peak EMG activity of the trapezius muscle, as well as in four muscles below the lesion: deltoid, biceps and triceps brachialis, and extensor carpi radialis (p < 0.05).

CONCLUSIONS: Participants of all levels of impairment successfully performed the arm cycling exercises. Increasing power production up to 15W improved modulation of EMG signals during the cycle and increased activation of some muscles below the lesion, crossing the shoulder, elbow and wrist joints. Including arm cycling exercises in rehabilitation programs should be considered to take advantage of spinal circuitry available below the level of injury and facilitate the recovery of upper extremity function after SCI.
Alterations In Scapular Kinematics And Scapular Muscle Activity After Fatiguing Shoulder Flexion And Extension Movements
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RESULTS: At taskB activity ranged from 589±343mV to 605±250mV during FLX and from 105±41mV to 164±73mV during EXT across muscles. At task, activity ranged from 594±304mV to 875±276mV during FLX and from 97±33mV to 147±57mV during EXT (mean±sd=141±113mV for LT, p<0.01; 191±153mV for UT, p<0.01). Scapula position angles continuously increased in upward rotation, posterior tilt and scapular muscle activity with a 3-lead sEMG of upper and lower trapezius (UT, LT) and serratus anterior (SA). Scapular position angles were calculated for every 20° increment between 20-120° humerorhaphic positions. Muscle activity was quantified by amplitudes (RMS) of the total ROM. Descriptive analyses (mean+SD) of kinematics and muscle activity at the beginning (taskA) and end (taskE) of the loading task was followed by ANOVA and paired t-tests.

CONCLUSIONS: Force reduction in consequence of fatiguing shoulder loading results in increased scapular muscle activity and minor alterations in scapula motion. Whether even small changes have a clinical impact by creating unfavorable subcircular conditions potentially initiating pain remains unclear.

Wrist Guards/supports In Gymnastics: Are They Helping Or Hurting You?
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Email: GymnasticsMedicine@gmail.com

BACKGROUND: The prevalence of wrist pain among gymnasts ranges from 46-79%. To reduce and prevent wrist pain, gymnasts wear “wrist guards/supports” (WG) and most worn are Tiger Paws (TP) or Skids/Ultimate Wrist Supports (SUWS). There are no studies that evaluated what WG do to shoulder loading in terms of motion and force. PURPOSE: To examine whether WG decrease or increase the angle and force at which the wrist impacts the ground while performing a back handspring. METHODS: A cross-sectional study design was used. Twenty-three young female gymnasts (age: 12±1.5 years) performed back handsprings with the following three conditions: wearing no WG, wearing SUWS, and wearing TP. Kinematics and kinetics were captured by 3D motion analysis and force plates. Analysis of variance (ANOVA) was employed to analyze the data. RESULTS: Not wearing WG was found to be statistically significant (P=0.036) in having an increased arc of motion when compared to wearing WG (no WG (67.8± 11.0 (62.6, 72.9)), SUWS (59.6± 9.4 (55.2, 64.0)), and TP (60.6± 11.2 (55.0, 66.1))). There was a statistically significant finding (P=0.001) in having an increased sagittal plane moment when performing a back handspring when compared to wearing no WG (no WG (7.35± 0.79 (3.39, 4.12)), SUWS (4.76± 0.76 (4.40, 5.12)), and TP (4.00± 0.97 (3.52, 4.48))). CONCLUSIONS: WG do decrease the arc of motion at the wrist when performing a back handspring which could be beneficial if a Sports Medicine provider is trying to limit motion at the wrist joint; however, our data indicated an increase in moment while wearing WG, which may be indicative to an increased risk of injury.

The Effect Of Kinesio Taping On Wrist Flexor Sensorimotor Control In Healthy People
Zhe Ming Lin, Kuang-Wei Lin, Li-Wei Chou. National Yang-Ming University, Taipei City, Taiwan.

Email: joy26427@gmail.com

RESULTS: An average decrease of 10 kg of force in the right hand and 6 kg in the left hand were found. The statistical test of Shapiro-Wilk was applied in order to conclude whether the sample had a normal distribution; finding that the data followed a non-parametric behavior, based on this result a Mann Whitney U test was used with a confidence interval of 92% confirming that the change of strength in the right arm had a substantial change effect with a p=0.061 and the left arm presented a non-significant variation p=0.022.

CONCLUSIONS: Prolonged exposure to video games with the use of joysticks represented a risk at the neuromuscular level in the forearm due to the continued position that each player usually maintained. Additionally, the loss of strength could lead to generate injuries such as tendinitis, carpal tunnel, epicondylitis and other musculoskeletal disorders or Trigger-finger due to the fatigue presented. Therefore, it is essential to develop strategies that improve the response level in the resistance and strength of the forearm in people who practice E-Sports both in professional or amateur mode.

Effects On Hand Grip Strength: An Evaluation For Fifa E-sport Players

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PURPOSE: This research project found the effects at the neuromuscular level in the forearm of training session usage of video games through measuring of hand grip strength in players of the FIFA19 video game. METHODS: The present study had a universe of 25 men aged 25±5 years, body mass 67.6±9.9 kg and body height 172.4 ± 6.72 cm, who practiced the FIFA video game for more than 3 days per week and three hours training sessions. Participants were asked for a 24-hour rest period in which they should not have done any physical activity, nor used their video game consoles. An initial measurement of hand grip strength was made using a portable dynamometer Baseline (±1) with a capacity of 90 kg of hand grip, and a competition dynamometer Baseline (±1) with a capacity of 90 kg of hand grip, and a competition dynamometer Baseline (±1) with a capacity of 90 kg of hand grip. In the FIFA19 all-in-all game, for a consecutive 30-minute practice per player. Finally, new measurements of hand grip strength were found to verify that the strength in the forearm changed. RESULTS: An average decrease of 10 kg of force in the right hand and 6 kg in the left hand were found. The statistical test of Shapiro-Wilk was applied in order to conclude whether the sample had a normal distribution; finding that the data followed a non-parametric behavior, based on this result a Mann Whitney U test was used with a confidence interval of 92% confirming that the change of strength in the right arm had a substantial change effect with a p=0.061 and the left arm presented a non-significant variation p=0.022.

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Free Communication/Poster - Health Promotion
Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

1067 Board #193 May 27 2:30 PM - 4:00 PM
Analysis Of The Current Situation Of Chinese Youth Science And Fitness
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PURPOSE: The purpose of this study is to analyze the status of Chinese youth participation in scientific fitness activities and to provide reference for enhancing the scientific fitness activities of Chinese youth.

METHODS: A total of 4663 healthy adolescents (age: 22.56 ± 5.81yrs, female: 54.5%) were investigated for the intervention from 33 provinces (central municipality, national autonomous region). Divided into three groups according to age: juvenile (12-17yrs), pre-youth (18-28yrs), and late youth (29-40yrs); divided into three regions based on the administrative districts: Eastern Region (ER), Central Region (CR) and Western Region (WR).

RESULTS: The Questionnaire consists of two parts: (1) Knowledge and Skills (RRC 0.91), and (2) Cognitive, Attitude and Behavior (ICC 0.97, RRC 0.93). The content validity of the questionnaire was assessed by 11 experts. The structural validity was evaluated by the factor analyses. The results show that: (1) fitness location analysis: 70.6% of youth fitness venues in playground and park squares, gyms accounted for 12.1%, and other proportions of 9.1%. (2) Analysis of fitness methods: 81.5% of fitness methods tend to run and ball sports, the proportion of fitness and bodybuilding projects is 9.4%, the proportion of water projects is 2.5%, and the other proportion is 6.6%. (3) Analysis of fitness duration: 58.1% of young people's fitness time is 30-120 minutes, 9.4% of less than 30 minutes or less accounted for 33.0%, and more than two hours accounted for 8.9%. (4) Fitness frequency analysis: 62.1% of teenagers report that regular fitness, 1.7% have planned fitness, and 20.9% do not exercise very much. (5) Analysis of the number of fitness times in the week: 57.5% of the youth fitness no more than 2 times, 29.2% of the teenagers were 3-4 times and 13.3% of the teenagers were 5 times or more.

CONCLUSIONS: Chinese youth participation in fitness activities is relatively concentrated; most of the youth fitness can be controlled within a relatively scientific range but the fitness activities are not regular. Relevant departments use a variety of strategies to promote the systematic and diverse participation of young people in fitness activities. (This study was supported by NPOPSS Grant 15CTY011)

1068 Board #194 May 27 2:30 PM - 4:00 PM
Physical Activity And Its Association With Other Wellness And Risk Behaviors From A College Sample
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PURPOSE: The University of Vermont Wellness Environment App Study is an app-based longitudinal research study focused on promoting health and reducing risky behaviors in a college student population. The mobile ecological momentary assessment over an academic year provides a unique opportunity to accomplish two aims in this study: 1) to assess physical activity (PA) variation across days of the week and throughout the academic year and 2) to explore the correlates that were associated with PA.

METHODS: Students who enrolled in the study were asked to report their wellness and risk behaviors on a 14-item survey through a smartphone app every day. Each student was also provided an Apple Watch to track their real-time PA. Data were collected from 805 college students, with an average of 97 days of daily surveys and steps data from Sept 2017 to early May 2018. Daily survey and step data were merged by day for each participant. General estimating equations were implemented in SAS PROC MIXED with an autoregressive covariance structure to estimate the daily steps by demographic variables and other wellness behaviors. Results: Based on average daily step counts, females were significantly more active than male college students (Female=8904 and Male=8488, p<.0082). Age-related PA decline was found from freshmen to seniors, but only freshmen was significantly more active than seniors (frequency =p<.0001). Students of seniority 4 (p<.0001) and 5 (p<.0001) had more active (p<.0001) during the weekday (Monday to Friday ranged from 8800 to 9383 steps than weekend (Sat=8356 and Sun=7145). Temporal patterns were also revealed that students were less active during Thanksgiving, Winter, and Spring breaks.

Strong correlations were found between daily steps and self-reported mood (p<.0001), sleep (p<.0001), fruit and vegetable consumption (p<.0001), water intake (p<.0001), and screen time (p<.0001). No significant associations were found for marijuana use (p=.97), cigarette use (p=.2518), drug use (p=1.546) but significant associated were observed for illicit pill use (p<.003), alcoholic drink consumption (p<.0001), and liquor shot consumption (p<.0001). CONCLUSION: The study provides a comprehensive surveillance on longitudinal PA pattern and its association with a variety of wellness and healthy behavior in college students.

Despite the benefits of physical activity (PA), 50.9% of Americans do not meet the American College of Sports Medicine (ACSM) guidelines for physical exercise. Inactivity, low cardiovascular fitness (CVF), obesity and body fat percentage (BF%) are risk factors for increased cardiometabolic morbidity and mortality. Universities create environment that do not promote PA, thus jeopardizing their employees’ health. PURPOSE: To educate university employees about the health-related benefits of PA and to meet the minimum ACSM PA guidelines. METHODS: Female physically inactive university employees were targeted (age 40 ± 11 yrs, body weight 76.9 ± 4.4 kg). Participants underwent basic anthropometric, mean arterial pressure, body composition measurements, and a submaximum oxygen consumption test (using a Bruce protocol) as baseline measurements. Participants were given the ACSM guidelines and instructed to follow them for 12 weeks. No other control was made on participants’ lifestyle factors between the pre- and post-measurements. They were given a Fitbit® tracker to record and monitor their PA activity levels. This is an ongoing funded project from the Advance of Interprofessional Collaboration and Education (ADVICE) project and the reported results reflect pre- and post-values from the end of weeks 1 to 4 (N=4). Thus, all measurements were repeated after 4 weeks of the intervention. One-way factorial ANOVA was used to detect changes between Week 1 and Week 2. Significance was set at p < 0.05. All analyses were performed using SPSS®.

RESULTS: BF% was significantly reduced by 38.8% (F = 9.943, p = .025, R² = .665). Lean mass was increased by 15.6%, mean arterial pressure was reduced by 9.6% (p = .005), waist circumference was reduced by 5.7% (p > .005), waist hip ratio was reduced by 20.7% (p > .005), minutes of being physically active were increased by 13.7% (p > .005), and predicted maximum oxygen consumption was increased by 4% (p < .005). CONCLUSION: Even though these results represent preliminary data from small sample size the practical significance of this study is that university employees can improve their risks factors for cardiometabolic morbidity and mortality by adhering to the ACSM PA guidelines for even 4 weeks.
Most U.S. office workers engage in little physical activity and increased time sitting which increases risk for adverse health conditions such as obesity. Research on the effectiveness of smartphones apps to increase physical activity and reduce sitting time in workers is limited in purpose. **Purpose:** To examine the efficacy of a smartphone app and worksite physical activity intervention program to increase daily physical activity with the goal of reducing sitting time via walking or increased steps on anthropometric changes over an 8-week period. **Methods:** Subjects (N=22) were obese, female volunteers, all of whom had access to a smartphone and the StridekickTM app, that recorded steps, with a progressive goal of 7,500-15,000 daily steps. Relative (% body fat was measured via DEXA scan, along with five anthropometric measurements, biceps, waist, abdomen, hips and thigh, prior to and after 8 weeks. Dependent samples t tests probed for significant differences at the p<0.05 level. Values are expressed as mean±standard deviation. **Results:** Significant changes were determined for the pre-post anthropometric measurements: biceps, hips and thigh (12.9±1.1 vs. 11.5±1.3; 42.8±5.1 vs. 42.2±5.2; 24.9±2.7 vs. 23.8±2.8, respectively). Pre-post BMI, waist, abdomen measurements and % relative fat were not significantly different (31.9±2.7 vs. 30.5±2.5 kg/m²; 34.1±3.8 in; 39.2±4.7 vs. 39.0±4.8 in; 41.4±6.6 vs. 41.8±5.3 %fat, respectively). **Conclusion:** This work is suggestive that the incorporation of a smartphone app into a worksite physical activity intervention may change anthropometric measures via increasing steps and ultimately reduce adverse health concerns.

**References:**


**Funding:** This research was supported by the American Heart Association (Grant No. 17POST30700584).
CONCLUSIONS: Student suggestions to enhance engagement in physical activity on campus included better advertisement of Campus Rec programs and reduced costs for intramurals and group exercise classes suggesting increased opportunities to engage more in organized sports and activities.

Purpose: To examine the relationship between bouts of physical activity and physical fitness in preschool children. Method: Sporadic sessions (2-4 sessions) of moderate- to vigorous physical activity (MVPA), short bouts (5-9 seconds) of MVPA; and medium-to-long bouts (≥10 seconds) of MVPA were measured over 7 days using ActiGraph GT3X accelerometers. Physical fitness was assessed by a 20-meter multistage shuttle run test (cardiorespiratory fitness), handgrip and standing long jump tests (musculoskeletal fitness), and the 20-meter shuttle run test (speed/ agility). A composite score of physical fitness was created from the mean of the standardized values of all physical fitness tests. The bouts of physical activity and composite scores were categorized into quartiles (Q1-Q4 group) by sex; the highest quartile (Q4) of composite scores were assigned as high healthy fitness (HPF). Logistic and linear regression were used to investigate the relationship between bouts of MVPA and HPF. Results: A total of 265 participants were included in the final statistical analysis (boys, 149; girls, 116; 57.19 ± 5.53 months). After adjusting for confounding factors, relative to Q1, the odds ratios (OR) for a HPF in Q4 were 11.72 (95% CI: 2.27- 60.53), 7.53 (95% CI:1-8.30-90.00) and 9.86 (95% CI:1-78.49-85.39) for sporadic MVPA, short bouts and medium-to-long bouts of MVPA in boys, respectively. Similar results were also observed in girls, 11.85 (95% CI:2-33.60-19.01), 12.34 (95% CI:2-47.61-57.98) and 8.98 (95% CI:1-70-43.41), respectively. There was a non-linear relationship between overall MVPA and HPF in boys. When the total MVPA ≤ 65 min/day, the OR of achieving HPF increased by 17% (OR = 1.17, 95% CI = 1.02-1.35) for every 1 minute/day increment in total MVPA; no increases in HPF were observed for >65 min/day. This non-linear relationship was not found in girls. Conclusion: There is a significantly positive relationship between bouts of MVPA and HPF in preschool children. To achieve HPF in preschool children, it is recommended that boys accumulate total MVPA 65 minutes or longer every day.

Supported by National Natural Science Foundation of China (81703252)
High volumes of sedentary instructional time during the school day contradicts research supporting the role of physical activity (PA) in enhancing students’ attention, academic achievement and executive function (EF).

**PURPOSE:** To describe PA, EF and academic performance in 5th grade student participants prior to a multimodal classroom curriculum called POWER that incorporates both PA and the teaching of EF skills.

**METHODS:** A convenience sample of six 5th grade classes in two diverse schools in New Jersey were studied. Three classes in one school received POWER starting September 2019 (POW); 3 waitlist control classes in the other school (CONT) will begin POWER in January 2020. Students wore wrist-worn accelerometers for a full school week and completed the Youth Activity Profile (YAP). EF was assessed by 3 cognitive tests from the NIH Toolbox (NIHTB). Academic performance was assessed via STAR math tests. Data are reported as mean (standard deviation). Groups comparisons were made by independent samples t-test.

**RESULTS:** 86 students (POW = 49; CONT = 37; mean age = 10.02 years) completed the YAP and NIHTB cognitive tests at baseline. A subset of 70 students (n = 35 in each group) wore accelerometers.

POW spent 77.4% (2.6%) of the school day in sedentary behavior and 20.2% (2.6%) in MVPA, while CON spent 87.2% (1.4%) and 11.39% (1.3%) respectively in sedentary and MVPA. The YAP activity score at school was 3.55 for POW and 3.25 for CON. The age-corrected composite score for NIHTB was 94.1 (10.8) for POW, and 97.4 (9.5) for CON (national average = 100). Students’ scaled score for the STAR math assessment was 73.5 (86.3) and 73.05 (78.7) (%70 percentile) for POW and CON, respectively.

**CONCLUSIONS:** POW PA was significantly higher than CON (p < .001), possibly due to intervention teachers’ implementing some aspects of POWER earlier than instructed. Students tested below age-corrected national averages on both the NIHTB and academic tests; there were no significant differences between groups (p = .15 and p = .81).

It is well known that High-Intensity Interval Training, such as CrossFit, positively influences physical and mental well-being. However, few rigorous studies evaluated both psychological and physical fitness variables in young people.

**PURPOSE:** To investigate if 8 weeks of CrossFit training program could positively influence the psychophysical well-being in adolescents.

**METHODS:** 30 healthy participants (18 males and 12 females) were matched into pairs based on gender and randomly allocated into an intervention group (n=15; 18.2 ± 0.8 years) that performed the 8 weeks CrossFit training program or control group (n=15; 18.3 ± 0.8 years). At baseline and after 8 weeks, physical fitness tests (i.e. squat, push-up, lunge, and 20-meter run) and psychological measures (PCS and MCS indexes of the Short Form-12, and Regulatory Emotional Self-Efficacy scale (RESE, negative and positive)) were performed.

**RESULTS:** After 8 weeks, the intervention group showed significant improvements in the number both of maximal repetitions for the squat test (Δ6.66 ± 2.58, p < 0.001), push-up test (Δ5.87 ± 4.23, p < 0.001), and lunge test (Δ7.89 ± 3.11, p = 0.001) and of maximal laps for the 20-m run test (Δ3.60 ± 2.27, p < 0.01). Also, higher scores for the PCS (Δ4.7 ± 1.3, p < 0.01) and MCS (Δ5.2 ± 0.9, p < 0.001) indexes, and the RESE negative (Δ6.0 ± 3.9, p < 0.001) and RESE positive (Δ4.0 ± 2.7, p < 0.001) scales were found in the intervention group. No statistical differences were detected in the control group for all dependent variables.

**CONCLUSION:** Findings suggest that an 8-week CrossFit intervention program could positively affect the general physical well-being and mental attitude and improve the emotional perceived self-efficacy in managing negative affect and in expressing positive emotions in healthy adolescents.
CONCLUSIONS: Internet access to social groups and health/PA information is important to women over the age of 50. This demographic is receptive to information and interventions accessed online that are age-appropriate and include a strong social support component.

1083 Board #209  May 27 2:30 PM - 4:00 PM  The Relationship Of Physical Activity And Motor Ability Development In Children Aged 7-8 Years  Hongjuan Li, Liang Ma. Beijing Sport University, Beijing, China. (Sponsor: Zhengheng Wang, FACSM) Email: janerobin@126.com

Two thirds of children do not meet physical activity (PA) guidelines in China. The fundamental movement skills (FMS) level is a good predictor of physical activity levels and weight status in children. Also, early motor skill has long-term effect on individual’s PA level. So, understanding the relationship of FMS and PA is important for physical activity intervention planning.

PURPOSE: To analyze the relationship of daily physical activity participation and the motor ability of children aged 7-8 years.

METHODS: The Movement Assessment Battery for Children-2 (M-ABC-2) and the Test of Gross Motor Development - 2nd edition (TGMD-2) were used to test the motor ability of 91 children aged 7-8 years. The ActiGraph GT3X+ accelerometer was used to measure the physical activity participation for 7 consecutive days.

RESULTS: The total time of boys spent in moderate physical activity (MPA) and moderate-to-vigorous physical activity (MVPA) was 21.4±7.5min and 27.3±11.2min, respectively, which was higher than that of girls (17.5±7.4min and 22.2±9.7min, P<0.05). The score of object control subscale in boys was 6.73±2.49, which is better than that of girls (5.71±2.14, P<0.05); children’s fine motor skill and locomotor skill were positively correlated with object control subscale (r: 0.33, P<0.05).

CONCLUSIONS: In this study, children spent less time in MPA, especially in girls. The development of object control ability in boys is better than that of girls; there is a positive correlation between children’s fine motor skills and physical activity. Therefore, children need to learn and practice FMS for participation and maintenance of PA. FMS should be tested in primary schools, so weaknesses could be identified in children and improved via proper intervention.

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1084 Board #210  May 27 2:30 PM - 4:00 PM  Hkjc Physical Activity Tracker (a Wrist Tracker) Validation Study Qi Yujie1, Wang Lin1, Li Wai Yee1, Stanley Sai-chen Hui1, FACSM1, 1Shanghai University of Sport, Shanghai, China. 2The University of Hong Kong, Hong Kong, Hong Kong. 3Chinese University of Hong Kong, Hong Kong, Hong Kong. Email: 15921092796@163.com

PURPOSE: To investigate whether the number of steps from the tracker can accurately reflect the energy expenditure and movement intensity in various exercise activities.

METHODS: Fifteen participants (9 males, 6 females; age range: 19-36 years; body mass index range: 18.4-29.7) were fitted with JC tracker on the wrist to record steps and Cosmed K5 metabolic analyzing system to measure energy expenditure. Participants performed low, moderate and high intensity exercise respectively, in which the exercise was randomly selected, including running, cycling, arm curl and squat. They performed these activities for 5 min or reached to the targeted number of repetition. Descriptive statistics and one-way ANOVA were used to test if with the change of exercise intensity, the number of steps of the JC tracker will change accordingly.

RESULTS: The Mean VO2 (ml/min/kg) was significantly changed as the exercise intensity elevated in running (low intensity:14.1±3.03; moderate: 28.5±3.12; high: 34.9±6.7; p<0.05), stationary bike (low intensity: 11.5±2.3; moderate: 25.8±2.8; high: 25.6±2.0; p<0.05) and arm curl (low intensity:6.88±1.6; moderate:10.17±5.82; high:14.54±4.3; p<0.05), but the changes are not obvious in the squat exercise (low intensity: 13.5±2.56; moderate:16.5±2.15; high:19.02±4.01; p=0.144). However, as the Mean VO2 changed, there was no significant difference of steps measured by the tracker. Moreover, although there was a trend of increasing the number of steps in the running exercise (low intensity: 607±579; moderate:736.6±97.8; high: 742.2±95.35), it was not statistically significant (p=0.252).

CONCLUSIONS: The JC tracker can reflect the changes in energy consumption in the dynamic movement, such as running; while doing stationary cycling, arm curl or squat, the tracker did not accurately reflect the participants’ actual energy expenditure. A tracker with both heart rate and steps may be able to more accurately measure and reflect energy expenditure and physical activity levels regardless of motion. This project was supported by Hong Kong Jockey Club Charity Trust Fund.

1085 Board #211  May 27 2:30 PM - 4:00 PM  Understanding Associations Of Children’s And Parents’ Enjoyment With Their Subsequent Co-participation In Physical Activity  Patrick M. Filanowski1, Emily Slade2, Sarah M. Camhi1, FACSM1, Jessica A. Whiteley2, Ronald J. Iannotti4, Laurie A. Milliken, FACSM1, Xavier University, Cincinnati, OH. 2University of Kentucky, Lexington, KY. 3University of Massachusetts Boston, Boston, MA. 4CDM Group, Inc., Bethesda, MD. (Sponsor: Laurie Milliken, FACSM) Email: filanowskip@xavier.edu

PURPOSE: To determine if children’s or parents’ enjoyment of physical activity (PA) is associated with future co-participation in PA.

METHODS: Each parent-child dyad (n=28, age (mean±SD): parents: 58.0±6.6 years, children: 6.0±1.7 years) was guided through five PAs (walking, jumping games, body-weight exercises, tag, dancing) in a research fitness center. Immediately after completing each PA, researchers provided the Visual Analog Scale (1=“Do not like it at all” to 5=“Like it very much”) to assess children’s and parents’ independent enjoyment of the PA. Dyads were asked to complete the PAs at home during the following week. Parents reported their dyad’s participation in the PAs one week later. Separate logistic regression analyses were performed to examine the association of children’s and parents’ PA enjoyment with subsequent completion of the PAs at home.

RESULTS: For all five PAs, children’s enjoyment of the activity was not significantly associated with the dyad’s completion at home (all p values >0.05). However, parents’ enjoyment of the activity was significantly associated with the dyad’s completion of the PA at home for jumping games (parental enjoyment (mean±SD): 4.73±0.65 for dyads that completed PA at home; 3.78±1.1 for dyads that did not; p=0.033) and dancing (parental enjoyment (mean±SD): 4.32±0.82 for dyads that completed PA at home; 3.71±1.74 for dyads that did not; p=0.032).

CONCLUSIONS: Parents’ enjoyment of PA may be more important than children’s enjoyment of PA in predicting whether dyads complete activities at home. This could inform future exercise promotion research of parent-child dyads by focusing on PAs that the parents enjoy.

1086 Board #212  May 27 2:30 PM - 4:00 PM  Applying The RE-AIM Framework To The Health Promotion Policy In Toyooka City. Shohi Nemidah1, Shinji Satō1, Shinigo Otsuki1, Toyooka Public Hospital, Hyogo, Japan. 2Tokyo Hiei University, Tokyo, Japan. 3Osaka Sangyo University, Osaka, Japan. Email: s314nnds@gmail.com

PURPOSE: To evaluate the effectiveness of health promotion policy of “Walking as a way of life” in Toyooka-city could reach 100% of homes.

METHODS: A sample comprising 2,500 randomly selected residents were mailed a questionnaire. The data were analyzed using the RE-AIM framework. The use of the RE-AIM framework can enhance the generalizability of results when implementing the enforcement of the policy. Reach was defined as the proportion of eligible citizens that reported being aware of this program. Effectiveness of physical activity and social capital factors (i.e., networks in the neighborhood, trust for the community, social participation) was compared between citizens who were aware of the policy against those who were not aware of it. Independent sample t tests were used to compare groups for differences. Adoption was evaluated according to the proportion of organizations that had delivered results. Implementation governed how the results would be publicized.

RESULTS: In total, 873 response questionnaires were completed and returned. There were 340 citizens (38.9%) who were aware of this policy. The group that was aware had significantly higher social capital than the group that was not (p < 0.01). However, no significant differences were found in adherence to physical activity. Of all organizations that had the most cited information sources, the print media from the municipal office was distributed to 100% of homes.

CONCLUSIONS: The use of the RE-AIM framework revealed that the health promotion policy of “Walking as a way of life” in Toyooka-city could reach residents with high social capital, but could not increase their physical activity. The authors have no conflicts of interest.
Optimizing physical education (PE) is a proven strategy to increase children’s physical activity. In Oregon, elementary schools are required to provide PE for ≥ 150 minutes/week. However, increasing PE delivery requires resources (e.g. personnel, funding) to support this mandate.

**METHODS:** A total of 752 Oregon public elementary schools reported yearly minutes of PE offered and the total number of school weeks in session per year. Mean PE min/week were calculated by dividing yearly PE minutes by weeks in session. Additional publicly available explanatory variables including rurality (rural vs. non-rural county designations) and school schedule (four vs. five-day school week) were collected. A linear-mixed effects model was fit to evaluate time based-changes in PE with min/week of PE as the dependent variable, school year, rurality, and school schedule as fixed effects, and school as a random effect.

**RESULTS:** Although significant year-to-year variability in PE minutes was observed (p < 0.001), between 2009-10 to 2014-15 mean PE minutes remained relatively stable at 74 to 77 min/week before experiencing two larger year-to-year increases in 2015-16 (+3.9 min/week from 2014-15 to 80.8 ± 1.1 min/week) and 2016-17 (+4.0 min/week from 2015-16 to 84.8 ± 1.9 min/week). Schools located in rural counties were offered significantly more PE than non-rural schools (80.7 ± 1.7 vs. 74.6 ± 1.8 min/week, respectively, p < 0.001). No significant difference in mean PE min/week was observed between four vs. five-day school week formats (77.3 ± 2.3 vs. 77.5 ± 1.3 min/week, respectively, p = 0.76).

**CONCLUSION:** Despite having a 10-year lead-in period to increase PE time to 150+ min/week, Oregon elementary schools were only offering about half the required PE min/week (56.7%) in the year prior to mandatory compliance. Unfunded mandates requiring large increases in PE offerings may not effectively increase PE min/week to the required level.

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Physical literacy is a growing concept in the United States and is vital for a child’s long-term physical activity participation. Physical literacy is the ability, confidence, and desire to be active. There is little known about the relationship between confidence and physical ability in children. To evaluate this association a child’s self-reported confidence and movement competency associations were present. The observed associations between self-reported confidence and competency are important because both factors impact future physical activity participation. Future research should evaluate if these results can improve the efficiency of measuring physical literacy, and identify the causal factors leading to confidence and competency.

**PURPOSE:** To evaluate the association between a child’s self-reported confidence and movement competency.

**METHODS:** We searched historical documents, searched government websites, Badu, Google, other search engines, and CNKI, VIP, other scientific research databases, to collect and sort out the policy documents related to sports injuries in China. The searched data were collated and analyzed in chronological order and the department category of the issued documents. We evaluated the effectiveness partnering with Cooperative Extension to train classroom teachers to implement Be Physically Active 2Day (BEPA 2.0), a standard-aligned classroom-based PE program. **METHODS:** Extension trainers (ET) were trained by the BEPA 2.0 Master Trainer (MT). Teachers (N=244) were subsequently trained by either ET or the MT. Trainers provided information about school-based physical activity, best practice strategies, and BEPA 2.0 activity simulations. Trainers also facilitated barrier-busting brainstorm sessions to elicit implementation problem solving strategies. Teachers completed post-training surveys to assess confidence, comprehension, and self-efficacy to implement BEPA 2.0. Survey scores were compared between MT and ET groups using the Wilcoxon-Mann-Whitney test. Transcriptions from the barrier busting strategies were assessed qualitatively to evaluate teachers’ perceptions of barriers and supports to implement BEPA 2.0. **RESULTS:** Surveys were returned by 152 teachers (response rate 62.3%). Over 94% indicated a high level of satisfaction with the training. There were no differences between MT (n=58) and ET (n=94) training groups in perceived confidence (p=0.12), comprehension (p=0.08), or self-efficacy (p=0.18) to implement BEPA 2.0. Qualitative results highlighted four themes encompassing implementing barriers and relaying problem-solving strategies: time constraints, space constraints, classroom interruptions/distractions, and limited school support. **CONCLUSIONS:** High training satisfaction and similar quality across ET and MT groups indicate the train-the-trainer approach is a promising strategy to enhance BEPA 2.0 dissemination. Cooperative Extension partnerships may be an overlooked mechanism to enhance physical activity promotion efforts in school settings.
Virtual reality (VR) has become a popular modality for exercise, physical therapy, and rehabilitation. VR-based exercise is becoming more available and could be a viable form of exercise. In addition, the self-determination theory (SDT; Deci & Ryan, 1985) has been used to examine college student’s motivation to exercise. However, more empirical research evidence is needed to examine college students’ motivation to participate in VR-based exercise from the SDT perspective.

**PURPOSE:** The purpose of this study was to examine the relationship between college student’s situational motivation and intention to participate in VR-based exercise.

**METHODS:** Seventy-two college students (Male = 39, Mage = 20.72, SD = 1.66) experienced at least 5 minutes of VR-based stationary bike gaming using the VirZoom Arcade. Afterward, they were assessed on situational motivation and intention to participate in VR-based exercise via a validated survey. The Situational Motivation Scale (Guay, Vallerand, & Blanchard, 2000) was used to assess situational motivation and one question was used to assess their intention for future participation in VR-based exercise. In order to determine the relationship between situational motivation (i.e., intrinsic, identified, external, amotivation) and intention to exercise, a multiple linear regression was performed to investigate motivation to predict intention to exercise.

**RESULTS:** The multiple regression model showed a statistically significant effect, F(2, 69) = 12.920, p < .001, R² = .272, indicating that 27.2% of the variation in intention to exercise can be explained by identified regulation (β = .43) and amotivation (β = -.23).

**CONCLUSIONS:** The results suggest that the intention for further participation in VR-based exercise is strongly predicted by the identified regulation or importance college students place on VR-based exercise. As with other modalities of exercise, lack of motivation and interests can be a deterring factor for participation in VR-based exercise. Further research is needed to understand how to empower college students who are amotivated to participate in VR-based exercise. Finally, these results confirm the theoretical tenets of the SDT.
Commercial physical activity (PA) tracking devices have gained popularity both in the general public and research settings to monitor and increase PA. High tech versions automatically track and record data while low tech versions require manual logging to retrieve the data. Different types of activity trackers require different data engagement, which may influence PA levels. Purpose: The purpose of the study was to investigate if the differences in data engagement from two types of activity monitors influenced PA levels. Methods: Employees at a midwestern university (N = 39) enrolled in a four-week worksite walking intervention. A 2-arm randomized design study was used to compare the influence of type of data engagement on average weekly steps between two types of activity monitors: 1) manual log (MANUAL) utilizing a standard hip accelerometer (NL-1000) and 2) digital log (DIGITAL) utilizing a wrist accelerometer (FitBit Charge 2). Participants were asked to wear a blinded activity monitor for week to determine baseline averages. Then participants were randomly assigned to track activity wearing one of the two types of activity trackers, for four additional weeks. The MANUAl group recorded their steps by hand daily in an activity log. The DIGITAL group was asked to monitor their steps through the activity tracker’s app which was downloaded to their personal smart phones. Results: Significant increases in weekly step averages was found for both the MANUAL (t (20) = 12.39, p < .001) and the DIGITAL (F(1,39) = 19.557, p < .001) groups from Week 1 to Week 4. There were no significant between group differences found for Week 1 step averages (t(39) = 224.17, p = .999) or Week 4 step averages (t(39) = 300.99, p = .200). Conclusion: Steps were significantly increased for both groups during the intervention but there was no statistical difference found between the groups. To our knowledge, no other study has examined if data engagement influences PA. With so many types of activity monitors on the market, these findings indicate that cheaper, low tech activity trackers are as effective in behavior change as their more expensive, high tech counterparts. Since differences in data engagement does not appear to impact short-term step increases individuals can choose either high tech or low tech options depending on resources and preferences.

Purpose: The purpose of this study was to investigate the physical activity preferences of middle school students. Methods: Participants were 219 students in grades 6-8 at a public, urban middle school. Data were collected via self-report questionnaire that included questions with specified options and questions with write-in opportunities assessing demographic information, physical activity preferences, and activities students would like to engage in. Results: Results indicated that the middle school boys (n = 113) were 12.65 ± 1.63 years old and overall preferred basketball (38.3%) and football (25.2%) and wanted to learn more about basketball (19.8%), football (12.9%) and soccer (11.9%). Eight grade boys (n = 26) preferred basketball (19.8%) and football (12.9%) and wanted to learn basketball (21.7%), football (17.4%) and baseball (13.0%). Seventh grade males (n = 43) preferred jogging (44.4%), basketball (28.9%) and football (15.6%) and wanted to learn basketball (20%), baseball (12.5%), soccer (17.5%), tennis (10.0%) and swimming (10.0%). Sixth grade boys (n = 42) preferred basketball (32%) and football (28%) and wanted to learn basketball (21.7%), football (17.4%) and baseball (13.0%). Girls (n = 106) were 12.57 ± 1.05 years old and overall preferred basketball (28.3%), jogging (23.2%) and dancing 12.1%, and wanted to learn about basketball (29.3%) and soccer (13.0%). Eighth grade girls (n = 28) preferred basketball (33.3%), jogging (29.6%) and dancing (11.1%) and wanted to learn baseball (30.4%) and soccer (13.0%). Seventh grade girls (n = 30) preferred dancing (17.9%), jogging (17.9%), swimming (17.9%) and basketball (14.3%) and wanted to learn about baseball (36%), soccer (16%), swimming (12%) and tennis (12%). Sixth grade girls (n = 47) preferred basketball (34.0%) and jogging (23.3%) and wanted to learn about basketball (25.6%), tennis (20.9%) and soccer (11.6%).

Purpose: Exergaming has been evident to be a novel and interesting channel to enhance young adults’ affection and emotion while engaging in physical activity, yet no known research has been conducted to compare its efficacy versus traditional exercise modality. In response, this project investigated mean differences in young adults’ rating of perceived exertion (RPE) and mood in different exercise modalities (exergaming aerobic dance vs. traditional aerobic dance). Methods: Forty young adults (20 females; M = 20.38) were recruited from a Chinese university and completed two separate 12-minute dance sessions: 1) non-stop exergaming aerobic dance (Xbox 360 Kinect Just Dance - Just Sweat around the World); and 2) traditional aerobic dance led by an experienced instructor. Participants’ RPE was assessed via the Borg Rating of Perceived Exertion (14-point Likert scale) every 4 minutes and mood was measured by the Brunn mood Scale (5-point Likert scale); anger, confusion, depression, fatigue, tension, and vigor) during each session. MANOVA with repeated measures was used to detect mean differences in these outcomes between the two dance sessions. Results: Significant differences were identified between dance sessions for the overall model, Wilks' Lambda = 0.13, F(7,33) = 31.05, p < .001, η² = 0.87. In detail, participants had significantly lower RPE toward exergaming dance (9.66 ± 1.07) compared to aerobic dance (11.36 ± 0.85), F(1,39) = 209.45, p < 0.01, η² = 0.64. In terms of mood, exergaming dance showed significantly lower confusion (3.00 ± 1.72) comparing to aerobic dance (4.25 ± 1.50), F(1,39) = 4.97, p < 0.05, η² = 0.11. Similarly, participants reported significantly lower fatigue in exergaming dance (3.00 ± 1.43) versus aerobic dance (4.00 ± 1.78), F(1,39) = 7.58, p < 0.01, η² = 0.16. No other significant differences were detected for other outcomes. Conclusion: Findings suggest that exergaming dance may lead to less perceived RPE, confusion and fatigue among young adults compared to traditional aerobic dance. The findings have practical implications, as young adults might be more likely to engage in game-like exercise when less effort, confusion and fatigue are perceived.

Purpose: The study aims to explore the applicability of SDT in understanding and promoting physical activity of Chinese school students. Participants should consider tailoring intervention to address school level differences to increase physical activity participation of students in PE.
HIV affects Black/African American gay, bisexual, and other men who have sex with men more than any other group in the United States. The Eastern Health Planning Region of Virginia contains the state’s highest percentage (34%) of new HIV diagnoses among Men Who Have Sex with Men (MSM). PURPOSE: This study investigated physical activity and body mass index relationship to HIV status, HIV risk perception, and knowledge of and attitudes toward PrEP (an anti-HIV medication) use among this population. METHODS: Thirty participants who had sex with men and transgender persons of color in the Hampton Roads area. METHODS: A cross-sectional, 61-item online survey was administered from September 28, 2017 to March 4, 2018 to a convenience sample of the priority population. Descriptive analysis summarized all self-reported baseline data, cross tabulations clarified differences in data patterns in respondent subgroups, and Pearson’s chi-square tests assessed examined variables of interest. One-way ANOVA assessed differences in subgroup means and was followed with Tukey post hoc analysis. The level of significance was p<0.05. RESULTS: Among the 289 participants included in the analyses, 87.5% were Black/African American and the mean age, weight, and height were 31.0 ± 8.7 years, 85.1 ± 21 kilograms, and 175.4 ± 9.4 centimeters, respectively. Mean body mass index (BMI) was 27.9 ± 5.5 kg/m² with 38.4% considered overweight and 23.5% obese. Only 30.4% of respondents reported achieving the national physical activity (PA) recommendation (≥ 30 minutes of moderate-intensity physical activity on ≥ 5 days per week) (USDHHS, 2008). Most respondents reported a negative HIV status (62.6%), 6.9% did not know their HIV status, and 19% had not heard of PrEP. After removing participants who self-identified as HIV positive, most respondents did not feel they were at risk for HIV (57.6%). HIV Status, Willingness to take PrEP, Perceived HIV Risk, and Prior Knowledge of PrEP were not associated with meeting national PA recommendations or BMI. CONCLUSIONS: High rates of obesity and low levels of physical activity may further complicate healthcare outcomes for this population with primary or comorbid chronic conditions creating a competition for prioritization of health conditions. Engagement in regular physical activity and exercise must be promoted.

Sedentary Death Syndrome (SeDS) is the 2nd greatest, yet preventable threat to public health, resulting in multiple chronic diseases and millions of premature deaths annually. Work-related environmental conditions have been implicated as factors related to declines in physical activity (PA) in the United States and abroad. Staff and faculty in a university setting may experience greater quantity of sitting time at work, which would impair the ability to achieve recommended levels of PA. Few studies exist that have evaluated sitting levels among university personnel. PURPOSE: The purpose of this investigation was to explore sitting levels among working members of Biola University. METHODS: Eligible survey respondents (N = 393) were men (n = 154, 44.9 ± 12.8 years of age, 178.7 ± 8.3 cm in height, 85.3 ± 15.0 kg in weight, and an average body mass index (BMI) of 26.7 ± 4.5 kg/m²) and women (n = 239, 40.9 ± 13.1 years of age, 164 ± 8.1 cm in height, 69.2 ± 15.5 kg in weight, and an average BMI of 25.56 ± 6.1 kg/m²) who are employees of Biola University. Participants completed the International Physical Activity Questionnaire (IPAQ), using the Survey Monkey® platform. Results: Average sitting time (SIT) (BMI) was 27.7 kg/m² with 38.4% considered overweight and 23.5% obese. Only 30.4% of respondents reported achieving the national physical activity (PA) recommendation (≥ 30 minutes of moderate-intensity physical activity on ≥ 5 days per week) (USDHHS, 2008). Most respondents reported a negative HIV status (62.6%), 6.9% did not know their HIV status, and 19% had not heard of PrEP. After removing participants who self-identified as HIV positive, most respondents did not feel they were at risk for HIV (57.6%). HIV Status, Willingness to take PrEP, Perceived HIV Risk, and Prior Knowledge of PrEP were not associated with meeting national PA recommendations or BMI. CONCLUSIONS: High rates of obesity and low levels of physical activity may further complicate healthcare outcomes for this population with primary or comorbid chronic conditions creating a competition for prioritization of health conditions. Engagement in regular physical activity and exercise must be promoted.

Bigu is a comprehensive health care technique based on the Chinese traditional health preservation method, including fasting, Qigong, and Chinese medicine. PURPOSE: To explore the efficacy and feasibility of a 7-day Bigu intervention on selected physical outcome measures among individuals with obesity. METHODS: Twenty-three participants, 11 male, and 12 female (age: 31.65±10.38 yrs; body height: 169.48±0.01 cm; body mass: 98.26±17.14 kg) were enrolled in the comprehensive 7-day intervention of Bigu, which consists of 1) fasting: drinking plenty of water but no food, except some fruits, such as grapes and apples. 2) Qigong exercise: including stretching exercise; eight sections of brocade for 90-minute daily under the instructions of Qigong master. 3) Chinese herb: Linggui Zhugan decoction as daily decotion. Before and after the Bigu intervention, the outcome measures were: body weight, body fat, fat-free body weight, waist circumference, heart rate, blood pressure, and blood glucose. The paired test was employed to examine the differences of the outcome measures before and after the Bigu intervention. RESULTS: After the Bigu intervention, the body weight (Pretest: 98.26±17.14 vs Posttest: 92.77±16.24, p<0.01), BMI (Pretest: 34.35±3.73 vs Posttest: 32.37±3.58, p<0.01), waist circumference (Pretest: 110.83±10.47 vs Posttest: 106.35±10.01, p<0.01) and body fat (Pretest: 41.91±8.42 vs Posttest: 40.79±8.57, p<0.01) of the participants were significantly decreased. Heart rate and blood pressure remained no change, however, the skeletal muscle (Pretest: 33.32±6.45 vs Posttest: 31.60±6.61, p<0.01) and fat-free body weight (Pretest: 59.28±10.66 vs Posttest: 56.28±11.02, p<0.01) were significantly decreased. The blood glucose (Pretest: 5.69±2.28 vs Posttest: 3.82±1.34, p<0.01) drops significantly within normal physiological range. CONCLUSIONS: Bigu may effectively help individuals with obesity to relieve obesity and control body weight and could be a feasible exercise for the individuals with obesity, however, there may be a risk of losing fat-free body weight during Bigu intervention. How to prevent the loss of fat-free body weight in Bigu intervention would warrant for future research.
Individuals with low socio-economic statuses (SES) have lower physical activity levels and poorer diet compared to their higher SES counterparts. Furthermore, these individuals typically have other health disparities (e.g., race, access to health care), which may impact their health status. Although lifestyle diseases (e.g., diabetes) are managed in the primary care setting, low-SES patients' behaviors and preferences for lifestyle are rarely assessed, despite being needed to guide care. PURPOSE: To examine qualitatively the preferences for lifestyle interventions for individuals with low SES within a clinical setting. METHODS: Patients (N = 185; 70.2% female; 51.5% African American) were surveyed at two free community health clinics. Survey questions focused on patients’ preferences for physical activity and nutrition services; patients’ current physical activity and food related behaviors; and desired health information. Data were analyzed using content analysis to identify themes. RESULTS: Patients reported preferences for programs that were similar to those provided at the YMCA, general nutrition counseling, and smoking cessation. Majority of individuals who exercised did so within a gym or at home. The most common reasons for not exercising or preparing food were lack of time, work schedule constraints, pain, and health issues. Patients reported regular fast food consumption. Participants reported they would value information on general wellness, low-impact physical activity, and weight loss. CONCLUSIONS: This study is the first to qualitatively examine low SES patients’ physical activity, diet, and other lifestyle behaviors along with intervention preferences within the clinical setting. Data demonstrates that individuals desire lifestyle intervention programs, especially ones that address reported barriers (e.g., pain, lack of financial resources, limited time). Notably, this study also asked patients their preferences rather than having program planners and researchers determine the best intervention for this population. As such, planners and researchers should tailor programming to this unique population’s needs. Further research and practice efforts should implement tailored lifestyle programs while also evaluating acceptability and feasibility of these programs.

PURPOSE: Physical activity (PA) promotion research has increasingly focused on Latina women, as they report comparatively lower rates of PA and higher rates of some related diseases. Nevertheless, there is a paucity of research on PA maintenance upon completion of interventions among this population, and whether smartphone apps could provide tools to help with PA maintenance. This study aimed to: (1) assess 3-month PA maintenance among Latinas who complete a PA intervention; (2) evaluate the acceptability and preliminary efficacy of smartphone apps as tools for PA maintenance; and (3) qualitatively explore the role that apps played in PA maintenance. METHODS: 27 participants who reported increasing their vigorous PA (MVPA) ≥ 60 minutes/week immediately after completing a 12-month PA intervention study were recruited. Participants were randomly assigned to enhanced maintenance (i.e., taught how to use 2 commercial smartphone apps, N=14), or control (N=13). After a 3-month maintenance period with no contact, participants’ PA was re-assessed via the 7-day PA Recall. Longitudinal mixed effects regression models assessed group by time effects on PA (Aim 1). Frequency and satisfaction with apps were evaluated via a Likert-style questionnaire (Aim 2). Qualitative data were collected and analyzed using individual interviews with 21 participants (Aim 3).

RESULTS: Mean minutes/week of MVPA was 16.85 (SD=24.73) before the intervention, 230.50 (SD=199.29) immediately after the tapered intervention, and 163.10 (SD=125.49) after the maintenance period. There were significant effects of time (β=102.24, SE=42.06 for pre-intervention to post-maintenance, and β=-85.17, SE=-34.62 for post-tapered intervention to post-maintenance), but not of group assignment, on self-reported PA. Nine out of 14 participants in the enhanced maintenance group reported using apps at least a little to help with PA maintenance. Reasons for not using apps included not finding them appealing or necessary. CONCLUSIONS: This study used quantitative and qualitative data to provide new knowledge regarding PA maintenance among Latinas. Few women reported returning to pre-intervention levels of PA, yet there was a significant drop in self-reported PA after the tapered intervention ended. Smartphone apps contributed little to PA maintenance.

In South Korea, Baby Boomers - those born after the Korean war, between 1955 to 1963, will contribute to demographic trends. Maintaining the health and independent functioning of the baby boomer generation is public health priority in the nation. Among the baby boomers, there is an increasing trend for older adults to adopt physically active lifestyles in an effort to remain healthy and preserve independence. While participating in physical activities (PA) is one of key elements for both personal health, we know surprisingly little about how baby boomers conceptualize PA and the role that PA plays in their lives.

PURPOSE: The objective of the study was to identify and analyze active baby boomers self-perceptions, the role that PA plays in their identity, and how they incorporate PA to their everyday lives.

METHODS: Consensus Qualitative Research (CQR) was employed. CQR is a qualitative research method that helps build consensus among a research team and an auditor to yield robust conclusions. Semi-structured interviews were conducted with 12 active baby boomers. Date from the interviews were coded and reviewed in depth by the research team with the goal of achieving consensus about the themes that emerged from the study.

RESULTS: The themes encountered were: self-perceptions and identity, the definition and significance of physical activity, the experience of PA among active seniors. The
major findings were: the active baby boomers perceived themselves and aging process positively due to their healthy bodies, continuing economic activities, and high self-esteem; they defined PA as all movements which needed for their every lives and they believed that their self-esteem and health could facilitate participating in PA; the interviewers appeared to be content with their decisions to maintain a physical activity routine and that self-satisfaction motivated them to continue physical activities and extend to new sports and hobbies.

CONCLUSIONS: The interview views showed PA appear to be important in active baby boomers lives. Increasing our understanding of how and why preferences and values interact with PA, will assist in the development of strategies for increasing PA among baby boomers who are not yet physically active with the goal of improving their health and quality of life.

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Women are generally less active than men but the reasons for this gender disparity are not well understood. Benevolent sexism is a seemingly positive, covert form of sexism based on the idea that women are fragile and feminine to compliment the masculinity of men. Endorsement of benevolent sexism has been shown to have a negative impact on work and academic performance in women. Benevolent sexism may inform underlying reasons for the PA gender disparity. PURPOSE: To explore the relationship between PA and endorsement of benevolent sexism in young women.

METHODS: Nineteen women (20.7±1.1 yrs.) completed the International Physical Activity Questionnaire Short Form and the Ambivalent Sexism Inventory (ASI). The IPAQ was scored for total weekly; minutes of moderate-to-vigorous PA (MVPA), MET-mins., and Sitting time (ST). The ASI is a 22-item questionnaire with two subscales measuring an individual’s endorsement of benevolent and hostile sexism; the mean score (range 0-5) on the benevolent sexism items was used for analyses. Spearman correlations assessed the associations between PA outcomes and endorsement of benevolent sexism. Participants were split into tertiles for each PA outcome. Wilcoxon Rank-Sum tests and Cohen’s d assessed the differences in ASI scores between the 1st (T1) and 3rd (T3) tertile. RESULTS: MVP and MET-mins were both negatively associated with benevolent sexism (r=-0.32, r=-0.35, respectively) but there was no association with ST (r=-0.06). There was no significant difference between endorsement of benevolent sexism between participants in T1 and T3 for MVP (r=0.1 and Interquartile Range [T1:3,840-1,400; T3:4,685-1,400]; p=0.84, d=0.1) and MET-mins [T1:3,200-1,500; T3:3,260-1,500]; p=0.44, d=0.72]. CONCLUSION: There was a small, inverse relationship between benevolent sexism and both MVP and MET-mins, in the hypothesized direction. Additional work needs to further explore these relationships in larger, more diverse samples.

In 2016, more than 1.9 billion adults aged 18 years and older were overweight in the world and of these over 650 million adults were obese. These are preventable conditions that lead to chronic diseases. Overweight prevention includes: changes in eating habits, reduced time in front of the TV and computer to less than two hours a day and increased physical activity. Physical activities and exercise programs have been promoted by social marketing, especially on the social networks (Facebook, Instagram, Twitter). Social marketing it is a carefully planned, long-term approach to change human behavior. This one can be used in different ways to promote the physical activity.

Purpose: To determine the association between body mass index and waist-hip ratio and parameters of diet and sleep in university students.

Methods: The sample consisted of 365 university students (n=107; male, n=258; female), aged 18-26 years, who enrolled course of Sports and Exercise in the academic year of 2018. Body mass index (BMI) and waist-hip ratio (WHR) were measured at the initiation of course. BMI was calculated by dividing body weight in kilograms by the square of height in meters. Waist circumference (cm) was measured using a measuring tape, from mid-point of the costal margin to the iliac crest in the mid-axillary line or above the belly button. The hip circumference (cm) was taken by measuring their widest point of the greater trochanter. WHR was then being calculated by the measurement of the waist circumference divided by the circumference of the hip. The data regarding parameters of diet and sleep, including dinner time, bedtime, and sleep duration, were collected by a set of online questionnaires which was used as a surveying tool at the end of course. The data expressed as percentage, means, and standard deviation. Pearson correlation was performed with statistically significant at level 0.05. Results: There was evidence that all categories of BMI, overweight (22.7%), normal weight (49.9%), overweight (10.7%), and obesity (16.7%), were mostly female. More than half of students had dinner at 6-8 p.m. which was greater in male (47.3%) than female (28.2%). The late bedtime, after 12 a.m., was apparently observed in male (52.3%) within sex. Most of students reported 4-6 hours of sleep duration, especially female (74.8%) within sex. BMI showed a positive association with WHR across all genders (p<0.001). While gender was inversely associated (p<0.005) among BMI, WHR, and dinner time. Conclusions: Gender has a unique affect BMI, WHR, and dinner time. Our results underscored some of the parameters put some individuals at more risks of developing health problems. This should be expanding the scope of wellness program for promoting health in the university students.

Association Between Body Mass Index And Waist-hip Ratio And Parameters Of Diet And Sleep In University Students

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(No relevant relationships reported)
INTRODUCTION: Many consumer activity monitors include features, such as visual and haptic prompts, designed to alter users sedentary (SED) or physical activity (PA) behaviors. However, the ability of these PA prompts to alter sedentary/PA behaviors is unclear. PURPOSE: To evaluate the effectiveness of PA prompts from consumer wearable devices in changing SED/PA behaviors in university employees. METHODS: 25 university employees (43.4±9.2yrs) without a history of consumer activity monitor, wear volunteered to wear a Fitbit Alta HR (FB) that was randomly assigned to administer PA prompts (Prompt group) or no PA prompts (Non-Prompt group). Participants were blinded to the aims of the study. Before receiving a FB, participants wore an activPAL (PAL) for 5 days to measure baseline SED/PA behaviors. After returning the PAL, participants wore the FB for 12 consecutive days during all waking hours and wore the PAL for the last 5 days of the FB wear period. PA prompts were triggered when participants achieved <250 FB steps in the first 50 minutes of an hour from 6 am to 8 pm each day. Changes in PAL measured SED/PA behaviors were adjusted for baseline values. Average FB steps were calculated during the first 50 mins and last 10 mins of each hour and compared between hours when a prompt was received (Prompt group) or would have been received (Non-Prompt group). RESULTS: When participants achieved >250 FB steps in the first 50 min of an hour, the average FB steps in the last 10 minutes of these hours was significantly lower (p<0.01) when a prompt was given (49±21 steps) compared to when a prompt was not given (Non-Prompt group) (91±45 steps). Changes in overall PAL sitting time were not significantly different (p=0.36) between the PA prompt group (Mean±SD change; 38.7±93.4 min/day) and Non-Prompt control group (3.9±88.5 min/day). Changes in PAL standing time were also not significantly different between groups (p=0.47) (Prompt group: 13.3±76.5 min/day, Non-Prompt group: 36.2±75.7 min/day). CONCLUSIONS: PA prompts did not influence SED/PA behaviors in university employees. Further research is needed to assess the effectiveness of PA prompts provided by other wearable brands and in larger and more diverse samples, including clinical populations.

B-76 Free Communication/Poster - Health Promotion/Interventions Among Those with Disabilities Wednesday, May 27, 2020 1:30 PM - 4:00 PM Room: CC-Exhibit Hall

Board #239 May 27 2:30 PM - 4:00 PM Perceived Barriers Of Physical Activity In Danish Manual Wheelchair Users Rasmus K. Hansen1, Ryan G. Larsen1, Uffe Laesoe2, Afsiah Samani3, Rachel E. Cowan1, 1Aalborg University, Aalborg, Denmark. 2University College Nordjylland, Aalborg, Denmark. 3The University of Alabama at Birmingham, Birmingham, AL. Email: rkopp@hst.aau.dk

Physical activity reduces the risk of chronic diseases in mobility disabled populations including manual wheelchair users (MWCU). Nevertheless, physical activity level is low in MWCU. PURPOSE: To define physical activity barrier prevalence and impact among Danish MWCU and association with physical activity level. METHODS: We translated The ‘Barriers to Physical Activity Questionnaire – Mobility Impairment’ (BPAQ-MI) from English to Danish according to published guidelines. Danish MWCU (N=133) completed BPAQ-MI online; 51% were female, 64% had a spinal cord injury and 50% were unemployed. Mean ± SD for age, BMI, & years in chair were: 48±13 yrs, 25.8 ± 6.3 kg/m², & 17±14 yrs. The BPAQ-MI covers subdomains of intrapersonal, interpersonal, organizational and community barriers. Participants first indicated if a barrier hindered them from physical activity participation in the last 3 months. If “no,” impact was scored as 0, and if “yes,” impact was scored 1-very small to 5-very big. Self-reported physical activity level (PAL) was rated from 1-“not being physically active at all” to 10-“extremely physically active”. Individual barrier prevalence was computed as frequencies (% of yes). Individual barrier impact was computed as 1 to 5 and reported as median. Summed barrier impact was computed as the sum of individual questions within each subdomain. Spearman’s rho identified associations between PAL and subdomain summed barrier impact. RESULTS: The 3 most prevalent barriers included 2 intrapersonal (~63%) and 1 community (55%) barrier. The 3 most impactful barriers all had a median score of 5 (very big impact), but were less common: 2 organizational (0.8%, 23%), and 1 community (40%) barrier, PAL was inversely associated with interpersonal (r=-0.175, p=0.05) and intrapersonal (r=-0.523, p<0.00) summed impact. PAL was not associated with organizational (r=0.124, p=0.16) or community (r=0.025, p=0.77) summed impact. CONCLUSION: Intrapersonal barriers were highly prevalent. Increased cumulative intrapersonal barrier impact was moderately associated with lower PAL, indicating that a higher perception of physical activity barriers are related to lower PAL. Finally, the results suggests that specific organizational and community barriers could be impactful at the individual level when they are present.

Board #243 May 27 2:30 PM - 4:00 PM DO PHYSICAL ACTIVITY PROMPTS FROM CONSUMER ACTIVITY MONITORS ALTER SEDENTARY OR PHYSICAL ACTIVITY BEHAVIORS? Benjamin D. Boudreaux, Julie A. Schenck, Zhixuan Chu, Michael D. Schmidt. University of Georgia, Athens, GA. (Sponsor: Robert R. Kraemer, FACSM) (No relevant relationships reported)
and at the end of the program. A subset of parents (n=9) participated in semi-structured interviews that focused on their child’s behaviors during the judo program. Non-parametric paired t-tests were conducted to examine differences in ABC subscales (irritability, hyperactivity, stereotypic behaviors, lethargy, inappropriate behaviors) at baseline and at the end of the program. Interviews were coded independently by two trained researchers and categorized into behavioral themes.

**RESULTS:** Participants attended an average of 7.04 ± 1.06 classes (out of 8 possible sessions). Although no significant difference in PA (6.38 vs 6.44, p > .05) and the average step counts were 3799.7 steps/day (SD = 2953.9), 81.8% of the participants met the recommended PA guidelines of 150 min of moderate to vigorous PA per week.

**CONCLUSION:** Although the majority of adults with ASD in this study met the PA guidelines, they were also extremely sedentary. More research is needed to determine if sedentary time, rather than PA, should be targeted to improve preventive health in adults with ASD.

**1116** Board #242 May 27 2:30 PM - 4:00 PM

**Use Of Smartphones To Self-report Eating And Exercise In Young Adults With Intellectual Developmental Disability**

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[No relevant relationships reported]

Internet applications (apps) have been shown to motivate people to form and maintain healthy dietary (D) and exercise (Ex) habits. However, research on the effectiveness of using apps by persons with Intellectual and Developmental Disabilities (IDD) is limited. **PURPOSE:** To evaluate the use of a smartphone app (Ap) compared to app plus text reminders (Ap+T) for tracking D and Ex behavior in persons with IDD in an independent setting without caregiver support. **METHODS:** Young adults (n=5, 19-26 yrs) who were enrolled in a college experience program consented to participate in the study which had been approved by the university’s IRB. Participants were living on campus and had their own smartphones. Baseline conditions were determined as participants used paper and pencil to self-record D and Ex for at least 5 days. In a single-case design, participants served as their own controls and were randomly assigned to alternating treatments of Ap or Ap+T conditions. The Ap (Kurbo Health Inc.) allowed tracking of food items and portions as well as exercise tracking in 10-minute segments. The Ap+T condition added 4 times/d text message reminders about recording D and Ex. Treatment conditions changed every 1-2 days in random order over the course of 3 weeks. Data analysis included evaluation of mean level increases and percentages of nonoverlapping data (PND) between conditions.

**RESULTS:** Participants demonstrated mean level increases from baseline to Ap (range: 15-66%) and baseline to Ap+T (range: 23-72%). Comparisons between baseline and treatment conditions yielded PND scores ranging from 45-77% for Ap and 33-92% for Ap+T. **CONCLUSION:** Although neither treatment emerged as superior, results of the study indicated that use of smartphone apps by persons with IDD increased self-recording of D and Ex behaviors and is a promising tool for promoting independent living skills.

**1117** Board #243 May 27 2:30 PM - 4:00 PM

**Objectively Measured Physical Activity And Sedentary Time In Adults With Autism Spectrum Disorder**

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[No relevant relationships reported]

**PURPOSE:** Adults with autism spectrum disorder (ASD) are purportedly inactive, but this conclusion is inferred from data on children and youth, and parent proxy reports. Objective assessment using activity monitors is needed to better understand physical activity (PA) and sedentary behavior in this population segment. The purpose of this study was to examine the general levels of PA and sedentary time in adults with ASD using accelerometry.

**METHODS:** Eleven adults aged 18-55 (6 females; mean = 31.9, SD = 12.5) and diagnosed with ASD were included in the study. Participants wore a GT3X+ accelerometer on their right hip for 7 days during waking hours except water-based activities, and accelerometers were programmed to collect data in 60-second epochs. ≥ 10 hours of device wear was defined as a valid day and ≥ 3 valid days was required for each participant to be included in the analyses. Activity intensities were determined using the following cutoffs (counts/min): sedentary (<100), low 100-499, light 500-2019, moderate 2020-5999, and vigorous >5999 (Tudor-Locke et al., 2010), and non-wear period was determined by a minimum length of 90 min of consecutive 0-breaks by Choi algorithm (Choi et al., 2011). Descriptive statistics were calculated for moderate to vigorous PA, light- and low-intensity PA, sedentary time, and walking steps.

**RESULTS:** The average total monitored length was 761.5 min/day (SD = 76.4). Results of the PA measures are as follows: moderate to vigorous PA - 42.8 min/day (SD = 30.5); light PA - 109.9 min/day (SD = 32.4); low PA - 97.9 min/day (SD = 33.9), and sedentary time - 511 min/day (SD = 84.6). The daily average percentage of time spent in moderate to vigorous PA was 5.8% (SD = 4.4), and the average step counts were 3799.7 steps/day (SD = 2953.9), 81.8% of the participants met the recommended PA guidelines of 150 min of moderate to vigorous PA per week.

**CONCLUSION:** Although the majority of adults with ASD in this study met the PA guidelines, they were also extremely sedentary. More research is needed to determine if sedentary time, rather than PA, should be targeted to improve preventive health in adults with ASD.

**1118** Board #244 May 27 2:30 PM - 4:00 PM

**Feasibility Of The Assessment Of The H-reflex In Adult Dancers And Non-dancers With And Without Down Syndrome: A Pilot Study.**

Núria Massó - Ortigosa. Universitat Ramon Llull, Barcelona, Spain.

Email: nuriam@blanquerna.url.edu

[No relevant relationships reported]

**PURPOSE:** The analysis of monosynaptic Hoffman’s reflex (H-reflex) involves recording the response to electrical stimulation of β-afferent fibers from the muscle spindle. The H-reflex can be used as a probe to study spinal neuronal pathways and mechanisms at rest and during movement in humans. The purpose of this study was to analyze the feasibility of the assessment of the H-reflex in people with Down syndrome (DS), and to compare it between adult dancers and non-dancers with and without DS.

**METHODS:** Twenty-five participants were recruited and divided into four groups (6 non-dancers and 6 dancers with DS, and 7 non-dancers and 6 dancers without DS). The H-reflex was recorded at the level of the soleus muscle in its central area. We analyzed the H response in three different conditions: decubitus prone, static standing position with open eyes and closed eyes.

**RESULTS:** Non-dancers with DS showed a faster H-reflex latency than both groups without DS (p < 0.05). In the present study, we provide evidence of the feasibility of eliciting the H-reflex in adults with DS. Interestingly, the H-reflex was present in decubitus position but not in standing position in most non-dancers with DS and dancers without DS.

**CONCLUSIONS:** The data from this study can help to perform future research in adults with DS and the development of full-scale studies to analyze this variable in adults with intellectual disability with and without DS.

**1119** Board #245 May 27 2:30 PM - 4:00 PM

**Heart Rate Variability Response Following Two Physical Activity Programs In Senior With Intellectual Disability**

Manel Font-Farré1, Ana Claudia Silva Farche2, Anielle Cristhine de Medeiros Takahashi1, Casimiro Javierre3, Míriam Guerra-Balic1, Guillermo Ruben Oviedo1. 1FPCEE - Universitat Ramon Llull, Barcelona, Spain. 2Universidade Federal de Sao Carlos, Sao Carlos, Brazil. 3Facultat de Medicina, Universitat de Barcelona, Barcelona, Spain.

Email: manelf@blanquerna.url.edu

[No relevant relationships reported]

**Introduction:** Improvements on heart rate variability (HRV) in healthy persons were found following exercise programs. There are gaps in our knowledge about the response of the HRV in seniors with intellectual disability (ID) without Down Syndrome (DS). **Purpose:** To compare the HRV response before, during and after 6-minutes walking test (6MWT) in seniors with ID without DS after two different exercise programs.

**Methods:** Fifteen seniors with mild to moderate ID without DS participated in this study. Participants were randomly divided into 3 randomized groups: sprint interval training group (SITG), combined-aerobic exercise group (AEG) and control group (CG). Participants from the SITG and AEG performed exercise 3 times/wk, 1.5 hs, and 6MWT in seniors with ID without DS after two different exercise programs.

**Results:** Distance walked on 6MWT, variance and 0%V values do not present effect of group, moment or interaction. Better values on mean (p < .001) and 2UV% (p < .01) indicates sympathetic and 2UV% parasympathetic modulation. Despite there is a tendency showing better HRV response values after physical activity programs, it cannot be concluded that exercise promotes beneficial...
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**1121 Board #247 May 27 2:30 PM - 4:00 PM**

**Impact Of Marriage On Physical Activity Behavior In Women With Multiple Sclerosis**

Megan E. Ware, Kevin K. McCully, FACSM. University of Georgia, Athens, GA. (Sponsor: Kevin McCully, FACSM)

Email: mew77577@uga.edu

*(No relevant relationships reported)*

**PURPOSE:** Support is critical for individuals with multiple sclerosis (MS) to adopt and continue physical activity (PA). The role that spouses play in the adoption and continuation of PA in women with MS has yet to be explored.

**METHODS:** Four women with MS volunteered for in-depth interviews lasting approximately an hour. The interviews were semi-structured and covered topics such as: marriage context, PA choices and behaviors, PA activities alone and with spouse, etc. Interviews were transcribed (with identifiers removed) and analyzed in case studies, then cross-cases for overlapping themes.

**RESULTS:** Four cases were developed. Theresa is an older woman with MS for which PA is encouraged by her spouse, and some PA is engaged in together, such as walking pets. She states, “It’s not walking like we used to walk, but we are out there together.” Margaret is an older woman with MS for which PA is engaged in completely alone. Intentional PA is performed because of her spouse’s lack of motivation. She states, “I always feel like he could use it as much as I could, but there’s no motivation and he has to motivate himself.” Claire is a young woman with MS who engages in PA outdoors with her spouse but feels her choices in PA done together can be dependent on her spouse’s desires over her own. She states, “Maybe sometimes if he’s not with me, I would just – push myself harder I think.” Joanna is a mid-life woman with MS who engages in PA outdoors with her spouse and children, as well as indoors with a personal trainer focused on mobility. She feels that her spouse provides support in both types of PA. She states, "Oh, he so strongly encourages it! He, he is honestly my #1 fan... knowing he has my back and is in my corner lets me know that you know it will be a struggle but it is, it is worth it.” All four women discussed the importance of support in PA, despite differences in spousal engagement in PA.

**CONCLUSIONS:** This study points to the importance of support and perception of support by marriage partners for women with MS. Future physical activity programs for women with MS should consider the role marriage partners play in decisions to be physically active. Effectiveness of PA interventions might be enhanced by increasing the involvement of marriage partners.

**Multimodal Pain Management Following Total Knee And Hip Arthroplasty: Impact On Functional Outcomes**

Jason Lou, David Jacobs, Wyatt Kuppersman, Daniel Krasna, Jacqueline Jacobs, Ankur Verma. Schwab Rehabilitation Hospital/University of Chicago, Chicago, IL. (No relevant relationships reported)

**PURPOSE:** To investigate if multimodal pain medication management improves functional status and decreases opioid consumption in the inpatient subacute rehabilitation setting following total hip and knee arthroplasty.

**METHODS:** Retrospective cohort electronic medical record analysis over a three-year period. Patients divided into 3 groups based on pain regimens: Opioid Only (O), Opioid and NSAIDS (NS), Opioid and Neuromodulators (ON). Morphine milligram equivalent (MME) doses were calculated for all opioids. Charts were evaluated for Functional Independence Measure (FIM) scores in walking, wheelchair, bathing, toilet transfer, bed transfer, and walking distance.

**RESULTS:** A total of 161 patients were included in the study: 99 O, 43 ON, and 19 NS. The mean age of the study population was 65 years old, with 70% of patients being female, African American, and having received unilateral knee replacement surgery. There were no significant inter-group demographic differences. The ON group showed the greatest improvement in FIM scores for Walking, Wheelchair mobility, Bathing, and Bed transfers (See FIM Score table). All patients treated with multimodal pain regimens improved from walking 50-149 feet on admission to greater than 150 feet on discharge, whereas 3/17 patients treated with opiates only did not improve to walking greater than 150 feet. At discharge, the O group was using ~59 morphine milligram equivalent (MME) doses per day, whereas the ON group was using 50 MME, and the NS group was using 41.5 MME. Differences in FIM scores and MME dosing did not reach statistical significance.

**1120 Board #246 May 27 2:30 PM - 4:00 PM**

**Analysis Of The Cortical Hemodynamic Responses To Active-assistive Exercise In Individuals With Parkinson’s Disease.**

Cindy Rhode, Jacqueline Truong, Michael Francisco, Ying Liu, Junghoon Park, Taeyou Jung. Schwab Rehabilitation Hospital/University of Chicago, Northridge, Northridge, CA. (No relevant relationships reported)

**Background:** Gait and motor impairments are common symptoms in people with Parkinson’s disease. Previous studies found active-assistive exercise to be effective in improving PD symptoms. The underlying neural mechanism contributing to these improvements is currently unknown. No previous studies have investigated how the brain responds to active-assistive exercise in people with PD.

**Purpose:** To investigate the cortical hemodynamic responses to active-assistive exercise in individuals with PD. Methods: A total of 7 individuals with PD (70.29 ± 5.44) and 10 controls (58.71 ± 9.30) participated in this cross-sectional study. All participants completed three modes of exercise including active exercise (AE), passive exercise (PE), and active-assistive exercise (AAE) using computerized cycling equipment (MOToMed viva 2, RECK MOToMed, Betzenwerder, Germany, 2017). Each mode of exercise was performed at a predetermined pace for 10 minutes on three separate days while a neuroimaging device, functional near-infrared spectroscopy (NIR Sport, NIRx Medical Technology, Berlin, Germany, 2017) captured oxy-hemoglobin (HbO) levels in the prefrontal lobe. Results: Repeated measures ANOVA showed no significant difference in ΔHbO among exercise modes. A trend showed that the PD group displayed the greatest level of ΔHbO during PE and minimum with AE. A 2x3 mixed model ANOVA revealed no significant group x mode interaction. However, a trend showed that the PD group displayed greater levels of ΔHbO during PE and AAE whereas the control group revealed greater levels during AE and AAE. Four representative channels were selected for regional comparison of brain activation during AAE between groups. They demonstrated significant differences in the middle frontal cortex (p < 0.049), orbital cortex (p < 0.039), intermediate frontal cortex (p < 0.033), and granular frontal cortex (p < 0.022). Conclusion: Our findings suggest that people with PD showed higher levels of brain activity during passive and active-assistive modes of exercise as compared to active cycling. Brain activity levels during active-assistive exercise can be different when compared to those without PD. The results may help understand the underlying neural mechanism associated with passive exercise following active-assistive exercise in PD.
CONCLUSIONS:
Patients treated with multimodal pain regimens achieved CDC recommended guidelines of <50 MME per day on discharge. Patients treated with opiates and neuromodulators showed the greatest functional outcome gains in 4/5 categories.

Functional Status

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<th>Bathing</th>
<th>Toilet transfer</th>
<th>Bed transfer</th>
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<td>1.52**</td>
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*p = 0.076
"p = 0.073

1123
Board #249
May 27 2:30 PM - 4:00 PM
Addition Of A Kinesiologist-guided Functional Exercise To Intradialytic Cycling Program: A Randomized Controlled Trial
Spela Bogataj1, Jernej Pajek1, Jadrana Buturovic Pokvar1, Maja Pajek1,2,3

Purpose
Intradialytic cycling is a widely used workout mode for hemodialysis patients whereas added benefit of other exercise modalities remains unknown. This is the first randomized controlled trial on the effects and sustainability of the functional training and exercise counseling in addition to a standard basic intradialytic cycling exercise program. Methods Patients were randomly assigned to a kinesiologist-guided functional training in addition to intradialytic cycling (n = 20, experimental group) or intradialytic cycling only (n = 20, control group) over 16 weeks. The experimental group attended kinesiologist-guided functional exercise and counseling session in the first 8-week induction phase. In the 8-week maintenance phase, the experimental group was encouraged to perform functional training at home on non-dialysis days. The main study endpoint was 10-repetition-sitting-to-stand test time at 8 weeks. Results In the 10-repetition-sitting-to-stand test at 8 weeks, the experimental group improved significantly better than controls (4.5±1.9 s, 95% CI -8.4 to -0.7; P=0.021), which was maintained at week 16 (4.7±2.1 s, 95% CI -9.0 to -0.3; P=0.037). For the secondary endpoints at week 8, the experimental group significantly outperformed controls at handgrip strength for 3.7±1.2 kg (95% CI 1.3 to 6.2; P=0.004), sit-and-reach lower body flexibility for 5.8±1.4 cm (95% CI 2.9 to 8.6; P<0.001), Stork balance test for 7.8±2.9 s (95% CI 4.0 to 1.1; P=0.001), and back scratch upper body flexibility test for 5.8±1.8 cm (95% CI 2.2 to 9.5; P=0.003). At week 16, superior results of the experimental group in secondary end-points remained preserved for handgrip strength, balance, and back scratch flexibility tests (p<0.05 for all). No major exercise-related adverse events were observed. Conclusions Functional training with exercise counseling added to basic intradialytic cycling program meaningfully improves physical performance and successfully prepares dialysis patients for sustainable home exercise.

1124
Board #250
May 27 2:30 PM - 4:00 PM
Effect Of A Rural Multidisciplinary Community Program On Postural Stability Among Individuals With Parkinsonism
Michelle Bateman1, Sahiba Parveen2, Brandt Brickell1, Chad Romoser1, Tim Passmore1, Northwest Missouri State University, Maryville, MO. Oklahoma State University, Stillwater, OK.

PARKINSONISM:

PARKINSONISM:
The purpose of this study was to examine the effect of a rural multidisciplinary community program on balance among individuals with Parkinson’s disease and Parkinson plus conditions. METHODS: Participants with idiopathic PD or corticobasal degeneration (CBD) with no co-existing neurological disorders (n=6) engaged in a 16-week rural multidisciplinary community program that met weekly for 90 minutes. The Biodex Balance System was used to assess postural stability which is an indicator of balance. The dependent variables were OSI, API, MLI with eyes opened and eyes closed. Wilcoxon Signed Rank test was utilized to analyze differences in balance pre and post 16-week intervention. The treatment of 45-minute dual-task fall prevention exercises followed by a 45-minute speech and cognitive program (i.e., the LOUD Crowd® program). RESULTS: The average duration of the disease was 5.5 years. There were statistically significant results at post-data collection for OSI eyes open (Z = -2.201, p = .028), MLI eyes closed (Z = -1.997, p = .046), API eyes closed (Z = -2.023, p = .043), and MLI eyes closed (Z = -2.207, p = .027). However, there were no statistically significant results for OSI eyes open (Z = -4.20, p = .675) and API eyes open (Z = -1.472, p = .141). CONCLUSION: Findings from the study suggest that a rural multidisciplinary community program that utilizes dual-task fall prevention, speech, and cognitive exercises may be beneficial for improving balance among individuals with Parkinson’s disease and Parkinson plus conditions. Researchers recommend a follow-up study with a larger sample size and a true control group. This research project was partially sponsored by the Parkinson’s Foundation Community Grant.

1125
Board #251
May 27 2:30 PM - 4:00 PM
Effectiveness Of SNPE On Disability, Range Of Motion, Muscular Strength, And Pelvic Pain In Women With Chronic Low Back Pain
Heejin Lee1, Jiyoo Yoon1, Jungki Cho2, Jihye Kyeong1, Somi Yun1, Yoonbin Lee1, Jae Gw Huwang1, Dae Tack Lee1. 1Kookmin University, Seoul, Korea, Republic of, 2Korea Good Posture Lab, Inc., Seoul, Korea, Republic of.

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No relevant relationships reported

Purpose
The SNPE (Self Natural Posture Exercise), developed and practiced widely in Korea uses unique tools and body correction belts to make tension release and to correct unbalanced posture. This study examined the effectiveness of SNPE on disability, range of motion (ROM), muscular strength, and pelvic pain in young women with chronic low back pain. Methods Twenty five women (27±6.5 yrs, 23.8±3.8 kg/m2) who had back pain for more than 3 months and scored 5-14 of the Korean Oswesty Disability Index (KODI) were divided into three groups: SNPE group (SNPEG, n=9), stretching group (SG, n=8), and non-exercise group (NG, n=8). SNPE and SG participated in a respective 60 min exercise program twice a week for 12 weeks, while NG did not. KODI, Remodified Schober Test, Finger-to-Floor Distance Test, back strength, and VAS were measured at pre and post of 12 weeks. Statistical analysis was performed by paired t-test and ANCOVA. Results The lumbar disorder index was significantly decreased in SNPEG (pre: 7.6±2.7 vs. post: 3.1±2.7, p<0.001), and the decrease was the biggest in SNPEG than other two groups (p<0.001). Flexion of lumbar increased from 22.4±2.7 to 26.8 ± 2.9 cm (p=0.05) while extension decreased from 12.2±1.0 to 10.9±1.0 cm (p=0.05). Flexion of lumbar decreased in all 10 sites from 46.8±3.9 to 42.5±2.7 cm in SNPEG and from 46.6±3.2 to 44.7±3.4 in SG (p=0.01), and lateral flexion to right side showed similar changes (p<0.01). No change was seen in the changes in lumbar extension, and lateral flexion to left and right were the largest in SNPEG (p<0.05). Back strength increased in SNPEG from 57.5±13.4 to 72.6±12.5 kg (p=0.001), while other groups did not increase. Pelvic pain in SNPEG decreased in all 10 sites from 4.6±1.1 to 3.5±1.5, 4.5±1.4, 5.8±1.6, 4.7±2.2, 5.7±1.9, 5.2±2.5, 6.3±2.1, 6.3±2.2, and 6.4±2.4 to 0.2±0.1, 1.2±1.3, 1.2±1.3, 2.3±1.5, 2.2±1.0, 1.2±1.3, 1.2±1.3, 1.2±1.3, 1.8±0.8, and 1.7±0.8 in Sacrum left and right (L-R), Iliopsoas L-R, Lateral Iliac Crest L-R, Adductor L-R, and Gluteus maximus L-R, respectively (p<0.05). Pelvic pain in SG also decreased in all sites (p<0.05) while not in NG. Conclusion The results suggest that the SNPE can be an effective exercise program for improving disability, ROM, muscular strength, and pelvic pain release in young women with low back pain.
CONCLUSIONS: Adapted judo program can improve psychosocial behaviors in children with ASD. More research is needed increasing the number of participants and the number of sessions per week.

1128 Board #254 May 27 2:30 PM - 4:00 PM Physical Activity And Shoulder Health Behaviors In Recreational Wheelchair Athletes

Charles Kenyon1, Mark Sederberg2, Donald Kasitinon2, Erek Latzka1. 1University of Washington, Seattle, WA. 2University of Texas Southwestern, Dallas, TX. Email: c.kenyon.do@gmail.com

PURPOSE: To assess exercise habits, injury prevention behaviors, and the prevalence of shoulder pain in a population with physical disabilities involved in adaptive sports.

METHODS: A cross-sectional descriptive survey was completed by 24 recreational wheelchair athletes (13 male, 11 female) age 13 and older. Participants were surveyed at two separate community events promoting adaptive sports participation. All participants were cognitively able to complete the survey independently. RESULTS: 70.8% of respondents practiced, competed, or trained in their primary sport year-round, and 29.2% participated in more than one adaptive sport. When in-season 58.3% reported achieving >150 minutes of moderate to strenuous exercise per week, and 41.7% achieving >240 minutes per week. Compared to the off-season, 45.8% and 25.0% of athletes completed >150 minutes per week and >240 minutes per week of moderate to strenuous exercise respectively. 58.3% reported not being satisfied with their amount of physical activity, citing time, access to adaptive equipment and facilities as the most common barriers. 62.5% reported shoulder pain as a result of adaptive sports participation, 41.7% had experienced shoulder pain in the past year, and 37.5% endorsed shoulder pain interfering with daily function. 75.0% reported regularly performing injury prevention exercises, but of those who did not, access to equipment and lack of information on current recommendations were cited as the most common barriers. Encouragingly, a majority of respondents reported discussing physical activity (95.8%) and shoulder health (75.0%) with a health care professional.

CONCLUSION: Within this group of adaptive athletes most participants reported significant amounts of physical activity when engaged in their primary sport, however a notable decrease in activity was noted during off-season periods. Most athletes had experienced shoulder pain as a result of sport participation, with this pain frequently interfering with daily function. Given barriers identified, implementation of adaptive fitness and injury prevention programs should focus on athlete education, be low-cost, and provide convenient access to appropriate adaptive equipment.

1129 Board #255 May 27 2:30 PM - 4:00 PM A Comparison Of Sleep And Physical Activity Patterns Between Typically Developing Adolescents And Adolescents With Developmental Disorders

Nicholas Lealy1, Jeanette Garciaia, Emily Vanderburgi. 1University of Central Florida, Winter Park, FL. 2University of Central Florida, Orlando, FL.

(Purpose: Youth with developmental disabilities (such as ASD and CP) may be less like to meet recommendations for moderate to vigorous physical activity (MVPA) or sleep duration compared to typically developing adolescents. However, there is limited research comparing objective measures of activity and sleep among TD children, children with ASD, and children with CP. The purpose of this study was to examine objectively-measured MVPA, sedentary behavior, and sleep quality in TD adolescents and adolescents diagnosed with CP and ASD. METHODS: Subjects consisted of 10 TD children, 10 children with ASD, and 8 children with CP, matched on age and gender (mean age: 10.5 years; 60% male). Children wore an ActiGraph GT9X accelerometers, over a 7-day period, to assess minutes per day of MVPA, sedentary behavior, and total sleep time. Sleep efficiency was also collected for all three groups. One-way ANOVA was used to examine differences among TD youth, youth with ASD, and youth with CP. Tukey post-hoc tests were then conducted to determine where differences existed between the three groups. RESULTS: Children with CP accumulated significantly more sedentary minutes (662 ±199) than TD children (388 ±77 p<0.002), while TD children accumulated significantly greater minutes of MVPA(118.45 ±50.36) compared to both children with CP(17.32 ±17.89) and children with ASD (55.7 ±45.8). Additionally, youth with CP (95% ± 3.6) had greater sleep efficiency than youth with ASD (89% ± 4.8; p<0.05). CONCLUSIONS: Children with developmental disorders may accumulate lower amounts of MVPA compared to TD youth, however, no differences were found between TD youth and youth with CP regarding sleep quality. These findings suggest that population-specific interventions are critical to improve health in both TD youth and youth with developmental disabilities.)
Epidemiological data demonstrate that employees of nursing homes frequently suffer from illness and musculoskeletal disorders. Previous studies were mainly based on medical diagnoses and registered days of absence. The prevalence of pre-diagnostic health problems (HP) and resulting subjective impairments in participation and job-related performance are thus unclear.

**PURPOSE**: Our study assessed these factors and their potential association with physical activity levels (PA).

**METHODS**: Employees of two stationary nursing homes in Germany (n = 47; age: 47 ± 23 years, 42 females) once per week completed the OSTRC questionnaire over a total period of six weeks. The instrument captures the occurrence of HP (illness and musculoskeletal disorders) as well as related symptoms and restrictions in job participation. Accelerometers, worn on seven consecutive days, were used to assess PA. The association between PA and parameters indicating pre-diagnostic HP and their consequences was tested by means of point biserial correlations.

**RESULTS**: About 85% of the participants reported a HP during the past six weeks. Musculoskeletal disorders were more prevalent than illness (66% vs. 47%). Almost one third of the employees (29.8%) had to reduce working time at least once due to a HP and more than 60% of persons (63.8%) experienced restrictions in job performance. The most frequent locations of orthopaedic problems were the neck, lumbar spine, shoulder and knee. With 48 ± 23 MET h/week, the sample was highly active, all participants fulfilled the WHO’s minimal recommendation of 7.5 MET/h per week. PA was not associated with the occurrence of HP and their consequences (all p>0.05).

**CONCLUSIONS**: The association of high PA levels and general/musculoskeletal health may not exist in employees of stationary nursing homes. The development of interventions aiming to tackle the burden of population-specific HP therefore retains high relevance in future research.
CONCLUSIONS: Mitochondrial function are typically associated with activity level. Surprisingly, functionally ambulatory children with CP did not have greater mitochondrial function, as compared to non-ambulatory children and might even be lower. Importantly, within ambulatory children walking capacity was related to maximal mitochondrial function.

1134  
**Board #260**  
May 27 2:30 PM - 4:00 PM  
**Fall Risks Increase In Aging Women**  
Priscilla Beaupré, Rubens A. da Silva, Tommy Chevrette.  
*Université du Québec à Chicoutimi, Chicoutimi, QC, Canada.*  
Email: priscilla.beaupre1@uqac.ca  
*(No relevant relationships reported)*

**PURPOSE:** Accidental falls are one of the leading causes of hospitalization for injury and result in a high death rate among older Canadians. There are about 30% of people over the age of 65 living in the community fall every year. In addition, aging process is related to individual decrease in physical and functional abilities that increase the risk of falls. Older women are more likely to experience more severe trauma after falling than men. The objective of this study is to evaluate the impact of aging on functionality, postural balance and falls risk in aging women. **METHODS:** 19 women formed two age groups (n = 7 in 45-54 years and n = 12 in 55-64 years) and performed three assessment tests: 1- Step Test to measure lower limbs speed, 2- Sit to Stand Test for lower limbs Strength and 3- Postural Balance Test using the force platform during semi-tandem position, with eyes open and eyes closed. Postural balance response was based in Centre of Pressure (COP) velocity sway in antero-posterior and in medio-lateral directions. **RESULTS:** A large effect size was observed (Hedge’s g = 1.447), and a significant lower extremity speed (p = 0.005) in the older group compared to the younger group. The Lower-limbs Strength showed a large effect size (g = 0.86), however, not significant (p = 0.075) between groups. A large effect size and significant COP velocity increase was observed in the older group for both antero-posterior (p < 0.05, g = 0.887) and medio-lateral (p < 0.05, g = 0.731) directions as compared to the younger group. Finally, significant differences (p < 0.001) and a large effect size were observed between eyes open (g = 1.306) and closed (g = 1.441) conditions for COP velocity sway for both directions. **CONCLUSION:** Aging in women can significantly change the postural balance performance as well as speed adjustments of the lower limb. These findings add to the body of knowledge on aging women and significantly change the postural balance performance as well as speed adjustments for COP velocity sway for both directions.

1135  
**Board #261**  
May 27 2:30 PM - 4:00 PM  
**People With Disabilities Perception Of Quality Of Life After Participation In A Student Service-Learning Program**  
Donald J. Brolsma.  
*California State University, Northridge, Northridge, CA.*  
*(No relevant relationships reported)*

**TITLE:** People with Disabilities Perception of Quality of Life After Participation in a Student Service-Learning Program  
**AUTHORS:** Donald Brolsma, Katia Abdolrazagh, Janet Sandow, Kristina Burch, Elizabeth Garcia, Alyssa Granillo, Kai Sun & Mai Narakasi-Jara  
**INSTITUTION:** California State University, Northridge  
**ABSTRACT:** It is observed that there is a continuous decline in physical function and associated decline in quality of life (QoL) among individuals with disabilities. It has been documented that participating in physical activity significantly improves QoL. Despite many studies proving physical activity improves one’s QoL, there is a limited amount of research showing how combining student service-learning with physical activity can improve the QoL of individuals with disabilities. **PURPOSE:** The purpose of this study was to qualitatively investigate the perception of QoL of individuals with disabilities and physical activity during a student service-learning program. **METHODS:** Semi-structured interviews were performed with 10 individuals with various disabilities. The interviews were designed to explore the perception of QoL and physical activity through each participant’s experience working with university students for the first time. Interviews were audio recorded and transcribed verbatim. Thematic analysis was completed using NVivo qualitative analysis software. **RESULTS:** Three main themes emerged from the qualitative thematic analysis: (1) peers and students were the motivational factors to physical activity with positive, non-judgmental, and supportive exercise environment, (2) increased adherence to physical activity, and (3) increased self-confidence performing activities of daily living. **CONCLUSION:** Physical activity combined with student service-learning programs can potentially improve many different aspects of individuals with disabilities QoL. Our results show improvement in general well-being, as well as a positive experience of working with students. This research, and future research in the field, will help establish a base of evidence to tailor this type of exercise program for individuals with disabilities.
Multiple sclerosis (MS) is a chronic, immune-mediated and neurodegenerative disease of the central nervous system. Since signs and symptoms associated with MS extend to several dimensions, people with MS (PwMS) can experience symptoms at both physical and cognitive dimensions. Among them, perceived fatigue is one of the most disabling symptoms affecting the majority of the MS population. Hydrotherapy is a novel therapeutic option to improve the perceived-fatigue in PwMS.

**PURPOSE:** To analyze the effects of aquatic-based exercise on perceived-fatigue in PwMS using a meta-analytic procedures and systematic review.

**METHODS:** Clinical trials comparing aquatic exercise to no exercise treatments were searched on four scientific databases up to June 2019. The standard mean differences (SMD +) was calculated for the outcome perceived-fatigue. Firstly, general fatigue was evaluated, from which three sub-dimensions were also assessed (physical, psychosocial, and cognitive). The methodological quality of the included studies was assessed employing the Modified Fatigue Impact Scale, showed a significant decrease (+ = -2.15 [95% CI = -3.44 to -0.87]; p<0.01; I² =91%). Regarding fatigue sub-dimensions, physical fatigue achieved a significant improvement in the experimental group compared to the controls (SMD + = -0.57 [95% CI = -0.88 to -0.25]; p<0.01; I²=92%). Perceived psychosocial fatigue (SMD = -1.13 [95% CI = -1.86 to -0.40; p<0.01; I²=76]) and cognitive fatigue were also significantly improved compared to the control group (SMD = -0.57 [95% CI = -0.88 to -0.25]; p<0.01; I²=0%).

**CONCLUSIONS:** Aquatic-based exercise significantly decreases all dimensions of perceived-fatigue in PwMS. Based on these findings, it would be useful for future studies to address the dose-response characterization of aquatic-based exercise programs (i.e. intensity, volume, frequency, training length, etc.) in order to optimize the physical exercise interventions for PwMS.
(22.2 ± 2.3 years), completed two occupational task exercise conditions in hyperthermic (HT, 38°C) and thermoneutral (TN, 22°C) environments on separate days. During each condition, participants completed a 10-minute treadmill walk at 70%-80% of their maximal heart rate followed by a 5-minute 50lb sandbag lift. Participants had 10 seconds to lift the sandbag onto a table then another 10 seconds to place it back on the ground. The walk and lift were completed two times each per condition. Heart rate (HR), ratings of perceived exertion (RPE), and core temperature (T) were recorded immediately before the start of the chamber (baseline), in the chamber at the conclusion of the occupational task (post-exercise), and outside the chamber after 10 min of rest (recovery). Two condition (HT, TN) by three time point (baseline, post-exercise, recovery) repeated measures ANOVAs were utilized to assess all dependent variables. Post-hoc analyses were performed using t-tests. RESULTS: Significant (F ≥ 8.6, p ≤ 0.003) condition by time interactions were observed for all dependent variables. There were no differences (p ≥ 0.07) across conditions in HR (76±11 bpm TN, 82±14 HT), RPE (6.4±1 TN, 7.1±2 HT), or T (37.2±0.3°C TN, 37.5±0.2°C HT) at baseline. However, each of these variables were significantly (F ≥ 2.3, p ≤ 0.05) greater post-exercise (104±12 bpm TN, 146±16 bpm HT; 8.9±2 RPE TN, 13.4±3.1 RPE HT; 37.6±0.3°C TN, 38.3±0.3°C HT) and during recovery (78±12 bpm TN, 92±13 HT; 6.7±1.2 RPE TN, 7.7±2.2 RPE HT; 37.4±0.2°C TN, 38.0±0.3°C HT) in the HT versus the TN condition. CONCLUSION: Concomitant occupational tasks and heat stressors increased physiologic and perceived measures of exertion and body temperature in police cadets beyond that of the occupational tasks alone.

**Purpose:** The profession is a high-risk activity, as these professionals need to deal daily with violence, brutality and death, leading to high levels of stress. Classically, chronic exposure to situations causing stress may lead and facilitate the development of chronic diseases, such as cardiovascular and metabolic diseases. Increased pulse blood pressure (PP) is related to stiffness of large arteries predisposing to acute and chronic diseases, such as cerebrovascular stroke, coronary artery disease, heart failure and kidney diseases, which negatively affect morbidity and mortality, with significant consequences for public health. In addition, heart rate variability parameters are supposed to work as biomarkers of cardiovascular risk in response to stress as well. METHODS: We investigate the effects of regular practice of physical activity (moderate to high intensity, minimum of 5 years of regular practice and ≥ 4/7 week) by police officers who regularly practice physical activity (PAct; ≥ 32.92 ± 5.87 years old; n = 25) from those who do not practice (PSED; 38.73 ± 6.92, n = 25) on systolic and diastolic blood pressure and on pulse blood pressure. The analysis of heart rate variability was performed by using 10 minutes of electrocardiography collection using the digital electrocardiography system (ECG PC, TEB®, Brazil). Body composition was analyzed using octopolar multifrequency bioimpedance (Maltron Inc, England).

RESULTS: PSED presented increased systolic (136,81 ± 21,31 mmHg × 125,56 ± 10,92; p < 0.01) and diastolic blood pressure (81,68 ± 13,80 x 75,37 ± 9.66 mmHg; p = 0.0123) as well as pulse blood pressure (57,28 ± 10,42 x 48,71 ± 8,27 mmHg; p = 0.0001) when compared with physically active ones. In addition, PSED also presented increased levels of perceived stress (p = 0.0008), fat mass (p = 0.0005), visceral fat (p = 0.0001) and reduced fat free mass (p = 0.0055), but not for resting heart rate neither for any parameter of heart rate variability (time and frequency domain: RNS, NNS, SDNN, RMSSD, VLF, L, HF). CONCLUSIONS: We conclude that increased levels of stress in police officers impacts functional biomarkers of cardiovascular diseases, which can be partially attenuated by a physically active lifestyle.

**Purpose:** Workers in physically demanding occupations are often required to demonstrate appropriate levels of physical capability throughout their careers by undertaking routine in-service physical ability assessments. However, integrating physical employment standards (PES) and associated tests into occupational policies and procedures can be challenging for employers and there is a shortage of best practice guidance in this area. The aim of this study is to describe the process of integrating a developed PES into a physical capability management procedure, using a real-world example in the UK Fire & Rescue Service. METHODS: Using physical demands and performance data from a series of studies to investigate the cardiopulmonary, strength and muscular endurance requirements for endorsed UK firefighting activities, a physical capability management process was developed with industry stakeholders, including management, trade unions and subject matter experts. The procedure was designed to manage all levels of physical ability within a physically demanding workforce, prioritising employee safety and fairness. RESULTS: Occupational scientists and industry stakeholders defined performance standards relating to unacceptable, unclear, and acceptable performance of criterion tasks for UK firefighters. Cuts-scores were identified for unacceptable (red), unclear (amber) and acceptable (green) performance standards related to each predictive test (Table 1). A process for triaging and managing all levels of workers physical abilities was agreed upon using the traffic-light system. CONCLUSIONS: This paper describes the processes involved in implementing a physical assessment procedure, for the administration of routine in-service PES and tests in a physically demanding occupation.

<table>
<thead>
<tr>
<th>Criterion Task(s)</th>
<th>Predictive selection test</th>
<th>Physical employment standard</th>
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<tbody>
<tr>
<td>HR/SC/EC/CE</td>
<td>VO,max (ml.kg.min^-1)</td>
<td>Unclear (red)</td>
</tr>
<tr>
<td></td>
<td>≤ 55</td>
<td>35.6 - 42.2</td>
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<tr>
<td></td>
<td>≤ 42.3</td>
<td></td>
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<tr>
<td>Ladder lift</td>
<td>Shoulder press (kg)</td>
<td>Unclear (amber)</td>
</tr>
<tr>
<td>Ladder lower</td>
<td>Single rope pull (kg)</td>
<td>≥ 30</td>
</tr>
<tr>
<td>Ladder extension</td>
<td>Repeated rope pull (reps)</td>
<td>≥ 35</td>
</tr>
<tr>
<td></td>
<td>≤ 51</td>
<td>52-59</td>
</tr>
<tr>
<td></td>
<td>≤ 14</td>
<td>15-22</td>
</tr>
<tr>
<td></td>
<td>HR hose run; SC stair climb; EC equipment carry; CE casualty evacuation; * 28 kg weight.</td>
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</table>

**Purpose:** Psychophysiological responses of Swat team members during active shooter training: A pilot study

Kristina M. Woodford, Heather E. Webb. Texas A&M University - Corpus Christi, Corpus Christi, TX. (Sponsor: Dr. Edmund O. Acevedo, FACSM)

Law enforcement is considered a stressful occupation, special weapons and tactics (SWAT) team members confront situations of imminent danger, that include exposure to traumatic and/or violent events beyond that of typical law enforcement officer duties. The stress related hormonal response of SWAT team members to active shooter training drills has not been investigated. PURPOSE: To investigate psychophysiological responses of SWAT team members during an active shooter training drill. METHODS: Six SWAT team members (age = 32 ± 4.1 yrs; SWAT experience = 28 ± 13.0 months) participated in a control condition wherein participants practiced building entry techniques and marksmanship drills. During this session, measures of state anxiety, salivary cortisol (SCORT) and testosterone (TEST) were collected prior to and after breaking techniques, and after firearm practice. Participants also engaged in an experimental condition that involved three active-shooter-training (AST) scenarios during which measures of state anxiety, task load, SCORT and TEST were collected prior to and immediately after each training episode. The scenarios included a slow-and-deliberate (S&D) search, a S&D search accompanied by a tactical robotic vehicle (TRV), and a rapid deployment scenario with TRV. RESULTS: Increases in anxiety approached (p = 0.07) across the entire AST, but no differences in task load demands (p = 0.17) were reported. Measures of SCORT approached significance across time (p = 0.07), and differences between conditions (p = 0.01, n2 = 0.95) with the AST resulted in elevated SCORT levels. TEST levels were different between conditions (p = 0.03, n2 = 0.83), and
increased significantly (p = 0.02, n2 = 0.28) across time in the AST condition only, with the greatest increases occurring after the S&D search. CONCLUSION: SWAT team members responded to realistic active shooter training scenarios with limited anxiety and cortisol responses, although testosterone increases did occur when compared to a control condition. The greater experience levels may have contributed to the lack of significant changes in measures of stress during the AST, whereas increases in testosterone might explain the benefit of increasing aggressive behaviors and fearlessness for SWAT team members.

1145 Board #271 May 27 1:30 PM - 3:00 PM Heat Strain Assessment Under Three Different Wet Globe Temperatures With Protective Clothing Yong suk Seo1, Tyler Quinn1, Tianzhou Wu1, Hayden D. Gerhardt1, Jung-Hyun Kim1, 1National Institute for Occupational Safety and Health, Pittsburgh, PA. 2Indiana University of Pennsylvania, Indiana, PA. 3Kyoung Hee University, Yongin-si, Korea, Republic of. (Sponsor: Edward J. Sinkule, FACSM) (No relevant relationships reported)

Personal protective clothing is an important part of personal protective equipment worn by health care workers and first receivers. Wearing a vapor-barrier layer of protective clothing inhibits sweat evaporation and impairs physiological and perceptual responses. PURPOSE: To evaluate thermoregulatory responses and heat strain indices during simulated healthcare and first receivers’ tasks under three different wet bulb globe temperatures (WGBT). METHODS: Four men (25.8±6.8 yrs, 176.5±6.1 cm, 75.3±16.9 kg) were consisting of a loose-fitting powered air-purifying respirator, chemical resistant coverall vapor-barrier ensemble, double gloves, boots, and an apron, while performing a battery of first receiver and health care simulation activities (walking, cutting and removing clothing, scrubbing, placing a splint and cervical collar, and weight carrying) for three repetitions under three different WGBT (18, 26, and 34°C) in counterbalanced order. Environmental conditions were intended to simulate healthcare workplace conditions during mass casualty incidents. Rectal temperature (Tre) and heart rate were continuously monitored and averaged during the last 1-minute of each activity and presented as mean ± standard deviation. Physiological (PSI) and perceptual strain index (PeSI) were calculated at the end of each activity. RESULTS: Over time, Tre, PSI, and PeSI all gradually increased. At the end of the trial, Tre was significantly higher in the 34°C condition (38.5±0.4°C) than the 18°C condition (37.8±0.4°C, p<0.029) but did not differ from the 26°C conditions (38.2±0.5°C, p=0.104). The PSI was significantly higher in 34°C (4.6±1.0) than 26°C (5.1±1.2, p<0.002) and 18°C conditions (4.6±1.1, p<0.001). The PeSI was significantly higher in 34°C (7.6±1.8) than 18°C conditions (5.9±1.5, p<0.006) but did not differ between 34°C (7.6±1.8) and 26°C conditions (5.7±1.4, p>0.075). CONCLUSIONS: Tre and heat strain indices gradually increased over time across all environmental conditions. Tre and PeSI did not differ between 26°C and 34°C WGBT conditions. Tre and PeSI responses may be blunted by wearing a vapor-barrier ensemble. Future studies should examine this hypothesis to clarify the current findings.

1146 Board #272 May 27 1:30 PM - 3:00 PM Effect Of Skin Temperature On Dermal Absorption Of Anthracene Caroline J. Smith, FACSM1, Killian D. Wustrow1, Martin R. Root1, Scott R. Collier, FACSM1, Emiel A. DenHartog1, Xinyi Sui2, Nelson R. Vinuace3, 1East Carolina University, Raleigh, NC. 2North Carolina State University, Raleigh, NC. 3National Institute for Occupational Safety and Health, Pittsburgh, PA. (Sponsor: Edward J. Sinkule, FACSM) (No relevant relationships reported)

Exposure to a variety of ubiquitous pollutants, including polycyclic aromatic hydrocarbons (PAHs), occurs during daily exposure to vehicular exhaust fumes, smoking, grilling, and in many occupations, including firefighting. Dermal absorption of potential carcinogens has received limited attention compared to respiratory routes due to the challenges with measurement in vivo. PURPOSE: Our aims were 1) establish the efficacy of microdialysis (MD) as a sampling technique for dermal absorption of PAHs and 2) determine the effect of skin temperature on dermal absorption of the non-carcinogenic PAH, anthracene (ANT). METHODS: Two MD fibers were inserted into the ventral forearm of 6 healthy participants (32 ± 5 yrs, 5 male, 1 female) and perfused with lactated Ringers and 10% 2-hydroxypropyl-β- cyclodextrin at a rate of 1 µl/min. 2% ANT cream was applied over each site, dialysate samples were collected and skin blood flow (SKBF) measured at a locally heated (20°C, 43°C) and thermonuclear (33°C) site. The concentration of ANT from dialysate samples was measured via targeted tandem mass spectrometry. RESULTS: Dialysate ANT concentration was similar between the HT and TN sites (3.2 ± 0.4 vs. 3.5 ± 0.4 ppm, p=0.26). Absolute SKBF was significantly higher at the HT versus TN site (35.7 ± 11.8 and 7 ± 1.0 CVC, p<0.001) CONCLUSIONS: These data provide support for MD as a sampling technique for dermal absorption of PAHs. Despite similar ANT concentrations between sites, dermal absorption and sampling can be modulated by multiple factors. Further research is required to elucidate the influence of skin temperature versus clearance on dermal absorption of ANT and other PAHs. This has important implications for understanding dermal absorption of potentially carcinogenic compounds in occupational workers and the general population.

1147 Board #273 May 27 1:30 PM - 3:00 PM Familiarization With Ambulatory Sleep And Blood Pressure Monitoring Scott R. Collier, FACSM, Kasey Kleiber, Caroline Smith, FACSM, Adam Hege, Erin Bouldin. Appalachian State University, Boone, NC. (No relevant relationships reported)

Purpose: Sleep is a life-sustaining action that has implications in aspects of physical, mental, and emotional health. One necessary event that occurs during sleep is nocurnal blood pressure dipping. Measurement of ambulatory sleep and blood pressure are gaining popularity as these can be completed in an individual’s home. However, little is known regarding the reliability of data and the time it takes oneself to familiarize with the equipment. Therefore, the purpose of this study was to determine how many nights of wearing the monitoring equipment were required to restore sleep architecture and blood pressure data to baseline. Methods: Eight male and female subjects completed all 3 nights of both sleep and blood pressure readings. Visit 1 consisted of anthropometric and resting blood pressure measurements. The subjects were also familiarized with the equipment and instructed to wear the Sleep ProfillerTM and SunTech Medical Oscar2 ambulatory blood pressure cuff simultaneously for 3 consecutive months of nights. Visit 2 consisted of the subjects returning the equipment and the data being downloaded to a laboratory computer. Results: The percent of time spent in N1, N2, N3, and REM were not statistically different between nights 1, 2, and 3. Time for wake after sleep onset was not statistically different between nights 1, 2, and 3. Time for sleep latency was statistically greater from night 2 to night 3 (p = 0.042). Percent nocturnal systolic and diastolic blood pressure dips were not statistically different between nights 1, 2, and 3. Cortical and autonomic arousals were not statistically different between nights 1, 2, and 3. Conclusions: These data demonstrate that ambulatory sleep monitoring takes 3 nights before the data is reliable and the person is familiarized with the mode of measurement.

1148 Board #274 May 27 1:30 PM - 3:00 PM Effect Of Aerobic Exercise And Different Levels Of Pm2.5 On Pulmonary Response In Wistar Rats JIEXIU ZHAO1, FEI QIN2, MINXIAO XU2, ZHONGWEI WANG1, ZHINING HAN1, YANAN DONG 1China Institute of Sport Science, Beijing, China. 1Jinan University, guangzhou, China. 1Changzhou Research Institute of Science and Medical Treatment, Changzhou, China. 2Beijing Institute of Sports Science, Beijing, China. (No relevant relationships reported)

Purpose: Exposure of particulate matter of less than 2.5µm (PM2.5) has been associated with adverse respiratory and the risk of inflammation. While regular physical activity (PA) reduces the risk of many adverse health effects. This study aimed to examine the protection of exercise on adverse pulmonary health induced by PM2.5 exposures in rats. METHODS: 80 Wistar rats were randomly divided into 8 groups: Sedentary (S), Exercise (E), Sedentary+ Low concentration PM2.5, exposures (S+LPM), Exercise+Low concentration PM2.5, exposures (E+LPM), Sedentary+Medium concentration PM2.5, exposures (S+MMPM), Exercise+Medium concentration PM2.5, exposures (E+MMPM), Sedentary+High concentration PM2.5, exposures (S+HPM), and Exercise+ High concentration PM2.5, exposures (E+HPM). The rats in all E-related groups went through 8-week aerobic interval treadmill training (5 days/week, 60/day). The PM-related groups of rats were exposed to different concentration PM2.5 exposure in Beijing. After one bout of PM exposure, the pulmonary function, structure of lung tissues and several pulmonary biomarkers were observed. RESULTS: 1) Compared with S group, following changes occurred in various S+PM2.5 exposure groups: lung tissues were seriously damaged, local bleeding, pus exudation, and inflammatory cell infiltration, as well as the decline of the SOD (S+LPM: p=0.370, S+MMPM: p=0.040, S+HPM: p=0.020) were decreased and CAT (E+LPM: p=0.040) were increased in related E+PM groups respectively. 2. Time for sleep latency was statistically greater from night 2 to night 3 (p = 0.042). Percent nocturnal systolic and diastolic blood pressure dips were not statistically different between nights 1, 2, and 3. Cortical and autonomic arousals were not statistically different between nights 1, 2, and 3. Conclusions: These data demonstrate that ambulatory sleep monitoring takes 3 nights before the data is reliable and the person is familiarized with the mode of measurement.
BACKGROUND: The Chinese special weapons and tactics (SWAT) trainees came from high school graduates, who have often lived in an indoor life style in China so long that many of them suffered from vitamin D deficiency, which made them at high risk of health problems that instructors had to face. PURPOSE: To investigate the therapy effects of outdoor exercise and Vitamin D3 Capsules Supplementation, and their combination on vitamin D deficiency symptoms of SWAT trainees.

METHODS: 158 SWAT trainees with low Serum 25-hydroxyvitamin D levels were divided randomly into 3 groups: Outdoor exercise (O), Vitamin D3 Capsules group (C), and their combination (OC). Participants in O-group maintained the outdoor training for four months (4 hours per day) while C-group used oral Vitamin D3 Capsules, (2000IU per day) with indoor training (in the gym), finally OC-group took both outdoor exercise and Vitamin D3 Capsules at the same time. The heating rates (Serum 25-hydroxyvitamin D level went beyond 30ng/ml was considered as healing) were compared 4 months later. The Serum 25-hydroxyvitamin D levels, the whole body muscle mass increment (kg) and the heart rate change (beats per minute) on Head-up Tilt (HUT) were tested both before and after the intervention.

RESULTS: The heating rates of O, C and OC groups were 78.0, 90.9, 100%, respectively; the average Serum 25-hydroxyvitamin D levels in OC (32.28±5.74) group after the intervention was higher than O (26.99±7.83, p = 0.05, η²=0.28 ) and C (31.11±7.59, p < 0.05, η²=0.20 ), and the whole body muscle mass increment (2.28±0.54) was significantly higher than that in other two groups (p <0.05, for OC vs O, η²=0.58 ) and (OC vs C, η²=0.21 ). However, the heart rate change showed no statistically significant change.

CONCLUSIONS: A combination of outdoor exercise and Vitamin D3 capsules supplementation was effective for the 25-hydroxyvitamin D level in serum and could get a better result in the four-month vitamin D deficiency intervention.

Insulin resistance (IR) increases the risk of adverse cardiovascular events. The triglyceride glucose index (TyG) is a simple IR marker. Low skeletal muscle mass is associated with IR. However, the relationship between muscle power and IR is not well known. PURPOSE: To investigate the relationship between TyG index and aerobic power in police officers. METHODS: Data from 716 police officers were analyzed (125 female and 617 men). They were classified by a TyG index >4.68 in IR (n= 417) and control group (n= 299) groups. All participants performed a graded exercise test in a speed of 5.6kmh (3.5 mph) and 0% grade for one hour in thermoneutral ambient conditions (20-22°C, 40-50% relative humidity). Participants were randomly assigned to four different types of respirators: filtering facepiece respirator (N95), half-facepiece elastomeric respirator (HFR), loose-fitting powered air-purifying respirator (LPAPR), and tight-fitting PAPR (TPAPR) with the same filter media. Facial temperature, respirator microclimate temperature, and humidity were continuously monitored. Subjective perceptions of facial heat and overall body comfort were recorded at 20-minute intervals. Measured results were compared using factorial repeated measures ANOVA.

RESULTS: Compared to rest, respirator microclimate temperature and humidity increased over time in all respirators, but at a significantly larger degree in N95 (+7.33°C/52.74%) and HFR (+6.38°C/36.13%) compared to LPAPR (+1.91°C/23.43%) and TPAPR (+2.69°C/24.15%) (p<0.001). As a result, facial temperature was also significantly higher in N95 (+1.62°C) and HFR (+1.01°C) than LPAPR (-.54°C) and TPAPR (-.79°C) (p<0.001). However, end point subjective perceptions of facial heat and overall body comfort (rated slightly warm - warm) were not different between respirators. In addition, no differences were found between genders in all measurements.

CONCLUSION: Subjects who wore PAPRs in our study had lower microclimate temperature, humidity and thus facial temperature, compared to other models, possibly due to the effect of forced air flow. However, these differences in measured parameters were not subjectively perceived and may be further offset for workers in hot, humid conditions and may lead to escalating factors for heat stress.
**Purpose:** To evaluate the ACFT in U.S. Army ROTC cadets.

**Methods:** Eighteen ROTC cadets volunteered to participate in the study (mean ± SD; age = 21.9 ± 3.4 y, height = 172.4 ± 7.9 cm, mass = 75.1 ± 10.4 kg, % fat = 16.3 ± 7.4%). Participants performed the APFT & ACFT seven days apart. Physiological data were collected for the ACFT using a bioharness monitoring device which included: physiological load (PL), physiological intensity (PI), maximal heart rate (MHR), and average heart rate (AVGHR). Pearson moment correlation coefficients were calculated to determine relationships between selected variables.

**Results:** Mean ACFT scores were 453.7 ± 88.1 with a 72% pass rate and APFT scores were 265.4 ± 26.9 with a 100% pass rate. Significant relationships were found between scores for the ACFT hand-release push-ups and standard APFT push-ups (r = 0.75, p < 0.01) as well as the ACFT and APFT 2-mile runs (r = 0.96, p < 0.01). There was no significant relationship between total scores of the ACFT and APFT (r = 0.28, p = 0.05). Body fat percentage and total ACFT score were significantly related (r = -0.55, p < 0.05). Physiological data for the ACFT were: MHR= 197 ± 18, AVGHR = 123 ± 29, PL = 454.5 ± 141.8, and PI = 6.1 ± 2.0.

**Conclusions:** The results demonstrate that high performance in the ACFT may not translate to high performance in the ACFT. In addition, the ACFT requires moderate to vigorous effort throughout the duration of the test. The results of this study are useful as Army leaders prepare to train cadets and soldiers for successful completion of the new ACFT.

**Purpose:** Gulf War Illness (GWI) is a chronic multi-symptom illness that affects veterans who served during the 1990- 1991 Gulf War. Similar symptoms between GWI and known mitochondrial disorders have sparked investigations into the health of mitochondria in veterans with GWI. The objective of this study is to characterize mitochondria in veterans with GWI. The objective of this study is to characterize mitochondria in veterans with GWI. The purpose of this study is to characterize the bioenergetic profile of peripheral blood mononuclear cells (PBMCs) in veterans with GWI (GWI+) and controls (GWI-) and assess the relationship with symptom severity and physical activity.

**Methods:** 55 Gulf War veterans (85.5% male; 55.0±6.7 years) were determined via the Kansas-Steele Questionnaire (KQ). Self-reported fatigue severity and physical activity (IPAQ kcal/week) were collected for the ACFT using a bioharness monitoring device which included: physiological load (PL), physiological intensity (PI), maximal heart rate (MHR), and average heart rate (AVGHR). Significant relationships were found for the ACFT hand-release push-ups and standard APFT push-ups (r = 0.75, p < 0.01) as well as the ACFT and APFT 2-mile runs (r = 0.96, p < 0.01). There was no significant relationship between total scores of the ACFT and APFT (r = 0.28, p = 0.05). Body fat percentage and total ACFT score were significantly related (r = -0.55, p < 0.05). Physiological data for the ACFT were: MHR= 197 ± 18, AVGHR = 123 ± 29, PL = 454.5 ± 141.8, and PI = 6.1 ± 2.0.

**Results:** 38 of 55 veterans met case definition for GWI. Self-reported symptom severity, physical activity level, and the profile parameters are reported in the table. Significant relationships were found for the ACFT hand-release push-ups and standard APFT push-ups (r = 0.75, p < 0.01) as well as the ACFT and APFT 2-mile runs (r = 0.96, p < 0.01). There was no significant relationship between total scores of the ACFT and APFT (r = 0.28, p = 0.05). Body fat percentage and total ACFT score were significantly related (r = -0.55, p < 0.05). Physiological data for the ACFT were: MHR= 197 ± 18, AVGHR = 123 ± 29, PL = 454.5 ± 141.8, and PI = 6.1 ± 2.0.

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**Purpose:** Gulf War Illness (GWI) is a chronic multi-symptom illness that affects veterans who served during the 1990-1991 Gulf War. Similar symptoms between GWI and known mitochondrial disorders have sparked investigations into the health of mitochondria in veterans with GWI. The objective of this study is to characterize mitochondria in veterans with GWI. The objective of this study is to characterize mitochondria in veterans with GWI. The purpose of this study is to characterize the bioenergetic profile of peripheral blood mononuclear cells (PBMCs) in veterans with GWI (GWI+) and controls (GWI-) and assess the relationship with symptom severity and physical activity.

**Methods:** 55 Gulf War veterans (85.5% male; 55.0±6.7 years) were determined via the Kansas-Steele Questionnaire (KQ). Self-reported fatigue severity and physical activity (IPAQ kcal/week) were collected for the ACFT using a bioharness monitoring device which included: physiological load (PL), physiological intensity (PI), maximal heart rate (MHR), and average heart rate (AVGHR). Significant relationships were found for the ACFT hand-release push-ups and standard APFT push-ups (r = 0.75, p < 0.01) as well as the ACFT and APFT 2-mile runs (r = 0.96, p < 0.01). There was no significant relationship between total scores of the ACFT and APFT (r = 0.28, p = 0.05). Body fat percentage and total ACFT score were significantly related (r = -0.55, p < 0.05). Physiological data for the ACFT were: MHR= 197 ± 18, AVGHR = 123 ± 29, PL = 454.5 ± 141.8, and PI = 6.1 ± 2.0.

**Results:** 38 of 55 veterans met case definition for GWI. Self-reported symptom severity, physical activity level, and the profile parameters are reported in the table. Significant relationships were found for the ACFT hand-release push-ups and standard APFT push-ups (r = 0.75, p < 0.01) as well as the ACFT and APFT 2-mile runs (r = 0.96, p < 0.01). There was no significant relationship between total scores of the ACFT and APFT (r = 0.28, p = 0.05). Body fat percentage and total ACFT score were significantly related (r = -0.55, p < 0.05). Physiological data for the ACFT were: MHR= 197 ± 18, AVGHR = 123 ± 29, PL = 454.5 ± 141.8, and PI = 6.1 ± 2.0.

**Conclusions:** The results demonstrate that high performance in the ACFT may not translate to high performance in the ACFT. In addition, the ACFT requires moderate to vigorous effort throughout the duration of the test. The results of this study are useful as Army leaders prepare to train cadets and soldiers for successful completion of the new ACFT.
number. CONCLUSION: Promoting sports participation in children and adolescents, particularly during peak growth years, is important in preserving long-term skeletal health benefits and may help to reduce MSKIs in Soldiers.

| TABLE 1: Baseline bone measures in recruits who played sports during peak growth years |
|----------------------------------|----------|----------|----------|----------|----------|----------|----------|
| Male                           | N        | Total vBMD | Trabecular vBMD | Trabecular BVTV | Cortical vBMD | Cortical BVTV | Cortical Thickness |
| LI MS                          | 231      | EE = -0.91; p = 0.81 | EE = 1.42; p = 0.05 | EE = 0.00; p = 0.49 | EE = 2.75; p = 0.43 | EE = 0.00; p = 0.84 | EE = 0.35; p = 0.86 |
| LI HS                          | 374      | EE = -0.10; p = 0.15 | EE = -5.86; p = 0.05 | EE = -0.41*; p = 0.04 | EE = -6.2; p = 0.02 | EE = 0.00; p = 0.99 | EE = 0.34; p = 0.36 |
| HI MS                          | 177      | EE = -5.83; p = 0.11 | EE = 5.78*; p = 0.03 | EE = 4.73; p = 0.62 | EE = -0.01; p = 0.54 | EE = 0.00; p = 0.44 | EE = 0.28; p = 0.19 |
| HI HS                          | 417      | EE = -7.77*; p = 0.02 | EE = -6.88; p = 0.04 | EE = -0.01; p = 0.09 | EE = 3.61; p = 0.39 | EE = 0.03*; p = 0.50 | EE = 0.58*; p = 0.01 |
| Female                         | 76       | EE = 13.19*; p = 0.02 | EE = -3.36*; p = 0.06 | EE = 0.04; p = 0.08 | EE = 8.35; p = 0.27 | EE = 0.05*; p = 0.26 | EE = 0.59; p = 0.26 |
| LI HS                          | 110      | EE = 0.43; p = 0.80 | EE = 2.54; p = 0.57 | EE = 0.00; p = 0.59 | EE = 7.12; p = 0.04 | EE = 0.01; p = 0.14 | EE = 4.43*; p = 0.02 |
| HI MS                          | 128      | EE = 3.42; p = 0.57 | EE = 10.74*; p = 0.02 | EE = 0.02; p = 0.05 | EE = -2.32*; p = 0.00 | EE = 0.02; p = 0.22 | EE = 1.05; p = 0.67 |
| HI HS                          | 153      | EE = 5.10; p = 0.38 | EE = 3.34; p = 0.50 | EE = 0.01; p = 0.68 | EE = 3.25; p = 0.50 | EE = 0.02; p = 0.50 | EE = 0.86; p = 0.71 |

* p < 0.05; + p < 0.10

**Table 1: Baseline bone measures in recruits who played sports during peak growth years.**

The ACFT appears to accurately assess important combat readiness and performance relationships of U.S. Service Academy Cadets (USASAC) on both the ACFT & APFT. METHODS: Performance relationships of U.S. Service Academy Cadets (USSAC) on both the ACFT & APFT.

RESULTS: The ACFT appears to accurately assess important combat readiness and performance relationships of U.S. Service Academy Cadets (USASAC) on both the ACFT & APFT. The present results reveal heightened acute stress responses through peaks in salivary cortisol and lactate following a tactical и stressful exercise. To characterize acute vs. chronic cognitive and physical stress responses within a tactical timeline, biomarkers of stress were extracted from saliva samples taken during a live-fire “Stress Shoot” (LFSS), eliciting acute stress. The LFSS was completed prior to (Pre) and following (Post) a 3-day intensive combat training exercise, eliciting mounting stress. METHODS: 46 active duty Soldiers (24.47 ± 4.13 years old, 4 women) completed the 3-day mission and 2 runs of the LFSS. The LFSS involved a marksmanship course with complex rules of engagement (high cognitive load) and physically taxing activities (shuttle run test, kettlebell presses). Salivary biomarkers were collected before (Baseline) and after the LFSS at 4 time points: at LFSS offset (T0) and in 20-minute intervals thereafter (T20, T40, T60). Biomarkers included cortisol to capture cognitive stress and lactate to capture physical stress. The main effects of Sample Time (T0 vs T20 vs T40 vs T60) and of Mission Phase (Pre vs Post) were analyzed with non-parametric repeated measures analyses (Friedman Test) with Bonferroni-corrected posthoc pairwise comparisons. RESULTS: Cortisol peaked at T20 (Pre DC = 3.39; p < 0.001; Post DC = 4.47; p < 0.001), while lactate peaked at T0 (Pre DC = 7.54; p = 0.001; Post DC = 2.72; p = 0.007). There was also a main effect of Mission Phase for cortisol at T20 (DC = 2.12; p = 0.03) and for lactate at T0 (DC = 2.72, p = 0.007). Both biomarkers showed decreased concentrations after the 3-day mission (Cortisol at T20: Pre = 4.30 pg/mL, Post = 3.47 pg/mL; Lactate at T0: Pre = 193745 ng/mL, Post = 114346 ng/mL). CONCLUSION: The present results reveal heightened acute stress responses through peaks in salivary cortisol and lactate following an acute tactical stressor (LFSS). Together, this suggests that the primary stress responses experienced by active-duty Soldiers are due to acute stress, rather than mounting stress.

**Figure 2-7 (Caption)**

**DISCUSSION:** The ACFT appears to accurately assess important combat readiness components. Further, the raw data performances and composite ACFT score appear sensitive in discriminating overall performance abilities as opposed to the previous composite APFT score. For soldier-athletes desiring success on the five combat readiness components: strength, endurance, mobility, power/speed, cardio-respiratory fitness, the ACFT appears to be a comprehensive combat fitness assessment and soldier-athletes should train and increase their overall physical capabilities. CONCLUSIONS: The ACFT appears to be a reliable field test which can classify, indicate one’s physical strengths and weaknesses, and assist in selecting personnel for more arduous military applications. Given the demand & robust nature of military applications coupled with the multi-dimensional ACFT assessment, increased physical performance metrics & thus an overall enhanced physical profile should be the goal of any soldier-athlete.

**POTENTIAL IMPACT:** The ACFT appears to accurately assess important combat readiness components. Further, the raw data performances and composite ACFT score appear sensitive in discriminating overall performance abilities as opposed to the previous composite APFT score. For soldier-athletes desiring success on the five combat readiness components: strength, endurance, mobility, power/speed, cardio-respiratory fitness, the ACFT appears to be a comprehensive combat fitness assessment and soldier-athletes should train and increase their overall physical capabilities. CONCLUSIONS: The ACFT appears to be a reliable field test which can classify, indicate one’s physical strengths and weaknesses, and assist in selecting personnel for more arduous military applications. Given the demand & robust nature of military applications coupled with the multi-dimensional ACFT assessment, increased physical performance metrics & thus an overall enhanced physical profile should be the goal of any soldier-athlete.
body fat (%fat), fat mass (FM), and fat-free mass (FFM) in both men and women. A widely accepted technique is air displacement plethysmography (ADP), which uses a mass-to-body volume ratio to determine %fat. Owing to the standard measurement procedures and accepted validity of this method, it would beneficial to compare military personnel at different bases to evaluate continuity of FFM and %fat in Air Force personnel.

PURPOSE: To compare body composition components among Air Force men and women at two different bases. METHODS: Men (n = 604) and women (n = 343) were evaluated using ADP to identify FM, FFM, and %fat. Participants were stratified into 4 age groups, determined by decade, with individuals <20 yrs (n = 21) combined with the 20-29 yr-old group. Self-appraised activity groups were denoted as sedentary, low active, active, and very active based on standard criteria. Height and weight were used to calculate BMI = kg/m². Fat-free mass index (FFMI) and fat mass index (FMI) were determined for each component relative to height (m²).

RESULTS: A base x activity (2 × 4) MANOVA in men revealed weight, BMI, FFM, and %fat were not significantly different (p>0.21) between bases, while active and very active groups were significantly better than sedentary and low activity groups. In women, BMI, FFM, and %fat were not significantly different (p=0.14) between bases but active and very active groups were significantly better than sedentary and low activity groups. BMI had a significantly higher correlation (p<0.001) with %fat in women (r = 0.79) than in men (r = 0.68). Discriminant analysis identified %fat as the best separator of activity groups, with a better success rate for discerning between sedentary (61%) and very active women (62%) than between low active and active groups (40%). In men, %fat was better for identifying those in the very active group (72%) compared to those in the other 3 groups (<53%). CONCLUSION: Body composition indices do not appear to differ greatly among Air Force personnel at different bases.

BACKGROUND: Military operations occurring in austere environments result in declines of androgen status and physical performance, which has been associated with the severity of negative energy balance. However, whether negative consequences of military operations differ between environmental conditions has not been well described.

PURPOSE: To characterize energy expenditure, body composition, and androgen status during warmer and winter military operations.

METHODS: Seventy healthy US Marines taking part in summer (18 ± 3°C, n = 46) or winter (2 ± 4°C, n = 21) training at Marine Corps Mountain Warfare Training Center participated in this longitudinal observation study. Doubly labeled-water was used to determine energy expenditure throughout summer and winter training. Body composition (InBody 770) and blood draws were performed before and after 15 days of mountain warfare training. Data presented as mean ± SD.

RESULTS: Energy expenditure was 3782 ± 688 kcal/day during summer and 4596 ± 688 kcal/day during winter Marine warfare training. Summer training resulted in a decline (p < 0.01) in body mass (-2.7 ± 1.5 kg), fat mass (-1.1 ± 1.0 kg), lean mass (-1.6 ± 1.3 kg), total body water (-1.2 ± 1.0 kg), and dry lean mass (-0.4 ± 0.3 kg). There was no difference in fat mass (0.5 ± 1.2 kg) following winter training. Following summer training a decline (p < 0.01) in IGF-1 (28 ± 27 ng/mL), but not testosterone (36 ± 24 ng/dL) was observed, while in both IGF-1 (51 ± 38 ng/mL) and testosterone (-11 ± 135 ng/dL) declined (p < 0.01) following winter training.

CONCLUSION: Findings from this investigation indicate that both summer and winter mountain warfare training result in declines in body mass and dry lean mass, while only winter training results in a decline in both circulating IGF-1 and testosterone.

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Abstracts were prepared by the authors and printed as submitted.
women on psychomotor vigilance and neurocognitive biomarkers IGF-I and α-Klotho. However, women demonstrate higher concentrations of BDNF in the presence of psychomotor vigilance and neurocognitive biomarkers IGF-I and α-Klotho. The results and opinions herein are those of the authors and do not necessarily constitute endorsement of the Department of Defense.

1162 Board #288
May 27 1:30 PM - 3:00 PM
The Cardiopulmonary Effects Of Thoracic Load Carriage While Resting
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PURPOSE: To investigate the cardiopulmonary effects of thoracic load carriage (LC) while sitting and standing. METHODS: Eight males and one female (Age: 21.0 ± 1.4 yr; Height: 178.9 ± 5.8 cm; Mass: 86.1 ± 13.2 kg; Body Fat: 20.2 ± 7.2%) without LC experience participated in the study. On separate days, subjects completed four trials of sitting quietly for 5 minutes, and then standing quietly for 5 minutes without assistance. Testing sessions included an unloaded (UL) trial, which served as the control, and wearing a light load (LL: 24lb = 10.9kg), moderate load (ML: 48lb = 21.8kg) and heavy load (HL: 80lb = 36.4kg) weighted vest. The testing order of the weighted vest trials was determined by counterbalanced assignment.

V̇e, RR, Tv, VO₂, heart rate, and ratings of perceived exertion (RPE) were assessed during all trials. An average standing from the last minute was calculated for V̇e, RR, VO₂, heart rate and used in a repeated measures ANOVA for statistical comparison. RESULTS: While standing, there were no differences observed across trials in any of the aforementioned variables. While standing, V̇e was significantly higher during ML (p = 0.013) and HL (p = 0.005) compared to unloaded (UL: 12.6 ± 3.2, LL: 12.2 ± 1.9, ML: 14.8 ± 3.7, HL: 14.9: ± 4.1 min¹). RR, Tv, and heart rate were not different during any of the standing trials. Relative VO₂, while standing was significantly higher for ML (p = 0.038) and HL (p = 0.001) compared to UL (V̇e: -4.3 ± 0.6, VO₂: 4.6 ± 0.6, ML: 5.0 ± 0.7, HL: 5.3 ± 0.8 ml·kg⁻¹·min⁻¹). Standing RPE was significantly higher for ML (p = 0.050) and HL (p = 0.014), compared to UL (UL = 6.1 ± 0.3, LL = 6.9 ± 1.6, ML = 7.6 ± 1.9, HL = 7.9 ± 1.7). CONCLUSION: Sitsitting while under thoracic load carriage did not elicit any significant changes. While standing, ML and HL elicited an increase in V̇e, although it is unclear if this response was due to RR, Tv, or a combination of both. ML and HL increased oxygen consumption by 16% and 23% respectively while standing, as well as increased the perceived effort.

Supported in part by LHU Faculty Professional Development Funds.

For active duty United States Marines physical and combat fitness is essential to be battle-ready and is necessary for day-to-day effectiveness. To help instill habits of self-discipline and maintain physical and combat fitness the United States Marine Corps (USMC) have installed a Physical Fitness Test (PFT) to measure physical fitness levels and a Combat Fitness Test (CFT) to assess a Marine’s functional fitness as it relates to the demands and rigors of combat operations. The USMC PFT involves three events; pull-ups/push-ups (PU), two-minute timed abdominal crunches/sit-ups (AC), and a timed three-mile run (RUN). The USMC CFT also involves three events relating to Movement to Combat (MTC), two-minute timed warm-up (WU), and Maneuver-Under-Fire (MANUF). PURPOSE: The purpose of this study was to investigate relationships between PFT (PU, AC, and RUN) and CFT (MTC, AL, and MANUF) scores assessed by active duty Marines. METHODS: The PFT and CFT scores from 19,678 active duty enlisted USMC males (age 22.5±1.3 years, height 1.77±0.07 m, body mass 79.4±10.3 kg) were analyzed. Pearson correlation coefficients (r) were calculated between the PFT and CFT total scores as well as individual events. RESULTS: The PFT mean±sd scores were as follows: PU = 18.0±5.0 (pull-ups), AC =111.2±90.0 (repetitions), RUN=1377.0±131.4 sec, PFT total=249.6±29.2. The CFT mean±sd scores as follows: MTC=172.5±16.3 sec, AL=113.2±10.4 repetitions, MANUF=138.3±17.2 sec, CFT total=271.6±25.6. Moderate significant (p=0.01) correlations were found between the PFT total and MTC (r=-0.47), PFT total and MANUF (r=-0.42), PFT total and CFT total (r=0.50), RUN and MTC (r=0.46), RUN and CFT total (r=0.43), & PU and CFT total (r=0.41). All other correlations between variables yielded “no to low” association. CONCLUSION: Within the parameters of this study, PFT and CFT event scores ranged from “no” to “moderate” correlations suggesting that different fitness aspects are being assessed and supports the need for both the PFT and CFT assessments.

1164 Board #290
May 27 1:30 PM - 3:00 PM
Abstract Withdrawn

1165 Board #291
May 27 1:30 PM - 3:00 PM
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The tactical demands of Marine Corps Forces Special Operations Command (MARSOC) personnel require high levels of physical performance. During combat deployments, Operators are supplemented with Combat Support personnel who specialize in mission specific tasks. Operators and Support personnel complete portions of tactical training and combat deployments together, often enduring similar training and tactical demands. Previous research comparing Operators and Support personnel has identified significant overall performance gaps, but research has yet to examine performance characteristics during a consistent training phase time point.

PURPOSE: To examine performance characteristics of Marine Operators and Support personnel prior to completing unit deployment training together. METHODS: Operators (N: 39, Age: 28.8 ± 3.11 years, Height: 1.78 ± 0.08 m, Mass: 87.1 ± 8.7 kg) and Support personnel (N: 16, Age: 27.9 ± 4.6 years, Height: 1.77 ± 0.07 m, Mass: 83.03 ± 13.8 kg) completed agility, speed, lower/upper body power, anaerobic capacity, strength, aerobic power, and body composition assessments. Differences between groups were evaluated using independent samples t-tests, or Mann-Whitney U tests (p < 0.05). RESULTS: Operators demonstrated better performance in agility (4.85 ± 0.21 vs. 5.04 ± 0.21; p = 0.005), anaerobic capacity (190.58 ± 16.24 vs. 174.82 ± 18.11 yr; p = 0.006), upper body power (185.03 ± 23.52 vs. 172.26 ± 27.39 cm; p = 0.044), strength (2,932.85 ± 639.59 vs. 2,443.75 ± 706.99 N; p = 0.019), aerobic power (1,114.83 ± 66.12 yd, 1,033.7 ± 100.1 yd; p = 0.001) and significantly lower body fat (17.63 ± 4.06 %BF, 21.01 ± 7.99 %BF; p = 0.035). No significant differences were found in lower body power (p = 0.069) and speed (p = 0.051). CONCLUSION: Performance deficits in Support personnel during active deployment training could have deleterious effects on tactical training, leading to increased risk of injury and potentially affecting subsequent deployment status. The significant discrepancies in key performance outcomes suggest the need for Support personnel to incorporate additional performance training focused on improving overall strength, anaerobic and aerobic capacity, prior to unit training, in order to achieve adequate levels of operational preparedness, similar to their Operator counterparts.

1166 Board #292
May 27 1:30 PM - 3:00 PM
Pulmonary Capillary Blood Volume And Membrane Conductance In Iraq And Afghanistan Veterans With Deployment-related Exposures
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No relevant relationships reported

Purpose: We have previously observed an isolated reduction in diffusing capacity of the lung for carbon monoxide (DLCO) to be a common pulmonary function pattern among symptomatic Iraq and Afghanistan Veterans. DLCO measurement reflects both alveolar capillary membrane diffusion (DMCO) and pulmonary capillary blood volume (VC). Therefore, additional techniques (i.e., simultaneous measurement of diffusion of nitric oxide (DLNO)) are necessary to separately examine DMCO and VC components. The purpose of this preliminary study is to evaluate the utility of the double-gas diffusion technique in Iraq/Afghanistan veterans to better understand the physiological basis of reduced DLCO. METHODS: 20 Iraq/Afghanistan non-smoking veterans (90% male; Age: 36.65 ± 7.3 years; BMI: 30.37 ± 3.8 kg/m²) volunteered for this study. Complete pulmonary function testing was performed, including the double-gas diffusion technique (DLNO/DLCO) and forced oscillation technique (FOT). Combined reference equation for DLNO, DMCO, V̇e, and DMCO/VC were used to calculate predicted and lower 2.5% percentile (LLN). FOT-derived frequency dependence of resistance (R4-R20) and reactance axis (AX) were calculated.

No relevant relationships reported

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there was no main effect of time points for cortisol (p > 0.05); nor was there an interaction between day and time point for cortisol (p > 0.05). Nevertheless, there was a time point effect for cortisol indicating that post-scenario cortisol was higher than pre-scenario cortisol (118.95 ± 90.25 U/mL; p < 0.0007). CONCLUSIONS: Cortisol increased stepwise across the pre- and post-scenario time points on Days 1 and 15, most likely indicative of the cumulative stress effects on the HPA axis. Conversely, sAA increased acutely in response to the stress of the hostage scenario, likely due to its association with norepinephrine and the acute SNS response. Despite training, there is still an increased SNS response during force-on-force drills; it remains to be seen if this response enhances or hinders performance in high-stress situations.

Effects of head trauma experienced in contact football is a growing health concern. Limited research has been conducted to assess exposures to later concussion related symptoms among former college football players. PURPOSE: To quantify the amount of contact football participation, diagnosed concussions, non-diagnosed self-reported head trauma, and the frequency of symptoms associated with post-concussion syndrome among former college football players. METHODS: We surveyed 275 former college football players who were at least 10 years post competition. Respondents provided data on their youth, high school, and college playing experience, undiagnosed head injury, diagnosed concussions, and concussion related symptoms (CRSs). CRSs included: cognitive impairment, impulsive behavior, depression, shot term memory loss, difficulty planning, emotional instability, substance abuse, and suicidal thoughts, were combined into a frequency of symptoms score (range 0-8). A Poisson regression was conducted to examine the association between playing experience and reported head trauma with reported symptom count. RESULTS: The majority of participants reported no diagnosed concussions in college (80%), but a large number reported non-diagnosed related head injuries (67%) that might have resulted in a concussion. A majority of participants (59%) reported no concussion related symptoms. After controlling for age, youth and high school football participation, playing time, non-football concussions, and participation in post-college football (pro, semi-pro), diagnosed concussions in high school or college did not significantly predict concussion symptoms later in life. However, non-diagnosed head injury significantly predicted concussion symptoms (b=47, p<.001) as did post-college play (b=71, p<.001). CONCLUSIONS: Diagnosed concussions were not associated with later self-reported concussion related symptoms. Non-diagnosed head injuries, which are less likely to be managed by a healthcare professional, were significantly associated with CRSs later in life. These findings suggest that proper identification and management of concussions may prevent later symptoms, but more data are needed to test this conclusion.

The relationship between DM and V10 was inversely associated with distal airway measures (R4-R20: ρ = -0.72, p < 0.001; R20-R5: ρ = -0.57, p = 0.003; R5-R2: ρ = -0.36, p = 0.1). Conclusion: In our preliminary analysis, we observed that 40% of our sample demonstrated reduced V4, which appears to be associated with distal airway dysfunction. Continued investigation in this population appears warranted.
Sports are the second most common cause of mild traumatic brain injury (mTBI) in young adults. Even when the athlete does not sustain mTBI, he/she may sustain subconcussive impacts, which are of unknown significance. Purdue University conducted a study in which half of the football players who did not display symptoms of mTBI showed changes in brain function on by the middle of the season impeding their ability to learn. None of these players had symptoms of mTBI. Therefore, subconcussive impacts may lead to neurocognitive decline and changes in balance.

RESULTS
The data was analyzed by comparing the athletes’ mean scores on ImPACT and ClearEdge testing and correlated with number of impacts, cumulative impact, and cumulative rotation. There were no significant correlations between the components of testing and the number or magnitude of impacts. From pre- to post-season, there was a statistically significant decrease in visual motor speed score, as measured by ImPACT from 42.5 to 39.5 (p value = 0.014). On ClearEdge testing, there was a statistically significant increase in multiple balance testing scores from pre- to post-season, including an increase in score on eyes closed standing side by side on foam 86.4 to 89.5 (0.013), eyes open tandem stance on foam from 87.6 to 89.4 (0.005), and aggregate stability measurement from 86.6 to 87.9 (0.009).

CONCLUSION
Neurocognitive and stability measures improved throughout the season on ImPACT and ClearEdge testing. These results do not support our hypothesis. The data could not be correlated with athletes who received a higher quantity and magnitude of impacts throughout the season would have increased symptoms, neurocognitive, and balance scores from pre- to post-season, as shown by ImPACT and ClearEdge testing.

METHODS
We hypothesized athletes who received a higher quantity and magnitude of impacts throughout the season would have increased symptoms, neurocognitive, and balance scores from pre- to post-season, as shown by ImPACT and ClearEdge testing. Both tests assess neurocognitive function, and ClearEdge also examines balance. Subjects wore an accelerometer in their headband to record number and magnitude of impacts during all full contact practices and games throughout the season.

CONCLUSIONS
It is recommended that athletes who receive a higher quantity and magnitude of impacts throughout the season may have increased symptoms, neurocognitive, and balance scores from pre- to post-season, as shown by ImPACT and ClearEdge testing. Both tests assess neurocognitive function, and ClearEdge also examines balance. Subjects wore an accelerometer in their headband to record number and magnitude of impacts during all full contact practices and games throughout the season.

Purpose To determine if oculomotor fatigue (OMF) was present following a sport-related concussion (SRC) in adolescents.

Methods: 121 Student-athletes (15.3 ± 1.4 years, 51 Female/70 Male) were administered Cards 1-3 of the K-D and then three trials of the NPC during their initial concussion evaluation (3.6 ± 1.8 days post-injury). OMF was defined as exceeding the sample mean difference from Trial 1 to Trial 3
EXiT clinical outcomes were similar to athletes recently cleared to RTP following SRC and agility task completion time across EXIT outcomes. (p>.05).

groups.

symptoms, RPE, and EXIT agility task completion time between RTP-A and CON

incorporates ACSM exercise prescription recommendations to replicate physiological

underlying attentional, cortical, cerebellar, or vestibular disorders. Our findings are

CONCLUSIONS: It appears that there was a decline in performance on the NPC (33%) and K-D (26%) in a subset of our cohort. Interestingly, internal consistency remained high for the measures, even when OMF group performance was significantly worse. Future research is warranted to determine if OMF is a clinical biomarker for underlying attentional, cortical, cerebellar, or vestibular disorders. Our findings are specific to adolescent, sport-related concussion patients seen within a week of their injury using clinician-administered NPC and version 1 of the K-D plastic cards and should not be generalized.

A multifaceted assessment to inform clinicians of an athlete’s readiness to return to play (RTP) following sport-related concussion (SRC) includes symptoms, and neurocognitive, vestibular, and ocular function. Athletes must also complete a progressive exertion protocol that systematically increases exercise intensity and sport-specificity. However, ambiguous exercise parameters and reliance on subjective symptom reports limit the current approach and there is a need for a brief, clinical assessment to better inform RTP decisions. A novel dynamic exertion test (EXIT) that incorporates ACSM exercise prescription recommendations to replicate physiological demands from a variety of sport types and provides objective criteria can address these limitations. A comparison of EXIT outcomes between athletes recently cleared to RTP (RTP-A) and matched healthy controls (CON) is warranted to determine the clinical feasibility and interpretation of EXIT. PURPOSE: Compare heart rate (HR), endorsed symptoms, rating of perceived exertion (RPE), and performance outcomes during the completion of a 1) aerobic treadmill protocol, and 2) 15 hand-timed agility tasks between RTP-A and CON groups completing EXIT. METHODS: Twenty-eight (ht.: 171.1±9.0 cm, wt.: 64.1±17.5 kg). Participants wore an Equivital Lifemonitor

Influence Post-concussion Psychological Distress: Active Rehab Study Findings

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(No relevant relationships reported)

understanding how concussion history and contact sport participation influence perceived psychological distress may improve management and provide opportunities for early intervention.

PURPOSE: To examine how prior concussion history and contact sport participation influence college and high school athletes’ change in perceived psychological distress following concussion compared to preseason baseline. METHODS: Student-athletes (n = 2629) from 6 Canadian and US colleges and 8 US high schools completed a concussion baseline assessment including the Brief Symptom Inventory-18 item scale (BSI-18). The same battery was completed by 165 participants that suffered a concussion. The BSI-18 items were summed to create a total score (higher = greater psychological distress). BSI-18 change score (post-injury minus pre-injury) was the primary outcome. Primary predictors were concussion history and contact sport participation. Covariates included age, sex, and participation level (college vs. high school). The association between concussion history, contact sport participation, and BSI-18 change score was examined using linear regression models clustered on study site using generalized estimating equations (a priori α≤0.05).

RESULTS: Analysis included 145 participants with complete predictor, outcome, and covariate data [45 females (30.8%); median age = 18 years (IQR: 18-20); 66 (45.5%) with 1+ prior concussions; 121 (83.4%) played a contact sport]. concussion history, when adjusting for all covariates was not statistically associated with BSI-18 change score (p=0.05). Participants in non-contact sports (6.0±8.0) compared to contact sport participants (2.1±7.4) reported a greater BSI-18 change score (Adjusted Mean Difference: 1.1, 95%CI 0.8, 4.5, p=0.06).

CONCLUSIONS: These data suggest individuals participating in non-contact sports may have greater increases in reported post-concussion psychological distress. These findings highlight psychological distress measures as an important consideration in concussion management. Participants in contact sports may respond to concussion differently than those in non-contact sports. Future research should investigate how this relates to overall quality of life post-concussion.

Supported by a grant from the National Football League

A multivariable regression analysis was conducted to determine which variables were associated with greater BSI-18 change scores. Multivariable regression models were generated using backward stepwise variable selection with an alpha level of 0.20 to remove variables from the model. RESULTS: A multivariable regression analysis was conducted to determine which variables were associated with greater BSI-18 change scores. Multivariable regression models were generated using backward stepwise variable selection with an alpha level of 0.20 to remove variables from the model.

CONCLUSIONS: The BSI-18 change score was positively associated with concussion history (p=0.001), contact sport participation (p=0.001), and the number of prior concussions (p=0.001). Performance outcomes included both attempted and made field goals, three-pointers, and free throws. Additional performance metrics included total points scored, turnovers, rebounds, gamescore and plus/minus scores. Within-subjects performance metrics were computed from 28-days prior to concussion to 28-days after the date of injury. All variables were normalized by scores played per game to reduce variability between bench, rotational, and starting players. To compare differences in player performance measures before and after concussion, we utilized paired t-tests with alpha levels set to 0.05.

RESULTS: Our analyses produced mostly nonsignificant mean differences between groups (p’s=0.05), however, we found a decrease in mean attempted free throws post-concussion (mean difference: -0.37±0.36 free throws, p=0.042). Although the remainder of the performance metrics did not yield significance, a majority of the variables indicated a negative trend post-concussion. CONCLUSIONS: Our

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Supported by a grant from the National Football League

Following a concussion, athletes typically display increased reaction time, compensatory gait mechanics, and altered postural control. Although commonly studied in collegiate athletes, there is a lack in the literature regarding post-concussive effects in the National Basketball Association (NBA), and how they affect player performance outcomes. PURPOSE: The purpose of this study was to determine if NBA player performance statistics were different 28 days post-concussion compared to their pre-concussion metrics. METHODS: NBA player performance statistics were obtained from a public website for thirty-six NBA players (age = 24.22±5.44 years, years in league = 4.08±3.38 years) who sustained a concussion between 2014 and 2018. Players were excluded if they played less than five games pre-injury, or if they did not return to play within four weeks post-concussion. Performance statistics included both attempted and made field goals, three-pointers, and free throws.

Additional performance metrics included total points scored, turnovers, rebounds, gamescore and plus/minus scores. Within-subjects performance metrics were computed from 28-days prior to concussion to 28-days after the date of injury. All variables were normalized by scores played per game to reduce variability between bench, rotational, and starting players. To compare differences in player performance measures before and after concussion, we utilized paired t-tests with alpha levels set to 0.05.

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results suggest player performance is not significantly affected up to 28-days post-
 concussion as compared to their pre-injury measures. Because we chose to compare
 28-days following injury, we position in player performance during the acute phase of recovery. Future analyses will stratify these findings by blocking time into seven day series to determine differences through typical recovery timelines.

**1177 Board #303 May 27 2:30 PM - 4:00 PM Concussion Management Among Speech-Language Pathologists: A Comparative Survey Of Placement And Practices**

Jennifer D. Best, Daniel W. Furnas. Jacksonville University, Jacksonville, FL. (Sponsor: Thomas Best, FACSM)

(No relevant relationships reported)

**PURPOSE:** The goal of this study was to examine the differences between medical and school-based Speech-Language Pathologists (SLP) knowledge, experience, and competence in pediatric concussion.

**METHODS:** A 34-question, anonymous web-based survey was sent to school and medically-based, practicing SLPs in the United States. Portions of the survey were adapted with permission from a preliminary study by Duff and Stuck (2015) which focused on pediatric concussion knowledge of school-based SLPs. The instrument consisted of six broad topics: demographics, concussion knowledge, referral, assessment, treatment, and clinical experience. Participants were recruited in three ways: 1) via posting the on-line message board for the American Speech-Language-Hearing Association; 2) sent to regional SLP associations or 3) via the “snowball” recruitment method. Descriptive statistics were used to analyze the data in SPSS.

**RESULTS:** The survey had 48 responses (46 females and 2 males). OUT OF the respondents, 85% possessed a master’s degree and 15% hold a doctoral degree (PhD or SL PD). Out of the 12 questions regarding concussion knowledge, SLPs had about an 85% correct response rate. Exceptions to this high accuracy were found regarding knowledge of minor concussion symptoms resolving in 14 days and injury to the brain occurring at the instant of contact. SLPs were noted to receive most of their concussion referrals from physicians (25%). 96% of SLPs agreed it was within their scope of practice to provide therapy to a concussed individual. However, 73% of these clinicians have never been involved in the assessment of pediatric concussion cases. In addition, only 50% received TBI education in school.

**CONCLUSIONS:** Concussion is an international public health concern that continues to receive increasing attention. A common theme of the results we reviewed suggests a recent interest in highlighting the value of SLPs in concussion care, although their role is not yet well understood. Results showed that both medical and school-based SLPs who work in concussion care are generally knowledgeable despite the vague guidelines for SLPs in concussion management. In order to further prepare SLPs for their role in concussion care, guidelines need to be developed to consistently incorporate concussion education in SLP graduate programs.

**1178 Board #304 May 27 2:30 PM - 4:00 PM Reliability Of The King-devick Test In Baseline Concussion Evaluations In A Mexican Professional Soccer Team**

Jose A. Garza1, Francisco Garcia Garcia1, Emilfo Frech Lopez1, Jose Mac Donald, FACSM1. Tecnologico de Monterrey, Escuela de Medicina y Ciencias de la Salud, Monterrey, Mexico. 1Ohio State College of Medicine. Nationwide Children's Hospital, Westerville, OH.

(No relevant relationships reported)

There is a need for a reliable and quick method to help screen for concussions in professional soccer. The last 2014 and 2018 FIFA World Cups have demonstrated that concussions during soccer matches pose a challenge for team physicians to diagnose and treat in a timely manner. King Devick (KD) is a rapid sideline screening test used for concussion diagnosis that relies on individual’s baseline measurement.

**Purpose:** To assess the test re-test reliability of the KD test in a cohort of professional soccer athletes. **Methods:** 24 professional soccer players from a Mexican First Division Professional Soccer League (Liga MX) team were evaluated. A baseline KD test as well as a SCAT3 Test was conducted before the 2017 season. The tests were repeated 1 year later as a baseline for 2018 season. 10 players transferred to other clubs after the first year were excluded from data analysis. 14 remaining athletes were included in the analysis. Corrections of year on year KD and SCAT3 measures of individuals were assessed. Statistical analyses were performed with IBM SPSS.

**Results:** Mean KD baseline test time for 2017 (KD1) = 41.71 seconds and for 2018 (KD2) = 41.66 seconds. KD1 and KD2 were strongly and positively correlated (0.93, p value <.0001). 1 player was evaluated for concussion during the season (KD1 = 41.75, KD2 after trauma = 44.25, KD2 = 41.45). 2 players had slowing of KD2 without having history of concussion during the previous year. 1 player with a self-declared learning disability had significantly slower KD time in follow up test (KD1 = 69.45, KD2 = 77s). 2017 and 2018 SCAT3 demonstrated positive and significant correlation for balance scores (0.601, p = 0.023), and delayed recall scores (0.596, p = 0.024).

**Conclusion:** Mean KD baseline test results showed a significant correlation between first and second year evaluations. The high correlation suggests that KD testing has adequate reliability for use as a diagnostic test. Of note, 5 players had slower times despite not having a history of concussion during the previous year. It may not be useful when establishing baseline test results in players with learning disabilities due to the considerable variation from KD1 to KD2 in player we evaluated. Further studies need to be done with professional soccer athletes in order to establish quick and efficient methods of diagnosis and management of concussion.

**1179 Board #305 May 27 2:30 PM - 4:00 PM Documenting The Prevalence Of Symptom Exacerbation Following The Completion Of A Computerized Neurocognitive Testing Battery In Athletes With Concussion**

Katie Stephenson-Brown1, Melissa Womble1, Philip Schatz1, R.J. Elbin1, 1University of Arkansas, Fayetteville, AR. 1Inova Sports Medicine Concussion Program, Fairfax, VA. 1Saint Joseph’s University, Philadelphia, PA. (Sponsor: Brendon McDermott, FACSM)

(No relevant relationships reported)

Symptom exacerbation following computerized neurocognitive testing (CNT) has been documented at the acute and subacute time points after concussion; however, the prevalence and indications of clinically significant symptom exacerbation following CNT is currently unknown.

**PURPOSE:** 1) To document the prevalence of symptom exacerbation following CNT in concussed athletes and 2) explore factors that may predict symptom increases associated with the completion of CNT.

**METHODS:** Two hundred and five concussed athletes (M = 16.48 ± 1.97 years; 47% female) completed a standard clinical visit that included a health and injury history, CNT (The Immediate Post-concussion Assessment and Cognitive Testing: ImPACT), Post-Concussion Symptom Scale (PCSS), and the Vestibular and Ocular-motor Screen (VOMS) within 30 days of injury (M = 7.73 ± 5.54 days). The PCSS was administered immediately before and after CNT, and changes on symptom total were used as outcome scores. To account for normal variation in symptom reporting, minimal clinically important differences (MCID) were calculated from the current sample. Two logistic regressions (LR) were used to explore the association between demographic (age, sex, history of SRC, migraine, anxiety, LD, ADHD) and injury-related factors that included vestibular/ocular motor impairment, symptom burden, time until first clinical visit, and removal from play status on post-CNT symptom exacerbation. Statistical significance was set at p < .05.

**RESULTS:** Approximately 33% (68/205) of concussed athletes exhibited clinically significant increases in total PCSS symptoms after CNT. The LR examining demographic variables and post-CNT symptom exacerbation was not significant (χ²(7, 203) = 2.62, p = .92), however the LR using injury-related predictors was significant (χ²(7, 195) = 17.29, p = .02). More specifically, a significant relationship between the ocular component of the VOMS and symptom exacerbation was revealed (adjusted OR= 0.43, p = .04).

**CONCLUSIONS:** The majority of the sample did not exhibit increased symptoms following CNT; however, the participants that do experience increases in post-concussion symptoms after completing CNT are more likely to have a co-morbid ocular impairment associated with their concussion. Clinicians should examine pre and post CNT symptom scores.

**1180 Board #306 May 27 2:30 PM - 4:00 PM Measuring Changes In Attention Task And Hemodynamic Oxygenation In Post-Concussion Patients Using Functional Near-infrared Spectroscopy**

Allyssa K. Memmimi1, Jessica Kim1, Xiaosu Hu1, Daniel H. Weissman1, Alexander Rogers3, Noelle Herzog1, Sarah Renberg1, McKenzie L. Sobzack1, Ioulia Kovelman1, Steven P. Broglio, FACSM1, 1University of Michigan, Ann Arbor, MI. 1Michigan Emergency Medicine, Ann Arbor, MI. (Sponsor: Steven Broglio, FACSM)

(No relevant relationships reported)

Current concussion assessment protocols rely on clinical functioning and thus may not be sensitive to underlying neural deficits. **PURPOSE:** The purpose of this study was to measure hemodynamic response changes using functional near-infrared spectroscopy (fNIRS) in asymptomatic, post-concussion participants (CON) compared to healthy controls (CTL). **METHODS:** CON participants (n=9, age=18.44±1.51 years, sex=66% female) diagnosed with a concussion at a Midwestern emergency department were recruited from 2018-2019. CTL participants (n=22, age=23.63±4.55 years, sex=54% female) were recruited through electronic postings and classroom announcements. During the first study visit, participants completed a demographics questionnaire, pain
and symptom severity scores, and an attention task. Participants were then fitted for a silicon headband with two INRS diode arrays consisting of eight emitters and ten detectors over each hemisphere’s temporal and frontal cortices, superior and middle temporal regions and the parietal cortex. The computerized behavioral attention task consisted of 144 trials spread over six 24-trial task blocks. Mean accuracy (%) and reaction times (s) were recorded, while the INRS device measured hemoglobin response. After the first visit, participants were monitored daily for symptom resolution, and a second and last visit occurred once symptom count and severity scores reached normative baseline values. Behavioral and neuroimaging INRS data from the attention task were analyzed using independent t-tests, with alpha levels set to \( p < 0.05 \). RESULTS: Once asymptomatic, attention task analyses yielded no significant differences between CON and CTL groups for both mean reaction time (0.003 ± 0.040 s, \( p = 0.953 \)) and accuracy (−0.50 ± 0.40%, \( p = 0.47 \)). Analysis of INRS data indicated hyperactivity in the pre-frontal cortex, temporal lobe and frontotemporal region of the CON group’s left hemisphere compared to the CTL group (\( p < 0.05 \), false discovery rate corrected). CONCLUSIONS: Our results suggest post-concussion participants may require additional cognitive resources during attentional tasks in order to maintain normative vigilance. Researchers should continue to evaluate hemodynamic changes, and how these effects may influence making a safe return to activity decision.

**Board #307 May 27 2:30 PM - 4:00 PM**

**Whole-body reactive agility testing reveals modifiable impairments among elite athletes with sport-related concussion history**

Gary B. Wilkerson1, Dustin C. Nabhan, FACSM2, Tyler S. Perry1. 1University of Tennessee-Chattanooga, Chattanooga, TN. 2United States Olympic Committee, Colorado Springs, CO.

PURPOSE: Assess the potential for training-induced improvement of whole-body reactive agility (WBRA) performance among elite athletes with a history of sport-related concussion (HxSRC).

METHODS: A cohort of 16 elite athletes (25.3 ± 8.8 years; males: 69.0 ± 3.8 cm, 160.7 ± 27.4 kg; females: 63.8 ± 2.0 cm, 144.7 ± 22.7 kg) representing 5 Olympic sports participated in 12 training sessions over 26 ± 9 days. A virtual reality motion analysis system measured whole-body responses to targets presented on the right and left sides of a monitor. A second dual-task (DT) trial simultaneously presented targets on both sides of the monitor, with correct response direction indicated by the center arrow of flanker test displays (<<<<, >>>>, <<><, >><>). Measures of WBRA included total distance of excursion, reaction time, speed, acceleration, and deceleration. Performance in right versus left directions was calculated for the latter 4 measures, as well as an average of asymmetries (Asym). Performance values were combined to create 3 training phases of 4 sessions each. The association of phase 1 measures with HxSRC status was assessed through ROC analysis. Repeated measures ANOVA was used to assess improvement from phase 1 to phase 3.

RESULTS: Self-reported HxSRC at 3.0 ± 2.2 years prior to testing (range: 0.3 - 8.0 years) represented 56% of the cohort (9/16, 5 males, 4 females). Total distance ≥ 27.3 m for DT demonstrated good discrimination between no SRC (NoSRC) and HxSRC cases (AUC = 0.85, \( p = 0.001 \)). Seven of 8 cases (AUC = 0.90, \( p = 0.001 \)) were correctly identified as HxSRC (\( p = 0.05 \)).

CONCLUSIONS: Measures of WBRA may identify subtle impairments in brain network connectivity. The WBRA training appeared to induce a visual-spatial calibration improvement that was greater among HxSRC athletes, which may reduce injury risk.

**Board #308 May 27 2:30 PM - 4:00 PM**

**Between trial reliability of the King Devick test in male high school athletes**

Robert L. Herron1, Brandon D. Spradley1, James P. Toldí2, Dani Ellis3, Chelsea L. Best4, Ashley D. Marass2, Anthony M. Martino2. 1United States Sports Academy, Daphne, AL. 2University of South Alabama, Mobile, AL. 3Encore Rehab, Mobile, AL.

The need for concussion-related safety programs in high-school sports is well recognized. To that end, valid-baseline assessments are compulsory in order for medical staff to identify athletes suspected of having a concussion and best inform appropriate medical-treatment protocols. PURPOSE: To determine the between-trial reliability of the King-Devick Test (KD) as part of a pre-season concussion-safety program in young, male high-school athletes. METHODS: KD baseline score data from high-school, male athletes (n = 377, aged 16 ± 1 years) were recorded on electronic tablets and later analyzed. The testing required participants to complete two, error-free trials, which were reported to the nearest 0.0 s. For both trials, descriptive data were reported, mean differences were examined via paired-samples t-tests, Cohen’s d effect size was considered, and two-way mixed-effects intraclass correlations (ICC) were implemented. RESULTS: The KD test showed strong reliability between trials (Trial 1 = 56.0 ± 15.2; Trial 2 = 53.3 ± 13.8 s; single-measure ICC = 0.93; 95% CI 0.91 - 0.94). Furthermore, similar reliability was observed when KD scores were grouped by Best score and Worst score (Best = 52.8 ± 13.6 s; Worst = 57.6 ± 15.3 s; single-measure ICC = 0.95; 95% CI 0.94 - 0.96). Paired-samples t-test identified small differences between both pairings (Trial 1 vs. Trial 2, \( p = 0.001 \), d = 0.25; Best vs. Worst, \( p < 0.001 \), d = 0.33). Most participants (78%) recorded their Best score on Trial 3. CONCLUSIONS: The KD test showed excellent reliability between trials in this population of young-male athletes. However, additional research is warranted with respect to how many valid baseline attempts are needed to acquire a stable KD score to best support safe-monitoring practices.

**Board #309 May 27 2:30 PM - 4:00 PM**

**Changes in trait anxiety throughout concussion recovery**

Christopher P. Tomczyk, Kyle M. Petit, Morgan Anderson, Aaron J. Zynda, Tracey Covassin. Michigan State University, East Lansing, MI.

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(No relevant relationships reported)

**Board #310 May 27 2:30 PM - 4:00 PM**

**Concussion history’s impact on instrumented bess scores in division i contact-sport athletes**

Theresa L. Miyashita1, Paul Ullicci2. 1Concordia University - Chicago, Chicago, IL. 2Bryant University, Smithfield, RI.

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(No relevant relationships reported)

Trait anxiety is the predisposition to perceive situations as threatening and higher levels lead individuals to frequently experience anxiety. Although concussion recovery is individualized, post-injury anxiety is an indicator of prolonged recovery. Therefore, higher levels of trait anxiety following concussion may alter recovery trajectories by increasing the likelihood of developing post-injury anxiety.

PURPOSE: To examine the level of trait anxiety in concussed athletes throughout recovery compared to healthy controls.

METHODS: Eighty-five high school and college-aged individuals (concussed [Cx]: age = 18.56 ± 2.55 years; healthy controls [HC]: age = 18.10 ± 2.56 years) were enrolled. The State Traint Anxiety Inventory (STAI) measures trait anxiety using a 20-item inventory scored on a 4-point Likert scale (score range: 20-80); where higher scores indicate a greater level of trait anxiety. All concussed participants were administered the STAI within 72 hours of injury (day 0), 5 days post-injury (day 5), and at the time they received full medical clearance (FMC). Healthy controls were tested at similar time points. A 2 x 3 repeated measures analysis of variance was used to compare the level of trait anxiety between each group across recovery. A prior \( p \) value was set at 0.05.

RESULTS: There was no significant group x time interaction (\( F_{2,80} = 1.20, p = 0.31 \)). Although, significant main effects for time (\( F_{2,80} = 29.10, p < 0.001 \), \( \eta^2 = 0.26 \)) and group (\( F_{1,40} = 29.10, p = 0.02, \eta^2 = 0.47 \)) were observed. Specifically, scores decreased across time (day 0: Cx = 38.81 ± 11.77, HC = 32.74 ± 10.04; day 5: Cx = 36.95 ± 11.83, HC = 31.24 ± 10.23; FMC: Cx = 34.65 ± 11.37, HC = 29.98 ± 9.05), and concussed athletes had higher trait anxiety (Cx = 36.81, SE = 1.61; HC = 31.32, SE = 1.63).

CONCLUSIONS: Concussed participants experienced the highest levels of trait anxiety at day 0 and declined as recovery progressed. This indicates that initial post-injury anxiety may be a result of increased trait anxiety. Healthcare professionals should be aware that concussed individuals may be more susceptible to anxiety immediately following injury which could negatively influence recovery outcomes.

Purpose: The purpose of this study was to determine if concussion history has an impact on sway velocity. A concussion injury can disrupt proper functioning of the vestibular system, and chronic disruption of this system can increase the chances of subsequent musculoskeletal or concussive injury. Athletes with a history of concussion injury who present with balance deficits, should be targeted for interventions to decrease the risk of sustaining a musculoskeletal or concussive injury.

Methods: 175 healthy Division I football & men’s lacrosse players (age = 19.8 ± 1.2; ht = 71.9 ± 2.2”; wt = 202.1 ± 33.9 lbs) participated in this study. Players were provided with a brief, 1-on-1, concussion discussion and then answered the questions “have you ever sustained a concussion? If yes, how many?” All players underwent a
balance assessment as part of their preseason screening and were medically cleared to participate in sports. Players performed the BESS test (double leg, single leg, & tandem) on firm & foam surfaces while standing on the VSR Sport™ (force plate by NeuroCom®).

**Results:** No difference was found between those with and without a previous concussion injury on any of the instrumented BESS stances (Table 1). To further analyze the data, a Spearman Rho correlation determined there was a smaller than typical correlation between number of concussions sustained and sway velocity measurements; double leg firm (r = 0.02), single leg firm (r = -0.09), tandem firm (r = -0.08), double leg foam (r = -0.01), single leg foam (r = -0.01), tandem foam (r = -0.02), & composite (r = -0.06).

**Conclusion:** Concussion history does not appear to have an impact on sway velocity measurements in contact sport athletes. The vestibulospinal system may be resilient to long-term deficits associated with concussion injury. In the absence of individualized baseline data, normative data may be used to determine balance deficits in those with a suspected concussion, regardless of previous concussion history.

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**B-80 Free Communication/Poster - Medical Management of the Athlete**

**Wednesday, May 27, 2020, 1:30 PM - 4:00 PM**

**Room:** CC-Exhibit Hall

**1186 Board #312 May 27 2:30 PM - 4:00 PM**

**Division 1 Football Players And Metabolic Syndrome Risk Factors: A Three Year Observational Study**

Wendy E St John Repovich, FACSM, Annika Vahk1, Garth J. Babcock1, Janet Peterson, FACSM, ’Eastern Washington University, Cheney, WA, ’Linfield College, McMinville, OR.

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(No relevant relationships reported)

**Professional football players, especially linemen are at increased risk for early Metabolic Syndrome (MetS) leading to cardiovascular disease and death. There are no longitudinal studies examining MetS to determine if risk factors are present during college and if the risk factors change over time. PURPOSE:** The purpose of this longitudinal study was to follow MetS risk factors in Division 1-FCs players over three years. MetS is defined by the NCEP ATP III standards. METHODS: Players were tested at the fall prior to or on the day of each practice. Of the players tested in the first fall, eight players completed all tests every year of the study. Testing included waist circumference (WC), systolic blood pressure (SBP), diastolic blood pressure (DBP), fasting blood glucose (BG), high density lipoprotein (HDL), and triglycerides (TG). Descriptive statistics and comparisons were analyzed. A repeated measures ANOVA was used to compare the means of each dependent variable across the three years. A Bonferroni correction was used to adjust for multiple comparisons. RESULTS: One participant met the criteria for MetS during all three years with the same risk factors, low HDL, elevated TG and WC. Another participant met the MetS criteria during the second year (low HDL, elevated TG and WC), but not during the first and third years. Both players were offensive linemen. There were no significant differences in SBP, DBP, BG or HDL across the three years. There was a significant difference in TG over time (F (1,122, 7.852) = 6.355, p = .034). Pairwise comparisons indicated a significant difference between year one-two, one-three, and two-three (p = .001, p = .001, p = .05; respectively). CONCLUSIONS: These findings suggest that nonskilled football positions have a higher incidence of MetS risk factors. Additionally, TG varied across the three years, indicating that nutrition may be a primary influencing factor as players maintain fitness training year-round. A primary limitation of this study was the small sample size based on players completing testing all three years. Pre-season evaluation for early detection of MetS with follow up for early intervention is recommended.

Further research should explore the nutrition practices of collegiate football players.

**1187 Board #313 May 27 2:30 PM - 4:00 PM**

**EVALUATION OF BIOMARKERS OF MUSCLE DAMAGE AND BONE FORMATION IN BALLET DANCERS DURING THE NUTCRACKER**

Lawrence W. Judge1, David M. Bellar, FACSM, ’Ball State University, Muncie, IN, ’University of North Carolina at Charlotte, Charlotte, NC.

Email: lwjudge@hotmail.com

(No relevant relationships reported)

There is evidence that rehearsals and performances among ballet dancers induce physiological stress. However, few studies have attempted to quantify muscle damage or changes in bone metabolism. PURPOSE: The present study was a cross-sectional examination of changes in biomarkers of muscle damage and activity of osteoblasts from the beginning of dress rehearsal to the final performance during the Nutcracker season. METHODS: Professional and amateur male and female dancers, ages six and up, were recruited from two ballet companies that participated in the Nutcracker series. The cohorts were divided into three age groups: 6-12yrs (n=6), 13-18yrs (adolescents n=7), >18yrs (adults n=24). Blood draws were performed in the morning prior to the beginning of rehearsals and the day after the last performance. Blood samples were analyzed for creatine kinase MM isoform (CKM) and bone-specific alkaline phosphatase (BAP). Individuals with pre-existing medical conditions (i.e. juvenile idiopathic arthritis) and non-dance participants were excluded from this study. RESULTS: CKM significantly increased (t=3.2, p=0.001) from baseline to post performance (P = 34.3 U/L ± 5.5, Post: 39.0 U/L ± 8.1). When examined by age group, both the adolescents (t=2.99, p=0.024) and adults (t=2.55, p=0.018) showed significant elevations, however no differences were noted in the youngest performers. No differences were noted in (BAP) concentrations across all groups (t=1.0, p=0.318). However, a trend in the data was noted in the youngest performers (t=2.17, p=0.08) with decreased concentrations post performance (P = 3.81 mg/ml ± 2.2, Post: 2.02 mg/ml ± 1.3). CONCLUSIONS: The data from the study demonstrate an increase in

**to use NSAIDs (over use: χ² = 34.0, p<0.001; substantial overuse: χ² = 28.2, p<0.001) and use them out of season (over use: χ² = 24.4, p<0.001; substantial overuse: χ² = 21.4, p<0.001) as compared to non-overuse and non-substantial overuse injured athletes.**

**CONCLUSION:** NSAID use is high and the majority of athletes purchase their own NSAIDs, instead of receiving them from a medical professional. Injured athletes are more likely to use NSAIDs both in and out of season. Sports medicine professionals need to monitor NSAID use and abuse in order to mitigate potential NSAID-related negative health impacts.
Three-dimensional (3D) infrared scanners, which estimate body composition via measurements of circumference, are gaining popularity. Since participants rotate 360° on a scale in front of a full-length mirror, visual changes in body shape are quickly assessed while numerical values are generated. PURPOSE: The aim of this study is to compare total body fat percentage (BF%) in participants using both the 3D-infrared and dual energy x-ray absorptiometry (DXA) scanner. METHOD: Non-pregnant individuals were invited to participate in total body composition measurements using both the 3D-infrared and DXA scanners within the laboratory. Participants wore the same compression clothing and scanned within 30 minutes of each other. After height and weight were obtained, a whole body DXA scan was performed and analyzed by trained technicians. For the 3D-infrared scan, participants stood on a rotating scale in a standardized position in front of a full-length mirror. Data are expressed as mean±SD, with significance set at p<0.05. RESULTS: Seventy participants (4 females; age=21±5 years; weight=96±21kg; height=1.80±0.07m) successfully completed both scans, in a randomized order. Significant difference was noted between the DXA vs. 3D-infrared scans in BF% (23.7±5.1 vs. 19.5±1.6, p<0.0001). A significant positive correlation was noted between the DXA versus 3D-infrared scan for BF% (r=0.93;p<0.0001). However, the slope of the regression line was not in the same compression clothing and scanned within 30 minutes of each other. After height and weight were obtained, a whole body DXA scan was performed and analyzed by trained technicians. For the 3D-infrared scan, participants stood on a rotating scale in a standardized position in front of a full-length mirror. Data are expressed as mean±SD, with significance set at p<0.05. RESULTS: Seventy participants (4 females; age=21±5 years; weight=96±21kg; height=1.80±0.07m) successfully completed both scans, in a randomized order. Significant difference was noted between the DXA vs. 3D-infrared scans in BF% (23.7±5.1 vs. 19.5±1.6, p<0.0001). A significant positive correlation was noted between the DXA versus 3D-infrared scan for BF% (r=0.93;p<0.0001). However, the slope of the regression line was not in alignment with the line of identity, with the 3D-infrared scanner underestimating BF% at low levels (<30%) while overestimating BF% at high levels of BF%. The mean difference (Bland-Altman) was 4.2±%, with the limits of agreement (LOA) between -4.3% to 12.7%. CONCLUSION: Although the correlation between the 3D-infrared versus DXA scan for BF% was high (87% of variance), the underestimation of BF% -4.3% to 12.7%.

Three-dimensional (3D) infrared scanners, which estimate body composition via measurements of circumference, are gaining popularity. Since participants rotate 360° on a scale in front of a full-length mirror, visual changes in body shape are quickly assessed while numerical values are generated. PURPOSE: The aim of this study is to compare total body fat percentage (BF%) in participants using both the 3D-infrared and dual energy x-ray absorptiometry (DXA) scanner. METHOD: Non-pregnant individuals were invited to participate in total body composition measurements using both the 3D-infrared and DXA scanners within the laboratory. Participants wore the same compression clothing and scanned within 30 minutes of each other. After height and weight were obtained, a whole body DXA scan was performed and analyzed by trained technicians. For the 3D-infrared scan, participants stood on a rotating scale in a standardized position in front of a full-length mirror. Data are expressed as mean±SD, with significance set at p<0.05. RESULTS: Seventy participants (4 females; age=21±5 years; weight=96±21kg; height=1.80±0.07m) successfully completed both scans, in a randomized order. Significant difference was noted between the DXA vs. 3D-infrared scans in BF% (23.7±5.1 vs. 19.5±1.6, p<0.0001). A significant positive correlation was noted between the DXA versus 3D-infrared scan for BF% (r=0.93;p<0.0001). However, the slope of the regression line was not in alignment with the line of identity, with the 3D-infrared scanner underestimating BF% at low levels (<30%) while overestimating BF% at high levels of BF%. The mean difference (Bland-Altman) was 4.2±%, with the limits of agreement (LOA) between -4.3% to 12.7%. CONCLUSION: Although the correlation between the 3D-infrared versus DXA scan for BF% was high (87% of variance), the underestimation of BF% -4.3% to 12.7%.

Eucapnic voluntary hyperventilation (EVH) challenges can provide objective evidence to support the diagnosis and long term management of athletes exercise-induced-bronchoconstriction (EIB). However, the repeatability of the EVH challenge has been questioned. PURPOSE: To investigate the use of EVH challenges to objectively monitor the long-term management of elite swimmers with EIB. METHODS: Twenty-seven elite international swimmers (14 males, 13 females; 20±2yrs) completed EVH challenges, separated by a calendar year. Following initial assessment, EIB positive athletes were prescribed appropriate inhaler therapy in accordance to greatest fall in FEV1max (FEV1max) and asked to maintain therapy throughout the year. Athletes were grouped depending on adherence to inhaler therapy (Non-adherent = EVH1>EVH2 n=15; adherent = EVH1≤EVH2 n=12). Differences between screening visits were analysed using paired sample t-tests and presented as mean ± SD. The test-retest repeatability between EVH1 and EVH2 was expressed as mean bias with 95% limits of agreement (LOA) and Pearson’s correlation coefficient (r). RESULTS: FEV1max was significantly lower in EVH2 than EVH1 (p<0.001). Baseline FEV1max was greater in EVH1 than EVH2 (p=0.04). EVH1<EVH2 did not differ significantly between screening visits (EVH1: 13.1±1.3 vs EVH2: 12.3±5.6; p=0.32). There was agreement between FEV1max in EVH1<EVH2 (mean bias 0.6%; 95% LOA = −5.9; 7.1); and significant strong positive correlation (r=0.833, p<0.001). CONCLUSION: Elite swimmers with EIB adherent to inhaler therapy increased baseline FEV1max, and reduced FEV1 max post-EVH. The EVH challenge demonstrated acceptable long-term test-retest repeatability in elite swimmers. EVH challenge is clinically useful to assess elite swimmers for EIB, and as a follow-up assessment to evaluate the effectiveness of inhaler therapy.

access to these biometric and dietetic resources, respectively. Western cross-country athletes (p = 0.0276) had the highest access to sport psychologists (50%); lowest access was in the Midwest (20%). CONCLUSIONS: Triad awareness and geographic resource disparities exist: Western coaches have a higher level of Triad awareness and superior access to psychological counseling, whereas; the South and Midwest had the lowest, respectively. Greater uniform access to resources amongst NCAA schools, regardless of geographic region, may positively impact Triad prevalence and outcomes.
In 2017, the Center for Disease Control reported 2.3 million new cases of sexually transmitted diseases in the United States. Specifically, in sports medicine, collegiate student-athletes (SA) are considered an at-risk population due to the risk-taking behaviors associated with athletics.

**Purpose:** To describe birth control (BC) methods used by female and male collegiate SA.

**Methods:** As part of a larger 5-year study, collegiate SA (n=862; females: n=552; males: n=310; 17-23 years old) from a NCAA Division I institution completed a web-based survey containing a 30-item tool exploring sexual health behaviors. Partial data was used for all descriptive analyses.

**Results:** Over half (n=314, 57.4%) of females reported currently taking oral contraceptives or female hormones prescribed mostly for irregular menses (n=78, 14.3%) or pregnancy control (n=106, 12.3%). Participants reported having vaginal (females=172, 36.8%; males=143, 59.1%), oral (females=191, 40.2%; males=155, 63.3%), and anal (females=17, 2.7%; males=6, 2.7%) intercourse in the past 30 days. Interestingly, many participants reported never using condoms or other protective barriers during oral (n=490, 82.1%) or anal (n=376, 78.3%) sex; however, 33.3% of participants (n=203) stated they always used protection for vaginal intercourse. When exploring their most recent sexual encounter, 60.2% (n=429) of participants reported using a form of BC to prevent pregnancy. The most frequent types of BC included oral contraceptive pills (n=345), male condom (n=327), and “pull out” (n=125). Finally, 10.7% (n=77) of participants reported using emergency contraceptives. Despite the lack of consistent BC use, only 2 individuals reported a pregnancy in the last 12 months, both unintentionally.

**Conclusion:** Participants reported using oral contraception to prevent pregnancy, but used it mainly for menstrual dysfunctions. Female SA should be educated on all BC options as it can affect sport performance. While many of the participants are engaging in sexual activity, the use of protective barrier is less for oral and anal intercourse which could be due to sexual education in the United States. However, the infrequent use of protective barriers, regardless of intercourse type, does pose a threat to a SA health for sexually transmitted infections.

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**1192 Board #318 May 27 2:30 PM - 4:00 PM Sexual Behaviors And Birth Control Use In Collegiate Student-athletes**

Madison Hauge, Zachary K. Winkelmann, Nancy A. Uriegas, Toni M. Torres-McGhee. University of South Carolina, Columbia, SC. Email: mhauge@email.sc.edu

(No relevant relationships reported)

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**1193 Board #319 May 27 2:30 PM - 4:00 PM Sleep Problems As A Predictor Of Gastrointestinal Symptoms During Endurance Competition**

Patrick Wilson. Old Dominion University, NORFOLK, VA. Email: pbwilson@odu.edu

(No relevant relationships reported)

**Purpose:** Gastrointestinal (GI) disorders like irritable bowel syndrome and functional dyspepsia are more common in people with sleep problems. No research, however, has examined the relationships between sleep problems and GI disturbances in endurance athletes, particularly symptoms that occur during competition.

**Methods:** Within 24 hours of finishing an endurance race (minimum of 1-hour duration), 73 participants (27 men, 46 women; 17-23 years old) completed the Medical Outcomes Study Sleep Scale (MOSSS) and reported the amount of time (min) slept the night before the race. In addition, participants reported the severity (0-10 scale) of four upper (nausea, regurgitation/reflux, fullness, bloating) and three lower (abdominal cramps, flatulence, urge to defecate) GI symptoms experienced during the race. Individual symptom scores were added together to obtain overall, upper, and lower GI symptom scores. Spearman’s rank-order correlations were used to examine whether scores on female’s Problems Index (SP-I) of the MOSSS was associated with GI symptom scores. Partial correlations were also calculated to control for age, gender, body mass index, race duration, and trait anxiety levels.

**Results:** There were significant correlations between scores on the SPI-I and total GI symptom scores (rho = 0.24, p = 0.045) as well as upper GI symptom scores (rho = 0.30, p = 0.013). Lower GI symptoms were not significantly correlated with SPI-I scores (rho = 0.14, p = 0.135). Only the correlation between upper GI symptoms and SPI-I scores remained significant (rho = 0.24, p = 0.049) after controlling for age, gender, body mass index, race duration, and trait anxiety levels. Sleep duration from the night before the race was not significantly correlated with any of the GI-symptom variables.

**Conclusions:** These results suggest that chronic sleep problems, but not acute pre-event sleep duration, is modestly associated with the severity of upper GI symptoms during endurance races.

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**1194 Board #320 May 27 2:30 PM - 4:00 PM Association Between Sleep Complaints And Musculoskeletal Injuries In Adolescent Athletes**

Andressa Silva, Marina Costa Pinto, Samuel Silva, Fernanda Viegas, Luisa Freitas, Marco Tulio Mello. Federal University of Minas Gerais, Belo Horizonte, Brazil. Email: silvadressa@gmail.com

(No relevant relationships reported)
PURPOSE: To investigate the influence of aerobic exercise in rats with polycystic ovary syndrome (PCOS).

METHODS: 32 23-day-old SD female rats were randomly assigned into 4 groups, i.e. normal control group (NC, n=8), exercise control group (EC, n=8), PCOS control group (PC, n=8) and PCOS exercise group (PE, n=8). PC group and PE group were modeled by injecting DHEA. EC group and PE group simultaneously implemented Masashi exercise intervention (unloaded free swimming, 20 min/time, 6 days for each group). Measure the serum testosterone (T), estradiol (E2) and the P450arom expression in ovarian tissue of the rats. There were obvious cystic dilated follicles in the ovarian tissue of the PC group, and compared with the, there are many normal follicles in the ovary of the PE group. The PC group exhibited a higher serum level of FSH, T, E2, and the P450arom expression in ovarian (P < 0.05). Compare with the PC group, the serum level of LP, T, E2 were decreased in the PE group (P > 0.05). However, compared with the NC group, the EC group showed no difference in the level of serum level of FSH, T, E2, and the P450arom expression in ovarian (P > 0.05). Besides, the PE and PC group showed no difference in the serum level of FSH and the P450arom expression in ovarian (P > 0.05). The serum LP level in rats was positively correlated with T (r=0.893), E2 (r=0.612), FSH (r=0.620) level and the P450arom expression (r=0.581) in ovarian tissue.

CONCLUSION: Aerobic exercise can reduce the levels of PCOS rats, relieve leptin resistance, alleviate estrogen hypersecretion, and normalize the serum levels of PCOS rats, but cannot eliminate the sex hormone disorder.

The Changes of T, FSH, E2, and OD among 4 groups(x±SD)

<table>
<thead>
<tr>
<th>Group</th>
<th>Sample</th>
<th>FSH (mIU/ml)</th>
<th>T (pg/ml)</th>
<th>E2 (pmol/l)</th>
<th>LP (ng/ml)</th>
<th>OD</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC</td>
<td>8</td>
<td>2.34±0.421</td>
<td>26.507±0.856</td>
<td>4.414±0.234</td>
<td>2.239±0.069</td>
<td>0.812±0.003</td>
</tr>
<tr>
<td>EC</td>
<td>8</td>
<td>3.11±0.272</td>
<td>25.829±0.823</td>
<td>4.603±0.421</td>
<td>1.911±0.005</td>
<td>0.182±0.0073</td>
</tr>
<tr>
<td>PC</td>
<td>8</td>
<td>4.25±0.591</td>
<td>31.549±1.475</td>
<td>5.582±0.789</td>
<td>3.446±0.639</td>
<td>0.192±0.0090</td>
</tr>
<tr>
<td>PE</td>
<td>8</td>
<td>4.05±0.085</td>
<td>29.462±0.894</td>
<td>4.899±0.489</td>
<td>2.474±0.002</td>
<td>0.186±0.0074</td>
</tr>
</tbody>
</table>

*P < 0.05, compared to NC; #P < 0.05, compared to PC

Purpose: The purpose of this study was to quantify self-reported current sleep habits in a range of athletes, and to compare these with self-reported ideal sleep habits. In addition, to determine any differences in sleep duration and sleep quality, depending on the sport type and competitive level.

METHODS: 313 athletes (243 males, 70 females; age 27 ± 8 y), competing in a variety of sports and competitive levels (recreational to elite), completed the Pittsburgh Sleep Quality Index (PSQI), and a questionnaire which assessed current and ideal sleep habits. Sleep quality was calculated using the PSQI global score, with a score of ≥ 5 indicative of poor sleep quality. A paired t-test was used to compare current and ideal sleep duration (p< 0.001, 95% CI (-2.0, -1.7 h). Sleep duration differed between sport types, with runners sleeping significantly less than basketball, soccer and rugby players (p< 0.05). Furthermore, recreational athletes slept significantly less (7 h 08 min ± 54 min) than competitive (7 h 32 min ± 1 h), national (7 h 50 min ± 1 h) and elite level athletes (7 h 49 min ± 51 min). At all competitive levels and sport types, ideal sleep duration was significantly greater than current sleep duration (p< 0.001). No differences in sleep quality were found between athletes competing at different levels or sport.

CONCLUSIONS: Half of the athletes failed to achieve 8 hours of sleep per night. Runners appear to sleep less than team sports athletes. Recreational athletes sleep less than athletes who compete at higher levels however, sleep quality does not seem to be compromised. Regardless of competitive level and sport type all athletes reported a higher ideal sleep duration compared to current duration.

Exercise is Medicine - On Campus (EIM-OC) was created in 2009. Over the last 10 years, the number of registered schools has risen to 267. At the Annual Meeting in 2019, there were 139 schools recognized for the work they performed on their campus. Purpose: In an effort to determine the scope of EIM-OC grant and research projects, the EIM-OC committee members have undertaken a meta-analysis and systematic review of the EIM-OC literature. Methods: Data was collected using multiple methodologies to ensure a complete capture of the work in this area. This included an email to EIM-OC registered schools to request publication, poster, and oral presentations titles, dates, and authors. As well as request to ACSM journal and meeting coordinators to review published and unpublished abstracts. Members of the writing team performed independent literature searches across 10 databases using defined keywords (“Exercise is Medicine” or EIM and campus* OR University* OR college* OR academy* OR institution* OR institution* OR department* OR school*). Search results returned 772 articles. Two members then reviewed all abstracts to ensure it contained information on methods, program analysis, or outcome data related to EIM-OC. The bibliography of each of the included manuscripts and posters was reviewed to capture articles not found in the original search. Results: To date, no article of this type has been published in the area of EIM-OC even though EIM-OC is one of the most robust EIM-OC program initiatives. This important research will document what has been done in this area and highlight gaps in the literature. Conclusion: The data collected will be used by EIM Staff, Committee Members, and Registered Schools to obtain internal and external research support. Schools looking to develop EIM-OC programs will also benefit from this research.
Training(RTC) classes for employees took place in September and October 2019 respectively. Participants for the CTC were 15 females (average age 43.80 ± 10.51) for the RTC. The EIM-OC provided PHC which involved a group of Health Mentors providing education & support to students looking to improve health behaviors. Participants were 7 males & 11 females (average age 21.61 ± 4.54). The EIM-OC Run Walk and Roll Club(RWRC) provided an opportunity to be physically active in a group atmosphere. The team provided free Otter Sports Center orientations, yoga & resistance training classes during October’s EIM-OC Week.

RESULTS The inaugural semester of EIM-OC was successful in launching these programs for CSUMB. The launch gained support in the form of social media following via Instagram and participation from University employees & students in the programs. The program encountered challenges including the retention of students in the PHC and gaining participation/interest from the campus during the EIM-OC week.

CONCLUSIONS The most successful part of EIM-OC at CSUMB were the employee exercise programs & will continue to be a major part of EIM-OC. Marketing of the RWRC & other events could be stronger to gain more participation. Strategies to improve retention for the PHC program are necessary. Based on recommendations, an afternoon RWRC will be added in the future. Overall, the first semester of EIM-OC at CSUMB was successful in making PA a part of the campus culture. Improving the programmatic efforts & troubleshooting challenges encountered, will ensure a sustainable EIM-OC program on campus.

Board #328 May 27 1:30 PM - 3:00 PM Exercise Is Medicine On Campus: Employee Circuit Training Course Increases Physical Activity
Maximilian Gastelum-Morales, Lisa J. Leininger, Joanna L. Morrissey, Nickolas Rahawi, Aaron Espitia Gonzalez, Kent J. Adams, FACSM. California State University, Monterey Bay, Seaside, CA.
Email: mgastelum-morales@csumb.edu

PURPOSE: Exercise Is Medicine On Campus (EIM-OC) is a global health initiative with over 200 participating college campuses. EIM-OC was implemented at California State University, Monterey Bay in Fall 2019, with offerings for both students and employees. Employee programming included exercise classes, including a four week circuit training course. The purpose of this pilot study was to evaluate physical activity participation among employees participating in the EIM-OC circuit training course.

METHODS: The research design was pre-post and tracked participants in the EIM-OC circuit training course. Twelve female employees who were participating in the class volunteered for the study. The Godin Leisure Time Physical Activity Questionnaire was administered online before and after the course. Paired sample t-tests were performed on Godin Scale Score, and number of strenuous, moderate, and light intensity activity days per week. Significance was set at α = 0.05.

RESULTS: There was a significant increase (t=1.787, df=11, p<0.05) in Godin Scale Score following the course (M=38.50±16.9; M=49.17±23.95). There was a significant increase in moderate activity physical days per week (t=2.419, df=11, p<0.02) following the course (M=2.5±1.17; M=3.3±1.30). There were increases in strenuous physical activity days per week and light physical activity days per week, although they were not statistically significant.

CONCLUSIONS: The inaugural EIM-OC circuit training class was effective in increasing physical activity among female employees. Future EIM-OC programs should work to expand their offerings to increase participation among employees, especially those who are inactive. Larger and longer studies could also be helpful to the growing body of knowledge on the EIM-OC initiative.

Board #329 May 27 1:30 PM - 3:00 PM Exercise Is Medicine® On Campus:evaluating Self-efficacy Levels Through An Employee Circuit Training Course
Nickolas Saade Rahawi1, Joanna L. Morrissey2, Lisa J. Leininger3, Kent J. Adams, FACSM2, Maximilian Gastelum-Morales2, Aaron Espitia-Gonzales2. 1California State University, Monterey Bay, Marina, CA. 2California State University, Monterey Bay, Seaside, CA. (Sponsor: Kent J. Adams, FACSM)
Email: nrhawi@csumb.edu

(Purpose) Exercise is Medicine® On Campus (EIM-OC) aims to establish physical activity(PA) as a vital sign & integrate PA into the lifestyle of university campuses. The EIM-OC initiative was launched at Cal State University, Monterey Bay(CSUMB) in Fall 2019 with the goal of integrating PA into the campus lifestyle. EIM-OC at CSUMB aimed to achieve this by providing exercise classes for employees & offering peer health consultation for students. The purpose of this project is to discuss the implementation of EIM-OC & identify the successes & challenges.

METHODS: The launch of EIM-OC at CSUMB included exercise classes, student PHC program & additional campus events. Circuit Training(CTC) and Resistance
METHODS: The research design was pre-post and tracked participants in the four week EIM-OC circuit training course. Fifteen female employees who participated in the circuit training course were monitored for the exercise (SEE) scale was administered online through an intake form before and after the employee circuit training course. A dependent t-test was performed to test for differences in exercise self-efficacy pre and post participation in the circuit training course. Significance was set at α = 0.05. We hypothesized to see significant improvements in exercise self-efficacy among participants. RESULTS: Average age was 43.8 ± 2.66 years, 93.3% of the participants were University staff. There was a significant increase (t = -2.87, df=11, p < 0.008) in self-efficacy for exercise score (M = 52.33±20.63; M=62.75±17.34) following the EIM-OC circuit training class. CONCLUSIONS: The inaugural EIM-OC circuit training class was effective in increasing exercise self-efficacy among participants. University employees felt more efficacious about exercising after the four week circuit training course. Larger and longer studies could be conducted to better understand how and why participation in a campus offered circuit training course influences participants’ self-efficacy to continue exercising if participants continue to exercise independent of the course offering. Evaluating exercise self-efficacy in EIM-OC exercise related programs could provide valuable insight into the adherence to and maintenance of exercise in University employees.

METHODS: This is a sub-study of the Exercise is Medicine initiative on the University of Arkansas campus in an effort to track PA and its association with health, student success, and work satisfaction. Twenty-nine faculty and staff members (47.3 years ± 12.6) walked for 150 minutes per week for 4 weeks. The virtual group (n=16) used a fitness tracker to log PA and virtual messaging for group interaction. Research staff provided little facilitation of virtual group interaction. The in-person group (n=13) met 5 days per week, walked for 30 minutes, and was encouraged to perform walking tasks around the office and lunch breaks. A research aide led each with in-person facilitated conversation. RESULTS: Three participants were excluded due to missing data. At baseline, BMI for males (n=5) was 28.9 ± 3.7 and 31.5 ± 8.1 for females (n=21), 50% of participants were classified as obese. The average aerobic capacity (VO2 max) of males was 28.5 ± 6.1 ml/kg/min, and average VO2 max of females was 24.2 ± 6.9 ml/kg/min. On average, virtual participants walked 177 ± 46.7 (range 101.4 to 267.3) minutes per week, 37.5% of participants met recommendations all 4 weeks. In-person participants attended an average of 82% (range 60 to 100%) of walking sessions. A paired t-test showed VO2 max of participants significantly improved (p = 0.035) after intervention. Participants reported high satisfaction with the program. CONCLUSIONS: Both walking groups were feasible and acceptable among university faculty and staff, and aerobic fitness improved. Future research should assess long-term effects of PA interventions on all components of fitness of faculty and staff.

PURPOSE: The purpose of this study is to assess medical student knowledge of the 2008 Health People Federal Physical Activity Guidelines. METHODS: 254 Medical Students completed a voluntary survey assessing knowledge of the 2008 Healthy People Federal Physical Activity Guidelines. RESULTS: Of the 254 respondents, 38% of respondents correctly knew the adult aerobic PA guidelines, 72.44% correctly identified the adult muscle strength PA guidelines, 31.10% correctly identified guidelines for pediatric aerobic PA guidelines, 55.12% correctly identified the pediatric muscle and bone strength PA guidelines and 24.89% of respondents correctly identified a form of vigorous physical activity among the list of moderate physical activities. Of the 254 survey respondents, 201 gave examples of how they incorporate physical activity into their lives, 26.5% of the responses included solely exercise examples. Walking to work/class was the most common non-exercise response. CONCLUSIONS: Medical student knowledge of federal physical activity guidelines and the difference between physical activity and exercise is lacking. More emphasis on PA guidelines in medical education curriculum could enhance medical student knowledge and ultimately influence future patient education, health and wellness.

METHODS: The inaugural EIM-OC circuit training class was effective in increasing exercise self-efficacy in college students. Little examination of cardiometabolic risk in college students has occurred; the number of studies exploring the influences of aerobic fitness and percent body fat on this topic are fewer still. PURPOSE: The purpose of this study was to determine the impact of aerobic fitness and obesity status on cardiometabolic risk in college students separately by gender. METHODS: Undergraduate students (n=5,986) completed an assessment battery which included an estimate of cardiorespiratory fitness (VO2max), BMI, aerobic fitness and obesity status on cardiometabolic risk in college students separately by gender. RESULTS: Of the 254 respondents, 38% of respondents correctly knew the adult aerobic PA guidelines, 72.44% correctly identified the adult muscle strength PA guidelines, 31.10% correctly identified guidelines for pediatric aerobic PA guidelines, 55.12% correctly identified the pediatric muscle and bone strength PA guidelines and 24.89% of respondents correctly identified a form of vigorous physical activity among the list of moderate physical activities. Of the 254 survey respondents, 201 gave examples of how they incorporate physical activity into their lives, 26.5% of the responses included solely exercise examples. Walking to work/class was the most common non-exercise response. CONCLUSIONS: Medical student knowledge of federal physical activity guidelines and the difference between physical activity and exercise is lacking. More emphasis on PA guidelines in medical education curriculum could enhance medical student knowledge and ultimately influence future patient education, health and wellness.

PURPOSE: The purpose of this study was to assess medical student knowledge of the 2008 Health People Federal Physical Activity Guidelines. METHODS: 254 Medical Students completed a voluntary survey assessing knowledge of the 2008 Healthy People Federal Physical Activity Guidelines. RESULTS: Of the 254 respondents, 38% of respondents correctly knew the adult aerobic PA guidelines, 72.44% correctly identified the adult muscle strength PA guidelines, 31.10% correctly identified guidelines for pediatric aerobic PA guidelines, 55.12% correctly identified the pediatric muscle and bone strength PA guidelines and 24.89% of respondents correctly identified a form of vigorous physical activity among the list of moderate physical activities. Of the 254 survey respondents, 201 gave examples of how they incorporate physical activity into their lives, 26.5% of the responses included solely exercise examples. Walking to work/class was the most common non-exercise response. CONCLUSIONS: Medical student knowledge of federal physical activity guidelines and the difference between physical activity and exercise is lacking. More emphasis on PA guidelines in medical education curriculum could enhance medical student knowledge and ultimately influence future patient education, health and wellness.

Methods of educating healthcare professionals on the principles of “Exercise is Medicine” (EIM) is challenging. Seminars are an efficient means of educating students about EIM. However, their effectiveness in translating EIM to clinical practice is unknown. PURPOSE: This present study assessed the effectiveness of an EIM educational seminar on improving knowledge and attitudes about prescribing exercise of student Physician Assistants. A secondary purpose was to compare the use of EIM between graduates who received EIM seminars with graduates who have not received training. METHODS: Second year Physician Assistant students from the classes of 2017-2019 were given a 45-minute EIM seminar focusing on the evidence for the prevention and treatment for chronic diseases as well as exercise prescription based off the FITT Principle. A pre- and post-survey was administered to evaluate the effectiveness of the seminar. To evaluate the translation to clinical practice, an email survey was sent to the classes of 2017-2019, who received EIM seminars, and the classes of 2014-2016, who did not. RESULTS: There was a 27% increase in the number of students that believed exercise is a part of their daily career. Following the EIM seminar, there was a 32% increase in student’s confidence to prescribe exercise. Additionally, their ability to correctly prescribe exercise increased by 31% when evaluated with a case study. With respect to the follow-up of clinicians, only 64% of the respondents asked about their patient’s physical activity habits (vital sign) with no difference between groups. While all respondents felt that physical activity can...
and champions to engage, advocate and help implement PA best practices.

CONCLUSION: Together, the qualitative and quantitative results begin to facilitate a strategic plan to improve the implementation of PA best practices. It is important for good health across the lifespan, the following key elements are needed: 1) rigorous training in exercise science at the medical school and residency level; 2) effective tools to assess and discuss PA as well as implement and follow up adherence to PA prescription; 3) further, these tools must be inexpensive, minimally burdensome and conform to the time constraints faced by busy pediatricians.

Purpose: The purpose of this study was to determine which factors were associated with increased weekly moderate to vigorous physical activity (MVPA) measured by Exercise Vital Sign (EVS) questions. Methods: Patients presenting to a sports medicine clinic between the ages of 5-18 were asked “On average, how many days per week did you participate in MVPA?” and “On average, how many minutes per day did you participate in MVPA?” Weekly physical activity, age, sex, BMI percentile, asthma, ADHD, depression and diabetes were recorded. A linear regression analysis was utilized in those who reported any physical activity to determine which factors were associated with increased MVPA. Results: Data were recorded on 14,440 subjects. Average age was 13.91±2.49 years and average BMI percentile was 65.50±27.74 percent. Females made up 54.1%. Asthma was reported by 2340 (16.2%), ADHD was reported by 818 (5.7%), depression was reported by 308 (2.1%), and diabetes was reported by 92 (0.6%). Overall, 45.6% of subjects reported 420 minutes or more of weekly MVPA. Those who reported any physical activity (n=13,708) averaged 242.14±287.45 minutes per week of MVPA. Those with a history of depression had almost 60 minutes/week less MVPA when controlling for age, sex, BMI percentile, asthma, ADHD, depression, and diabetes (p<.001). Discussion: Physical activity is an important health determinant in children’s current and future health. The majority of youth do not meet current physical activity recommendations. Children suffering from depression should be screened for MVPA to encourage meeting physical activity activity recommendations. As females continue to obtain significantly less MVPA than males, targeted interventions need to be developed for this population. Regular screenings of MVPA levels should be implemented for children to help identifying and counsel those who are insufficiently active.

**Purpose:** The study aims at unveiling key influential factors of the EIM in China and investigating the relationship among the factors through employing Interpretative Structural Model (ISM). METHODS: Twelve semi-structured interviews were conducted with experts (male, 3; female) with medical, sport and government background. Matrix questionnaires were also completed by the interviewees. Data Analysis:1) Interpretative Structural Model (ISM) was designed following a consultation process with expert group, and key factors were selected to construct adjacency matrix A=[a_{ij}], SR(S indicates S and related); A=[a_{ij}], S'R(S indicates S and related). 2) Calculate the reachability matrix by using Hood Calculation ,L=S'R(S indicates S and related) and then delete rows and columns corresponding to elements in L, the reachability matrix is obtained; 4) Establish multi-level directed graph and analysis SIM.RESULTS: The first level contains R(S',S;A,S;A,S;A,S;A,S;A,S;A,S;A,S;A,S;A,S), the second level is {S',S,S,S}, the third level is {S,S,S,S,S}. These factors of Exercise is Medicine can be divided into three layers by ISM analysis, including the surface factors, the middle factors and the decisive factors. CONCLUSIONS: As decisive factors, the policy system and economic environment, which are the significantly influential to the policy related to EIM, could be regarded as important contextual factors for the design
In the past decades the urbanization of the Lao people has been dramatic. All-cause mortality is shifting to chronic diseases. Social changes have exacerbated the challenges of caring for a growing elderly population. Little is known about the health, quality of life, physical activity, and fall risk of this population.

METHODS: Eight volunteers from the RDA were trained and solicited elders to be surveyed in Vientiane province (Demographic and Health Status Questionnaire, SF36, IPAQ & Thai-FRAT - fall risk).

RESULTS: Of the interviewees, 98.3% were ethnic Lao, 43% were men and 56% were women, with 60% living in urban settings, 31% suburban and 9% in a rural community. On average all age groups were classified as overweight, except men 71-80 yrs. Just over 20% were smokers with a large majority consuming alcohol on a regular basis. About 1/3 reported having high blood pressure; evenly distributed across gender, age and location. About 71% of respondents reported being moderately active. Just over 40% experienced depression. On average the majority of women and men over 70 in the urban and suburban settings did not meet the ACSM minimum of 150 min/week of moderate/vigorous physical activity, while those in the rural setting exceeded this goal. Pain was a significant issue for younger urban men and all those living in rural areas and those with health and mobility issues. The domain of physical functioning showed those in the rural setting being the most active and healthy. Eighty participants reported having at least 1 fall in the past 6 months. No significant differences in fall rates were found between genders. All but 1 of the falls occurred in the urban or suburban environments. The vast majority of the falls occurred in those over 71 years of age.

CONCLUSION: This study was the first of its kind in Laos. While the sample size was beyond expectations, rural areas and those with health and mobility issues were underrepresented. Those approached to complete the surveys were eager to participate. The goal is to expand this study throughout Laos.
Exercise is Medicine® - EIM: Exercise and Various Diseases and Health Conditions

**Wednesday, May 27, 2020, 1:30 PM - 4:00 PM**

**Room:** CC-Exhibit Hall

1215
Board #341
May 27 1:30 PM - 3:00 PM
High Intensity Inspiratory Muscle Training In Individuals With Chronic Disease: A Systematic Review With Meta-analysis

Fabricio Boscolo Del Vecchio1, Thamires L. Seus2, Juliana Moraes Leal3, Rafael B. Orcy4, 1Federal University of Pelotas, Rio Grande do Sul, Brazil. 2Catholic University of Pelotas, Rio Grande do Sul, Brazil. Email: fabricioboscolo@gmail.com

(No relevant relationships reported)

Inspiratory muscle training (IMT) is a strategy of treatment of patients with poor inspiratory muscle performance, with dyspnea, low exercise tolerance, and low functional status. Moderate loads are currently used (30 - 50% of maximal inspiratory pressure, MIP) and high-intensity IMT (HI-IMT) with 60% or more of MIP is being studied in randomized clinical trials. **PURPOSE:** To determine the effect of high intensity inspiratory muscle training (HI-IMT) on respiratory muscle strength in individuals with chronic diseases. **METHODS:** For this meta-analysis, the sources were conducted in PubMed, Scopus, SciELO and Bireme, using different keywords and operators. The review was recorded in the systematic review platform PROSPERO, under registration number CRD42019131984, and follows the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines. Two researchers carried out the search independently in July of 2019. The outcomes of the search were the effect and characteristics of interventions with high intensity inspiratory muscle training in individuals with chronic diseases. The variables were inspiratory muscle strength (Pimax) before and after intervention or the difference between this, training load, number of sessions, numbers of sets, and number of repetitions chosen for the control and intervention groups. **RESULTS:** Were found 166 studies in initial source. After excluded of duplicates (n=30) and reading of title and abstracts, five studies were included on meta-analysis. Populations analyzed included chronic pulmonary disease, cystic fibrosis and cancer patients. As characteristics of interventions, the mean duration was 8.8±5 weeks, 4.5±1.1 sessions per week, the most common effort intensity was 60% of MIP with 15.3±12.8 repetitions, 4.75±1.9 sets and 1.5±0.5 min of recovery between them. The results indicated that HI-IMT increases in 15.58 cmH2O [95%CI = 2.40 - 28.75] the strength on inspiratory muscle when compared to control group (p<0.02). **CONCLUSIONS:** High intensity inspiratory muscle training is able to increase the respiratory muscle strength of patients with chronic pulmonary disease, cystic fibrosis and cancer.

1216
Board #342
May 27 1:30 PM - 3:00 PM
Exercise To Treat Women With Pulmonary Lymphangioleiomyomatosis (LAM)

Thomas W. Lowder. University of Central Arkansas, Conway, AR.

Email: lowderw@uca.edu

(No relevant relationships reported)

Lymphangioleiomyomatosis is an interstitial, cystic lung disease that destroys the lung parenchyma, ultimately leading to respiratory failure. This disease affects females almost exclusively. Only two long-term treatment options exist: 1) single or bilateral lung transplant, which only slows the disease as the newly-transplanted lungs will soon succumb to the disease, and 2) rapamycin (Rapamune), a costly mTOR inhibitor that may result in multiple side effects and is not always tolerated by users. We sought to examine if moderate- to high-intensity exercise could slow or reverse the pulmonary decline seen with LAM. **PURPOSE:** To determine if a three-month exercise intervention had a positive impact in women with LAM. **METHODS:** Eight women with LAM (aged 27-60) were recruited to participate in an in-person exercise training intervention consisting of moderate- to high-intensity aerobic and anaerobic exercise. Prior to the study VO2max was assessed, as well as pulmonary function (FEV1, FVC, FEV1/FVC, and peak flow) and bone mineral density (BMD). After three months these measures were again tested. **RESULTS:** After three months of training, VO2max increased 12% from baseline (p=0.06). FEV1 improved by 4%. While this was not statistically significant (p=0.19) this is nonetheless substantial, as this is the primary clinical measure used to assess a decline in pulmonary function. This is also the first non-pharmaceutical study to demonstrate an increase, rather than a decline, in lung function. Peak flow also improved by 11% (p=0.18). BMD also slightly improved over three months (p=0.12), also significant as LAM patients have been shown to demonstrate a loss of BMD at a five-fold increase compared with healthy females. Though underpowered, this is the first non-pharmaceutical intervention study to show improved exercise tolerance, lung function, and bone health in women with LAM.
1219 Board #345 May 27 1:30 PM - 3:00 PM
Association Between Physical Activity With Bone Mineral Density And Handgrip In Children With Osteogenesis Imperfecta
Andrée Cassimiro de Oliveira¹, Rafael Mancini¹, Ellen de Oliveira Goiano², Miguel Akkari², Victor KehIan Rodrigues Matsudo¹, Cláudio Santilli². ¹Center of Studies of the Physical Fitness Research Laboratory from São Caetano do Sul – CELAFISCS, SÃO PAULO, Brazil. ²Faculty of Medical Sciences of São Paulo, SÃO PAULO, Brazil.
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Purpose: To evaluate the association between physical activity by bone mineral density and handgrip in children with osteogenesis imperfecta. Methods: The sample consisted of 8 children of both sexes (8±1.3 years old, with osteogenesis imperfecta (I, III and IV type), body weight (24.0±7.9 kg), height (116.9±14.1 cm), cycle of intravenous pamidronate therapy (7.2±4.9). These patients are linked to the Reference Center for Osteogenesis Imperfecta in Santa Casa Medical School. Weight (kg), height (cm), handgrip (kg) were evaluated by CELAFISCS standardization. Physical activity (MET’s) [Barros et al., 1993], total bone mineral density (g/cm²), total bone less head TBLH (g/cm²) lumbar bone mineral density (g/cm²)[Bishop et al., 2008] and bilateral handgrip (Matsudo, 2005). Statistical Analysis: Pearson’s correlation (r) was used for association between usual weekly physical activity and the following variables: total bone mineral density (g/cm²), total body less head TBLH (g/cm²), lumbar bone mineral density (g/cm²), and bilateral handgrip (kg). It was used a significant level of p< 0.05. Results: There was a positive and significant high intensity correlation between physical activity with lumbar bone mineral density, but not with total bone mineral density, total body less head TBLH, and bilateral handgrip (see table below). Conclusion: it seems that physical activity exert a positive effect on the lumbar bone mineral density. However, physical activity was not significantly associated with total bone mineral density, total body less head TBLH and handgrip in children with osteogenesis imperfecta.

<table>
<thead>
<tr>
<th>Weekly Physical Activity n=8 (55.0±32.7) MET’s</th>
<th>r</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Bone Mineral Density (g/cm²)</td>
<td>.199</td>
<td>0.636</td>
</tr>
<tr>
<td>Lumbar bone mineral density (g/cm²)</td>
<td>.916*</td>
<td>.001</td>
</tr>
<tr>
<td>Total Body Less Head TBLH (g/cm²)</td>
<td>.109</td>
<td>0.797</td>
</tr>
<tr>
<td>Right Handgrip (kg)</td>
<td>-.240</td>
<td>0.567</td>
</tr>
<tr>
<td>Left Handgrip (kg)</td>
<td>-.136</td>
<td>0.749</td>
</tr>
</tbody>
</table>

* p< 0.05: Pearson Correlation

1220 Board #346 May 27 1:30 PM - 3:00 PM
The Effect Of Baduanjin Exercise On University Students With Neck/shoulder Muscle Strength Imbalance
Zhen M. Bai, Rafael Nunez, Ting Luo, Jian Y. Yang. Beijing Sport University, Beijing, China.

Purpose: this study tested the efficacy of Baduanjin exercise (BDJ), a traditional Chinese mind-body exercise, on shoulder and neck muscle strength imbalance, and see if it is possible through this method provide a new idea of sports rehabilitation for shoulder and neck diseases problems.

Methods: 80 sedentary university students, with either forward head posture and/or round shoulder posture were randomized to the BDJ intervention group (n=20) and control group (n=20), the same evaluation protocol was used before and after the intervention. During six weeks of training, The BDJ group was given Baduanjin training combined with a basic health education program, and the control group was treated only with a basic health education program. Baduanjin training program was conducted three times a week, every time 50 minutes. The contents of health education program include healthy lifestyle tips, postural education and muscle stretching method.

Results: Significant changes were found within the BDJ group, specially on Forward Head Angle test, Maximal Internal/External Rotation test and upper quarter Y-balance test.

Conclusions: this randomized control trial provides some evidence to support the positive effect of BDJ exercise as a new method of sport therapy for rehabilitation among people with shoulder/neck MSI.

1221 Board #347 May 27 1:30 PM - 3:00 PM
Racing running Training For 12 Weeks Improves Physical Fitness And Promotes Skeletal Muscle Hypertrophy In Adolescents And Young Adults With Cerebral Palsy
Ferdinand von Walden¹, Emma Hjalmarsson¹, Rodrigo Fernandez-Gonzalo¹, Alexandra Palmcrantz², Ola Krist¹, Eva Ponten¹. ¹Karolinska Institutet, Stockholm, Sweden. ²Karolinska University Hospital, Stockholm, Sweden.

Purpose: Individuals with cerebral palsy (CP) typically lead sedentary lives, predisposing this patient group to metabolic dysfunction and cardiovascular disease. There are currently not many exercise options for individuals with severe disabilities. A novel addition to the RaceRunning, a bicycle propelled forward by stepping on the ground. The purpose of this study was to investigate training adaptations following a 12-week Racerring training protocol in individuals with CP.

Methods: Fifteen adolescents/young adults (mean age 16, range 9-29, 8 males/7 females) with CP (GMFCS I-IV; 1-3-4) completed 12 weeks, 2 times per week, of RaceRunning training. Measurements of physical fitness (6-min RaceRunning test, average and maximum heart rate), passive range of motion (pROM) of hip, knee and ankle joints and skeletal muscle thickness in the thigh and lower leg were collected before and after the training period.

Results: Distance covered during the 6-min RaceRunning test increased on average 36% (pre 576 ± 325 m vs. post 765 ± 428 m, p<0.001). Average and maximum heart rate during the 6-min RaceRunning test was not different pre vs. post training. Muscle thickness of m. gastrocnemius increased in response to training (p<0.05) on the more affected side. Dorfsall PROM in the more affected ankle decreased (p<0.05), while hip flexion PROM in the less affected side increased (p<0.05).

Conclusions: Twelve weeks of RaceRunning training improves physical fitness in individuals with CP. Moreover, RaceRunning stimulates skeletal muscle hypertrophy of the calf muscle. These results speak in favor of RaceRunning as a powerful and effective training modality in individuals with CP promoting both central and peripheral adaptations.

1222 Board #348 May 27 1:30 PM - 3:00 PM
Supervised Physical Activity is Important To Counteract Negative Impacts Of Cancer On Physical Activity Behavior
Maxime Caru¹, Daniel Curnier, Ph.D.², Ariane Levesque³, Serge Sultan, Ph.D.², Valérie Marcil, Ph.D.², Caroline Lavérièdre, M.D.¹, Daniel Sinnett, Ph.D.¹, Lucia Romo, Ph.D.², Laurence Kern, Ph.D.². ¹Sainte-Justine University Hospital Research Centre, Montreal, QC, Canada. ²University of Paris Nanterre, Nanterre, France.

Purpose: The theory of planned behavior (TPB) is used to document children’s psychological parameters linked to their physical activity practice to better understand their physical activity behavior. The TPB model evaluates the informational and motivational parameters that contribute to the practice of physical activity. This study aimed to assess the evolution of children’s physical activity levels (MVLPA) during the first months of their cancer, in addition to document the evolution of the TPB measures, self-reported fitness and self-esteem in the physical domain to better understand children’s physical activity behavior.

Methods: A total of 16 children (8 boys and 8 girls) with cancer were recruited in the context of the VIE (Valorization, Implication and Education) study. Patients answered psychosocial questionnaires at their diagnosis of cancer (time 1), six to eight weeks following their diagnosis (time 2) and six weeks after the physical activity program (time 3). The physical activity program was composed of two physical activity sessions (≈45min) per week for six weeks at moderate intensity. The integration of the family in the physical activity process was taken into consideration.
RESULTS: A significant decrease of 41.2 min/day of daily MVLP A was observed between the two groups at 18 weeks (13.7 ± 8.1 min/day) and at 36 weeks (17.9 ± 11.0 min/day). The percentage of participants with a significant increase in MVPA was similar between groups at 18 weeks (41.2%) and at 36 weeks (41.9%). The percentage of participants with a significant decrease in MVPA was similar between groups at 18 weeks (35.3%) and at 36 weeks (34.3%). The percentage of participants with no change in MVPA was similar between groups at 18 weeks (23.5%) and at 36 weeks (24.4%).

CONCLUSIONS: Physical activity levels were similar between groups at 18 weeks and at 36 weeks. There was no significant change in physical activity levels between groups at 18 weeks and at 36 weeks.

1223 Board #349 May 27 1:30 PM - 3:00 PM Impact Of A Free-living Activity Intervention On Real-time Fatigue In People With Multiple Myeloma Treated With Autologous Hematopoietic Cell Transplantation Eileen D. Hacker, Shu-Yu Chung, Rae Lynn Richards. Indiana University, Indianapolis, IN. Email: edhacker@iu.edu (No relevant relationships reported)

PURPOSE: Autologous hematopoietic cell transplantation (HCT) is commonly used to treat multiple myeloma (MM). Moderate to severe fatigue is associated with the treatment. Sustainable physical activity incorporated in daily activities may reduce fatigue. This study evaluated the impact of a free-living physical activity intervention (STEPS) compared to usual care on real-time fatigue.

METHODS: A two-group, randomized block, repeated measures design (n=32) was used. The six-week STEPS intervention aimed to increase physical activity by 10% weekly through education, goal-setting, daily step tracking using wearable technology, and guided integration of physical activity into daily routines following HCT hospital discharge. Real-time fatigue was measured with a one-item fatigue intensity scale using computerized ecological momentary assessment eight times per day over seven days. Participants rated their fatigue intensity on a 0 (no fatigue) to 10 (worst fatigue) scale.

RESULTS: Participants provided 6906 ratings of real-time fatigue (3469 prior to HCT and 3437 seven weeks following HCT discharge). Prior to HCT, the STEPS group reported fatigue as mild (57.5%, n = 1974 ratings), moderate (29.7%, n = 563 ratings) or severe (12.8%, n = 217 ratings). Following the intervention, the STEPS group reported fatigue as mild (60.5%, n = 1068 ratings), moderate (27.7%, n = 409 ratings) or severe (11.7%, n = 207 ratings). The usual care group reported fatigue as mild (53.3%, n = 1035 ratings), moderate (32.3%, n = 575 ratings) or severe (9.2%, n = 165 ratings) and mild (61.7%, n = 1033 ratings), moderate (28.5%, n = 476 ratings) or severe (9.8%, n = 164 ratings) after the intervention period.

CONCLUSIONS: Although preliminary, differential improvement in real-time fatigue following the STEPS intervention did not occur in the STEPS. Between 35% and 40% of real-time fatigue ratings were classified as moderate or severe demonstrating ongoing need for intervention development.

1224 Board #350 May 27 1:30 PM - 3:00 PM The Influence Of A 12-week Home-exercise Program On Physical Fitness And Physical Functioning In Childhood Survivors Of Acute Lymphoblastic Leukaemia: Results Of A Randomised Clinical Trial Robinson Ramirez-Velez1, Jahn Dubery Manchola-Gonzalez2, Carlit Bagur-Calafat2, Montserrat Girabent-Farrés3, Josep Ricard Serra-Grima2, Roser Alvarez Perez2, Manuel Vicente Garracho-Castillo2, Isabel Badsell4. 1Publi-University of Navarra, Pamplona, Spain. 2Universitat Internacional de Catalunya, Barcelona, Spain. 3Hospital Santa Creu i Sant Pau, Barcelona, Spain. 4Pompeu Fabra University, Barcelona, Spain. Email: robin640@hotmail.com (No relevant relationships reported)

PURPOSE: Positive effects of home-exercise programmes on physical fitness have been reported in studies with childhood malignancy. However, conclusive evidence on the impact of home-exercise programmes for physical fitness indicators or functional capacity during daily life activities outcomes in leukaemia is yet to be established. Therefore, the research question for this randomised controlled trial was: Does home-exercise programme improve the physical fitness and physical functioning outcomes more than usual care among children survivors of ALL?

METHODS: A parallel-group, assessor-blinded, pilot randomised controlled trial was conducted at the Santa Creu i Sant Pau Hospital in Spain (NCT03005392). Twenty-four survivors of ALL were assigned to usual care (control group, n=12, 11.0±3.7 years) or to a home-exercise programme (intervention group, n=12, 11.8±4.3 years). Peak oxygen uptake (VO2peak, ml/kg/min), minute ventilation (VE L/min), output of carbon dioxide (VCO2 L/min), respiratory exchange ratio (RER), peak heart rate (beats/min), maximal load (W), VO2 at anaerobic threshold (VO2 AT, ml/kg/min), pulse oxygen (PO2, ml/beat), heart rate at anaerobic threshold (beats/min), hand grip test (pounds), flexibility (cm), Timed Up & Go test (TUG) (s), and Timed Up and Down Stairs test (TUDS) (s) were measured at baseline and over 16 weeks of intervention.

RESULTS: Adjusted mixed linear models revealed a significant group-time interaction of +6.7 (95% CI = 0.6-12.8 ml/kg/min; ηp2 = 0.06) for VO2peak. Similarly changes in mean values was observed after the home-exercise programme compared to baseline for VE (L/min) -8.3 (0.0) (P=0.035), VCO2 (0.23 (0.08), (P=0.041), maximal load (W) −35.5 (12.8) (P=0.024), TUDS (s) 0.8 (2.6) (P=0.010), and TUG (s) 0.60 (0.1) (P=0.001), however the group-time interaction were not significant. CONCLUSIONS: The home-exercise programme resulted in changes in measures of VO2peak, VE, VCO2, and functional capacity during daily life activities (TUDS and TUG test). This is an interesting and important study that surely adds to the current body of knowledge.

1225 Board #351 May 27 1:30 PM - 3:00 PM The Practice Of Physical Activity Protects The Lung Function And Mechanics In Hypertensive Elderly Renilson Moraes Ferreira1, Maysa Alves Rodrigues Brandão-Rangel1, Anamie da Silva Reis1, Victor Hugo Souza Palmeira2, Claudio Ricardo Frison3, Rodolfo Paula Vieira4,1Federal University of Sao Paulo (UNIFESP), Santos, Brazil. 2Brazilian Institute of Teaching and Research in Pulmonary and Exercise Immunology, São José dos Campos, Brazil. 3Universidade Brasil (Anhembi Morumbi University / UNIFESP, São Paulo, Brazil. Email: renilsonmoraesferreira@gmail.com (No relevant relationships reported)

PURPOSE: Hypertension is still a growing problem in public health, presenting higher rates among elderly. Recent studies have pointed out that hypertension may be an independent factor impairing the lung function. In addition, several studies have demonstrated that physical activity promotes beneficial effects in hypertensive individuals, but never before the impact of physical activity on lung function and mechanics in hypertensive and non-hypertensive elderly have been evaluated.

METHODS: 110 physically active hypertensive elderly (ActH; 69.39 ± 5.49 years old) and 187 sedentary hypertensive elderlies (SedH; 70.09 ± 7.51). The inclusion criteria: no respiratory diseases, unable to perform spirometry test, no respiratory symptoms (cough, dyspnea), no respiratory infections in the last 30 days. Lung function (spirometry) and lung mechanics (by impulse oscillometry) was evaluated according to American Thoracic Society recommendations by using IOS Masterscreen Jaeger (Germany). Graph Pad Prism 5.0 was used to perform statistical analysis and p<0.05 were considered significant.

RESULTS: The analysis of lung function revealed that physical activity preserved the lung function (forced vital capacity - FVC) as demonstrated by comparison between ActH versus SedH group (3.65 ± 0.05 x 2.79 ± 0.07; P<0.01). Simillary, the forced expiratory volume in the first second (FEV1) was higher in ActH when compared with SedH elderly (2.96 ± 0.04 x 2.12 ± 0.05; P=0.02) as well as the FEV1/FVC relation (0.84 ± 0.07 x 0.75 ± 0.07; P<0.03). Concerning the lung mechanics, the results
revealed that physical activity was able to reduce the risk of cardiovascular disease and diabetes.

CONCLUSIONS: Physical inactivity is associated with many chronic diseases and premature mortality. Increasing evidence also suggests that high levels of sedentary time may increase the risk of chronic diseases and mortality.

METHODS: Reporting quality of 24 randomised controlled trials from a meta-analysis on that topic in order to evaluate the transferability of findings into clinical practice.

RESULTS: The study involved 24 participants. All participants were admitted to the study and followed the protocol.

PURPOSE: To analyse the change on leptin, body composition, blood pressure (BP), cardiorespiratory fitness (CRF) and biochemical parameters in overweight/obese adults and men (W) and men (M) according to the exercise intervention (HTN), and to evaluate the potential sex differences in the change after intervention.

METHODS. Participants (n=37 women, n=40 men, 52.9±6.9 yrs) from the EXERDET-HTA study were randomized into attention control group (physical activity recommendations) or one of three supervised aerobic exercise groups (two days/week) for 12 months. All participants received the same hypocaloric diet. All variables were assessed pre and post-intervention. A blood sample (12.5 ml) was collected from each participant following an overnight fast to determine the biochemical profile and leptin values.

24-h ambulatory BP monitoring was used to analyze systolic and diastolic BP.

A cardiopulmonary exercise test was performed to determine peak oxygen uptake (VO_{peak}.) Results. Following the intervention, there were significant increments (P<0.01) in VO_{peak} vs. W=21.1±3.7 ml·kg⁻¹·min⁻¹, M=26.3±6.0 ml·kg⁻¹·min⁻¹ and decreases (P<0.05) in leptin (W=49.5±23.0 vs. 41.8±19.9 ng·ml⁻¹, M=20.5±14.8 vs. 12.9±18.6 ng·ml⁻¹, body mass (W=84.7±12.1 vs. 80.3±11.5 kg, M=97.3±14.4 vs. 91.5±13.3 kg), waist perimeter (W=97.4±10.7 vs. 94.3±10.9 cm), fat mass (W=21.5±5.1 vs. 19.7±5.7 cm), fat mass (%M=31.2±5.0 vs. 28.0±4.4 %), systolic BP (W=26.3±5.1 vs. 23.8±0.4 %), diastolic BP (W=29.1±3.7 vs. 26.3±1.2 mmHg), total cholesterol (M=216.1±44.5 vs. 196.1±35.0 mg/dL), insulin (M=13-4.7±3.9 vs. 9.4±1.4 mU/L). There were significant between-sex differences in body mass (W=55.2%, M=6.5%, P=0.023), waist circumference (W=31.1%, M=5.9%, P=0.004), and VO_{peak} (W=14.2%, M=20.5%, P=0.036). CONCLUSIONS. Aerobic exercise along with a hypocaloric diet is an effective non-pharmacological intervention to induce beneficial changes in W and M in BP and leptin as a mediator of obesity-induced HTN, and other regulatory mechanisms such as body composition, CRF and biochemical profile. The found sex-related differences could confirm the need for individual non-pharmacological strategies.

Diabetes mellitus (DM) is a chronic progressive disease characterized by high blood glucose levels and stands out as an important and growing health problem worldwide, which can lead to reduced functional capacity (FC) and the quality of life (QOL). However, the association is still poorly studied.

PURPOSE: To evaluate FC through Shuttle Walking Test Endurance (SWTE) and its association with QOL of type II diabetic (T2D) patients.

RESULTS: Forty-one patients (24 women/17 men) participated in the study, with a mean age of 57±10 years. Most of them were overweight or obese patients with a BMI of 29.5±3.8 kg/m². The average distance achieved by patients in SWTE was 1020 (360-2200) meters. The mean scores on the SF36 questionnaire were 40 (2-100), 83 (1-100) and 543 (105-740) respectively for the “Pain”, “Emotional Aspects” and Total Score domains. Significant correlations were found between the distance covered in SWTE and the domain “Pain”, the domain “Emotional Aspects” and the total score of the SF36 questionnaire, respectively (R = 0.4; R = 0.4 and R = 0.4; p<0.01). Significant correlation was also

Abstracts were prepared by the authors and printed as submitted.
found between the distance covered in SWTE and age: R = -0.4; p < 0.01 of T2D patients. CONCLUSION: The findings of the present study suggest that SWTE may be a simple and useful tool in clinical practice for FC measurement and performance in this field test may be strongly associated with QOL of T2D patients.

**1230 Board #356 May 27 1:30 PM - 3:00 PM**

**Preparing For A Behavioral Physical Activity Intervention In Women With Gestational Diabetes Mellitus**

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(No relevant relationships reported)

**PURPOSE:** In preparation for a behavioral physical activity (PA) intervention promoting walking/stepping in place in women diagnosed with gestational diabetes mellitus (GDM), this study sought to assess the accuracy of the Fitbit Charge 3 in recording steps during walking and stepping at three cadences in pregnant women. The study also sought to elicit women’s thoughts and feelings on the proposed walking/stepping intervention.

**METHODS:** Women diagnosed with GDM (N=15) were recruited in the third trimester. Participants were a Fitbit Charge 3 on the non-dominant wrist and completed a total of six 2-minute bouts that varied by mode (walking vs. stepping in place) and cadence (67, 84, and 100 steps/minute). Bout sequence was randomized. Actual steps were determined by hand-tally, the criterion, in duplicate. One-way and two-way ANOVA were used to examine differences in the mean percentage of steps recorded, by mode and cadence. Participants also completed a 20-minute semi-structured interview with questions on opportunities for PA, challenges to PA, PA preferences, and use of a Fitbit to track steps and set goals during walking/stepping. Interviews were audio-recorded and transcribed, then analyzed using descriptive and interpretive coding to identify themes.

**RESULTS:** There was a statistically significant difference in the percentage of steps recorded by cadence (p<.01), but not by mode (p>.23); no interaction was detected between mode and cadence (p>.17). Analyses of cadence only suggested that 67 steps/minute (lowest) may differ significantly from the other cadences (67 steps/minute = 113.5%, 84 steps/minute = 97%, 100 steps/minute = 95%, p<.05). In the interviews, most reflected on the complexity of their lives making daily PA difficult, and indicated preference for three 10-minute bouts of walking/stepping over one 30-minute bout per day.

**CONCLUSIONS:** The Fitbit Charge 3 may overestimate steps at lower cadences. However, step count did not differ with respect to mode at the cadences examined. Results suggest that the Fitbit Charge 3’s step count is suitable for use in a behavioral PA intervention promoting walking/stepping by tracking and goal setting. Interview data additionally suggested that walking/stepping interventions for women with GDM should afford convenience and flexibility to participants.

**1231 Board #357 May 27 1:30 PM - 3:00 PM**

**The Cross-sectional Effect Of Abnormal Glucose Metabolism On Balance Ability, Muscle Strength, And Body Composition In Men**

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(No relevant relationships reported)

**PURPOSE:** To investigate the association between balance ability, muscle strength, and body composition, and fasting blood glucose METHODS: 1) Subjects: 2693 men (aged 19-73 years old) were recruited from three health management central of hospitals in China, without any diagnosed diseases other than diabetes. 2) Measurements: People’s grip strength was measured 3 times in dominant hand in a standing position and read the highest value; balance ability was measured by one-leg standing time with both eye-closed; body composition was measured by BFA; fasting venous blood was taken for blood glucose test. All subjects were divided into normal blood glucose group (Normal: < 6.1 mmol/L), impaired fasting glucose group (IFG): 6.1-7.0 mmol/L, and diabetes group (DM: ≥7.0 mmol/L). 3) Statistics: Multivariate analysis of variance was used for comparison among groups; Pearson test was used for correction analysis; the significance level (α) for hypothesis testing was set to 0.05.

**RESULTS:** Normal glucose men were significantly younger than those in the IFG and DM group (38.76±9.45 vs. 44.57±9.09 vs. 45.87±7.79 yrs, P < 0.05). Normal glucose men had significantly lower body weight and lower percent body fat than those in the IFG and DM group (BW: 70.70±11.29 vs. 75.68±10.40 vs. 77.23±11.66 kg, P < 0.05; BMI:15.5±5.38 vs. 18.97±5.82 vs. 25.12±5.62, P < 0.05). Balance ability, relative grip strength, and muscle percentage [(body muscle/ body weight)*100] were different in three groups (P < 0.05). There were inverse linear associations between incremental level of blood glucose and lower values of balance ability, relative grip strength, and muscle percentage (r =-0.067, r =-0.158, r =-0.171, P < 0.05 for each). After adjusted age, the blood glucose level was still correlated with balance ability (r =-0.035 , P =0.068).

**CONCLUSION:**The men’s balance ability decreases with the increase of blood glucose level. There is inverse linear associations between muscle strength and blood percentage and blood glucose level.

**1232 Board #358 May 27 1:30 PM - 3:00 PM**

**Comparative Study Of Resistance And Aerobic Exercise In Pre-diabetes: An Rct**

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**PURPOSE:** Although the benefit of aerobic exercise in IGR is proven, the impact of resistance exercise on IGR is still unclear. Therefore, the differences between aerobic and resistance exercise on IGR was analyzed to provide a theoretical and practical basis for DM prevention and IGR management.

**METHODS:** Single-blind RCT. IGR participants were divided into 3 groups randomly: aerobic exercise (A, n= 26), resistance exercise (R, n= 23), and control (C, n=21). The effect of aerobic and resistance exercise on IGR was analyzed and the relationship with obesity was investigated after 12-weeks intervention.

**RESULTS:**
1. FPG in groups A and R was decreased significantly by 6.17% and 4.81%, and OGTT 2h PG was also decreased significantly by 20.39% and 16.50%. 69.2% in group A showed a decrease in blood glucose level to normal value with a significant difference compared with group C. 2) HOMA2-IR in groups A and R was significantly decreased by 8.34% and 18.31%, with a significant difference compared with group C. 3) A significant decrease of BMI (3.1±2.2 kg/m²), showed a moderately positive correlation with the decreased FPG and waist (3.1±2.7 cm) was found in group A with a significant difference compared with group C. BMR(1±1.2 kg/m²) and waist(1.5±3.8 cm) also decreased significantly in group R, but no significant difference between groups. The change of body composition showed in figure 1.

**CONCLUSION:**
1. Both resistance and aerobic exercise lowered blood glucose and decreased blood glucose to normal level in a large percentage of IGR. 2) Both aerobic and resistance exercise improved IR in IGR. The effect of resistance exercise on IR improvement was superior to that of aerobic exercise. 3) Aerobic exercise lowered weight and waist significantly in IGR, and decreased blood glucose through weight loss. But the improvement of IR by both aerobic and resistance exercise might not be related to the control of obesity.

**Acknowledgement:** Supported by SGA China (2014B007), Sun Yat-sen University (1709089). **$$MISSING OR BAD IMAGE SPECIFICATION {A7846F29-370B-4CE9-A26D-0BD95A423485}$$

**Figure 1 Charge rate of HOMA2-IR, FAT% lean body mass in 3 groups in IGR**

*P<0.05, **P<0.01, compared with pre-intervention within group; * P<0.05, **P<0.01, compared with group C**
Common medical advice for patients with obesity and metabolic syndrome (MS) is weight loss through negative energy balance: eat less and do more physical activity. Guidelines suggest that moderate to vigorous intensity physical activity (MVPA) is better than low intensity physical activity (LPA). However, patients with morbid obesity and metabolic syndrome have difficulties to achieve MVPA levels, particularly when they take beta-blockers. PURPOSE: To monitor long-time loss of a patient with morbid obesity and MS who underwent regular exercise and energy-restricted diet.

METHODS: This case study followed a male patient (age 65y, baseline weight 131,0kg, BMI 43,8) with MS (obesity, high blood pressure, dyslipidemia, prediabetes) for 12 months. He took medication for every disease and also beta-blockers. His program was assisted by medical doctor, nutritionist and exercise therapist, has regular blood tests. All the trainings (1628 sessions) were monitored by heart rate activity tracker (POLAR A300).

RESULTS: Overall, the patient's weight loss was variable but permanent (23,1kg, BMI decrease 9,2%); however, blood pressure (BP), lipids and glucose did not change significantly from baseline to follow-up. From baseline to follow-up, revealed TG of 118.4±50.1 mg/dL, TC of 172.0±21.2 mg/dL, HDL of 52.6±10.2 mg/dL, LDL of 97.8±24.9 mg/dL, and BG of 117.25±5.4 mg/dL. From baseline to follow-up, it was observed that the patient's weight loss was variable but permanent (23,1kg, BMI decrease 9,2%).

CONCLUSIONS: This case study followed a male patient (age 65y, baseline weight 131,0kg, BMI 43,8) with MS (obesity, high blood pressure, dyslipidemia, prediabetes) for 12 months. He took medication for every disease and also beta-blockers. His program was assisted by medical doctor, nutritionist and exercise therapist, has regular blood tests. All the trainings (1628 sessions) were monitored by heart rate activity tracker (POLAR A300).
sufficiently from 0.54(0.04-3.00) to 0.35(0.01-1.43) mg/dL, leading to a reduction of inflammatory stress (ISCRP- 0.30mg/dL) from 44.7% to 29.8%. Except HD, ISCRP decreased in all other groups, while only HIIT reduced significantly (ß=0.23) the IS. CONCLUSIONS: The 10-wk LISM was effective in reducing systemic inflammation, being more effective in HIIT and less in HDY, dissociable from WC changes and specific fitness improvements. Supported by CNPq and CAPES.

B-83 Free Communication/Poster - Measurement Studies in Exercise Oncology

**Wednesday, May 27, 2020, 1:30 PM - 4:00 PM**

**Room:** CC-Exhibit Hall

**Board #363**

**May 27 2:30 PM - 4:00 PM**

**Myocardial Fibrosis Impairs Exercise Capacity By Limiting Cardiac Output Among Anthracycline-treated Women With Breast Cancer**

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(No relevant relationships reported)

**PURPOSE:** Physiologic reserve, the capacity for augmented function between rest and peak exercise, declines in organs and biological systems with aging. Chemotherapy can rapidly accelerate this decline, as noted by substantially lower exercise capacity in survivors of breast cancer (BC). We assessed cardiac function reserve and myocardial tissue characteristics and determined their contribution to exercise capacity reserve (VO2R) in 16 anthracycline-treated BC survivors and 16 age- and BMI-matched controls (CON). METHODS: Participants performed a maximal cardiopulmonary test on an upright cycle ergometer and also inside a 3T magnetic resonance imaging scanner using a horizontal, resisted, stepping device. Real-time, free-breathing, ungated cine images were acquired at rest and peak exercise. Left ventricular (LV) volumes and ejection fraction (EF) were calculated from a biplane model of 2- and 4-chamber long axis views. The reserve of LV volumes, EF, cardiac output, and VO2 were calculated as peak minus rest values. Native T1, mapping, a measure of myocardial fibrosis, was performed using the SASHA method. Groups were compared with independent t-tests and linear regression was performed between cardiac variables and relative VO2.

**RESULTS:** VO2R was 25% lower in BC versus CON (18.7 ± 25.7 mL/kg/min, p=0.02). Hemoglobin, LV mass, resting LV volumes, cardiac output, and EF were similar between groups. Myocardial T1 times were elevated in BC compared to CON (p=0.02). The reserve in heart rate, LV volumes, and EF did not differ between groups. A trend toward lower stroke volume reserve (14±8 vs 19±7 mL/kg; p=0.02) resulted in lower cardiac output reserve in BC versus CON (8.52±2.5 vs +10.3±2.4 L/min, p<0.05). As predicted by the Fick equation, indexed cardiac output reserve (4.3 to 1.2 L/min/m² kg, p=0.003) was an independent predictor of VO2R in the BC group, as was myocardial T1 (0.018, 95%CI: 0.25 to -0.10, R2=0.65%, p<0.001). Mediation analysis demonstrated that the relationship between cardiac output and VO2peak is mediated by the extent of myocardial fibrosis.

**CONCLUSIONS:** Exercise intolerance following anthracycline treatment for breast cancer can be partially explained by reduced ability to augment cardiac output due to myocardial fibrosis.

**1237**

**Board #365**

**May 27 2:30 PM - 4:00 PM**

**Relative Reliability Of A CT-Based Measurement System To Assess Body Composition In Colon Cancer Patients**

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(No relevant relationships reported)

Body composition is associated with important clinical and functional outcomes in colon cancer patients. Colon cancer patients often undergo computed tomography (CT) in routine clinical care. These images may then be used to assess body composition to potentially identify individuals who may benefit most from physical activity (PA) intervention. Developing reliable and accurate ways to measure body composition is a prerequisite to using CT-generated body composition to inform disease management. PURPOSE: To determine inter- and intra-rater reliability of CT to measure body composition in colon cancer patients in a randomized controlled trial (PA vs. usual care). METHODS: 25 CT scans were randomly selected from 10 men and 8 women (59.1±9.7yrs), all post-primary treatment for stage II-III colon cancer. Manual image analysis was conducted for each single CT image slice using SliceOmatic software (Tornovision, Montreal, Canada) to mark the third lumbar vertebra and segment quantify muscle (MUS), intramuscular adipose tissue (IMAT), visceral adipose tissue (VAT), subcutaneous adipose tissue (SAT), and the muscle attenuation coefficient (MA). Inter-rater reliability was assessed by estimating the agreement between measures from a) 2 trained manual analysts and b) a manual analyst and automated software (Voronoi Health Analytic ABACS L3 Module), respectively. Intra-rater reliability was evaluated by estimating the agreement between measures by the same manual analyst one month apart. Inter- and intra-class correlation coefficients (ICCs) were calculated with ICC ≥ 0.9 deemed excellent reliability. Results: ICCs were excellent for both measures of inter-rater reliability (analyst 1 vs. 2: MUS=0.999, IMAT=0.998, VAT=0.999; SAT=0.999, MA=0.999; manual vs. automated: MUS=0.981, IMAT=0.710, VAT=0.997, SAT=0.999, MA=0.992), and intra-rater reliability (MUS=1.000, IMAT=0.971, VAT=1.000, SAT=0.999, MA=1.000) (all p<0.01). Conclusion: Body composition analyses using clinical CT scans, SliceOmatic software, and a trained analyst is feasible for a single analyst across time, between two separate analysts, and between a manual analyst/automated software. Reliably CT analyses of body composition is possible in stage II-III, post-primary treatment colon cancer patients.

**1238**

**Board #364**

**May 27 2:30 PM - 4:00 PM**

**Self-selected Walking Cadence After Light-Intensity Physical Activity Intervention For Older Cancer Survivors**

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**PURPOSE:** The MY Health randomized controlled trial evaluated the effectiveness of a wrist-worn activity monitor and health coaching to replace sedentary behavior with bouts of light-intensity physical activity among older cancer survivors. Participants were asked to 1) increase average daily steps ≥ 1000 above baseline and 2) disrupt sedentary behavior at least twice per hour. No specific recommendations regarding intensity or minimum bout duration were provided. In this secondary analysis, we hypothesized that participants would self-select to walk faster to meet their daily step goal. METHODS: Average daily steps and free-living walking cadence were measured in 41 participants (age 69.5±3 yr), using an ActiV PAL activity monitor for 7 days pre- and post-intervention. Step accumulation patterns associated with intensity of ambulatory behavior were sorted in cadence bands of one step/min from 40-59 (incidental movement) to ≥120 steps/min (fast locomotor movement). Repeated measures ANOVA was used to evaluate intervention induced changes in walking cadence; Wilcoxon rank-sum tests were used to highlight group differences within cadence bands. Medians and interquartile range are reported. RESULTS: Intervention (n=24) and Waitlist Control (n=17) participants exhibited similar characteristics at baseline. The Intervention group increased average daily steps by 976 (IQR: -388 to 3532) from pre- to post-intervention; the control group increased by 354 steps/day (IQR: -658 to 1300); p<.19. There was a significant interaction of the intervention on cadence bands (p<.001). Steps taken in cadence bands denoting moderate intensity physical activity (MPA; 100-119 steps/min) increased by 478 (IQR: -121 to 1844) steps/day in the intervention group, compared to a decrease of 92 (IQR: -510 to 181) steps/day in the control group (p<.01). CONCLUSION: While only 29% of intervention group participants met the daily step goal, there was a displacement of steps taken from cadence bands associated with lower to those of higher intensity of stepping, i.e., participants self-selected to walk faster. These findings may have important clinical implications as both duration and intensity have shown to offer cardioprotective and other health-related benefits.
Several studies demonstrate the beneficial effect of exercise on side effects and well-being during high dose/induction chemotherapy in patients with acute leukemia. Nevertheless, not only the chosen intervention and the exercise intensity vary between these studies but also the operationalization of exercise intensities differ. Although advances to use a graded exercise test in cancer patients exist, the suitability of this exercise testing in this specific group of patients has not been examined yet as far as the author knows.

Purpose: Investigate whether maximal effort of the participants has been generated during the graded exercise test.

Methods: As part of a bigger randomized controlled trial, 53 participants took part at the graded exercise test after being hospitalized to start high dose/induction chemotherapy treating acute leukemia or aggressive lymphoma. A graded exercise test starting at 20 watt increasing 10 watt per minute was performed. The ACSM criteria for a maximal exercise test were reviewed to determine whether the effort was maximal. These criteria are (1) a plateau in VO₂ with increased workload, (2) failure of heart rate to increase with increases in workload (3), a post-exercise venous lactate concentration > 8.0 mmol/l (4) a rating of perceived exertion at peak exercise > 17 on the 6-20 scale (Borg-Scale), and (5) a peak RER ≥ 1.10.

Results: Criteria one and five could not be tested, due to the study design. Only one participant fulfilled the first criteria. Lactate concentration was measured right after the test and three minutes later. 15.4% (6 participants) and 21.4% (9 participants) respectively, reached a lactate concentration > 8.0 mmol/l and thus fulfilled the third criteria. A higher value than 17 on the Borg-Scale was stated by 66.0% (35) of the participants fulfilling the fourth criteria. Five (16.7%) and seven (23.3%) participants respectively met both the third and fourth criteria simultaneously.

Conclusion: Following the ACSM criteria, this investigation states that the majority of participants did not reach the limit of exhaustion, suggesting that the graded exercise test might not be suitable for this group of patients.

INTRO: The physical decrements associated with cancer and its treatments can be attenuated with exercise. For this reason, exercise testing is essential to purposeful and individualized exercise prescriptions. Currently, the only treadmill protocol validated in cancer survivors is the University of Northern Colorado Cancer Rehabilitation Institute (CANCER) Treadmill Protocol. The Modified Bruce Treadmill Protocol (MB) is widely used for exercise testing in clinical settings and has been validated in healthy populations, but not cancer survivors. It is unknown whether the MB is an appropriate assessment tool compared to the validated cancer treadmill protocol. Multiple peak oxygen consumption (VO₂peak) predictive equations for the MB exist, however the accuracy of these equations in cancer survivors is unknown.

PURPOSE: To determine whether the MB yields as accurate VO₂peak values as the CANCER protocol in cancer survivors. The secondary purpose was to examine which MB predictive equation, if any, most accurately estimated VO₂peak in cancer survivors.

METHODS: Twenty-two cancer survivors completed two VO₂peak treadmill tests, the CANCER and the MB protocol. One protocol was performed once per week in a randomized order. VO₂peak values were obtained via gas analysis using a research-grade metabolic cart. A paired samples t-test was performed to determine if differences occurred between CANCER and MB VO₂peak values. A repeated measures ANOVA was performed to determine differences between four MB predictive VO₂peak equations. RESULTS: Due to its difficulty, one subject could not complete the MB, but completed the CANCER protocol. There were statistically significant differences between VO₂peak values (ml kg⁻¹ min⁻¹) found between the MB (26.38 ± 7.90) and CANCER protocol (28.65 ± 7.91) (p = 0.037). Furthermore, the American College of Sports Medicine (ACSM) walking/running equation from the last completed stage was the only predictive VO₂peak equation that was not statistically different than actual VO₂peak (p = 0.930) for the MB. CONCLUSION: Findings from this preliminary data suggest the MB underestimates VO₂peak in cancer survivors and may be too difficult for some to complete. This data proposes the MB may not be suitable to determine VO₂peak in cancer survivors.
Purpose: Cardiac rehabilitation (CR) improves recovery from cardiac events and may aid in the recovery from cancer. We conducted a scoping review to systematically describe research on CR use by adults with cancer and examined acceptability and benefits of CR for adults with cancer.

Methods: We searched 4 databases through September 16, 2019. Studies were required to have enrolled adults with cancer into CR or into a CR-based rehabilitation program.

Results: We identified 780 articles. Ten articles from 9 studies met inclusion criteria. Studies occurred in the United States (n=3), Canada (n=4), and the United Kingdom (n=2). Five studies used a quasi-experimental pre-post design, 3 used a retrospective design, and 2 developed a new cancer rehabilitation program based on a CR model. Cardiovascular, cancer, and behavioral barriers to attending CR were about acceptability of CR. Adults liked the peer support of CR and believed that CR would aid in the recovery from cancer. We conducted a scoping review to systematically describe research on CR use by adults with cancer and examined acceptability and benefits of CR for adults with cancer.

Conclusion: CR may safely improve physical and psychosocial health of adults with cancer. Future studies would benefit from the use of more rigorous study designs with a control group, inclusion of a diverse sample of adults with cancer, and more feedback on acceptability of CR from adults with cancer.
Resistance Training Attenuates Cancer Cachexia-Induced Cardiac Remodeling

Scott Baunel, Eric Bredahl. Creighton University, Omaha, NE. (Sponsor: Joan Eckerson, FACSM)

Purpose: To investigate the effects of exercise training on markers of cachexia in mice in a preclinical tumor model. The purpose of this study was to examine the effects of exercise training on markers of cachexia to determine if exercise training (TM), resistance training (RT), or combined training (TM+RT) would be most effective. METHODS: Male Balb/c mice were randomly assigned to Sed+Tumor, with the exception of gastrocnemius mass (P < 0.05; -35%), forelimb strength (P < 0.05; +211%), and heart weight (P < 0.01; +25%). Moreover, MHCIIa and IIb atrophied similarly in Sed+Tumor mice. All exercise groups had significant improvements in all examined markers of cachexia compared to Sed+Tumor, with the exception of gastrocnemius mass (P < 0.05). Additionally, RT significantly improved relative grip strength versus all other groups (P < 0.05). Overall myofiber CSA increased significantly with all EX modes (P < 0.05). CONCLUSIONS: These data support past literature in that exercise provides significant benefit to cachetic mice, and this may be due, in part, to decreased systemic inflammation. Specifically, RT, alone and with TM, provided the most benefit.

Free Communication/Poster - Preclinical Exercise Oncology

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

Doxorubicin (DOX) is a powerful chemotherapeutic agent with potent cytotoxic effects that result in increased rates of cell death and reduced viability. Recent evidence has shown that creatine (Cr) may minimize DOX-induced cytotoxicity to non-cancerous tissues; however, few studies have investigated the effect of Cr on tumor proliferation with or without DOX. Purpose: To determine if supplementation with Cr or creatine (CrN) alters cell viability in a tumor model when combined with DOX over a 48 hr time period. Methods: Walker 256 mammary carcinoma cells were cultured in growth medium (90%) in DMEM 10% FBS until they reached 90% confluency. Cells were seeded on to a 96-well plate at a density of 10,000 cells/well with fresh growth media and incubated for 24 hr. Cells were then exposed to growth media containing either 10 μM of DOX, 10 μM of Cr, 10 μM CrN, 10 μM DOX + 10 μM Cr, 10 μM DOX + 10 μM CrN, or regular growth media as a control for an additional 48 hr. Cell viability was measured using an MTT assay at 72 hr. Results: Addition of Cr to DOX-treated cells resulted in a significant increase in cell viability compared to DOX alone (P < 0.05). The combination of Cr and DOX resulted in an even greater increase in cell viability compared to DOX alone (P < 0.01). CONCLUSIONS: These data support past literature in that exercise provides significant benefit to cachetic mice, and this may be due, in part, to decreased systemic inflammation. Specifically, RT, alone and with TM, provided the most benefit.

The Effect Of Creatine And Creatine Supplementation On Doxorubicin Treatment Of Walker 256 Mammary Carcinoma Cells In Vitro

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No relevant relationships reported

Cancer-induced cachexia is a state of ill health characterized by cardiac and skeletal muscle atrophy that has profound impacts on cardiovascular function and quality of life. Resistance training (RT) during treatment has been shown to improve cardiac function via cardiac hypertrophy. PURPOSE: To assess the capacity for RT to minimize cachexia-induced cardiac remodeling. METHODS: All procedures were done in accordance with an IACUC approved protocol. Male-Wistar rats (n=48) were randomly assigned to a sedentary (SED), RT, SED+cancer, and RT+cancer group. Animals assigned to RT groups trained for a total of 13 wk using an elevated food model to simulate low intensity RT. SED animals were placed in standard animal housing for an equivalent amount of time. At week 10, animals were injected with Walker-256-mammarytumor carcinoma cells (10^6 cells) or an equivalent amount of saline. Left ventricular morphology was measured using echocardiography prior to injection and at the end of the 13 wk experiment. Differences in cardiac morphology (i.e. thickness and diameter) and diastolic function were analyzed using Echopac (0.89, 95% CI 0.78 - 1.03). However, those who decreased PA levels had a significantly higher risk of colon cancer (1.13, 95% CI 1.03-1.23).

CONCLUSIONS: Our results suggest that consistent participation in PA and increasing PA from low levels in the life course may be most protective of colon cancer risk. Promotion of PA throughout life for all ages and abilities is critical to minimize colon cancer risk, develop effective interventions, and disseminate prevention messages.

Effect Of Exercise On Cachexia In Mice Bearing The Colon-26 Carcinoma

Nicole R. Wood, Jacob Garriston, Alissa Mathias, Reid Hayward. University of North Carolina, Greeley, CO. (Sponsor: Joan Eckerson, FACSM)

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No relevant relationships reported

Colorectal cancer (CRC) is the third most prevalent cancer in the U.S. and risk is increased by lifestyle factors such as poor diet and physical inactivity. Also, CRC patients are highly susceptible to developing cachexia, which is characterized by muscle wasting, fatigue, and immune function immaturity that lead to increased morbidity and mortality. Studies have shown that aerobic and resistance training, independently, can effectively attenuate the deleterious effects of cachexia, and though research on concurrent training is limited, studies are reporting that combined exercise positively affects muscle wasting. PURPOSE: The purpose of this study was to examine the effects of exercise training on markers of cachexia to determine if aerobic training (TM), resistance training (RT), or combined training (TM+RT) would be most effective. METHODS: Male Balb/c mice were randomly assigned to (n = 24) or EX (n = 36) groups. EX mice were further allocated to either TM (n = 12), RT (n = 12), or TM+RT (n = 12). After 5 weeks of EX, 12 SED and all EX mice were inoculated with C26 cells; EX continued for 3 additional weeks before mice were sacrificed. Cachexia was assessed via histochemical/biochemical analyses and forelimb grip strength. RESULTS: Cachexia was induced in Sed+Tumor, evidenced by significant changes in body mass (P < 0.05; -14%), gastrocnemius mass (P < 0.01; -16%), gastrocnemius cross sectional area (CSA) (P < 0.05; -35%), forelimb grip strength (P < 0.01; -18%), splanchnemogy (P < 0.01; +83%), and plasma IL-6 (P < 0.01; +211%). Moreover, MHCIIa and IIb atrophied similarly in Sed+Tumor mice. All exercise groups had significant improvements in all examined markers of cachexia when compared to Sed+Tumor, with the exception of gastrocnemius mass (P < 0.05). Additionally, RT significantly improved relative grip strength versus all other groups (P < 0.05). Overall, myofiber CSA increased significantly with all EX modes (P < 0.05). Systemic inflammation was significantly decreased in all EX groups, as evident by decreases in spleen mass and plasma IL-6 (P < 0.01). CONCLUSIONS: These data support past literature in that exercise provides significant benefit to cachetic mice, and this may be due, in part, to decreased systemic inflammation. Specifically, RT, alone and with TM, provided the most benefit.
was assessed at 0, 12, and 48 hr using an EarlyTox™ Cell Integrity Kit and analyzed via a Nikon live cell confocal imaging system. Results: At 12 hr post-treatment, DOX and DOX+Cr had significantly lower cellular viability compared to baseline (P <0.05). At 48 hr, Cr, CrN, and DOX+Cr had significantly lower cellular viability compared to baseline (P <0.05). No significant differences in viabilities were found in the control group. Conclusion: The addition of Cr or CrN did not affect the cytotoxic effects of DOX.

**MEDICINE & SCIENCE IN SPORTS & EXERCISE®**

**WEDNESDAY, MAY 27, 2020**

**Concluding remarks in mice resulting in decreased tumor incidence for a variety of**

**Moderate-intensity exercise has been shown to have significant effects on tumor**

**Introduction:**

**CONCLUSIONS**

**PURPOSE: Regular physical exercise provides a significant risk reduction for breast**

**RESULTS:** PyMT mice average running distance was 6.4±1.2 km/day. No significant**

**RESULTS:**

**CONCLUSIONS:** In this highly aggressive, genetic, breast cancer model, an average**

**RESULTS:**

**INTRODUCTION:** Exercise has been shown to reduce the prevalence of certain cancers. Moderate-intensity exercise has been shown to have significant effects on tumor initiating mechanisms in mice resulting in decreased tumor incidence for a variety of cancers including pancreatic, gastrointestinal, and mammary. This is the first report of the role that exercise plays in the suppression of spontaneous murine lung cancer. Methods: CCSPCireL-KrasG12D mice were generated by crossing a mouse with the LSL-K-rasG12D mutant allele with a mouse harboring Cre recombinase inserted in the Clara cell secretory protein (CCSP) locus. Tumor-bearing progeny were assigned to either exercise (EX) or sedentary control groups. At tumor onset (4wk of age), 10wks of moderate exercise training was conducted for the EX group on a motor-driven treadmill (13.5 mm/min) for 45min/day, 5days/wk. Tumor burden was assessed by two variables: (1) visual count of lung surface nodules; and (2) internal tumor volume established from H&E stained. Homogenized spleen samples were analyzed via ELISA for IL-6 and TNF-α protein levels. Results: For sedentary mice (N=14) lung tumor count was 40.57 ± 3.483 tumors (mean ± SEM). Lung tumor count in the exercised mice (N=10) was significantly reduced to 21.8 ± 3.705 tumors (P <0.001). Sedentary mice (N=6) tumor percentage of lung volume was 12.34 ± 0.528%. Percent lung tumor volume in exercised mice (N=10) was significantly reduced to 6.91 ± 0.626% resulting in a 44% reduction of tumors within lung tissue. IL-6 and TNF-alpha spleen data did not show any significant changes due to exercise in relation to lung cancer. Conclusions: These results demonstrate that moderate exercise can slow the progression of tumorigenesis in a mouse model of lung cancer. However, the exercise mechanism of action remains unclear; while we did see a trend toward decreased levels of IL-6, no significant changes in pro-inflammatory cytokines IL-6 and TNF-alpha. Lung cancer is the leading cause of cancer mortality worldwide with current treatments resulting in an average 17% five year survival rate. Moderate exercise may be a practical method for patients to help suppress tumor progression.

**Board #377 May 27 2:30 PM - 4:00 PM**

**Board #378 May 27 2:30 PM - 4:00 PM**

**Use Of Creatine And Creatinine To Improve Cell Viability in Doxorubicin-treated Cardiac Myoblasts, Skeletal Muscle Myoblasts, and Aortic Myoblasts**

**Eric Bredahl, Creighton University, Omaha, NE. (Sponsor: Joan Eckerson, FACSM)**

**Email:** ericbredahl@creighton.edu

(No relevant relationships reported)

**Board #379 May 27 2:30 PM - 4:00 PM**

**Impaired Protein Synthesis And Elevated Methylarginines May Contribute To Cancer-associated Cachexia**

**Hawley E. Kunz, Jessica M. Dorschner, Taylor E. Berent, Zachary C. Ryan, Theodore A. Craig, Rajiv Kumar, Ian R. Lanza. Mayo Clinic, Rochester, MN.**

(No relevant relationships reported)

Cachexia, an illness-associated syndrome characterized by muscle wasting that cannot be reversed with nutritional support, is a significant contributor to cancer-associated morbidity and mortality. The mechanisms driving the loss of muscle mass are not well defined, and predictive or early diagnostic biomarkers have not been identified. **PURPOSE:** To determine factors that may contribute to cancer-associated losses in muscle mass and to identify potential biomarkers indicative or predictive of the severity of muscle wasting. **METHODS:** Lewis lung carcinoma (LLC1) cells or vehicle (CON) were injected subcutaneously into the left flank of seven week-old C57BL/6 male and female mice. After 21 days, skeletal muscle mass and function were assessed. Mitochondrial energetics were assessed in permeabilized muscle fibers using high-resolution respirometry, and fractional protein synthesis rates following the administration of 13C-glucose and 15N-glutamine were measured by mass spectrometry. To explore potential mechanisms and biomarkers of cachexia, untargeted metabolomics was performed using plasma and skeletal muscle from LLC1 and CON mice. **RESULTS:** Tumor-bearing mice showed evidence of cachexia, with 6.8% lower body mass (p <0.001), 10.0% lower quadriceps mass (p =0.010), 9.7% lower gastrocnemius mass (p <0.001), and 9.6% lower grip strength (p <0.004) at day 21. Mixed muscle protein synthesis was impaired in LLC1 mice (-18.6%, p=0.0279). Synthesis of both the sarcoplasmic and myofibrillar proteins was lower in LLC1 mice (-34%, p <0.0001 and -24.5%, p <0.0039, respectively). Mitochondrial protein synthesis was not significantly affected, and no differences in mitochondrial energetics were observed between LLC1 and CON mice. Untargeted metabolomics revealed significant increases in asymmetric dimethylarginine (ADMA) and N-monomethyl L-arginine (N-LNMA) in both the skeletal muscle and plasma of LLC1 mice. **CONCLUSION:** The synthesis of contractile and sarcoplasmic proteins was inhibited in cachetic, tumor-bearing mice. Elevations in ADMA and N-LNMA, endogenous nitric oxide synthase inhibitors formed during proteolysis, may both serve as biomarkers of cachexia and play a mechanistic role in the loss of muscle mass.

Project supported by the Andersson Corporate Foundation and T32AR056950.

**Board #380 May 27 2:30 PM - 4:00 PM**

**Use Of Creatine And Creatinine To Improve Cell Viability In Doxorubicin-treated Cardiac Myoblasts, Skeletal Muscle Myoblasts, And Aortic Myoblasts**

**Eric Bredahl, Creighton University, Omaha, NE. (Sponsor: Joan Eckerson, FACSM)**

**Email:** ericbredahl@creighton.edu

(No relevant relationships reported)

**Introduction:** Exercise has been shown to reduce the prevalence of certain cancers. Moderate-intensity exercise has been shown to have significant effects on tumor initiating mechanisms in mice resulting in decreased tumor incidence for a variety of cancers including pancreatic, gastrointestinal, and mammary. This is the first report of the role that exercise plays in the suppression of spontaneous murine lung cancer. **Methods:** CCSPCireL-KrasG12D mice were generated by crossing a mouse with the LSL-K-rasG12D mutant allele with a mouse harboring Cre recombinase inserted in the Clara cell secretory protein (CCSP) locus. Tumor-bearing progeny were assigned to either exercise (EX) or sedentary control groups. At tumor onset (4wk of age), 10wks of moderate exercise training was conducted for the EX group on a motor-driven treadmill (13.5 mm/min) for 45min/day, 5days/wk. Tumor burden was assessed by two variables: (1) visual count of lung surface nodules; and (2) internal tumor volume estimated from H&E stained. Homogenized spleen samples were analyzed via ELISA for IL-6 and TNF-α protein levels. Results: For sedentary mice (N=14) lung tumor count was 40.57 ± 3.483 tumors (mean ± SEM). Lung tumor count in the exercised mice (N=10) was significantly reduced to 21.8 ± 3.705 tumors (P <0.001). Sedentary mice (N=6) tumor percentage of lung volume was 12.34 ± 0.528%. Percent lung tumor volume in exercised mice (N=10) was significantly reduced to 6.91 ± 0.626% resulting in a 44% reduction of tumors within lung tissue. IL-6 and TNF-alpha spleen data did not show any significant changes due to exercise in relation to lung cancer. Conclusions: These results demonstrate that moderate exercise can slow the progression of tumorigenesis in a mouse model of lung cancer. However, the exercise mechanism of action remains unclear; while we did see a trend toward decreased levels of IL-6, no significant changes in pro-inflammatory cytokines IL-6 and TNF-alpha. Lung cancer is the leading cause of cancer mortality worldwide with current treatments resulting in an average 17% five year survival rate. Moderate exercise may be a practical method for patients to help suppress tumor progression.

**References:**

1. Department of Exercise Science and Pre-Health Professions, Creighton University
2. Treatment of Medical Microbiolgy and Immunology, Creighton University
3. Doxorubicin (DOX) is a powerful chemotherapy agent that is associated with a number of deleterious side effects, including cardiac, smooth, and skeletal muscle loss. Although the mechanisms behind the observed motility are not fully understood, the bulk of muscle loss is attributed to the generation of reactive oxygen species (ROS) and interference with DNA replication. Conversely, creatine (Cr) supplementation has been shown to have a therapeutic role in several disease states characterized by high ROS generation and metabolic dysfunction, which are common with DOX treatment. **PURPOSE:** To investigate the effects of Cr and creatinine (CrN) treatment on cell viability in DOX-treated myoblasts. **METHODS:** Skeletal muscle cells (RKSNCM), HP2C cardiac myoblasts, and Aortic smooth muscle cells were maintained in growth medium (10% FBS and 90% DME) until they reached 90-95% confluence. Cells were then collected and seeded on a 96-well plate at a density of 10,000 cells/ml containing fresh skeletal muscle growth media and allowed to recover for 24 hours. Cells were then exposed to fresh growth media containing either 25 µM of DOX, 10 mM Cr, 10 mM CrN, 25 µM DOX + 10 mM Cr, or 25 µM DOX + 10 mM CrN for an additional 24 hours. Rates of apoptosis were assessed using a cell viability kit (Molecular Devices) and analyzed via a Nikon live cell confocal imaging system. **RESULTS:** DOX treatment resulted in significantly lower viability regardless
of cell type (P<0.05). On average, viability was 46.3±7.1% for DOX treated cells. The addition of Cr or CrN with DOX significantly increased viability to 78.4±8.1% and 79.9±14.6%, respectively (P<0.05). **CONCLUSION:** Initial evidence from this investigation provides direct evidence to support the use of Cr and CrN to improve cell viability with DOX treatment.
C-07 Thematic Poster - Aging, Mobility and Neurobiology

Thursday, May 28, 2020 - 9:30 AM - 11:30 AM
Room: CC-2000

1293 Chair: Todd Manini, FACSM. University of Florida, Gainesville, FL.
(No relevant relationships reported)

1294 Board #1 May 28 9:30 AM - 11:30 AM
EARLY AND LATE RAPID NEUROMUSCULAR PARAMETERS OF THE PLANTAR FLEXORS IN MIDDLE-AGED AND OLDER MALES

Benjamin E. Dalton, Alex A. Olmos, Matthew T. Stratton, Phuong L. Ha, Trisha A. VanDusseldorp, Alyssa R. Bailly, Yuri Feito, FACSM, Gerald T. Mangine, Tyler M. Smith, Garrett M. Hester. Kennesaw State University, Kennesaw, GA. (Sponsor: Dr. Yuri Feito, FACSM)
(No relevant relationships reported)

Rapid torque production is important for physical function in older adults. Early and late rapid torque parameters are influenced by different physiological factors; therefore, they may be differentially affected by aging. Few comparisons exist between middle-aged and older adults for early and late rapid torque measures.

PURPOSE: To compare early and late rapid torque measures of the plantar flexors (PFs) in middle-aged (MM) and older (OM) males.

METHODS: Twenty-nine MM (n=14; 45.3±3.6 yrs) and OM (n=15; 65.3±3.2 yrs) performed maximal voluntary isometric contractions of the PFs using a dynamometer. Peak torque (PT), as well as rate of torque development (RTD; Δtorque/Δtime) and impulse (area under the curve) during the early (0-50 ms; RTD$_{0-50}$, IMP$_{0-50}$) and late (100-200 ms; RTD$_{100-200}$, IMP$_{100-200}$) contraction phases were calculated. Torque at 50 (TQ$_{50}$), 100 (TQ$_{100}$), and 200 ms (TQ$_{200}$) was also obtained. Additionally, RTD and TQ variables were normalized to PT. The onset was 2.5 Nm for all torque variables.

Electromyography of the medial gastrocnemius was recorded in order to obtain rate of electromyography rise (RER). RER was calculated as the linear slope of the normalized electromyography signal at 30, 50, and 75 ms from the onset. Independent samples t-tests were used for group comparisons.

RESULTS: PT (p=0.15), early (p=0.162), and late (p=0.074) RTD were similar between groups. TQ$_{50}$, TQ$_{100}$, and TQ$_{200}$ (MM: 69.7±11.68 vs. OM: 55.9±18.54 Nm; r$_{1}$=−0.046, TQ$_{50}$, (MM:114.7±26.79 vs. OM:91.5±28.10 Nm; r$_{1}$=−0.031), and IMP$_{100-200}$ (MM:4.79±1.11 vs. OM:3.83±1.17 Nm; p=0.032) were lower in OM. Normalized torque variables showed no differences (p>0.05). RER (p=0.077-0.072) was similar between groups.

CONCLUSIONS: Our data indicates that late rapid torque parameters of the PFs were preferentially influenced by age, yet PT appeared to mediate this result. Although not significant, the effect sizes for RER (d=0.69-0.74) may suggest that rapid muscle activation was influential as well.

1295 Board #2 May 28 9:30 AM - 11:30 AM
Associations Between Physical Fatigability, VO2 Peak And Measures Of Muscle Strength In Older Adults

Brett Davies¹, James Sampley², Heather Quiriarte¹, Eunhan Cho¹, Bailey Theall¹, Josh Granger¹, Matthew C. Scott¹, Steven B. Heymsfield³, Frank Greenway¹, Neil M. Johannsen, Guillaume Spielmann¹, Brian A. Irving, FACSM.¹ Louisiana State University, Baton Rouge, LA. ²Pennington Biomedical Research Center, Baton Rouge, LA. (Sponsor: Brian A. Irving, FACSM)
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(No relevant relationships reported)

Age related declines in cardiorespiratory fitness (VO2 peak) and muscle strength lead to impaired physical function and frailty in older adults. Higher levels of perceived fatigue, fatigability, exacerbate impairments in physical function and frailty in older adults. However, the independent and combined associations between VO2 peak, muscle strength and fatigability remain incompletely defined. PURPOSE: This study examined the cross-sectional associations between VO2 peak, muscle strength, and self-reported physical fatigability among untrained older adults. METHODS: The present analyses included, twenty (13F, 7M), older adults (X±SD: 71±4y) participating in an ongoing exercise intervention (REALPA). VO2 peak was determined using a graded exercise test on treadmill. Isometric and isokinetic knee extensor strength was assessed on the non-dominant leg using a Biodex Dynamometer. Peak isometric torque was measured at an angle of 60°, while peak isokinetic torque was measured at 60°/second. Physical fatigability were determined using the Pittsburgh Fatigability Scale. We used multiple linear regression to measure the association between the Physical Fatigability Score (0-50, no fatigue to extreme fatigue), VO2 peak, peak isometric strength, and peak isokinetic strength after adjusting for age. RESULTS: The X±SD for body mass index (BMI), VO2, peak, peak isometric torque, and peak isokinetic torque, were 28.4±kg/m², 20.4±ml/kg/min, 149.3±34 Nm, and 119±40 Nm, respectively. The physical fatigability scores were 12±7, ranging from 2 to 26. Before adjusting for age, peak isometric and isokinetic strength were inversely correlated with physical fatigability (r = −0.42, p = 0.07 and r = −0.41 p = 0.07, respectively). After adjusting for age, the partial correlations became statistically significant (r = −0.48, p=0.04 and r = −0.50 p = 0.03, respectively). In contrast, VO2 peak was not correlated to physical fatigability. CONCLUSION: The present results suggest that untrained older adults with lower measures of peak isometric and isokinetic strength report higher perceived physical fatigability. Further studies should examine the impact of increased skeletal muscle strength and its effect on perceived physical fatigability in older adults. This study was supported by the NIH R01AG058181-02.

1296 Board #3 May 28 9:30 AM - 11:30 AM
Perceived Physical Fatigability Explains The Association Between Physical Activity And Gait Speed

Yujia (Susanna) Qiao¹, Robert M. Boudreau¹, Mary K. Wojczynski², Kaare Christensen³, Stacy L. Andersen³, Stephanie Cosentino⁴, Nancy W. Glynn⁴.¹University of Pittsburgh Graduate School of Public Health, Pittsburgh, PA. ²Washington University School of Medicine in St. Louis, St. Louis, MO. ³Institute of Public Health, University of Southern Denmark, Odense, Denmark. ⁴Boston University School of Medicine, Boston, MA. ¹Columbia University Medical Center, New York, NY. (Sponsor: Andrea M Kriska, FACSM)
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(No relevant relationships reported)

Lower physical activity (PA) and greater perceived physical fatigability (fatigability) contribute independently to slower gait speed.

PURPOSE: To fully understand these complex relationships and inform potential interventions, we examined the bidirectional effects between PA and fatigability on gait speed in two generations of older adults (probands and their offspring) enrolled in the Long Life Family Study, a cohort enriched for exceptional longevity.

METHODS: At Visit 2 (2014-2017), we measured self-reported PA (typical day over past year) using the Framingham PA Index, perceived physical fatigability with the Pittsburgh Fatigability Scale (PFS, 0-50), and usual gait speed (m/s; fastest of two 4m trials). Linear mixed-effect models (accounting for family relatedness) were used to conduct regressions and mediation adjusted for age, sex, BMI, current smoker, health indicators, depression and field center.

RESULTS: At Visit 2, participants (N=2059) ranged in age from 60-107 yrs, with 54.1% female, 99.6% white, PA = 36.6 ± 7.0 MET-hrs/day, PFS = 13.9 ± 9.4, and gait speed = 1.02 ± 0.31 m/s. Compared to offspring (mean ± SD 69.9 ± 6.2 yrs, n=1762), probands were older (92.0 ± 6.9 yrs, n=297), with lower PA, greater PFS scores, and slower gait speed (all p<0.001). Each five MET-hrs/day less PA was directly associated with 0.025 m/s (probands) and 0.005 m/s (offspring) slower gait speed, for fatigability, each five points greater PFS was directly associated with 0.04 m/s (probands) and 0.03 m/s (offspring) slower gait speed (all p<0.001). Further, fatigability explained 41.2% (probands) and 44.4% (offspring) of the effect of less PA on slower gait speed, whereas PA explained 11.0% (probands) and 4.8% (offspring) of the effect of greater fatigability on slower gait speed.

CONCLUSIONS: Given that fatigability largely explained PA's effect on slower gait speed, and the consistency between generations, our findings support fatigability as a potential mediator in the pathway from PA to gait speed. Although we need longitudinal data to confirm the casual directionality, increasing PA may be a likely intervention to reduce perceived physical fatigability and slow the downward spiral leading to worse physical function among older adults.

Funded by NIA U01AG023712, U01AG023744, U01AG023746, U01AG023749, U01AG023755.
Aerobic Fitness Protects Against Age-Related Cognitive Decline In A Population At Risk For Alzheimer’s Disease

Ryan J. Dougherty, Clayton Vesperman, Brandon Mergen, Julian Gaitán, Sarah Lose, Sterling Johnson, Ozioma Onokwo, Dane B. Cook, FACSM. University of Wisconsin - Madison, Madison, WI. (Sponsor: Dane B. Cook, FACSM)

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(No relevant relationships reported)

PURPOSE: To determine whether mid-late life aerobic fitness prospectively predicts longitudinal cognitive trajectories in a sample of cognitively unimpaired older adults at risk for Alzheimer’s disease.

METHODS: One hundred and four adults (mean age at baseline 64.47 ± 6.1) from the Wisconsin Registry for Alzheimer’s Prevention underwent a graded treadmill exercise test and neurocognitive examinations at baseline assessment. Two additional biennial neurocognitive examinations were conducted 2.54 ± 0.96, and 4.00 ± 0.41 years after baseline testing (follow-up range: 1.54 - 4.80 years). Aerobic fitness was defined as the highest oxygen consumption (VO$_{2peak}$, mL/kg/min) value recorded during the final stage of the maximal exercise test when standardized criteria were met. The cognitive measure of interest was the preclinical Alzheimer’s Cognitive composite (PACC) score which includes neurocognitive measures that have demonstrated to be sensitive to early age-related decline in preclinical Alzheimer’s disease, i.e., measures from the Rey Auditory Verbal Learning Test and the Wechsler Intelligence and Memory Scales. A linear mixed effects model was used to investigate whether longitudinal trajectories of cognition varied as a function of fitness while controlling for the variance explained by age, sex, and education.

RESULTS: On average, participants displayed a VO$_{2peak}$ of 26.57 ± 6.40 mL/kg/min. At baseline, age was negatively associated with fitness (r = -0.33, p < .001) and cognitive function (r = -0.27, p = .007). Longitudinal analysis revealed a significant time × VO$_{2peak}$ interaction (p = .032), indicating that greater aerobic fitness mitigated cognitive decline over a 2 - 4 year period.

CONCLUSIONS: Cognitive function declines with age and the progression of Alzheimer’s disease. These data indicate that aerobic fitness may preserve cognition in older adulthood, and suggest that engagement in activity aimed at improving fitness (e.g. exercise training) may mitigate age-related cognitive decline. Future studies that assess changes in fitness will be needed to better elucidate the causality of the observed relationship.

Ryan J. Dougherty was supported by a NIH NRSA grant: F31AG062009

Hippocampal Plasticity After Acute Exercise In Older Adults: A Diffusion Tensor Imaging Study

Daniel Callow, Junyeson Won, Alfonso Alfiniti, Jeremy Purcell, Lauren Weiss, Wang Zhan, J. Carson Smith, FACSM. University of Maryland, College Park, MD. Email: ddcc2442@gmail.com

(No relevant relationships reported)

PURPOSE: The hippocampus is a critical region for many cognitive and memory processes that experience structural and functional decline with age. Exercise is beneficial for the aging brain and shows preferential benefits for hippocampal volume, activation, and memory-related cognitive processes. However, research thus far has primarily focused on the effects of exercise on long-term volumetric changes in the hippocampus using structural MRI. Critically, microstructural alterations within the hippocampus over short time intervals have been associated with neuroplasticity and cognitive changes that do not alter its volume but are still functionally relevant. It is not yet known, however, if microstructural neuromorphology occurs in the hippocampus in response to a single session of exercise.

METHODS: We used a within subject-design to determine if a 30-minute bout of moderate-intensity aerobic exercise altered bilateral hippocampal diffusion tensor imaging (DTI) measures in healthy older adults (n=30) compared to a seated rest control condition.

RESULTS: Following exercise there was significantly lower fractional anisotropy (FA) relative to seated rest within the bilateral hippocampus, and this effect was driven by higher radial diffusivity (D). No significant differences in mean diffusivity (MD) or axial diffusivity (D) were observed. Additionally, cerebral blood flow (CBF) data were obtained in a subset of participants (n=13). Differences in D, within the bilateral hippocampus were significantly associated with differences in bilateral hippocampal perfusion.

CONCLUSIONS: These findings suggest that a single session of exercise can lead to microstructural changes in the hippocampus of healthy older adults, and that these changes may be associated with changes in the extracellular space and glial, synaptic, and dendritic processes within the hippocampus. Repeated microstructural alterations from acute bouts of exercise may accumulate and precede larger volumetric and functional improvements in the hippocampus, a region that is often susceptible to age and pathological-related cognitive decline.

Late-life Physical Exercise, Neuropsychiatric Symptoms And The Risk Of Incident Mild Cognitive Impairment

Janina Krell-Roesch1, Jeremy A. Syrijanen1, Maria Vassilaki1, Alexander Woll1, Walter K. Kremers2, Mary M. Machulda2, Michelle M. Mielke2, David S. Knopman3, Ronald C. Petersen2, Yonas E. Geda1.1 Karlsruhe Institute of Technology, Karlsruhe, Germany. 2Mayo Clinic, Rochester, MN. 3Mayo Clinic, Scottsdale, AZ.

(No relevant relationships reported)

PURPOSE: Mild cognitive impairment (MCI) is the intermediate stage between normal cognitive aging and dementia. We examined the association between lack of engaging in physical exercise (PE) and presence of neuropsychiatric symptoms (NPS), both separately and combined, with the outcome of incident MCI.

METHODS: This prospective cohort study in the setting of the population-based Mayo Clinic Study of Aging in Olmsted County, MN, included 3206 cognitively unimpaired persons aged ≥ 50 years (1629 males; 833 APOE e4 carriers; 74 years median age). The outcome of interest in the Cox proportional hazard models was incident MCI, with age as the time scale. Predictors were lack of engaging in light, moderate and vigorous intensity PE within one year of baseline assessment; and presence of NPS (apathy, anxiety, depression, appetite change, nighttime behavior, sleep disturbance, and irritability) as measured by the Neuropsychiatric Inventory Questionnaire. We also compared the risk of incident MCI between four groups of participants: no NPS/ engaging in PE (reference group); NPS/ engaging in PE; no NPS/ not engaging in PE; and NPS/ not engaging in PE. Analyses were adjusted for sex, education, global cognition, medical comorbidities, and Apolipoprotein E (APOE) e4 status.

RESULTS: After a median follow-up of 5.3 years, 599 participants developed incident MCI. Individuals who did not engage in light (HR [95% CI]: 1.25 [1.00, 1.55]), moderate (1.19 [1.00, 1.41]) or vigorous intensity PE (1.36 [1.01, 1.83]) had an increased risk of incident MCI. Having anxiety (1.60 [1.09, 2.33]), apathy (1.91 [1.39, 2.62]) or depression (1.66 [1.30, 2.12]) was also associated with an increased risk of incident MCI. Participants who did not engage in PE (be it of light, moderate or vigorous intensity) in the presence of NPS had the highest risk of incident MCI. For example, not engaging in moderate intensity PE and having anxiety (1.94 [1.20, 3.15]), apathy (2.04 [1.34, 3.13]) or depression (1.93 [1.41, 2.66]) was associated with an increased risk of incident MCI as compared to the reference group.

CONCLUSIONS: Lack of engaging in late-life PE and NPS are independent risk factors of incident MCI. A combination of both factors is associated with an even more elevated risk of developing MCI, with NPS appearing to be a stronger driving force than lack of PE.
Nitrate-rich beetroot juice can increase salivary-pH. As expected, nitrite (NO₂⁻) and nitrate (NO₃⁻) were highest in the NO₃⁻-trial (all P<0.001). Salivary-pH followed a similar pattern (NO₂⁻-trial - Pre-exercise 7.4 ± 0.4 Post-exercise 7.4 ± 0.4, negative-control - Pre-exercise 7.1 ± 0.3 Post-exercise 7 ± 0.2, positive-control - Pre-exercise 7 ± 0.3 Post-exercise 7.0 ± 0.2, all P<0.05). Compared to negative-control, salivary-pH AUC was significantly increased following carbohydrate in positive-control and placebo (Pre-exercise - positive-control 33 ± 2.9, placebo 33.2 ± 2.7, negative-control 36.3 ± 1.8. Post-exercise – positive-control 32.1 ± 3, placebo 32.7 ± 2.4, negative-control 36.2 ± 1.9, all P<0.05). Conversely, AUC was similar in negative-control and NO₃⁻ despite ingestion of carbohydrate in the NO₃⁻-trial (Pre-exercise 34.8 ± 2.5, Post-exercise 34.5 ± 2.6, both P>0.221). Conclusion: Ingesting NO₃⁻ rich beetroot juice attenuates the reduction in salivary-pH after carbohydrate supplements suggesting that NO₃⁻ may protect athletes’ teeth from acid erosion caused by frequent carbohydrate ingestion.

Exercise intolerance is the primary cause of morbidity and decreased quality of life in patients with chronic heart failure (HF). The strong prognostic value of exercise capacity in patients with HF warrants identification of interventions which maximize exercise capacity in this population. Although the etiology of HF is complex, reduced nitric oxide (NO) bioavailability is an underlying characteristic that has been shown to moderate physiological processes related to exercise including vascular function, tissue perfusion, mitochondrial function and contractile efficiency. Dietary inorganic nitrate supplementation has been shown to increase NO bioavailability and increase exercise tolerance in several clinical populations, including peripheral arterial disease, pulmonary disease, and HF with preserved ejection fraction. Purpose: To determine the effect of dietary inorganic nitrate supplementation on exercise capacity in patients with heart failure with reduced ejection fraction (HFpEF). Methods: Sixteen patients with HFpEF (15 men, 63 ± 4 y, BMI: 31.8 ± 2.1 kg m⁻²) participated in a randomized, double-blind, crossover design study. Participants consumed either beetroot juice (BRJ - 16mmol nitrate/day), or a nitrate-depleted placebo (PL) for five days prior to completing a cardiopulmonary exercise test (CPX).

**RESULTS:** Following BRJ supplementation plasma nitrite increased significantly compared to placebo (511.5 ± 461.1nM vs. 195.0 ± 176.8nM; p<0.05). No differences were observed for the onset of VT (BRJ: 611.0 ± 119.7s; PL: 611.0 ± 142.3s; p>0.05) or V̇O₂AT (BRJ: 1159.7 ± 207.3ml min⁻¹; PL: 1132.4 ± 221.0ml min⁻¹; p=0.53).

**CONCLUSIONS:** Dietary nitrate supplementation, despite significant increase in circulating nitrate, produced no changes time to anaerobic threshold or sustainable sub-maximal oxygen uptake. Supported by Australian Heart Foundation Vanguard Award 101389 to Jason D. Allen.

Oral disease is prevalent in elite athletes and is associated with frequent carbohydrate ingestion which lowers salivary-pH. Conversely, ingestion of nitrate (NO₃⁻)-rich beetroot juice can increase salivary-pH. **Purpose** To determine the effect of NO₃⁻ on salivary-pH following carbohydrate ingestion before and after exercise. **Methods** Eleven male endurance runners completed a double-blind randomised placebo-controlled study comprising four experimental trials. Participants ingested the following fluids one hour before each trial: (a) 140 ml of water (negative-control), (b) 140 ml of water (positive-control), (c) 140 ml of NO₃⁻-rich beetroot juice (~12.4 mmol NO₃⁻) after beer of juice (BRJ - 16mmol nitrate/day), or a nitrate-depleted beetroot juice (placebo). During the negative-control trial, participants ingested 795 ml of water in three equal aliquots: before, during, and after 90 min of submaximal running. In the other trials they received 795 ml of carbohydrate supplements in the same fashion. One venous blood was collected before and after exercise. At the same time points, saliva was sampled before and repeatedly for 20 min following carbohydrate or water ingestion, area under the curve (AUC) was calculated for each sample. **Results** As expected, nitrite (NO₂⁻) and nitrate (NO₃⁻) were highest in the NO₃⁻-trial (all P<0.001). Salivary-pH followed a similar pattern (NO₂⁻-trial - Pre-exercise 7.4 ± 0.4 Post-exercise 7.4 ± 0.4, negative-control - Pre-exercise 7.1 ± 0.3 Post-exercise 7 ± 0.2, positive-control - Pre-exercise 7 ± 0.3 Post-exercise 7.0 ± 0.2, all P<0.05). Compared to negative-control, salivary-pH AUC was significantly increased following carbohydrate in positive-control and placebo (Pre-exercise - positive-control 33 ± 2.9, placebo 33.2 ± 2.7, negative-control 36.3 ± 1.8. Post-exercise – positive-control 32.1 ± 3, placebo 32.7 ± 2.4, negative-control 36.2 ± 1.9, all P<0.05). Conversely, AUC was similar in negative-control and NO₃⁻ despite ingestion of carbohydrate in the NO₃⁻-trial (Pre-exercise 34.8 ± 2.5, Post-exercise 34.5 ± 2.6, both P>0.221). Conclusion: Ingesting NO₃⁻ rich beetroot juice attenuates the reduction in salivary-pH after carbohydrate supplements suggesting that NO₃⁻ may protect athletes’ teeth from acid erosion caused by frequent carbohydrate ingestion.
groups: nitrate plus placebo (NIT), beta-alanine plus placebo (BA), placebo (PLA), or active treatments (ACT) and participated in this 12-week double-blind, placebo-controlled study. At pre-intervention testing, participants completed body composition measures. VO\(_2\) max, 30-second Wingate test on day one, and 40-yard dash and Yo-Yo Intermittent Recovery Test: Level 2 (YOYO2R) on day two and testing sessions were repeated at 6- and 12-weeks post-training and supplementation. A 4x3 repeated measures ANOVA was used to analyze the data with a priori p value set at ≤0.05.

**RESULTS**: There was a significant time effect (P<0.05) on the following variables indicating that the training protocol induced performance adaptations: VO\(_2\) max (p=0.00), Wingate peak power and mean power (p=0.04, p=0.006), 40-yard dash (p=0.003), and YOYO2R (p=0.00). Change in performance over time (% change) for VO\(_2\) max was NIT: 9%, BA: 7%, ACT: 12% vs PLA: 8%. Wingate mean power % change was NIT: 11%, BA: 6%, ACT: 4% vs PLA: 5%. Wingate peak power % change was NIT: 10%, BA: 11%, ACT: 10% vs PLA: 9%. YOYO2R % change was NIT: 48%, BA: 54%, ACT: 74% vs PLA: 10%. Despite this, there were no significant group by time effects for any variables.

**DISCUSSION**: After 12 weeks of daily supplementation, no statistical differences were shown between groups for the variables tested. Despite this, improvements were made by each group in comparison to the placebo group.

**CONCLUSIONS**: Although further research is warranted, addition of these supplements may be beneficial to soccer players.

**Abstracts were prepared by the authors and printed as submitted.**

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**Board #6**

**May 28 9:30 AM - 11:30 AM**

**Influence Of Chlorinated Pool Water Exposure On Oral Nitrate Reduction In Healthy Adults**

Stephen J. Bailey. Loughborough University, Loughborough, United Kingdom.

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(No relevant relationships reported)

Dietary nitrate (NO\(_3\)) supplementation can improve exercise performance with this effect mediated by reduction of NO\(_2\) to nitrite (NO\(_2\)) and then nitric oxide. The reduction of NO\(_2\) to NO\(_2\) is catalyzed by oral NO\(_3\) reducing bacteria. Chlorine is an antimicrobial agent that is commonly used to sterilize pool water, but it is presently unclear whether the lack of an improvement in swimming performance in trained swimmers following dietary NO\(_3\) supplementation can be ascribed to impaired oral NO\(_3\) reduction (ONR).

**PURPOSE**: To test the hypotheses that ONR would be greater:

1) in non-swimmers (NS) compared to elite swimmers (ES), and 2) before compared to after a pool training session in ES.

**METHODS**: Thirteen ES (18 ± 2 yrs) and fourteen NS controls (9 males, 21 ± 4 yrs) participated in this study. In a randomized, double blind, crossover experimental design, ONR was assessed in ES before (AM-Pre and PM-Pre) and after (AM-Post and PM-Post) a morning and afternoon pool training session. In NS, ONR was only assessed in the morning. For assessment of residual oral NO\(_3\) concentration ([NO\(_3\)]), participants held 10 mL of water in their mouth for 3 min and subsequently expectorated the content of their oral cavity. Following a 3 min recovery, participants repeated this process with either 10 mL of water (PL) or 1 mL KNO\(_3\) solution (NIT). Salivary [NO\(_3\)] was assessed using ozone-based chemiluminescence. In ES, ONR was assessed via a 2 × 2 repeated-measures ANOVA, while differences in ONR between ES and NS was assessed using an independent-samples t-test.

**RESULTS**: There was a significant difference in ONR between ES (10 ± 0.07 µmol min\(^{-1}\)) and NS (12 ± 0.13 µmol min\(^{-1}\), P<0.05). There was a condition × time interaction effect for ONR in ES (P<0.05). Compared to PL, ONR in NIT was higher at AM-Pre, AM-Post, PM-Pre and PM-Post (P<0.05); however, ONR in NIT was not different between the AM-Post (10.12 ± 0.11 µmol min\(^{-1}\)) and AM-Pre (10.0 ± 0.07 µmol min\(^{-1}\)) or PM-Post (3.17 ± 0.15 µmol min\(^{-1}\)) and PM-Pre (0.16 ± 0.10 µmol min\(^{-1}\)) conditions (P>0.05). Oral NO\(_3\) reduction in NIT was higher in PM-Pre compared to AM-Pre (P<0.05). **CONCLUSIONS**: Similar ONR was exhibited in ES and NS, and ONR was not acutely attenuated in ES following morning or afternoon pool training sessions. These observations suggest that exposure to chlorinated pool water does not interfere with ONR.

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**Board #7**

**May 28 9:30 AM - 11:30 AM**

**Beetroot Supplementation Lowers Blood Pressure, But Does Not Improve Exercise Efficiency In Female Masters Swimmers**

Lisa Ferguson-Stegall, FACSM, Owen Sloop, Alyssa Q. Eastman. Hamline University, St Paul, MN.

(No relevant relationships reported)

Beetroot supplements are high in dietary nitrate, which increases nitric oxide (NO) in the blood circulation. While NO can lower blood pressure and reduce the oxygen cost of exercise, this has mainly been studied in male athletes. Less is known about the effects of BRS in female athletes, especially swimmers. **PURPOSE**: To determine if acute beetroot supplementation (BRS) lowers blood pressure (BP) and improves exercise efficiency in female masters swimmers during treadmill exercise.

**METHODS**: 11 swimmers (57.8±10.5 y) underwent 2 randomized, double-blinded trials and ingested beetroot supplement (BE) or placebo (PL). BP, heart rate (HR), and NO response, determined indirectly via changes in salivary nitrite (NO\(_3\)) was measured pre-ingestion (Base), pre-exercise (Pre), and 5 min post-exercise (Post). Oxygen consumption (VO\(_2\)), HR, and rating of perceived exertion (RPE) were measured during the modified Balke test until HR reached 85% of age-predicted maximum. Changes in salivary NO\(_3\) were determined using NO\(_3\) detection strips and quantified as percentage of reference standard. 2-way repeated measures ANOVA was used to determine differences in BP, HR and salivary NO\(_3\). Peak VO\(_2\), treadmill time, and peak RPE were analyzed by 2-tailed t-tests.

**RESULTS**: Salivary NO\(_3\) increased from Base to Post in BE compared to PL (32.5±7.0 vs 2.7±3.9%, p<0.001). No treatment differences existed for peak VO\(_2\) (BE: 29.3±2.0 vs PL: 29.7±2.7 ml·kg\(^{-1}\)·min\(^{-1}\), p=0.31), treadmill time (BE: 15.5±1.9 vs PL: 15.4±1.8 min, p=0.92), or peak RPE (BE: 6.2±0.5 vs PL: 6.5±0.5, p=0.26). Diastolic BP was significantly lower in BE vs PL, respectively (BE: 74.6±1.7 vs 73.2±2.3, Pre: 73.6±1.8 vs 74.5±2.1, Post: 74.5±1.7 vs 76.1±2.2 mmHg, p=0.03, treatment x time), while systolic BP changes trended towards significance in BE vs PL (Base: 116.6±1.5 vs 115.5±1.6, Pre: 115.0±1.7 vs 116.0±1.7, Post: 116.5±1.4 vs 118.3±1.5 mmHg, p=0.053). HR at Base, Pre, and Post was not different in BE vs PL (62.0±2.4, 63.2±2.5, and 72.6±3.2 vs 63.6±2.1, 65.4±2.2, and 74.6±2.4 bpm, p=0.86). **CONCLUSIONS**: Acute BRS lowers diastolic BP, but does not improve exercise efficiency in this group of trained, normotensive female masters swimmers. More research is needed in other female masters athlete groups such as runners and cyclists, and in female athletes with hypertension.

**Abstracts were prepared by the authors and printed as submitted.**
Yoga may elicit numerous benefits including weight loss. However, it is unclear if adults with obesity will lose more weight as frequency and amount of yoga increases within a behavioral weight loss intervention. **PURPOSE:** To compare the association between yoga participation and weight loss across two styles of yoga. **METHODS:** Fifty adults with obesity (BMI: 31.3±3.8 kg/m²; 45.8±9.5 years) participated in a 6-month group-based behavioral weight loss intervention. All participants were prescribed a calorie and fat-reduced diet (1200-1800 kcal/day, 20-30% fat intake). Randomization was to either a Restorative (RES) or Vinyasa (VIN) style of yoga, with one supervised session per week and 4 home-based sessions using videos developed and provided by the investigators on an electronic tablet. Yoga sessions increased from 20 to 40 to 60 minutes per session across the intervention. Weight was assessed at baseline and 6 months. Analysis of variance with repeated measures was used to assess weight loss. Linear regression analyzed the association between yoga participation with weight loss. **RESULTS:** Total participation minutes in yoga was significantly and linearly related to weight loss in all RES and VIN styles (β=0.088, p=0.018; β=0.089, p=0.001, respectively). Total participation minutes in yoga and sedentary behavior (SB) were not differentially affected by DIET and EX. **CONCLUSIONS:** Findings indicate that the amount and frequency of participation in yoga is associated with weight loss within the context of a comprehensive behavioral intervention. Future studies need to examine strategies to enhance yoga participation in adults with overweight or obesity, and to understand the pathways by which yoga may influence body weight regulation.
Purpose: The present study examined, among weight-stable overweight or obese adults, the effect of increasing doses of exercise energy expenditure (EEex) on changes in total daily energy expenditure (TDEE), total body energy stores (Es), and body composition.

Methods: Participants included healthy, sedentary females and males aged 21 to 45 with a body mass index between 25 and 35 kg/m² who were randomized to one of three groups for a period of 26 weeks: moderate exercise group (MedEx; EEex goal of 17.5 kcal/kg/week), high exercise group (HighEx; EEex goal of 35 kcal/kg/week), or observation group (Obs). Participants maintained body weight within 3% of baseline weight. Pre/post measurements included body composition, EEex, calculated energy intake, total daily energy expenditure (TDEE), total body energy stores (Es), and resting metabolic rate (RMR). Outcomes were compared among groups, and among group by sex.

Results: Sixty weight-stable participants (31 males and 29 females) completed the protocols. There were no differences among groups in any baseline variable. EEex increased in a stepwise manner as compared to Obs (p < 0.001). As compared to OBS, there was no group effect on changes in TDEE, energy intake, fat mass or RMR.

Fat mass and total energy stores decreased among the high HIIE females (p < 0.001). As compared to OBS, there was a sex difference in the relationship among energy balance components. These results suggest that, without substantial weight change, the doses of exercise produced a compensatory reduction in non-exercise energy expenditure, and potentially a sex-specific change in body composition.

Conclusions: The increase in EEex did not result in an equivalent increase in TDEE. There was a sex difference in the relationship among energy balance components. These results suggest that, without substantial weight change, the doses of exercise produced a compensatory reduction in non-exercise energy expenditure, and potentially a sex-specific change in body composition. This project was funded by an unrestricted grant from the Coca Cola Company.

Purpose: To determine if aerobic exercise (AEx) and resistance exercise (REx) differentially influence acute energy intake and appetite regulation. Methods: Physically inactive adults with overweight/obesity (n=24, 35±1.7 yrs, BMI: 28.5±1.0 kg/m²; 50% female) completed 2 conditions; AEx (treadmill walking at 65-70% of age-predicted maximum heart rate for 45 minutes) and REx (1-set to failure of 12 resistance exercises). Each condition was initiated in the postprandial state (35 minutes post breakfast). Appetite (visual analog scale for hunger, satiety and prospective food consumption [PFC]) and hormones (ghrelin, PYY, and GLP-1) were measured before post exercise food cravings (following 90 min VAS and blood draw via Food Cravings Inventory [FCI] questionnaire) and ad libitum energy intake at the lunch meal were also measured. Results: There was no difference in post-exercise ad libitum energy intake between conditions (AEx: 937.65 kcal vs. REx: 991.168 kcal). There were also no differences in post exercise food cravings, nor area under the curve (AUC) for hunger, satiety, or PFC. However, there was a trend for higher satiety scores 150 min post breakfast in the REx condition (AEx: 35±4 mm vs. REx: 42±4 mm, p=0.07). For GLP-1, the higher AUC for AEx was due to significantly higher AUC for all of the post-exercise time points compared to REx (p<0.001). For PYY, the higher AUC for AEx was due to greater values for all of the post-exercise time points evaluated (p<0.05). For GLP-1, the higher AUC for AEx was due to significantly higher levels at the 90 minute postprandial time point (p<0.001), and a trend for greater levels at the 120 minute time point (p=0.07). Conclusions: The data suggest that an acute bout of aerobic exercise appears to increase both ghrelin and anorectic gut peptides, as well as PYY and GLP-1, anorectic gut peptides, compared to an acute bout of resistance exercise. However, ad libitum energy intake was not different between conditions. Future work is needed to determine if exercise modulates chronic energy intake and appetite regulation.
To determine the effects of high-intensity interval training (HIIT) and moderate-intensity continuous training (MICT) on energy compensation in response to 12-weeks of supervised aerobic exercise. After a 4 wk lead in period of 3x/wk of MICT, subjects (N = 24) were randomly assigned into HIIT or MICT, for an additional 8 wks. HIT included a 10x1 min protocol 3x/wk and MICT included 30 min of exercise 5x/wk. Subjects completed both stationary cycling and inclined treadmill exercise. 13 participants (1 M, 12 F) were randomized into the HIIT group (28.0 ± 9.7 yr; BMI = 23.9 ± 3.9 kg/m²; VO2max = 29.0 ± 6.0 ml/kg/min). 11 participants (2 M, 9 F) were randomized into the MICT group (26.0 ± 6.9 yr; BMI = 27.4 ± 8.7 kg/m²; VO2max = 26.2 ± 7.3 ml/kg/min).

Resting metabolic rate (RMR), body composition, and maximal oxygen uptake (VO2peak) were measured at baseline and after 4 and 12 wks. Energy and macronutrient intake were measured for 7-day periods pre-intervention and during wks 5 and 12. Compensation was calculated through caloric equivalents of fat and lean mass compared to cumulative total exercise energy expenditure. 5 of 11 in MICT and 6 of 13 in HIIT were categorized as compensators.

CONCLUSIONS:

- VO2peak was measured at baseline and after 4 and 12 wks. Energy and macronutrient intake were measured for 7-day periods pre-intervention and during wks 5 and 12. Compensation was calculated through caloric equivalents of fat and lean mass compared to cumulative total exercise energy expenditure.

**MEDICINE & SCIENCE IN SPORTS & EXERCISE**®

**C-10 Thematic Poster - Skeletal Muscle Health and Aging**

**PURPOSE:**

- To characterize the transcriptional and morphological profile of aging skeletal muscle. **METHODS:** Raising various lateralis muscle biopsies were collected from 9 young (Y; 27±3yr, 179±7cm, 82±10kg, 26±5BMI) and 9 older adults (O; 68±5yr, 172±8cm, 77±19kg, 26±5BMI) following an overnight fast. Whole transcriptome next-generation RNA sequencing was performed on cDNA synthesized from skeletal muscle RNA. Differentially expressed genes (FDR-adjusted P-value ≤ 0.05) were identified through DISeq2 and subjected to bioinformatic analyses using DAVID (v6.8). Skeletal muscle morphology including fiber type, satellite cell (SC) content, and capillarization was assessed through immunofluorescent microscopy. **RESULTS:** In total, 900 differentially expressed genes were identified in the skeletal muscle of O versus Y (1.5 fold change = 213; 1.5 fold change = 127). DAVVID functional analyses indicated that aging was associated with functions related to glycosgen metabolism, amino acid metabolism, ubiquitination, and transition between fast and slow fibers. Consistent with the latter, a significant difference (P<0.048) in myosin heavy chain (MyHC) fiber type profile was identified (Y = 29±4%; MyHC: 71±4%; O = MyHC: 46±7%; MyHC: 54±7%). Moreover, aging was associated with a numerical reduction in SC specific to MyHC (Y = 0.13±0.02; O = 0.07±0.02 SC/MyHC fiber, P<0.07) but not MyHC fibers (Y=0.12±0.03; O=0.08±0.02 P<0.373). Independent of fiber type, capillaries per fiber was significantly lower (P<0.015) in O (1.53±0.34 vs. Y (4.59±0.85). **CONCLUSION:** Ageing is associated with changes in the transcriptional and morphological profile of skeletal muscle. These findings highlight potential therapeutic targets for the preservation of skeletal muscle mass and function with advancing age.

Supported by a JumpStart Grant, CHS, ASU.

**C-10 Board #1**

**May 28 9:30 AM - 11:30 AM**

**The Impact Of Age On The Transcriptional And Morphological Profile Of Skeletal Muscle**

Nathan Serrano1, Andrew C. D’Lugos1, Jordan C. Ormsby2, Nicholas T. Thomas2, Kaylin R. Sweeney2, Chad C. Carroll2, Farshad Fani Marvasti2, Marcus A. Naymik3, Matthew J. Huerzeler3, Jared M. Dickinson, FACSM4, 1Arizona State University, Phoenix, AZ. 2Purdue University, West Lafayette, IN. 3Translational Genomics Research Institute, Phoenix, AZ. 4Arizona State University and Central Washington University, Ellensburg, WA. 

**Email:** nserrano1991@gmail.com 

(No relevant relationships reported)
but less is known about age-related differences in ME during dynamic contractions. **PURPOSE:** To examine age-related differences in ME during maximal effort isometric, isotonic, and isokinetic contractions of the knee extensor muscles. We hypothesized that age-related differences in ME would be present only during dynamic contractions. **METHODS:** 10 young (Y; 27.5±1.2 yr, 6 men) and 10 older (O; 71.2±1.6, 5 men) healthy adults performed three 24-s bouts of maximal knee extensor contractions: 1) sustained isometric contraction (MVIC), 2) isokinetic contractions (120°/s; 0.5 Hz), and 3) isotonic contractions with a load of 20% MVC (MVDC120; 0.5Hz). Phosphorus magnetic resonance spectroscopy of the vastus lateralis was used to calculate ATP flux through the creatine kinase reaction, non-oxidative glycolysis, and oxidative phosphorylation. Quadriceps muscle contractile volume was measured using serial fat-water magnetic resonance images. All spectroscopy and imaging data were acquired utilizing a whole-body 3T magnetic resonance system. The torque-time integral (TTI) during the MVIC, and power-time integral (PTI) during MVDC120 and MVDC20° were calculated. Total ATP flux was used to determine the ATP cost of each 24-s bout, and ME was calculated as specific TTI or PTI, divided by ATP cost. Differences between groups were evaluated using independent samples t-tests. **RESULTS:** ME was not different between young (0.12±0.01 Nm/cm2·mM ATP; p>0.765) and older (0.11±0.01 Nm/cm2·mM ATP; p>0.001) muscle during the MVIC. However, during both MVDC120 and MVDC20°, me was greater in young than older muscle (MVDC120: 0.011±0.001 vs. 0.007±0.001 W·cm2·mM ATP; p<0.002, respectively) and MVDC20°: 0.011±0.001 vs. 0.009±0.001 W·cm2·mM ATP; p<0.031, respectively). **CONCLUSION:** These results show an age-related deficit in ME that is evident only during dynamic contractions, potentially due to the higher energy demand of these contractions.

**1321**
**Board #3** May 28 9:30 AM - 11:30 AM
**Age-specific Resistance-type Exercise Training Improves Performance Without Altering Strain-injury Susceptibility**
CDC/NIOSH, Morgantown, WV. (Sponsor: Stephen E. Alway, PhD, FACSM)
Email: bwb3@cdc.gov

**Purpose:** Two tenets of exercise programming/training are injury prevention and performance enhancement. The purpose of this study was to determine whether a validated model of resistance-type exercise training (RTET) utilizing stretch-shortening contractions (SSCs) could alter susceptibility to the mechanical induction of skeletal muscle strain injury with aging. **Methods:** F344xBN rat dorsiflexor muscles were SSC RTET in vivo for 1 month on a custom-built isokinetic rodent dynamometer, utilizing age-specific RTET protocols. Performance for dorsiflexor muscles were analyzed temporally, and immediately following skeletal muscle strain injury. ANOVA was used for statistical analysis; α was set at p < 0.05. **Results:** Rodents receiving no SSC RTET prior to injury had significant static (-48.6% and -54.5%, respectively) and dynamic (-40.9% and -49.8%, respectively) peak force deficits. Age-specific, SSC RTET improved muscle performance in young and old rodents by 15% and 18%, respectively (p < 0.05). Interestingly, young and old rodents undergoing SSC RTET still incurred significant static (-48.8% and -55.7%, respectively) and dynamic (-47.5% and -48.7%, respectively) peak force deficits, which were similar deficits compared to untrained rodents. **Conclusions:** Although age-specific SSC RTET increases skeletal muscle adaptation, these results suggest that skeletal muscle strain induction susceptibility is unaltered following SSC RTET, irrespective of age.

**1322**
**Board #4** May 28 9:30 AM - 11:30 AM
**Impaired Recovery From Muscle Disuse In Early Life Compared To Young And Mature Adulthood**
Emory Perlman,1 Abbas Doctor,1 Ziad Mahmassani,2 Alec McKenzie,2 Jonathan Petrocelli,2 Naomi de Hart,2 Paul Reidy,2 Micah Drummond.3 Miami University, Oxford, OH. 1University of Utah, Salt Lake City, UT. (Sponsor: Kyle Timmerman, FACSM)

Physical inactivity negatively influences health and wellness, which has been a particular concern with aging. Less is understood regarding the impact of muscle disease during early stages of postnatal skeletal muscle development. **PURPOSE:** We propose that exposure to muscle disuse early in life will adversely impact muscle recovery compared to adulthood. **METHODS:** Postnatal day 30 (Young), mature 5 month (Adult) and aged ~25 month (Old) mice were studied as freely moving (Control) or experienced muscle disuse in the form of hindlimb unloading (HU) for two weeks followed by a 7 day recovery period when they were allowed to freely ambulate or "reload" (RL7). We assessed tissue composition, hindlimb and forelimb muscle size and myofiber diameter and cross-sectional area (CSA).

**RESULTS:** Muscle weight was not recovered in the Young and Old for soleus (absolute, normalized) or plantaris (absolute) (P>0.05). In the soleus, the difference between Control and RL7 was 1.9±0.38, 0.21±0.32, 0.81±0.32 mg for Young, Adult and Old, respectively. There was a trend for the Young to have recovered injury vs adult (p=0.056). In the plantaris, the difference between Control and RL7 was 1.84±0.77, 0.37±0.65, 1.50±0.64 mg for Young, Adult and Old, respectively. The soleus myofiber CSAs were not recovered in any group and the MHC I myofiber were particularly affected in the Young. In Control and RL7, the contractile volume was not recovered in the Young due to an impaired recovery in the MHC Ix+b myofibers. **CONCLUSIONS:** Postnatal mice are particularly susceptible to muscle disease as shown by impaired muscle recovery compared to young adult and old adult mice. Supported by NIA R01AG AG050781

**1323**
**Board #5** May 28 9:30 AM - 11:30 AM
**Muscle Density, Not Size, Is Inversely Associated With All-cause Mortality: The Multi-Ethnic Study Of Atherosclerosis**
Britta Larsen,1 John Belletiere,1 Matthew Allison1, Robyn L. McClendon1, Miljko Miljkovic2, Chantal Vella, FACSM3, Pamela Ouyang2, Michael Criqui3, Jonathan Unkart4, UC San Diego, La Jolla, CA. 1University of Washington, Seattle, WA. 2University of Pittsburgh, Pittsburgh, PA. 3University of Idaho, Moscow, ID. 4Johns Hopkins University School of Medicine, Baltimore, MD. (Sponsor: Chantal Vella, FACSM)
Email: blarsen@ucsd.edu

**Purpose:** Little is known about associations between lean muscle and mortality in healthy adults. The purpose of this study was to evaluate associations between abdominal muscle quantity (area) and quality (density) with risk of all-cause mortality in a diverse cohort. **Methods:** Abdominal muscle area and density were measured in men (n=946) and women (n=955) from the Multi-Ethnic Study of Atherosclerosis using computed tomography scans at the L2-L4 spinal column, with muscle density scored as attenuation in Hounsfield units. Sex-stratified Cox proportional hazard models were used to assess risk of all-cause mortality across sex-specific quartiles of muscle area and density adjusting for confounders, with area and density entered simultaneously. **Results:** Mean age for men and women at baseline was 64.2 and 65.1 years, respectively (median follow-up time was 10.6 and 10.9 years, respectively). The mortality rate for men was higher than for women (19.9% vs. 12.5%). Hazard ratios of all-cause mortality by quartiles of muscle area and density are shown in Table 1. For muscle density there was an inverse dose response with mortality, such that men and women in the highest quartiles of muscle density had 73% and 57% lower risk of mortality, respectively, in fully adjusted models compared to those in the lowest quartiles. There was no association between muscle area and mortality. **Conclusions:** In a large, diverse cohort of men and women, greater abdominal muscle density, but not muscle size, was associated with a markedly lower risk of all-cause mortality with over a decade of follow-up. These results suggest that high muscle quality as a powerful predictor of mortality in relatively healthy community dwelling adults. Future studies are needed to investigate biological mechanisms linking skeletal muscle fat infiltration with mortality.

<table>
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<th>Muscle Density Quartile</th>
<th>Male N</th>
<th>Female N</th>
<th>Male Mortality</th>
<th>Female Mortality</th>
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**1324**
**Board #6** May 28 9:30 AM - 11:30 AM
**Associations Of Skeletal Muscle Lipid Infiltration With Hypertrophy And Physical Performance Outcomes In Older Adults**
Douglas E. Long1, S. Craig Tuggle2, Alejandro G. Villasante Tezanos3, Marcos M. Bamman, FACSM4, Philip A. Kern4, Charlotte A. Peterson1, R. Grace Walton5, 1University of Kentucky, Lexington, KY. 2University of Alabama at Birmingham, Birmingham, AL. (Sponsor: Brian Noshen, FACSM)

Preserving muscle mass and quality is critical for long term health and longevity. Unfortunately, the hypertrophic potential of aged individuals is diminished, with some experiencing less than favorable outcomes from supervised resistance training programs. This has led investigators to explore the "poor" responder muscle.
CONCLUSIONS: The purpose of this study was to determine whether muscle lipid infiltration plays a role in anabolic adaptation responses, such as muscle growth and physical performance.

METHODS: The effects of a 14-week progressive resistance training (PRT) program on muscle size and quality, strength, and physical function in 48 individuals aged 65 and older (mean age ± SD, 70.8 ± 4.5 yrs) was determined. Computed tomography (CT) imaging of cross-sectional mid-thigh regions was used to measure intramuscular adipose tissue (IMAT) and thigh muscle density (TMD) as measures of thigh muscle lipid content. Associations between these lipid depots and baseline function, as well as muscle adaptations to PRT, were made for muscle size (DXA muscle mass and CT muscle area) and physical function and performance (strength, power, SF-36, PROMIS) using multiple linear regression models adjusted for potential confounders such as sex, BMI, CT muscle area, and baseline muscle strength. The association of muscle lipid and physical activity were conducted as a secondary analysis.

RESULTS: At baseline, TMD (mean Hounsfield unit ± SD, 42.1 ± 4.0 HU), but not IMAT (mean area ± SD, 12.5 ± 4.3 cm²), was significantly associated with all physical function and performance variables (R² range 0.45-0.75, p < 0.05) except leg extension strength and power. Neither IMAT nor TMD was related to physical activity. Following PRT, IMAT was not associated with any exercise adaptation, whereas TMD was negatively associated with percent change in isometric strength (R² 0.17) and muscle power (R² 0.28, p < 0.05).

CONCLUSIONS: Muscle fatty infiltration can impact strength and power gains following PRT in older persons. More work is needed to understand the dynamics of aging or OA.

Surrounding an OA joint. Future work will enable us to better determine if increased inflammatory signaling were elevated in Sx muscle only, suggesting upregulation of the cGAS-STING pathway may play a role in the inflammatory burden often unique to muscle phenotype.

1325
May 28 9:30 AM - 11:30 AM
Effects Of Age And End-stage Osteoarthritis On Markers Of Skeletal Muscle Long INterspersed Element-1 Activity
Shelby C. Osburn1, Matthew A. Romero2, Petye W. Mumford1, Derek Wiggins1, Regina Seay2, Christian Kelley2, S. Louis Bridges3, Marcas M. Bamman1, Michael D. Roberts1. Auburn University, Auburn, AL. 4University California, Los Angeles, Los Angeles, CA. 5Lindsey University, Saint Charles, MO. 6UAB Center for Exercise Medicine, Birmingham, AL.

PURPOSE: Long INterspersed Element-1 (L1) is the only active, autonomous transposable element (termed retrotransposon) in the mammalian genome. L1 retrotransposons can insert themselves into the genome and, consequently, have been associated with a number of diseases and aging. L1 transcripts that are not reverse transcribed into the genome can accumulate in the cytoplasm and activate an inflammatory response via the cGAS-STING pathway. The purpose of this study was to examine skeletal muscle L1 markers and STING protein levels in younger/healthy participants as well as older participants with end-stage osteoarthritis (OA) undergoing total hip or knee arthroplasty.

METHODS: We analyzed a total of 26,486 genes (i.e., RNA transcripts) in skeletal muscle and found that 11,262 genes in young subjects and 11,830 genes in the older adults were up-regulated after 12 weeks of RET. On the other hand, we observed a down-regulation of 11,079 and 11,214 genes in the young and old groups, respectively. In particular, we found that autophagy linked gene expression (e.g., ATG12, PIK3R4, ULK2, ULK3) and transcripts related to muscle hypertrophy (e.g., AKT, EIF2S2, GSK3b) were differentially expressed between young and older adults. Interestingly, we identified 21 genes (e.g., COL5A2, COL3A1, COL1A1) encoding extracellular matrix (ECM) and ECM-associated proteins that were significantly upregulated only in the elderly (P<0.05). CONCLUSIONS: Skeletal muscle gene expression is differentially regulated in older adults in response to RET which may contribute to anabolic resistance and reduced muscle hypertrophy with aging. Future studies will include mechanistic experiments to identify how aging alters gene expression and whether anabolic resistance can be reversed. Funding: NIH/NIA R56 AG051267

C-11
Thematic Poster - Walking with Knee Arthritis and Arthroplasty
Thursday, May 28, 2020, 9:30 AM - 11:30 AM
Room: CC-2010

1327
Chair: Julia Freedman Silvernail. University of Nevada, Las Vegas, Las Vegas, NV.

PURPOSE: Ultrasound has been used to evaluate femoral cartilage cross-sectional area (CSA) and echo intensity (EI) in young individuals without knee pathology. Yet it remains unknown if ultrasound derived measures of CSA and EI are associated with patient reported outcomes (PRO) and physical performance (habitual walking speed) in individuals with knee osteoarthritis (KOA).

METHODS: Twenty-one individuals with medial compartment KOA (76% female, age = 61 ± 8 yr, BMI = 29.3 ± 4.0 kg/m²) participated in this study. Habitual walking speed was assessed over a 6-meter walkway using infrared timing gates. PRO were measured using the Western Ontario and McMaster Universities Osteoarthritis Index function subscale (WOMAC-Function). Participants were seated with their knees extended on an examination table for 45 minutes in order to unload the femoral cartilage and acquire a resting ultrasound image. Three images were acquired on the involved limb and the derived measures (CSA and EI) from the medial femoral cartilage were averaged. Separate, stepwise linear regression models were used to
determine the associations between WOMAC-Function and walking speed (predictor variables) and the medial femoral cartilage CSA and EI (criterion variables) after accounting for BMI and Kellgren-Lawrence scores of the involved limb.

RESULTS: Smaller CSA was associated with slower habitual walking speed ($R^2=0.249$, $P=0.014$) and greater EI was associated with worse WOMAC-Function ($R^2=0.261$, $P=0.014$).

CONCLUSIONS: PRO and habitual walking speed are easily obtainable measures for clinicians and significantly associate with medial femoral cartilage CSA and EI measured using ultrasound. CSA and EI may provide valuable information about potential structural and compositional alterations in femoral cartilage in individuals with KOA. A comparison of ultrasound outcomes to previously established imaging modalities, such as MRI, is needed to determine the clinical significance of CSA and EI.

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**TABLE 1: Differences on 3D mechanical markers between pain and pain-free trials**

<table>
<thead>
<tr>
<th></th>
<th>Pain trial Mean in degrees (95%CI)</th>
<th>Pain-free trial Mean in degrees (95%CI)</th>
<th>Paired samples tests (T-test or Wilcoxon test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sagittal plane: Flexion (+)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexion at heel strike</td>
<td>9.9° (7.0;12.7)</td>
<td>9.7° (5.8;13.7)</td>
<td>$P=0.84$</td>
</tr>
<tr>
<td>Flexion amplitude during loading **</td>
<td>10.8° (7.1;13.9)</td>
<td>20.5° (16.6;24.4)</td>
<td>$P&lt;0.001 **$</td>
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<tr>
<td>Flexion amplitude during stance</td>
<td>15.2° (10.9;19.6)</td>
<td>16.7° (12.5;20.9)</td>
<td>$P=0.13$</td>
</tr>
<tr>
<td>Maximum flexion during swing</td>
<td>62.6° (57.7;67.5)</td>
<td>63.0° (56.8;63.9)</td>
<td>$P&lt;0.59$</td>
</tr>
<tr>
<td>Range of motion during gait cycle</td>
<td>58.4° (53.5;63.2)</td>
<td>60.3° (56.8;63.9)</td>
<td>$P=0.25$</td>
</tr>
<tr>
<td>Frontal plane: Varus (+)/ Valgus (-)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Varus at heel strike</td>
<td>6.9° (4.1;9.7)</td>
<td>8.3° (3.0;13.6)</td>
<td>$P=0.59$</td>
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<tr>
<td>Varus thrust during loading</td>
<td>2.5° (1.3;3.7)</td>
<td>2.4° (0.1;4.8)</td>
<td>$P=0.48$</td>
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<tr>
<td>Varus during stance</td>
<td>6.5° (3.2;9.7)</td>
<td>5.2° (2.4;8.1)</td>
<td>$P=0.19$</td>
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<tr>
<td>Transversal plane: External rotation (+)/ Internal rotation (-)</td>
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<td></td>
<td></td>
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<tr>
<td>External tibia rotation at heel strike</td>
<td>4.0° (1.4;6.6)</td>
<td>5.0° (2.5;7.6)</td>
<td>$P=0.59$</td>
</tr>
<tr>
<td>Internal tibia rotation during loading **</td>
<td>-0.3° (-2.2;1.6)</td>
<td>2.0° (-1.0;4.2)</td>
<td>$P&lt;0.001 **$</td>
</tr>
</tbody>
</table>

This was funded by the FPQIS (Quebec Government).

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**TABLE 2: Pain and functional outcomes at baseline and follow-up**

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Follow-up</th>
<th>Change</th>
<th>$P$-value</th>
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<tr>
<td>Pain trial Mean in degrees (95%CI)</td>
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<td>Pain-free trial Mean in degrees (95%CI)</td>
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<td>Paired samples tests (T-test or Wilcoxon test)</td>
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**Abstracts were prepared by the authors and printed as submitted.**
Knee flexion deformity and gait impairments (GIs) are common clinical...eters...ed with a dynamic kinematic test. It is likely to have sagittal GIs. However, the majority of patients who had sagittal GIs did not have a limited DROM. More than half of the patients with a limited DROM did not have a flexion deformity by goniometry. They assessed the presence of four known sagittal GIs in a random sample of patients. All patients completing clinical evaluation had a fixed flexion during loading (72.9%) and a fixed flexion during stance (80.8%). The proportion of patients with a limited DROM (69.2%) is higher in the group who had a flexion deformity (72.9%) compared to the control group (61±3.5 vs. 68±3.9 Nm, p=0.047). CONCLUSION: Increased deficits in joint knee moment with power output are greater for older adults with knee OA compared to healthy controls. Older adults with knee OA should exercise caution when pedaling at higher power outputs during rehabilitation.

Cycling is often prescribed for rehabilitation of older adults with knee osteoarthritis (OA), during which the power output or external workload is manipulated to facilitate training for muscular and aerobic fitness. The effect of cycling power output on external knee adduction moment (a surrogate measure of severity and progression of knee OA) in older adults with and without knee OA is unknown. PURPOSE: To determine the effect of cycling power output on external knee adduction moment in older adults with and without knee OA. METHODS: Thirteen older adults with knee OA (66.0±8.6 years) and 13 controls (64.0±7.2 years) completed 3-minute cycling trials at power outputs of 75 Watts (W) and 100 W at a cadence of 60 revolutions per minute on a stationary cycle ergometer. Reflective markers (n=33) were attached bilaterally on participants’ pelvis, lower extremity, shoes, and force pedals. Three-dimensional marker positions and pedal reaction forces were sampled synchronously at 240 Hz. Using an inverse dynamics approach, external knee adduction moments were computed for both power output conditions. Peak external adduction moments were identified and averaged across 60 crank cycles for the more affected leg in the knee OA group and the dominant leg in the control group. A two-way mixed model ANOVA was used to examine the effects of power output (75 vs. 100 W) and group (knee OA vs. control) on peak external knee adduction moment. RESULTS: A group x power output interaction was observed (p=0.029; partial eta=0.183). Peak external knee adduction moment increased with power output in both groups, but the magnitude of increase was much greater for the knee OA group (6.8±3.5 vs. 7.7±3.9 Nm, p<0.001) compared to the control group (6.1±3.5 vs. 6.8±3.9 Nm, p=0.047). CONCLUSION: Increases in detrimental knee joint moment with power output are greater for older adults with knee OA compared to healthy controls. Older adults with knee OA should exercise caution when pedaling at higher power outputs during rehabilitation.
young TKR patients also reported less perceived knee pain when completing tasks of daily living (18.2±4.5 vs. 12.7±3.7) and a higher overall health-related quality of life (76.7±4.1 vs. 68.7±1.7) than reported by the older TKR patients (p < 0.05). **Discussion:** The younger TKR patients are at reduced risk (higher balance confidence and functional mobility) of falling and reported less falls than the older TKR patients. The age-related differences in perceived knee pain and health-related quality of life following TKR suggest a patient’s age should be a factor when deciding the intervention protocols used for rehabilitation following TKR. Future research should investigate potential age-specific intervention protocol strategies, including pain management and psychomotor training.

More than 600,000 knee replacements are performed each year in the U.S. for patients with knee osteoarthritis (OA), a rate expected to rise as high as 3 million by 2030. However, mechanical axis malalignment during total knee arthroplasty (TKA) has been found in almost one-third of surgeries. Recent advances in surgical technology include the use of robots to improve implant precision, including the Mako Robotic-Arm Assisted System, with the goal of improving clinical outcomes and gait biomechanics. **Purpose:** To examine the differences in knee biomechanics between patients with total knee arthroplasty (TKA), and comparisons between patients who underwent traditional TKA (TRAD), as well as to healthy participants. **METHODS:** Gait biomechanics were collected on female participants (6 MAKO, 7 TRAD, 16 HEALTHY limbs; age: 50-80 years) using an 8-camera Vicon motion capture system and two force plates. The Forgotten Joint Score (FJS) and Knee Injury and Osteoarthritis Outcome Score (KOOS) surveys were collected on all TKA participants. One-way ANOVAs compared biomechanics between participants, while unpaired t-tests compared survey data between surgical groups. Effect sizes (ES) were calculated using Cohen’s d. **RESULTS:** Both surgical groups exhibited lower hip extension excursion, which may indicate compromised gait stability compared to healthy participants. The external knee varus moment was trending lower for the MAKO group compared to the HEALTHY and TRAD groups with a large effect size (MAKO: 33 ± 17 Nm/kg, TRAD: 44 ± 09 Nm/kg, HEALTHY: 49 ± 14 Nm/kg, p = .005, ES = 1.15). No differences were seen in survey scores between groups, but a large effect size was observed for the FJS (MAKO: 68.8 ± 21.9, TRAD: 50.5 ± 23.6, p = 0.17, ES = 0.80). **CONCLUSIONS:** TKA participants exhibited limited hip extension excursion, which may indicate compromised gait stability compared to healthy participants. The external knee varus moment was trending lower in MAKO participants compared to traditional TKA and healthy participants. Because elevated knee varus moments have been correlated with pain and disease progression in knee OA, this finding indicates the Mako procedure may lower a major correlate of disease.

TKA patients had higher FJS scores, which indicates they are less aware of their artificial joint. No grant support was provided.

Loading-response KEMs were smaller (p=0.006) in replaced limbs (0.94 Nm/kg) than non-replaced limbs (0.97 Nm/kg). Similar findings were seen in peak push-off (p=0.015) KEMs. Peak loading-response knee abduction moment (KABM) were mostly similar between the replaced limbs of three TKA groups and healthy controls in downhill walking. Peak loading-response KABM were smaller in non-replaced limbs of BCS (0.34 Nm/kg, p=0.018) and PS (0.37 Nm/kg, p=0.001) patients compared to that in their non-replaced limbs (BCS: -0.53 Nm/kg & PS: -0.49 Nm/kg).

**Conclusion:** The results from this study showed that during downhill walking, peak KEMs were lower in replaced limbs than non-replaced limbs for all TKR patients, suggesting a deficit in knee extensor strength regardless of TKA designs. Post-surgery rehabilitation should focus on eccentric strength training of quadriceps for their replaced knees to reduce the asymmetry in knee movement and loading. BCS and PS patients may need additional attention in strengthening of quadriceps and hamstrings of the replaced limbs.

The two-parameter critical power (CP2) model states that the tolerable duration (Tlim) of severe-intensity cycling is determined by critical power (CP) itself, and the finite energy store that may be expended at work rates above CP (W′). Notwithstanding its ability to provide useful predictions of Tlim across a variety of exercise modes, the two-parameter model (CP2) consistently overestimates Tlim for ramp incremental exercise. **Purpose:** To determine whether a three-parameter model of CP (CP3) provides more accurate predictions of Tlim compared with those made by the CP2 model. **METHODS:** Seventeen healthy, recreationally-active adults (1 female, age: 29 ± 4 yrs, BMI: 25 ± 3, peak O2 uptake: 50 ± 8 ml kg^-1 min^-1) completed a ramp cycling protocol, and a series of exhaustive, constant work rate (CWR) trials across 5 separate visits (~70-100% peak work rate). The CWR trials were used to establish each participant’s power-Tlim relationship, from which the CP2 and CP3 models were fitted to data. Cross-validation (CV) was used to assess external model validity. Finally, the observed Tlim during the ramp incremental protocol was compared to that predicted by the CP2 and CP3 models. **RESULTS:** CP2 was higher than CP3 (239 ± 14 W v. 233 ± 13 W, p < 0.05), whereas W′ was smaller for the two- vs three-parameter model (20.3 ± 1.3 kJ v. 27.2 ± 2.9 kJ, p < 0.05). The CP3 model yielded a better fit to power-Tlim data than the CP2 model, as judged by the lower root-mean-square error (RMSE) computed from the CV procedure (128 s v. 141 s). The predicted ramp Tlim obtained via the CP2 model was longer than the actual Tlim for ramp incremental cycling (Δ12.9 s, p < 0.05); however, the ramp Tlim predicted by the CP3 model was not different from the actual ramp Tlim (Δ1.7 s, p > 0.05). Furthermore, there was higher absolute agreement between actual and predicted ramp Tlim for the CP2 model compared with the CP3 model, as evidenced by a higher concordance correlation coefficient (0.98 v. 0.94) and lower RMSE (16.4 ± 27.7 s). **CONCLUSIONS:** Our findings indicate that the CP3 model provides better predictions of ramp exercise performance than the CP2 model. These findings provide further support for the idea that Tlim for supra-CP cycling is determined not only by the magnitude of W′, but also by a maximal rate at which W′ can be accessed, particularly at high work rates.
Muscle Strength And Size Correlations At Baseline And Following Unilateral Resistance Training


Purpose: We examined the effect of resistance training on the relationship between muscle volume (VOL) and muscle strength, measured as both dynamic (one repetition maximum; 1-RM) and isometric (maximal voluntary contraction; MVC) strength. We further tested for sex differences in these relationships. Methods: 665 healthy young (18–age=40) and untrained individuals (254 men and 411 women) were tested. Muscle volume (by magnetic resonance imaging) and strength (1-RM and MVC) measures were taken before and after 12 weeks of resistance training of the non-dominant biceps/triceps. Subjects trained with progressively increasing weights twice per week using biceps preacher curl, biceps concentration curl, standing biceps curl, overhead triceps extension, and triceps kickback. We used Pearson correlations to test strength-size relationships in the entire cohort and within sex both at baseline and percent change following training. Results: Weak to moderate correlations were seen at baseline: VOL-1-RM (r=0.43 in all, 0.32 in women and 0.14 in men, all p<0.01) and VOL-MVC (r=0.34 in all, 0.19 in women and 0.28 in men, all p<0.01). Following training, specific relationships between percent changes in strength and size were: VOL-1-RM (r=0.04 in all, p=0.06; 0.15 in women, p<0.001; and 0.14 in men, p<0.01) and VOL-MVC (r=0.13 in all, p=0.01; 0.19 in women, p<0.01; and 0.12 in men, p<0.05). Conclusion: At baseline, significant but weak correlations exist between strength and size, regardless of sex. Following training, correlations became weaker, and even insignificant for change in volume to change in 1-RM in the whole cohort and change in volume to change in MVC in men. Together, these data provide evidence that isometric and dynamic strength are complex traits, especially following resistance training, that are affected by factors beyond size.

Hormonal, Psychological, And Muscle Damaging Effects Of An Acute Bout Of Farmers' Walk Exercise


Purpose: To investigate the hormonal, psychological, and muscle damaging effects of an acute bout of the Farmers’ Walk Carry (FWC) when compared to an individual’s unloaded walking pattern (NWC). Methods: Fifteen participants (mean ± SEM; age: 21.6 ± 0.5 y; height: 172.5 ± 2.4 cm; weight: 81.8 ± 4.0 kg) completed a series of testing sessions. In the initial session, participant’s demographic information, anthropometrics, body composition, lower body power, and strength were measured. Subsequently, participants completed two counterbalanced conditions during which they performed 10 repetitions of a 20 m walk while either carrying 70% of their 1-repetition maximum deadlift or non-weighted walk. Participants were allowed a 30 s rest period after odd-numbered repetitions, and 2 min of rest after even-numbered repetitions. Participants provided self-reported evaluations of muscle soreness (VPSMs), blood sampling for myoglobin (Mb) and creatine kinase (CK-MB), and saliva samples for testosterone (T) which were collected prior to the exercise protocol, immediately after the exercise protocol, and 30- and 60-min after completion of the exercise. Post-exercise assessment consisted of blood sampling, saliva, countermovement jump (CMJ) height, and VPSMs scores collected at 24 h, 48 h, and 72 h in both conditions. Results: Increases were observed for overall (p<0.001) and upper body VPSMs measurements (p<0.01) along with decreases in CK-MB (p<0.04) during the FWC. No significant differences were revealed for Mb, T, or CMJ height. Conclusion: The discrepancy found between upper- and lower-body muscle soreness (VPSMs) during the FWC may be related to differences in primary muscle recruitment and their joint concentric, eccentric, and isometric muscle actions. These variances may have indirectly minimized post-exercise muscle damage, hormonal responses, and neuromuscular inhibitions of lower body performance.

High-velocity Resistance Training Improves Power Output Across The Entire 1RM Percentage Spectrum In Elderly Individuals


Purpose: To compare the mean and peak power output adaptations to twelve weeks of HVRT. Methods: Thirteen older adults (69.4 ± 6.2 years; 71.5 ± 16.0 kg; 161.8 ± 8.9 cm) were recruited and, after giving their informed consent, completed two familiarization sessions and, on a separate day (baseline), were assessed for their legpress one repetition maximum (1RM) and mean and peak power output at loads corresponding to 30–90% 1RM using a linear encoder. Four weeks after baseline and prior to the intervention (pre-intervention) both 1RM and power tests were repeated and all participants underwent twelve weeks of HVRT twice per week. The exercise training protocol comprised of five exercises (legpress, knee extension, seated bench press, seated row and calf raise) and progressed from 1-3 sets of 10 repetitions per exercise at 40–60% 1RM. Tests were repeated post-intervention and mean and peak power comparisons were made using one-way ANOVAs with repeated measures and Bonferroni's post hoc. Results: Mean and peak power output results are shown in Figure 1. Peak power improved significantly at all loads when compared to both baseline and pre-intervention (all p < 0.05), while mean power output improved from 30–70% 1RM (all p < 0.05) but not at 80 and 90% 1RM. No differences were observed between baseline and pre-intervention measures (all p > 0.05). Conclusion: HVRT is an effective alternative to counteract power output declines across a wide range of loads in older adults. This is relevant as different functional tasks seem more associated to muscle power at different percentages of 1RM.
similar to the demands of basketball. PURPOSE: Therefore, the purpose of the present study was to examine the effects of basketball practice on maximal isometric force and LFF.

METHODS: Eleven NCAA Division 1 basketball players (Males = 6 and Females = 5) performed a Maximal Voluntary Isometric Contraction (MVIC) and neuromuscular electrical stimulation of the knee extensors at a high and low frequency before (Pre), immediately after (Post) and 24-hours (24Post) following a basketball practice during the pre-season. Athletes wore Inertial Measurement Units to capture the external load of formal training load of the practice. The ratio of force produced during the low to high frequency muscle stimulation was used as an index of LFF. A one-way repeated measures analysis of variance was performed to determine differences in MVC and LFF across time, with significance set at p ≤ 0.05. Effects sizes (Cohen’s d) were calculated for pairwise comparisons and interpreted as trivial (0.00-0.19), small (0.20-0.49), medium (0.50-0.79), and large (0.80 and greater).

RESULTS: The average of the tETL parameters during practice were PlayerLoad = 636.5 ± 66.1 arbitrary units (au); PlayerLoad per minute = 4.76 ± 0.69au; Total Jumps = 143.8 ± 53.3 count (ct); Inertial Movement Analysis (IMA), High = 39 ± 2ct; IMA, Medium = 135 ± 53ct; IMA, Low = 582.8 ± 156ct. There was a significant time effect for MVC (p = 0.001), but post-hoc pairwise comparisons revealed no significant difference across time (p > 0.05). There was a significant time main effect for LFF (Pre = 0.515 ± 0.025; Post = 0.483 ± 0.038; 24Post = 0.513 ± 0.033, p = 0.019), with post-hoc pairwise comparisons revealing no significant difference from Pre- to Post-practice (p = 0.104), but did exhibit a large negative effect (d = 1.0). There was a significant increase from Post- to 24Post-practice (p = 0.039, d = 0.84). CONCLUSIONS: Based on these preliminary findings it appears basketball practice induces LFF in collegiate basketball athletes that recovers back to baseline within 24 hours of the bout. Although LFF was present, MVC was unaffected.

1342 May 28 10:45 AM - 11:00 AM
Relative Contributions Of Muscular Strength, Muscle Size, And Tissue Oxygenation To Isometric Performance Fatigability
Joshua L. Keller, Terry J. Housh, FACSM, John Paul V. Anders, Tyler N. Schriver, Kipp J. Hergenrader, Richard J. Schmidt, Glen O. Johnson, FACSM. FACSM, University of Nebraska - Lincoln, Lincoln, NE. (Sponsor: Terry Housh, FACSM)

Table 1. Regression models for predicting performance fatigability.

<table>
<thead>
<tr>
<th>Predictor</th>
<th>r</th>
<th>p-value</th>
<th>Standardized Beta</th>
<th>r</th>
<th>p-value</th>
<th>Standardized Beta</th>
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<tr>
<td>Strength</td>
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<tr>
<td>mCSA</td>
<td>0.66</td>
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<td>0.52</td>
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<tr>
<td>TSI%</td>
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</table>

CONCLUSION: Muscular strength independent of muscle mass and rate of decline in TSI% contributed to PF. There was, however, 59% unexplained variance, so future standardized ßs, respectively (Table 1). The stepwise linear regression analysis was used to determine the full-model and stepwise linear regression model. Regression analyses were used to determine the effects of muscular strength, muscle cross-sectional area (mCSA), and tissue oxygenation to isometric performance fatigability.

Previous work has shown greater declines in average concentric velocity (ACV) values during sets to fatigue for the bench press compared to the squat. The decline in ACV during sets of the overhead press (OHQP) and deadlift (DL) has not yet been investigated. This information would be useful for those using ACV to prescribe training loads.

PURPOSE: To determine the effect of different loads on ACV during single sets of repetitions to failure with the OHQP and DL.

METHODS: 30 individuals (23.3 yrs) with current training experience with both the OHQP and DL completed 1RM protocol for the OHQP and DL. Participants then returned to the lab on two separate occasions and completed one set of the OHQP and DL to volitional fatigue at either 70% or 90% of their 1RM in a randomized order. The open barbell system measured ACV of all repetitions. The absolute and relative (%) decline in ACV was calculated for each condition and compared between loads (70% vs. 90%IRM) and between lifts (OHQP vs. DL). Paired samples t-tests were used to compared ACV values between individual repetitions within each condition.

RESULTS: There were significant differences (p = 0.05) in both absolute and relative ACV decline between lifts and between loads. The absolute and relative decline in ACV was greater for the 70%OHQP condition (0.36±0.12 m/s; 58:11%) followed by 90%OHQP (0.19±0.10 m/s; 43:30%); 70%DL (0.16±0.08 m/s; 31:14%); and 90%DL (0.09±0.06 m/s; 26:17%). For the 70%OHQP condition, ACV was significantly (p<0.014) greater for the third repetition (0.59±0.15 m/s) compared to all subsequent repetitions; for 90%OHQP, ACV was significantly (p<0.004) greater for the first repetition (0.39±0.13 m/s) compared to the third and all subsequent repetitions. For the 70%DL condition, ACV was significantly (p<0.014) greater for the third repetition (0.49±0.08 m/s) compared to the first, fourth, sixth, and all subsequent repetitions; for 90%DL, ACV was significantly greater (p<0.043) for the second repetition (0.32±0.04 m/s) compared to all other repetitions.

CONCLUSIONS: These data suggest the velocity decline during sets to fatigue is influenced by both the load and the lift performed. Greater declines in velocity are apparent during the OHQP compared to the DL and when lifting lower (70%IRM) compared to higher loads (90%IRM).

1344 May 28 11:15 AM - 11:30 AM
Neuromuscular Fatigue Following Concentric Versus Eccentric Maximal Single Joint Exercise Of Similar Mechanical Work
Pierre Clos1, Yoann M. Garnier2, Alain Martin1, Romuald Lepe尔斯1. 1University of Bourgogne Franche Comté, Dijon, France. 2Université Jean Monnet, Saint-Étienne, France. (Sponsor: Michael Bemben, FACSM)

Table 1. Regression models for predicting performance fatigability.

<table>
<thead>
<tr>
<th>Predictor</th>
<th>r</th>
<th>p-value</th>
<th>Standardized Beta</th>
<th>r</th>
<th>p-value</th>
<th>Standardized Beta</th>
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<tbody>
<tr>
<td>Strength</td>
<td>0.64</td>
<td>0.01</td>
<td>0.52</td>
<td>0.64</td>
<td>0.01</td>
<td>0.52</td>
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<tr>
<td>mCSA</td>
<td>0.66</td>
<td>0.05</td>
<td>0.52</td>
<td>0.66</td>
<td>0.05</td>
<td>0.52</td>
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<tr>
<td>TSI%</td>
<td>0.67</td>
<td>0.07</td>
<td>0.08</td>
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</tbody>
</table>

CONCLUSION: Based on these preliminary findings it appears basketball practice induces LFF in collegiate basketball athletes that recovers back to baseline within 24 hours of the bout. Although LFF was present, MVC was unaffected.

CONCLUSIONS: These data suggest the velocity decline during sets to fatigue is influenced by both the load and the lift performed. Greater declines in velocity are apparent during the OHQP compared to the DL and when lifting lower (70%IRM) compared to higher loads (90%IRM).

Previous work has shown greater declines in average concentric velocity (ACV) values during sets to fatigue for the bench press compared to the squat. The decline in ACV during sets of the overhead press (OHQP) and deadlift (DL) has not yet been investigated. This information would be useful for those using ACV to prescribe training loads.

PURPOSE: To determine the effect of different loads on ACV during single sets of repetitions to failure with the OHQP and DL.

METHODS: 30 individuals (23.3 yrs) with current training experience with both the OHQP and DL completed 1RM protocol for the OHQP and DL. Participants then returned to the lab on two separate occasions and completed one set of the OHQP and DL to volitional fatigue at either 70% or 90% of their 1RM in a randomized order. The open barbell system measured ACV of all repetitions. The absolute and relative (%) decline in ACV was calculated for each condition and compared between loads (70% vs. 90%IRM) and between lifts (OHQP vs. DL). Paired samples t-tests were used to compared ACV values between individual repetitions within each condition.

RESULTS: There were significant differences (p = 0.05) in both absolute and relative ACV decline between lifts and between loads. The absolute and relative decline in ACV was greater for the 70%OHQP condition (0.36±0.12 m/s; 58:11%) followed by 90%OHQP (0.19±0.10 m/s; 43:30%); 70%DL (0.16±0.08 m/s; 31:14%); and 90%DL (0.09±0.06 m/s; 26:17%). For the 70%OHQP condition, ACV was significantly (p<0.014) greater for the third repetition (0.59±0.15 m/s) compared to all subsequent repetitions; for 90%OHQP, ACV was significantly (p<0.004) greater for the first repetition (0.39±0.13 m/s) compared to the third and all subsequent repetitions. For the 70%DL condition, ACV was significantly (p<0.014) greater for the third repetition (0.49±0.08 m/s) compared to the first, fourth, sixth, and all subsequent repetitions; for 90%DL, ACV was significantly greater (p<0.043) for the second repetition (0.32±0.04 m/s) compared to all other repetitions.

CONCLUSIONS: These data suggest the velocity decline during sets to fatigue is influenced by both the load and the lift performed. Greater declines in velocity are apparent during the OHQP compared to the DL and when lifting lower (70%IRM) compared to higher loads (90%IRM).
Conclusions: After the completion of a given work at maximal exercise intensity, reduction in MVIC did not mirror the greater magnitude of knee extensors torque loss in CON than ECC. ECC and CON contractions elicited central fatigue and peripheral fatigue, respectively. Fatigue magnitude and etiology both depended on the amount of work performed.

C-13 Clinical Case Slide - Hand
Thursday, May 28, 2020, 9:30 AM - 11:10 AM
Room: CC-2005

1345 Chair: Aaron Lee. MacNeal Hospital, Berwyn, IL.
(No relevant relationships reported)

1346 Discussant: Christopher McMullen. University of Washington, Seattle, WA.
(No relevant relationships reported)

1347 Discussant: Sherrie L. Ballantine-Talmadge, FACSM. CU Sports Medicine and Performance Center, Boulder, CO.
(No relevant relationships reported)

1348 May 28 9:30 AM - 9:50 AM
Right Hand Dominant Musician With Right Hand Weakness
Sarah Merrill1, Marcia Faustin2.
1. UC San Diego, San Diego, CA.
2. UC Davis, San Diego, CA.
(No relevant relationships reported)

HPI: EM is a RHD 19yF musician presenting with insidious onset, progressive RH weakness worsening over the last 1-2 years. No trauma. She has difficulty with pincer grasping. Weakness is constant but exacerbated when playing guitar or flute for long periods of time. No numbness, pain, tingling or swelling of the RUE. Denies any fevers, chills, recent URI, polyarthralgia. No family history of neurologic or autoimmune disease.

PE: No notable muscle atrophy or TTP in the RUE. Full ROM in neck, shoulder, elbow and wrist. 4/5 strength in pincer grip on right, 5/5 strength in right rotator cuff muscles, tricep, bicep, wrist flexion/extension. + Median nerve weakness, radial and ulnar nerve intact. Normal sensation and RUE reflexes. Positive Adson’s. Negative Spurling, Roos tests., Hoffman, Negative Tinel’s and Phalen’s at the wrist. DDX: Radial neuropathy, Carpal tunnel syndrome, Paget-Schroetter Syndrome, Thoracic outlet syndrome, Pars interarticularis fracture, Liddle.

TEST AND RESULTS: Labs: Within normal limits EMG: Results consistent with a significant True Neuromuscular Thoracic Outlet Syndrome on the right. There is also electrodiagnostic evidence of a mild right ulnar mononeuropathy at the elbow groove. Xray cervical spine: Enlarged transverse processes bilaterally at C7, larger on the right. Partial fusion at C3-4 with 2 mm retrolisthesis of C4 on C5 in extension that reduces Xray cervical spine: Enlarged transverse processes bilaterally at C7, larger on the right. Partial fusion at C3-4 with 2 mm retrolisthesis of C4 on C5 in extension that reduces flexion. MRI Brachial plexus: Right cervical rib (at C7), with a hypointense C8 spinal nerve coursing through this area, as are the medial cord, and visualized proximal ulnar nerve and possibly of the median nerve, likely attributable to mass effect from the cervical rib and/or an accompanying fibrous band. RUE vascular study: negative.

FINAL WORKING DIAGNOSIS: Neuromuscular Thoracic Outlet Syndrome

TREATMENT AND OUTCOMES: Initial EMG pointed to neurogenic TOS. Subsequently, patient completed cervical spine x-rays and MRI of the brachial plexus, revealing cervical ribs with likely brachial plexus compression. Patient attended physical therapy to focus on posture while playing instruments, stretching of scalene muscles and strengthening scapular stabilizers. Unfortunately, she did not improve with conservative management. She has been seen by orthopedics and vascular surgery and is currently awaiting cervical rib resection surgery.

1349 May 28 9:50 AM - 10:10 AM
Not Your Ordinary Cause Of Hand Pain
Shannon C. Clemons, Haven Donavan. UHS Wilson Memorial Hospital, Vestal, NY. (Sponsor: Andy Getzin, MD, FACSM)
Email: sportsdocshannon@gmail.com
(No relevant relationships reported)

History: An 18-year-old senior high school football player sustained an avulsion fracture to the left 5th digit proximal phalanx on October 2018 during practice which was treated with an ulnar gutter cast for 6 weeks. He played through the remaining football season and baseball season, after which, he presented to the clinic with what he felt was instability in his left hand. He reported no new trauma. Upon examination, there was mild tenderness in the 5th digit and tenderness localized to the head of the 4th metacarpal. The patient denied numbness, weakness, swelling, or bruising to the site of pain, but endorsed clicking of the 4th digit when making a fist and opening his hand again.

Physical examination: Mild Boutonniere’s deformity of 5th. Full ROM with all finger motions. Snapping sensation when going from fully flexed position to 4th digit to fully flexed position. Tenderness to palpation at 5th digitPIP and at 4th digit just proximal to MCP. Slightly more movement with anterior - posterior translation of the 4th metacarpal dorsally compared to the proximal phalanx. Sensation intact to light touch.


Tests and Results: X-rays: Interval healing of nondisplaced fracture of the fifth digit proximal phalanx. Cystic lesion of the head of the fourth metacarpal not evident on initial x-ray study. MRI: Avascular necrosis of the 4th metacarpal head including articular surface flattening with adjacent subcortical marrow edema bordered by linear somewhat serpiginous hypointense signal, perhaps sclerosis, and with some tiny subchondral cystic foci as well. Small amount of T2 hyperintense marrow signal in the visualized distal shaft of the 4th metacarpal as well. Small 4th MCP joint effusion.

Final/Working Diagnosis: Dieterich’s Disease (avascular necrosis of the metacarpal head)


1350 May 28 10:10 AM - 10:30 AM
Hand Injury - Basketball
Jared W. Willard, Ashlee Lafontaine, Andrew Gregory, David Liddle. Vanderbilt University Medical Center, Nashville, TN.
Email: jared.willard@vumc.org
(No relevant relationships reported)
May 28 10:30 AM - 10:50 AM
Hand Injury- Football: Thumbs Up
Joshua H. Wood, Arthuro Islas, Mark Stovak, FACSM, Robert Bogart. University of Nevada, Reno, NV.

HISTORY: 22 yo collegiate quarterback present to clinic with thumb pain in his throwing hand which began that morning in practice. During practice he was throwing a ball, and it hit his thumb on a defensive player’s helmet which caused immediate pain and weakness. The athlete’s past medical history includes a Bennett fracture repair 17 months prior on the same hand.

PHYSICAL EXAMINATION: Examination in the clinic revealed tenderness on palpation over the thenar eminence and the anatomical snuff box. Sensation was intact. He had weakness with adduction of the thumb, and decreased ROM in all planes. Grip strength in the right hand was decreased.

DIFFERENTIAL DIAGNOSIS: 1. Recurrent Bennett’s Fracture
2. Ulnar collateral ligament injury
3. Rolando’s fracture
4. Scaphoid fracture
5. Bone bruise

TEST AND RESULTS: X-ray: Impression: Right minimally displaced Bennett fracture with near anatomical reduction. There is old sign of some ulnar collateral ligament injury noted at the MCP. CT: Showed an acute fracture at the base of his thumb with a large fracture fragment noted attached to the ulnar collateral ligament.

FINAL WORKING DIAGNOSIS: Re-current Bennett’s fracture

TREATMENT AND OUTCOMES: 1. The patient was immediately placed in a thumb Spica brace. Due to the continued pain and previous history of a Bennett’s fracture and concern for a new fracture a CT was ordered. The CT showed a new Bennett’s Fracture.
2. Surgical repair with 3 screws
3. Started rehab 3 weeks after surgery and was cleared for competitive play 7 weeks out from surgery.

Author Comments: Images available

May 28 10:50 AM - 11:10 AM
Hand Injury - Football
Email: leonardspormed@gmail.com

HISTORY: An 18-year-old high school football player suffered a hand injury after tackling the quarterback and celebrating by punching the artificial turf. He continued playing, however during the second half, he noticed his hand was swollen. He reported no pain, full range of motion, and no numbness or tingling in his hand or fingers. He denied wrist or elbow pain.

PHYSICAL EXAMINATION: Sideline examination was performed remarkable for a mildly swollen right hand, no obvious deformity of the wrist, hand or fingers. There was mild tenderness to palpation along the ulnar aspect, with full active range of motion at the wrist and fingers. He had normal strength with flexion and extension at the wrist, MCP, PIP, and DIP, however wrist flexion and MCP flexion was painful. He was able to make a full fist and rotational alignment was not significant. Supportive tape was applied, and he continued to play without increase of swelling or pain.

DIFFERENTIAL DIAGNOSIS: 1. Fracture of metacarpal bones
2. Soft tissue contusion
3. Sprain of hand ligaments

IMAGING: AP, lateral, and oblique views of the right hand revealed a mildly displaced transverse right fifth metacarpal shaft fracture. Volar angulation of approximately 30°

FINAL DIAGNOSIS: Boxer’s Fracture (Fracture of the 5th metacarpal bone)

TREATMENT AND OUTCOMES: 1. Operative management with plate and screw fixation considered, however nonoperative care was ultimately decided on. Patient placed in an ulnar gutter pre-fabricated splint and immobilized for at least 8 weeks.
2. Pain control with NSAIDs if needed
3. He was allowed to continue football competition; splint wrapped in a partial club cast. He was not allowed to play offensive receiver; other positions he had no limitations
4. Repeat radiographs at 4 weeks showed no interval change in the fifth metacarpal shaft fracture and early callus formation noted on orthogonal views. Patient had full ROM and strength on exam. Continued ulnar gutter splint immobilization and partial club cast for competitions, with light physical therapy initiated.
5. Repeat radiographs at 6 weeks showed continued fracture healing, well aligned, normal strength on exam
6. Nonoperative management with ulnar gutter splint immobilization allowed patient to complete the football season with successful preliminary stages of fracture healing.

C-14 Clinical Case Slide - Hip II
Thursday, May 28, 2020, 9:30 AM - 11:10 AM
Room: CC-2016

May 28 9:30 AM - 9:50 AM
Hip Pain In A Female Military Trainee: A Cautionary Tale Of Catastrophic Complications
Jaime Gonzalez, Alexis Ortiz, FACSM. University of the Incarnate Word, San Antonio, TX. (Sponsor: Alexis Ortiz, FACSM)

Hx: A 31 yo F client presented to a PT by self-referral, with a primary c/o R hip and groin pain. The client was a previously competitive runner and triathlete and was currently undergoing US Army Initial Entry Training.

PE: The client presented with a moderately antalgic gait, exhibiting a “compensated gluteus medius” gait pattern. Grossly limited ROM in the R hip complex due to pain. No apparent edema, erythema, ecchymosis, atrophy, or deformity on observation. Positive heel tap, fulcrum, patellar-pubic percussions test.

DD: 1. Femoral Neck Stress Fx
2. Pelvic stress fx
3. Adductor strain/avulsion
4. Hip flexor strain/avulsion
5. Femoral shaft stress fx
6. Lumbar spinal referral
7. Non-organic etiology

Tests & Results: Plain radiography, bone scan, and MRI; consistent with the primary clinical hypothesis following the clinical examination, a FNSF.

Final Diagnoses: FNSF, mid-femur fx, osteomyelitis

Treatment & Outcomes: Pre-op the client was given crutches and instructed in a NWB gait. She underwent an uncomplicated ORIF. The immediate post-op course, including PT, was uneventful and included reinforcement of the importance of compliance with the post-op instructions, including NWB progressing to TTWB gait with crutches.

The client experienced a fall shortly after being d/c’d from her inpatient stay, which resulted in a fx of the ipsilateral femur. She underwent a 2nd uncomplicated ORIF of her R femur fx. Again, the immediate post-op course, including PT, was uneventful. However, approximately 2 weeks following her d/c from the inpatient stay, the client began to report vague constitutional symptoms including fatigue, fever, and nausea. The PT ordered lab studies including CBC/diff, CMP, and ESR. Results were broadly abnormal and the ortho surgical service was contacted directly and a same-day referral made. Subsequent imaging and serial lab studies confirmed an infection and the patient was taken back for a 3rd surgery, ultimately resulting in an osteotomy and revision of the FNSF ORIF. After a brief stay in the ICU, the patient was transferred to the ortho floor and remained there for several weeks, while receiving IV antibiotics and serial imaging and lab studies. The client was d/c’d and transferred to the medical hold unit to begin the process to be removed from military service.

Abstracts were prepared by the authors and printed as submitted.
Radicular Pain And numbness To The Lower Extremity Not Always A Radiculopathy.

Richard A. Fontanéz, Eduardo Ramos. University of Puerto Rico Medical Science Campus, San Juan, PR.

Email: fontanetz richard@gmail.com

(No relevant relationships reported)

History: A 47-year-old male scuba diver instructor complained of a few months history of progressive low back and right gluteal pain with associated bilateral lower extremity numbness, weakness, tingling, and right leg limp. Past medical history remarkable for obesity and hyperthyroidism. Denies recent illness, trauma, falls or use of any drug or steroid. Physical Exam: Antalgic gait with right lower extremity limp and no muscle atrophy. Tenderness over lumbar paraspinous muscles, anterior groin and greater trochanteric area. Full passive range of motion (ROM) and limited active ROM on right hip flexion, extension and abduction due to pain. Negative straight leg raise, positive log roll, internal rotation over pressure and Stinchfield’s test. Strength 5/5 in bilateral lower extremities, except for 4/5 on right hip flexion and extension due to pain. Differential Diagnosis: 1 Right hip OA. 2 Lumbar facet joint arthropathy. 3. Lumbar radiculopathy. 4. Gluteus medius tendinosis. 5. Femur fracture. Dysraphic osteonecrosis of the right femoral head TEST AND RESULTS: 1. Lumbar spine AP and lateral views X-rays-multiple degenerative changes of the lumbar spine with osteopenia and spondylosis. 2. Pelvis AP x-ray-osteochondral extension of the hip bilaterally with sclerotic pattern involving the right femoral head. 3. Lumbar MRI AP and lateral view x-ray- Degenerative changes of the femoral head with evidence of the osteonecrosis and articular collapse. 4. Right hip MRI w/o contrast-Advance degeneration of the right hip joint secondary to prior AVN of the femoral head and subchondral collapse. 5. Quantitative bone scan: Increase uptake in the right hip acetabulum and femoral neck area. 6. Electrodiagnostic study: Femoral L4-L5 radiculopathy with no electrodiagnostic evidence of the right lumbosacral radiculopathy.

Final/Working Diagnosis: Dysraphic osteonecrosis of the right femoral head.

Treatment and Outcomes: 1. Right total hip replacement. 2. Admission to acute inpatient rehabilitation hospital. 3. Standard protocol for total hip replacement. 4. Neurourosurgical and orthopedic training. 5. Return to scuba diving after 3 months as recommended by his orthopedic surgeon and PM&R specialist. Patient was able to walk without assistive device and have the strength to carry a diving equipment.

Right Groin Pain In A Collegiate Offensive Lineman

Michael Pitzer1, Heather Bauby2, Kaylyn Hill2. Virginia Commonwealth University, Richmond, VA. Randolph-Macon College, Ashland, VA.

(No relevant relationships reported)

History: The patient was a 21-year-old football player who had been having atraumatic right groin pain for one month. He reported feeling a lump in the area of the pain. The pain was worse with activity and relieved by rest. He had also been experiencing subjective fevers, night sweats, nausea, and fatigue. He endorsed an intermittent rash during the course of the first month of symptoms that became very pronounced during a short episode of viral gastroenteritis. Trials of antibiotics did not improve symptoms.

Physical Examination: He was a well appearing male that was afebrile. His abdominal and genitourinary exam revealed a soft and nontender abdomen with normal bowel sounds. There was no evidence of a right inguinal hernia. There was no testicular mass or testicular pain or tenderness. No discrete nodules were palpable in the right groin but there was fullness in the area compared to the opposite side. On examination of the right hip he was nontender to palpation over the anterior hip and moderately tender over the proximal hip adductors. There was no tenderness to palpation over the greater trochanter. He had full range of motion with hip flexion, extension, abduction, and adduction without pain. He reported some pain with resisted adduction. FAIRDIR test was negative.


Test and Results: CMP, CBC, and UA were without significant findings. HIV, hepatitis B, hepatitis C, and Epstein Barr virus were negative. ESR, CRP, rheumatoid factor, and ANA were within normal limits. Lyme Disease test was negative. A diagnostic ultrasound showed a lobulated hypoechoic nodule with a fatty hilum in the right inguinal region with a volume of 6.9 mL consistent with a fatty hilum in the right inguinal region. ESR, CRP, rheumatoid factor, and ANA were within normal limits. Lyme Disease test was negative. A diagnostic ultrasound showed a lobulated hypoechoic nodule with a fatty hilum in the right inguinal region with a volume of 6.9 mL consistent with a fatty hilum in the right inguinal region. ESR, CRP, rheumatoid factor, and ANA were within normal limits. Lyme Disease test was negative. A diagnostic ultrasound showed a lobulated hypoechoic nodule with a fatty hilum in the right inguinal region with a volume of 6.9 mL consistent with a fatty hilum in the right inguinal region.

Final/Working Diagnosis: Kikuchi-Fujimoto Disease.

Treatment and Outcomes: He was started on a prednisone taper to which he had dramatic symptom improvement but with a rebound in symptoms after completing the course. He was then started on hydroxychloroquine and reported adequate symptom improvement for football participation.

Hipp and Groin Pain - Skating

Sarah A. Pierotti. Advocate Lutheran General, Park Ridge, IL.

(No relevant relationships reported)

Hipp and Groin Pain - Skating

Sarah Pierotti, Kaleigh Suh, Advocate Lutheran General Hospital, Park Ridge, IL.

History: A 14-year-old female softball catcher was seen in Sports Medicine clinic for follow up for left hip injury. She sustained a fall with hyperextension her left leg while rollerblading. She was evaluated at an urgent care for left hip and groin pain. An X-ray pelvis was normal and she was discharged with a diagnosis of a hip flexor strain. She was re-evaluated the next day in the ER as the pain had progressed. After CT demonstrated a pelvic hematoma she was admitted to the PICU where she developed numbness and tingling in the affected leg with decreased strength of hip flexion and knee extension.

Physical Exam: The patient was wheel chair dependent but stood with support. Her lumbar spine was normal other than tenderness overlying the paraspinous and iliac crest of the left side. Her left lower extremity range of motion was pain-free with hip flexion past 120, external rotation to 55 degrees and internal rotation to 25 degrees. She was unable to fully extend the hip - maintaining approximately 5 to 10 degrees of hip flexion. She had decreased sensation to light touch of anterior, medial, and lateral thigh, medial shin and medial foot. Strength of hip flexion was 3+/.

Differential Diagnosis:
- Hip flexor strain
- Femoral neck fracture
- Labral tear
- Anterior inferior iliac spine avulsion

Test and Results:
- CT Pelvis without contrast:
  - 5.0 x 7.0 x 8.6 cm high density mass along the iliac bone deep and within the iliacus muscle at the iliac bone anteriorly and into the iliacus with mass effect on the psoas.
- Hemorrhage extending along the posterior left psoas muscle superiorly into the abdomen and descending colon

CTA Abdomen/Pelvis with contrast:
- Small 4 mm blush of contrast in the inferior and posterior aspect of the left psoas hema-toma possibly a small area of active extravasation.

No discrete connecting vessel identified.

Final Diagnosis:
- Iliopsoas hematoma
- Femoral nerve neuropathy

Treatment and Outcomes:
1. Refer to Neurology with follow up for monitoring of neuropathy
2. MRI to re-evaluate hematoma size, evaluate muscle and nerve involvement
4. Referral to PT for mobilization.
Chondral injury and heterotopic ossification (HO) secondary to chronic cam type femoroacetabular impingement

TREATMENT AND OUTCOMES:
1. Right hip revision arthroscopy with labral resection and labral reconstruction with allograft tissue
2. Right hip revision arthroscopic cholecystectomy/femoroplasty
3. Right hip arthroscopic excision of HO fragment measuring 3 cm x 2 cm in anterior lateral joint capsule
4. Right hip arthroscopic chondroplasty of acetabulum with microfracture/bone marrow stimulation procedure
5. Immediate post-operative physical therapy (day of surgery)
6. Single dose of external beam radiation on post-operative day 1 to minimize risk of recurrence of HO
7. 20 pounds flat foot weightbearing restriction for six weeks
8. Naproxen 375 mg bid x 6 weeks to minimize risk or recurrence of HO
9. Continuous passive motion in immediate post-operative period

FINAL WORKING DIAGNOSIS:
L shoulder displaced greater tuberosity fracture
TREATMENT AND OUTCOMES:
Patient underwent open ORIF of greater tuberosity fracture with two 6.5 PEEK anchors and parachute suturing. During procedure anterior/lateral rotator cuff tear was noted and repaired using high five sutures. Post surgical rehabilitation consisted of a modified RCR protocol:
- Week 0-2: Brace immobilizer and PROM only in flexion to 90 deg.
- Week 2-4: Brace continued. Progressed to PROM in all directions and pendulums in 4 weeks
- Week 4-8: Progressive AAROM to AROM and gentle isometrics
- Week 8-12: Progressed to RC strengthening and functional activities
Patient outcomes were excellent with SPADI 4/100, full ROM in all directions, and only minor weakness in abduction/external rotation. Patient returned to full recreational athletic activities.

HISTORY: A 15 year-old right hand dominant male presented to sports medicine clinic due to left shoulder pain. The mechanism of injury was while playing football the day prior where he jumped to catch a pass, and landed directly on grass onto his left shoulder with arm by his side. Heard a “pop” when he landed, and was experiencing intermittent, generalized shoulder pain since the event. Denied prior injury of affected extremity as well as denied numbness or tingling. There was no swelling, discoloration, or bruising per the patient or the mother of the patient. There was no obvious reported deformity of the shoulder as well. The patient denied any neck or elbow pain. Symptoms were improved at rest and with arm at his side.

PHYSICAL EXAM: Left Shoulder: Pain with passive abduction, flexion on range of motion (ROM) testing. Active ROM is full in all directions. Tenderness at palpation (TTP) at the AC joint and scapular angle; no TTP at scapular body. Strength: 2/5 of motion (ROM) testing. Active ROM is full in all directions. Tender to palpation of GH joints are intact.

DIFFERENTIAL DIAGNOSIS:
1. Acromioclavicular sprain
2. Rotator Cuff injury
3. Glenoid labrum injury
4. Distal clavicle contusion
5. Glenohumeral dislocation

TEST AND RESULTS:
1. XR Left Shoulder: no acute fracture, dislocation, or soft tissue abnormality
2. MR Left Scapula: No acute displaced fracture.
3. MRI (no IV contrast) Left Shoulder: Feathery edema in the rotator cuff musculature centered about the scapula. Low grade muscular strain vs underlying non-displaced scapular body fracture. 4. CT Shoulder Trauma w/ Joint (no IV contrast): Non-displaced hairline fracture in the mid scapular body perpendicular to the long axis. AC and GH joints are intact.

FINAL WORKING DIAGNOSIS:
Non-displaced extra-articular fracture in the mid scapular body
TREATMENT AND OUTCOMES:
1. Immobilization with sling for initial 4 weeks with pendulum swings twice daily
2. At week 4, no pain at rest with asymptomatic full strength. Physical Therapy initiated.
3. Cleared for non-contact and non-collision activities at week 8.
4. Returned to all activities without restriction at week 12.

1366 May 28 10:10 AM -10:30 AM
Shoulder Pain-Wheelchair Basketball
Ryan P. Nussbaum, DO, Prakash Jayabalan MD, PhD. Shirley Ryan AbilityLab/Northwestern University, Chicago, IL.
(Sponsor: Dr. Joseph Ilm, MD, FACSMB)
Email: nussbaum@srallab.org
(No relevant relationships reported)

HISTORY
39 year old male wheelchair basketball player was referred for shoulder pain and need for potential glenohumeral joint injection. He had experienced one year of left-sided shoulder pain that began after colliding with an opponent at high velocity during a game. At the time of the trauma, he had sudden onset burning left side neck pain that radiated down his arm to his left thumb. He noticed that raising his left arm above his shoulder worsened the shoulder pain. Additionally, he noticed left-sided weakness with elbow flexion and shoulder abduction that made wheelchair transfers difficult.

PHYSICAL EXAMINATION
4/5 strength with left shoulder abduction and elbow flexion. Active left shoulder abduction and flexion was limited to 90 degrees, due to pain. Empty can, Hawkin’s, and Neer’s tests caused left anterior shoulder pain. Decreased sensation over the left lateral upper arm to pinprick and light touch. Hoffman’s elicited on the left. Reflexes: 3+ left biceps. Cervical forward and left lateral flexion limited due to pain. Left Spurling’s exacerbated shoulder pain.

DIFFERENTIAL DIAGNOSIS
1. Cervical radiculopathy/myelopathy
2. Left supraspinatus tear
3. Left subacromial impingement
4. Left adhesive capsulitis
4. Left brachial plexopathy

TESTS AND RESULTS
Left Shoulder MRI
- No supraspinatus tear
- Subtle superior/lateral tear
- Trace biceps tenosynovitis

Cervical Spine MRI
- Left paracentral disc herniation causing moderate spinal canal stenosis with compression of spinal cord and myelomacia at C5-6 level.
- Moderate to severe foraminal stenosis, worse on the left at C5/6.

Left Brachial Plexus MRI
- No abnormality

Upper Extremities EMG/NCS
- Left primarily demyelinating median nerve mononeuropathy across the wrist.
- Observation and re-innervation at the level of the left triceps brachii muscle without abnormalities in other C6 or C7 innervated muscles or radial innervated muscles to assist with innervation suggestive of cervical radiculopathy

FINAL WORKING DIAGNOSIS
- Left cervical radiculopathy/myelopathic features
- Referral to Neurosurgery for potential surgical decompression in setting of cervical myelopathic findings.
- Initiated physical therapy focusing on McKenzie based program with spine stabilization.

1367 May 28 10:30 AM -10:50 AM
Shoulder Injury - Wrestling
Alex K. Ngan, Benjamin Ma, Cindy J. Chang, FACSMB.
University of California San Francisco, San Francisco, CA.
(Sponsor: Cindy J. Chang, FACSMB)
Email: alexngan93@gmail.com
(No relevant relationships reported)

History:
A 14 year-old wrestler was injured during a match when he was thrown over his opponent’s shoulder, landing directly on his left shoulder. He reported immediate swelling of his shoulder and tingling of fingertips; at the emergency department (ED) shoulder radiographs were negative. He was given a ketorolac injection; bruising appeared a few days later. He returned to the ED one week later with left sided chest and abdominal pain; chest radiographs were negative. Two months later, he presented to our sports medicine clinic with 7/10 “achy all over” shoulder pain that worsened with movement. He denied instability, weakness or radicular symptoms.

C-16 Rapid Fire Platform - Athletes and Behavior
Thursday, May 28, 2020, 9:30 AM - 10:50 AM
Room: CC-Exhibit Hall

1368 Chair: Thomas Andre. University of Mississippi, University, MS.
(No relevant relationships reported)

1369 May 28 9:30 AM - 9:40 AM
Relationship Between A Burnout Syndrome Evaluation And Hopelessness In Mexican College Athletes.
(No relevant relationships reported)

PURPOSE: To find the relationship between Burnout Syndrome and Hopelessness.

METHODS: 307 Mexican college athletes were evaluated by trained psychologists with a battery which included a Sport Burnout Syndrome Inventory (conformed by 18 items; divided in 3 factors: Emotional Exhaustion (EE), Depersonalization (D) and Reduced Personal Realization (RPR); qualified in 4 grades: “Low Risk”, “Moderated Risk”, “High Risk” and “With Burnout”) and Beck’s Hopelessness Scale (conformed by 6 items). The association between “Moderated Risk” of Burnout Syndrome risk and “Moderated Risk” and “High Risk” were statistically significant in EE Factor (p=0.02). Likewise, “High Risk” scores in EE (p=0.002) and “With Burnout” in D (p=0.03) seem to be predictors of “Slight Hopelessness”. On the other hand, “High Risk” scores in EE was associated with “Moderated Hopelessness” (p=0.04). We did not obtain “Severe” evaluated athletes in our sample.

CONCLUSIONS: Beck’s Hopelessness Scale is an instrument that allows us to identify some indicators associate with the risk of committing suicide. Our results suggest that our college athletes do not show signs of suicide risk. Nonetheless, we see how higher Burnout Risk has an association with higher hopelessness scores. Both Burnout and suicide are public health issues, so we are convinced that more similar studies are necessary.
Table 1. Association between Burnout syndrome risk and Hopelessness levels.

<table>
<thead>
<tr>
<th></th>
<th>EE</th>
<th>D</th>
<th>RPR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With BO</td>
<td>Without BO</td>
<td>With BO</td>
</tr>
<tr>
<td>Slight hopelessness</td>
<td>1.87 (0.56 - 6.20)</td>
<td>1.02 (0.37 - 2.79)</td>
<td>1.86 (0.85 - 4.05)</td>
</tr>
<tr>
<td>Moderate hopelessness</td>
<td>15.96* (1.22 - 209.07)</td>
<td>3.77 (0.35 - 40.32)</td>
<td>3.86 (0.58 - 25.53)</td>
</tr>
</tbody>
</table>

Data expressed as OR (95% CI). BHS: Beck Hopelessness Scale; BO: Burnout. D: Depersonalization. EE: Emotional Exhaustion. RPR: Reduced Personal Realization. *Sample size was too low to perform the analysis.

* p<0.05

Flow, Optimism and Hope are psychological constructs that have been studied separately in applied sport psychology and positive psychology, but never together at the same time. PURPOSE: The purpose of the present study was to explore the relationships among Flow, Optimism and Hope, and determine whether Optimism and/or Hope was/were a predictor of Flow. METHODS: For the study, 640 triathletes (37.80 ± 10.35 yrs; 24.18 ± 34.30 total triathlons) completed an online survey consisting of a demographic questionnaire, and validated psychometric scales for Flow, Optimism and Hope. Correlations, step-wise regressions, Confirmatory Factor Analyses and Structural Equation modeling (SEM) were used to explore the data. SEM was employed to generate a number of different models consistent with hypotheses and theory. RESULTS: Ultimately, SEM showed that the best model was one in which Hope was a moderately strong predictor of Flow, while the small predictive value that Optimism had on Flow was indirect and moderated through Hope. For this mediation model, the SEM fit statistics demonstrated that the data fit the baseline structural model modestly well. The scaled χ^2 (x2) (1162, N = 640) = 2466.24, p < .00; TLI = .93; CFI = .95; GFI = .86; RMSEA (90% CI) = .042 (.040 - .044) denoted that the data fit the structural model objectively well. In the mediation model, Hope, and Optimism through Hope, predicted Flow (42% explained variance). CONCLUSION: Hopeful triathletes are optimistic triathletes, and hopeful triathletes experience higher levels of Flow than less hopeful triathletes. Lastly, Hope moderates the influence of triathlete Optimism on Flow.

Previous research on NCAA Division II student-athletes (SA) as it relates to multi-dimensional wellness is scarce. PURPOSE: To examine differences in wellness levels between SAs who completed a college wellness course and those who did not. METHODS: Overall, 530 SAs (n_solid = 355, n_liquid = 175) between 18 and 23 years of age (M = 19.40, SD = 1.33) from 21 teams voluntarily completed the paper-based Multi-Dimensional Wellness Inventory (Mayol, Schreiber & Scott, 2017) and a demographic questionnaire. The 45-item MDWI measures one’s perceived behavior with respect to personal wellness orientation within nine dimensions: physical wellness exercise (PWE), physical wellness nutrition (PWN), mental (MW), social (SW), intellectual (IW), environmental (EW), occupational (OW) and financial (FW). A factorial MANOVA was performed to analyze the differences in wellness levels. An alpha level of p = .05 was set for statistical significance. RESULTS: There was a statistically significant multivariate effect in SAs, F(9, 451) = 4.72, p < .001, Wilks’ Λ = .91, partial η^2 = .109 with seven significant univariate main effects seen for PWE, F(1, 459) = 8.60, p = .004; PWN, F(1, 459) = 21.35, p < .001; MW, F(1, 459) = 13.01, p < .001; SW, F(1, 459) = 12.32, p < .001; IW, F(1, 459) = 14.13, p < .001; OW, F(1, 459) = 14.66, p < .001; and FW, F(1, 459) = 10.58, p = .001. No statistically significant univariate effects were seen for SPW and EW (p > .05). SA wellness course completers demonstrated higher PWE, PWN and MW levels (M = 14.43, SD = 3.29; M = 13.36, SD = 3.40; M = 17.08, SD = 2.14) than SA non-completers (M = 13.36, SD = 3.40; M = 13.36, SD = 3.40; M = 16.18, SD = 3.32). Additionally, SA wellness course completers showed higher SPW, EW and OW levels (M = 15.44, SD = 1.83; M = 15.08, SD = 2.65; M = 16.34, SD = 2.30) than SA non-completers (M = 14.87, SD = 2.03; M = 14.24, SD = 2.70; M = 15.81, SD = 2.36). CONCLUSIONS: Results demonstrated higher scores in PWE, PWN, MW, SW, IW, OW and FW for SAs who completed the wellness course versus SAs who did not. Findings indicate a need for future research pertaining to holistic wellness programming for SAs as well as targeted programming and support for this population. A multi-dimensional wellness intervention may assist in identifying and improving wellness deficits to further facilitate overall well-being in SAs.

Abstracts were prepared by the authors and printed as submitted.
2. Athletes showed higher spontaneous activity in precuneus (cluster size =337, peak coordinate= 6, -3,39, peak t =6.65) in somatomotor network.

1. Athletes showed higher spontaneous activity in postcentral gyrus (cluster size =230, peak coordinate=5, -2, 53, peak t =5.02) in somatomotor network.

Neurological Institute(MNI) space. t-test was then conducted using SPM12 to investigate whether there were significant differences between groups. Results were reported when voxel significant at a level of p < 0.01. Cluster-level whole-brain family wise error (FWE) was applied for multiple comparison correction (cluster p< 0.01). Coordinates are given in Montreal Neurological Institute[MNI] space.

RESULTS: Athletes showed higher spontaneous activity in precuneus (cluster size =337, peak coordinate =30, -66.39, peak t =10.38) in dorsal attention network.

CONCLUSIONS: Difficulty engaging in motor training may promote functional network activation patterns. Elite skating athletes showed better functional connectivity in somatomotor network and dorsal attention network, left fronto-parietal network and visual network. A two-sample t-test was then conducted using SPM12 to investigate whether there were significant differences between two groups. Results were reported when voxel significant at a level of p < 0.01. Cluster-level whole-brain family wise error (FWE) was applied for multiple comparison correction (cluster p< 0.01). Coordinates are given in Montreal Neurological Institute[MNI] space.

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attributable to mindfulness was examined in a regression model. Mindfulness explained 32% of the variability beyond the 21% explained by MT for a total of 53%. CONCLUSIONS: This is the first study to explore the compatibility of MT and SC via mindfulness in the collegiate environment. Results suggest considerable overlap between MT and SC via mindfulness, supporting the hypothesis. Preliminary findings are in accordance with Wilson et al. (2019): mindfulness may be crucial to increasing and conserving both constructs in the sporting environment. Results may also support the notion that mindfulness be investigated as a possible component of MT, too. Suggestions for future research include larger-scale studies and triangulation through multi-rating. Possible limitations include convenience samples, unequal sample sizes, and self-reported data.

Wildland fire suppression presents a working environment that often exceeds an energy expenditure of 20 MJ/day. Despite high levels of chronic physical exertion, we have noted maladaptive alterations in adiposity and blood lipids in a small cohort of wildland firefighters (WLFF). PURPOSE: To determine changes in clinical health metrics and serum lipids resulting from 5 months of seasonal wildland fire suppression. METHODS: We recruited 79 WLFF (72 males and 7 females from six crews (5 Hotshot crews, 1 Initial Attack crew) based in MT and CA and conducted a pre- and post-season observational study. After an overnight fast, nude body composition (body fat percentage, BP, grip strength, and a step test (-VO₂ -20 mL/kg/min) for heart rate (HR) steady state were recorded. Blood samples were collected and analyzed for serum total cholesterol (CHOL), high density lipoprotein (HDL), low density lipoprotein (LDL), very low-density lipoprotein (VLDL), and triglycerides (TRIG). A 2-tailed dependent t-test was used to compare pre- and post-seasonal values. Statistical significance was established at p<0.05. RESULTS: Body mass was increased (pre 77.4 ± 9.7 vs post 78.4 ± 9.5 kg, p<0.001). Systolic and diastolic BP decreased (pre 133.3 ± 13.7/76.1 ± 10 vs post 128.1/74.3 ± 9 mmHg, p<0.001 and 0.05, respectively). Grip strength remained unchanged (pre 56.3 ± 10.7 vs post 56.3 ± 11.4 kg, p=0.05). There was a decrease in the HR response during the step test (pre 102.1 ± 13 vs post 96.9 ± 8 BPM, p<0.001). Serum CHOL and LDL did not change over the season (p=0.05). In contrast, serum TRIG (pre 73.3 ± 35 vs post 92.5 ± 55 mg/dl, p<0.0001) and VLDL (pre 14.7 ± 7 vs post 18.1 ± 11 mg/dl, p<0.0001) were significantly increased by the end of the season, p<0.001. Similarly, HDL was significantly reduced (pre 68.8 ± 15 vs post 64.1 ± 13 mg/dl), corresponding to an increase in the TC/HDL ratio (pre 1.2 ± 0.8 vs post 1.6 ± 0.3, p<0.0001). CONCLUSIONS: Despite favorable changes in BP and aerobic fitness, there were maladaptive changes in serum lipids that occurred in conjunction with an increase in body mass. Further studies should explore the influence of diet, mental/emotional stress, and/or smoke exposure on the mechanisms responsible for the dysregulation of lipid metabolism in WLFF. Supported by the United States Forest Service, National Technology and Development Program.

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In firefighters, hypertension is an important risk factor for cardiovascular mortality while little is known regarding HS in this population. It is not known if lower or higher strength levels could be associated to different BP levels. **Purpose:** To evaluate the association between HS and BP in Firefighters. **Methods:** We evaluated 176 male firefighters with mean age of 28 ± 1.57 yrs, BMI of 24.6 ± 2.8 kg/m², systolic blood pressure (SBP) of 123.6 ± 11.32 mmHg, diastolic blood pressure (DBP) 72.5 ± 8.66 mmHg, and HS of 102.2 ± 17.1 kg. Isometric HS was measured using a handheld Sahan dynamometer (Model SH 5001) in standing position with the arm extended straight down. Two maximal contractions were performed separated by one minute. HS was calculated as the sum of the largest value recorded from each hand and expressed in kilograms. HS was evaluated according to age as: poor, fair, good, very good and excellent. Afterward, firefighters were classified as having higher HS (good, very good and excellent categories) or lower HS (poor and fair categories). BP was measured in sitting position by an automatic digital arm pressure device. We compared the SBP and DBP of volunteers according to the HS classification (higher vs lower). The independent t-test (p<0.05) was used for the analysis. Data are presented as mean ± SD. Results: SBP was not different between those with higher and lower HS (p<0.05); however, DBP was significantly different between both groups (p<0.01). **Conclusion:** This study demonstrated that there is an association between muscle strength and DBP in this sample.

**Table 1. Blood pressure comparison between higher and lower grip strength**

<table>
<thead>
<tr>
<th></th>
<th>SBP (mmHg)</th>
<th>DBP (mmHg)</th>
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</thead>
<tbody>
<tr>
<td>Higher</td>
<td>123.5 ± 12.9</td>
<td>73.8 ± 8.5</td>
</tr>
<tr>
<td>Low</td>
<td>122.3 ± 13.9</td>
<td>69.6 ± 8.3</td>
</tr>
<tr>
<td>p-value</td>
<td>0.56</td>
<td>&lt;0.01*</td>
</tr>
</tbody>
</table>

*: independent t-test; SBP: systolic blood pressure; DBP: diastolic blood pressure.

**1411 Board #5 May 28 9:30 AM - 11:00 AM Effect Of Occupational Hyperthermia On Upper Body Motion While Wearing Firefighters’ Protective Clothing In Hot Environment**

Ali M. Aljarroudi, Amit Bhattacharya, Tyler Quinn, Warren J. Williams, Sam Houston State University, Huntsville, TX. University of Cincinnati, Cincinnati, OH. National Institute for Occupational Safety and Health, Pittsburgh, PA.

Firefighters perform strenuous activities for unpredictable duration periods under high environmental heat conditions. In addition to the thermal load, the tasks associated with firefighting place high physical demands on the upper extremities of the human body and dynamic balance stability. **Purpose:** To investigate the effect of occupational hyperthermia [Core temperature (Tc) > 38 °C], induced by exercise in a hot environment while wearing firefighters’ protective clothing (FPC), on upper body motion. **Methods:** Twelve healthy males (Age: 24 ± 3.20 years; VO₂max: 56.33 ± 7.42 mL/kg/min) were recruited to complete a Timed Up and Go (TUG) test while wearing inertial sensors before and after exercising inside an environmental chamber (30°C, 70% relative humidity). The exercise protocol included 40-min of treadmill walking at 40 % VO₂max while wearing FPC. For the TUG, participants were instructed to sit on a chair, stand up upon researcher’s command, walk 3-meters, turn around, walk back to the chair, and sit down. Pre- and post-exercise measurements were compared using paired-sample t-test with alpha level set at p < 0.05. **Results:** Following the exercise session in a hot environment wearing FPC, subjects’ Tc significantly increased (36.92 ± 0.27 vs. 38.25 ± 0.36 °C, p < 0.01), exceeding the lower threshold limit of occupational hyperthermia (Tc ≥ 38 °C). Following the exercise session, a significant increase was found in swing velocity of the torso (77.17 ± 27.04 vs. 85.17 ± 25.89 %, p = 0.03), right arm (184.33 ± 79.09 vs. 230.50 ± 104.98 %, p < 0.01), and left arm (228.92 ± 77.20 vs. 250.75 ± 74.48 %, p < 0.01). A significant increase was also found in range of motion of the right arm (184.33 ± 79.09 vs. 230.5 ± 104.98 %, p < 0.01), and the left arm (228.92 ± 77.20 vs. 250.75 ± 74.48 %, p < 0.01). **Conclusions:** Occupational hyperthermia can result in significant alterations in upper body motion which may contribute in perturbing the dynamic balance associated with gait function. The significant increase in arms and torso motion suggests that exercise in a hot environment while wearing FPC may result in physically exerting the lower extremities and increasing energy demand to maintain the dynamic balance associated with locomotion.
The firefighting profession requires high levels of physical fitness. Specifically, cardiovascular fitness has shown a strong relationship with the ability to perform occupational tasks. Despite this, not all firefighters maintain ideal fitness levels. Sudden cardiac arrest is the leading cause of on-duty fatalities for firefighters. Recent data suggests the prevalence of obese and overweight firefighters exceeds that of the general US population. Obesity is often correlated with low fitness levels in the general population, however when aerobic fitness improves, favorable outcomes in health related quality of life (HRQoL) have been reported. The relationship between HRQoL, aerobic fitness levels and body composition has not been studied in the professional firefighter population. PURPOSE: To determine the relationship of HRQoL, aerobic fitness, and body composition measures in professional firefighters. METHODS: 16 professional firefighters (14 male; 36.8±7.1yrs; 178.8±5.4 cm; 87.9±11.2 kg) volunteered for the study. BMI and percent body fat were calculated using BodyPod. VO_{2peak} was assessed using a graded treadmill exercise test. Descriptive statistics (mean ± SD) were reported. Pearson correlation tests were used to assess association between variables. RESULTS: Overall participant anthropometrics are as follows: body fat (23.5 ± 6.8 %), VO_{2peak} (44.9 ± 6.0 ml/kg/min), physical health composite score (56.5 ± 2.6), and mental health composite score (48.9 ± 6.1). According to BMI classifications 6 firefighters were obese (>30 kg/m^2) and 4 were overweight (25.9-29.9 kg/m^2). There were statistically significant negative correlations between VO_{2peak} and body fat mass (r = -0.88; p < 0.000), and fat mass (r = -0.86; p < 0.001). There was a positive correlation between physical health composite score and age (r = 0.57; p < 0.001). No other relationships were found to be statistically significant. CONCLUSIONS: The observed inverse relationship between aerobic fitness and body fat percentage supports prior findings. The novel finding that HRQoL was not correlated with aerobic fitness or body composition measures in this sample may warrant further study.

Heart rate variability (HRV) is a non-invasive marker of autonomic nervous system (ANS) connectivity and is used to determine the relative balance of the sympathetic and parasympathetic nervous systems. HRV is used to assess the risk for cardiovascular disease and higher HRV is thought to be cardioprotective. PURPOSE: To examine the relationships between resting HRV and heart rate and aerobic capacity (VO_{2peak}) during a maximal treadmill test. METHODS: 37 male career active-duty firefighters (mean ± SD, 39.1 ± 8.9 y; 178.8 ± 5.4 cm; 87.9 ± 11.2 kg) participated in this study. All participants completed a 5-minute resting HRV sample followed by a maximal graded exercise test on a treadmill using a modified version of the submaximal Wellness Fitness Initiative test for firefighters. Heart rate and oxygen consumption were monitored throughout the test and maximal HR (MHR) at cessation of the test and VO_{2peak} were recorded for each participant. HRV was determined by measuring the time intervals between R-waves and reflected as the mean RR for the 5-minute resting sample. Bivariate Pearson correlations determined the relationship between resting RR, MHR, and VO_{2peak}. An alpha of 0.05 determined statistical significance. RESULTS: Resting RR (864.8 ± 134.0 ms) had a moderate significant relationship with MHR (r = 0.59, p < 0.000), and VO_{2peak} (7.1 ml/kg/min, r = -0.458, P = 0.004) and MHR (181.5 ± 10.7 bpm, r = -0.360, P = 0.029), but VO_{2peak} was not related to MHR (r = 0.308, P = 0.064). CONCLUSION: Higher resting RR was associated with greater VO_{2peak} but lower MHR. The positive relationship between RR and VO_{2peak} is consistent with prior research suggesting that a higher resting HRV is related to higher fitness. The inverse relationship between HRV and MHR suggests that greater parasympathetic nervous system control at rest (i.e. lower HHV) may extend into maximal exercise tasks. Thus, for a firefighter, the benefit of a more favorable resting HRV may not only be cardioprotective, but also influence the relative intensity of a maximal task.
North Texas during a 6-month training program. METHODS: Twenty-five professional firefighters completed 6 months of high-intensity group training, consisting of 2 training sessions per week. These individuals underwent a pre- and post-fitness protocol that consisted of body composition, range-of-motion, anaerobic power, muscular endurance, and cardiorespiratory fitness. A repeated-measures MANOVA was used to determine any differences between testing periods. A significance level of 0.05 was used. RESULTS: Improvements (p < 0.05) in flexibility, anaerobic performance, fatigue index, muscular endurance, and aerobic fitness were found following the 6-month training program. No differences in body composition or peak power were observed (p > 0.05). Conclusion: Six months of high-intensity group exercise may improve measures of physical fitness in firefighters.

Table 1: Health and Physical Fitness Measures Before and After 6 Months of Exercise Training in Firefighters

<table>
<thead>
<tr>
<th>Test</th>
<th>Pre-Test</th>
<th>Post-Test</th>
<th>Percent Change</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Mass (kg)</td>
<td>96.0 ± 17.9</td>
<td>93.1 ± 20.1</td>
<td>-3.0%</td>
<td>0.597</td>
</tr>
<tr>
<td>Body Fat (%)</td>
<td>30.5 ± 11.0</td>
<td>29.9 ± 7.2</td>
<td>-2.0%</td>
<td>0.113</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>29.2 ± 5.0</td>
<td>29.0 ± 5.0</td>
<td>-0.7%</td>
<td>0.597</td>
</tr>
<tr>
<td>Flexibility (cm)</td>
<td>24.9 ± 6.3</td>
<td>34.6 ± 7.0</td>
<td>+39.0%</td>
<td>0.001</td>
</tr>
<tr>
<td>Push-ups</td>
<td>28.8 ± 14.9</td>
<td>36.4 ± 18.1</td>
<td>+26.4%</td>
<td>0.001</td>
</tr>
<tr>
<td>Curl-ups</td>
<td>22.1 ± 15.8</td>
<td>53.4 ± 30.6</td>
<td>+141.6%</td>
<td>0.002</td>
</tr>
<tr>
<td>Peak Power (W)</td>
<td>1052.2 ± 275.5</td>
<td>1063.3 ± 287.9</td>
<td>+1.1%</td>
<td>0.815</td>
</tr>
<tr>
<td>Mean Power (W)</td>
<td>633.4 ± 150.4</td>
<td>672.4 ± 152.2</td>
<td>+6.2%</td>
<td>0.006</td>
</tr>
<tr>
<td>Fatigue Index (%)</td>
<td>60.5 ± 7.4</td>
<td>52.8 ± 9.3</td>
<td>-12.7%</td>
<td>0.001</td>
</tr>
<tr>
<td>VO₂max (ml/kg/min)</td>
<td>34.7 ± 4.9</td>
<td>38.4 ± 5.9</td>
<td>+10.7%</td>
<td>0.006</td>
</tr>
</tbody>
</table>

All values are means ± s.d. *Significantly different than Pre-Test. BMI = body mass index; VO₂max = maximum oxygen consumption.
The combination of thermal extremes and metabolic demands associated with wildland firefighter (WLFF) job tasks may elicit acute impairment in work capacity. As heat injuries persist in WLFF and other tactical occupations, field evaluations can gather insight into characteristics of job tasks that may contribute to thermoregulatory challenges. PURPOSE: To evaluate the activity and physical demands of wildland firefighting as they relate to the associated environmental conditions. METHODS: Direct observation and real-time wireless physiological monitoring allowed for weather and physiological metrics, including heart rate (HR), percentage of HR max (%HRmax), core temperature (Tc) and physiological strain index (PSI), of male (n=301) and female (n=33) WLFFs to be monitored during wildfire management activities. Activity levels (ACT; counts min−1) were recorded using an ActiCal activity monitor (Mini Mitter) located in the left pectoral pocket. Heat Index estimations (HI) were calculated using temperature (TEMP) and relative humidity (HUM) inputs recorded using an Omega Temperature Data Logger. One-way ANOVAs were used to compare means of HI quartiles data using HR, ACT, and PSI as dependent variables. RESULTS: TEMP and HUM values were computed to heat index (n = 3891 hours) and divided into quartiles (Q1: 13.3-25.1°C; Q2: 25.2-26.4°C; Q3: 26.5-28.9°C; Q4: 29.0-49.1°C). Average ACT displayed a negative, linear correlation with HI (Q1: 535 ± 731 counts min−1; Q2: 423 ± 615 counts min−1; Q3: 384 ± 571 counts min−1; Q4: 309 ± 416 counts min−1; p < 0.05). However, this reduction in activity level resulted in only a moderating effect on HR and PSI as average HR (Q1: 113 ± 27 bpm; Q2: 116 ± 26 bpm; Q3: 116 ± 26 bpm; Q4: 111 ± 25 bpm) and PSI values (Q1: 3.5 ± 1.6; Q2: 3.7 ± 1.6; Q3: 3.7 ± 1.5; Q4: 3.5 ± 1.5) were lowest in Q1 and Q4. Average Tc values (Q1: 37.49 ± 0.46°C; Q2: 37.59 ± 0.48°C; Q3: 37.60 ± 0.47°C; Q4: 37.59 ± 0.41°C) and PSI values (Q1: 3.5 ± 1.6; Q2: 3.7 ± 1.5; Q3: 4.6 ± 1.0; Q4: 3.5 ± 1.5) increased only slightly with increasing HI (Q1: 37.49 ± 0.46°C; Q2: 37.59 ± 0.48°C; Q3: 37.60 ± 0.47°C; Q4: 37.59 ± 0.41°C). CONCLUSIONS: Although physical activity occurred for approximately half of a 12 to 16-hour work shift, physical exertion was the primary indicator of challenges to thermoregulation in this population. Reductions in activity levels with increasing heat index values suggest adequate regulation of body temperature in the majority of WLFF field operations.

RESULTS: Table 1 - Duty cycle (x100) by respirator and energy expenditure

<table>
<thead>
<tr>
<th>Energy Expenditure</th>
<th>Standing</th>
<th>1 L/min</th>
<th>2 L/min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline (instrument mask only)</td>
<td>34.11 (8.46)</td>
<td>41.07 (6.44)</td>
<td>41.86 (4.69)</td>
<td>44.17 (5.56)</td>
</tr>
<tr>
<td>Small loose-fitting PAPR</td>
<td>34.99 (4.77)</td>
<td>42.10 (2.78)</td>
<td>44.06 (3.50)</td>
<td>46.97 (3.43)</td>
</tr>
<tr>
<td>Medium loose-fitting PAPR</td>
<td>43.53 (9.37)*</td>
<td>46.32 (5.53)*</td>
<td>46.02 (4.92)</td>
<td>47.41 (3.95)</td>
</tr>
<tr>
<td>Large loose-fitting PAPR</td>
<td>46.86 (11.09)*</td>
<td>47.27 (4.59)*</td>
<td>46.41 (3.90)*</td>
<td>48.74 (4.06)*</td>
</tr>
<tr>
<td>Tight-fitting PAPR</td>
<td>40.24 (8.66)*</td>
<td>42.30 (3.34)</td>
<td>45.54 (3.43)</td>
<td>44.77 (3.40)</td>
</tr>
</tbody>
</table>

All values are reported as mean (standard deviation). *significant different than baseline within energy expenditure (p < 0.05).

Uncompensable heat from wildland firefighter (WLFF) personal protective equipment decreases the physiological tolerance while exercising in the heat. Our previous work demonstrated that the WLFF helmet significantly increases both perceived and actual head heat. PURPOSE: This study compared heat accumulation under simulated working conditions while wearing standard non-vented WLFF helmets (H) versus a vented helmet (VH). METHODS: Ten male subjects with VO2max of 59.8 ± 3.6 ml·kg−1·min−1 completed two trials. Following a 10-minute seated acclimation period, subjects walked 180 minutes (at 3.5 mph, 5% grade) in a heat chamber (35% and 30% relative humidity) with three intervals of 50 minutes of exercise and 10 minutes rest followed by a work capacity test to exhaustion. Subjects randomly completed opposing helmet trials separated by a two-week washout. Each trial measured physiological strain index (PSI), visual analog scale (VAS), helmet temperature and relative humidity (Th, Rh), rating of perceived exertion (RPE) and heart rate (HR). Data was analyzed using a 2X6 repeated measures ANOVA. RESULTS: All subjects finished all trials. Work capacity was significantly greater in the VH trial (95.9±10.3 KJ H vs. 109.3±8.5 KJ VH, p<0.001). At the end of the 3 hour trial HR (146.8±17.2 bpm H, 144.3±17.9 bpm VH), PSI (6.08±1.45 H, 5.89±1.24 VH), RPE (14.2±1.7 H, 13.3±1.7 VH), Th (35.52±0.47°C H, 35.75±0.50°C VH), and Rh (45.46±5.14 H, 41.01±5.9% VH) showed a significant effect of time (p<0.05) but were not significant between trials. End trial PSI and HR significantly related to work performed (r=−0.8, P<0.001). CONCLUSION: Elevated work, trends for RPE, helmet microenvironment, and VAS suggest greater heat dissipation and comfort with the vented helmet. This suggests the standard unventilated WLFF helmet may contribute to accumulated heat over time, which may affect work output and safety in the field. Supported by the USFS (18-4-CR-1113810-005).

Unpublished...
169.5±4.2 cm) Type I Intergener Hotshot (IHC) WLFF were studied during an 11-day critical training period. Daily body weight (BW), upper body (US), and lower body (LS) muscle soreness scales were collected. Venous blood was collected from the antecubital region on Days 1, 4, 8, and 11 to measure creatinine kinase (CK) and lactate dehydrogenase (LDH). Skin fold measurements were taken on Day 1 and Day 11 to calculate body fat percentage (BF). One-way ANOVA were used to analyze mean differences in CK, LDH, US, and LS. Paired samples t-tests were used to identify differences in US and LS. Data presented as mean±SEM. All differences in body weight were observed between Day 1 and Day 11 (p=0.065) of CT. BF significantly decreased from Day 1 and Day 11 (15.3±1.4% vs. 14.1±1.1%, p<0.002). US and LS showed a main effect of time, elevated from baseline for subsequent days, with a peak on Day 3 (US: 3.8±0.5 cm, p<0.001; LS: 4.3±0.3 cm, p<0.001). CK showed a significant effect of time, elevated from baseline, with a peak on Day 4 (154.1±14.4 U/L vs. 15.4 U/L, p<0.001). LDH showed a significant effect of time, where Day 11 significantly increased from Day 1 (159.4±5.5 IU/L vs. 164.4±6.9 IU/L, p=0.040). CONCLUSION: These data suggest that WLFF undergo significant physiological stressors to induce muscle soreness and damage during CT. Although there have been previous case reports of rhabdomyolysis during CT, these IHC WLFF remained sub-clinical. Despite this, these data demonstrate that CT presents a stress that may jeopardize WLFF performance and safety in the field. Careful preparation and monitoring of the training stimulus is key to avoid clinical ramifications.

Funded by the USFS 16-CR-11138200-005

1425  Board #19  May 28 9:30 AM - 11:00 AM  Physical Fitness Maintenance In Members Of A Southeastern United States City Professional Firefighting Department

Cody E. Morris1, Scott W. Arnett. 1University of Alabama at Birmingham, Birmingham, AL. 2Western Kentucky University, Bowling Green, KY. (Sponsor: Scott Lyons, FACSM)

PURPOSE: Previous studies report that firefighters lacking an adequate level of physical fitness, even those classified as experts, can experience a severe physiological challenge in unpredictable environmental conditions. The purpose of this study was to assess and track the annual physical fitness performance of the members of a professional firefighting department.

METHODS: As part of the annual health and fitness testing (data from 2002-2017) performed by the Bowling Green Fire Department (BGFD) in Bowling Green, KY, 153 firefighters had their physical fitness evaluated using standardized and recommended protocols performed by the International Association of Fire Fighters. A mixed methods analysis was employed to examine differences over time for each of the dependent variables (push-ups, plank hold, handgrip strength, static arm pull, and static leg pull) using SPSS (v25).

RESULTS: Handgrip strength performance significantly improved in the first 4 years after baseline (p<0.05) followed by a steady, significant decline each following year (p<0.05), with the exception of year 15 (p=0.504). Push-up performance significantly declined from baseline (p<0.05). The plank hold performance was maintained over the first 5 years of testing (p>0.05) before showing marked improvement in the most recent year (p<0.05). Although small, flexibility significantly improved from year 1 to year 2 (p=0.05), but then was maintained over each subsequent year of testing (p>0.05). Static arm pull and static leg pull both significantly improved for the first 4 years (p<0.05), but then showed a steady decline thereafter (p<0.05).

CONCLUSIONS: Based on these results, physical fitness showed a consistent improvement in the first several years tested; however, several of the muscular strength-related variables showed a consistent decline thereafter. It will be important to continue to monitor and adjust the physical training regimen to attempt to alleviate any physical fitness decline.

1426  Board #20  May 28 9:30 AM - 11:00 AM  Impaired Sleep In Volunteer Firefighters Responding To Nighttime Calls


(No relevant relationships reported)

In Canada and the US, there are approximately 813,000 volunteer firefighters (FFs), a unique subset of shift workers who, despite possessing separate careers, provide 24-hour emergency services. Despite accounting for 67% of North American FFs, volunteers are often overlooked in firefighter research in favour of their career counterparts. It is known that calls at night reduce sleep and that sleep deprivation can adversely affect executive function however, the degree of sleep deprivation among on-call volunteer FFs remains a paucity. PURPOSE: To quantify the impact of volunteer FFs’ night time call response on sleep volume and stage-specific distribution. METHODS: Eight male volunteer FFs (34.76 ± ±2.56 years) were validated wristband sleep monitors to track total, stage-specific, and percent distribution of sleep on nights without a call (CON), and on nights where there was a call response between 1900 and 0700 (CALL). Data was extracted via the device’s app to a tablet and recorded via spreadsheet. One firefighter experienced two nights with a call and only one without. Both sets of CALL data were compared to the CON resulting in 9 sets of CON/CALL data which were analyzed using a one-way ANOVA. RESULTS: Significant differences were found in total sleep (CON: 417.125 ± 52.044 mins; CALL: 261.111 ± 61.116 mins), time spent in rapid-eye movement (REM) (CON: 109.88 ± 28.47 mins; CALL: 51.44 ± 17.92 mins) and light sleep (CON:225.75 ± 26.20 mins; CALL: 157.89 ± 37.54 mins), and percentage of sleep spent in REM (CON: 22.25 ± 3.73%; CALL: 16.44 ± 3.17%). This was accompanied by respect specific effects (t(29)) of 0.570, 0.537, 0.429, and .511. Despite comprising 22.57% of total CON sleep, REM sleep decreased disproportionately, accounting for 37% of CALL sleep loss. CONCLUSIONS: Volunteer firefighters responding to overnight calls experience significant total sleep deprivation at levels previously shown to impede cognitive performance. Significant and disproportionate decreases in total and percentage of REM sleep were also observed on nights with a call. Considering the impact of REM sleep on optimal executive function, this degree of sleep deprivation has the ability to impact critical decision-making events, not only on the fire ground, but at the firefighter’s day job, thereby increasing risk of injury/death.

1427  Board #21  May 28 9:30 AM - 11:00 AM  Physical Activity And Health In Career Firefighters In A Low-income Area

Jordan A. Graves, Brandy E. Phipps, Kathy Carter, FACSM. Central State University, Wilberforce, OH. (Sponsor: Kathy Carter, FACSM)

(No relevant relationships reported)

Fifty percent of firefighter (FF) line-of-duty deaths result from cardiovascular incidents. Factors including physical stress, sleep patterns, and sedentary behavior that occur while running between runs may contribute to increased cardiovascular risk in firefighters and other first responders. Wellness programs have been shown to increase health in firefighters, but departments in low-income communities are often unable to provide wellness programming. This provides opportunities for institutions like Central State University to fill the needs of those departments as part of our land-grant mission.

PURPOSE: To determine health and cardiovascular disease (CVD) risk of local career FF in a low-income community for use in developing ongoing wellness interventions. METHODS: We used physical activity surveys shown to be reliable and valid, and collected anthropometric measurements (waist circumference (WC), weight, height, and body fat percentage (BF)). Raw data was used to assess overall fitness of the department, as well as any correlations between physical activity and fitness. RESULTS: Almost 84% of the participants were obese/overfat, with body mass index (BMI; r=0.806) and WC (r=0.615) strongly correlated with BF. Frequency of cardiovascular exercise (CVE; r=0.269) and strength training (ST; r=0.257) were negatively associated with BF, which remained true when the data was corrected for age. CONCLUSIONS: The data collected suggest a strong need for health interventions, which is in agreement with national fire service reporting. We hope to use this information (along with other data gathered in this pilot study) to develop educational and fitness interventions to increase the wellness of this population and other first responders in our area.

1428  Board #22  May 28 9:30 AM - 11:00 AM  Comparison Of Three Internationally Certified Firefighter Protective Clothing On Mobility, Comfort And Physiological Responses

Aitor Coca, Borja Gutierrez, Iker Saez, Aitor Santisteban. University of Deusto, Bilbao, Spain.

Email: aitor.coca@deusto.es

(No relevant relationships reported)

Firefighting, being one of the most dangerous jobs, requires specialized equipment and strategies to safely and effectively respond to fire emergencies. It is essential for this profession to wear firefighter protective clothing (FPC) to provide barrier protection from the dermal contact of hazardous materials such as heat, flame, and combusted product (Kim et al. 2017). However, the mobility, comfort and physiological responses using FPC are affected by its mass and bulkiness. Purpose: The aim of this study was to compare three internationally certified FPC from USA, European Union (EU) and South Korea (SK) on mobility, comfort and physiological responses. Methods: Ten male professional firefighters performed a battery of exercises in the laboratory from the dermal contact of hazardous materials such as heat, flame, and combusted product (Kim et al. 2017). However, the mobility, comfort and physiological responses using FPC are affected by its mass and bulkiness. Purpose: The aim of this study was to compare three internationally certified FPC from USA, European Union (EU) and South Korea (SK) on mobility, comfort and physiological responses. Methods: Ten male professional firefighters performed a battery of exercises in the laboratory following the ASTM F3031 to evaluate range of motion (ROM) for shoulder and trunk, subjective fit comfort. After these exercises, participants walked on a treadmill for 20 min at 3.2 m/h and 5% incline. Weight, heart rate (HR) and core temperature (Tco) measurements were taken prior and after walking. All participants carried out the evaluation wearing each of the FPC in a random order. Results: There were no significant differences in any of the ROM evaluated for trunk and shoulder, overall comfort shows no significant differences, however on a scale from 1 (worst) to 10 (best) the EU FPC was rated 7.2±1.0, SK 6.5±1.7, and USA was rated 6.0±1.1. There
were no significant differences on weight, HR or Tco between the 3 FPC but there was a significant decrease in weight and increase in HR and Tco from the start to the end of the 20 min exercise. Participants showed an average Tco (38.2°C vs 38°C) and HR (142.7 US vs 136.9 /SK/ EU) at the end of exercise while wearing the USA FPC. Conclusion: These findings suggest that the EU FPC might be the most comfortable and that the USA FPC creates more physiological burden. Comparing the materials and burn prediction data (Kim et al, 2017) with our comfort and physiological data we could observe the inverse relationship between total heat loss (THL) and thermal protective efficiency (TPP) suggesting that comfort increases as THL increases and TPP decreases. The EU FPC, clothing material that certified to the EU standards, is more comfortable but may not protect at the same level as the other two FPCs.

INTRODUCTION: Our laboratory has previously demonstrated the total energy fluid demands of wildland firefighters (WLFF) during arduous fire suppression. However, it remains unclear how current hydration strategies, occupational activity, and fire line provisions may alter overall hydration and electrolyte balance. PURPOSE: To determine WLFF fluid retention and urine production as influenced by environmental conditions, self-selected hydration practices, and work output during fire suppressions shifts. METHODS: 59 WLFF (9 female, 50 male; 29±6 yr) from various crew types were deployed to fire incidents across the United States during the 2019 fire season and were observed throughout a single work shift. Before and after shifts, a measure of nude body weight was obtained. In a subset of subjects (n=25), pre and post-shift blood samples were also drawn to evaluate serum electrolytes. Fireline-certified researchers monitored fluid intake and urine output parameters (frequency, specific gravity [USG], volume) in real-time via observational data capture using graduated cylinder, refractometer, and mobile tablets. Dependent t-tests were performed for all comparative analyses and statistical significance was established at p<0.05. RESULTS: WLFF worked shifts of 13.9±1.1 hr, during which 4.7±1.6 L of water were consumed. WLFF eliminated 2.3±1.1 L via 5.7±2.7 voids (412/192 mL void). There were no noted differences in USG from morning voids compared to those measured post midrimeridem (1.0106±0.0147 and 1.0106±0.0187 for AM and PM USG, respectively; p>0.05). No changes in nude body weight were observed across the work shift (80±13.4 and 79.8±13.2 kg for pre- and post-shift, respectively; p>0.05). Serum sodium and potassium did not change between pre- and post-shift blood draws (pre- = 142±2.2 and 4.3±0.3, post = 141.2±2.2 and 4.2±0.3, respectively; p>0.05). CONCLUSION: These results demonstrate adequate fireline electrolyte provisions and currently-employed WLFF hydration strategies. Moreover, the uniformity of pre- and post-shift measures (body weight, serum electrolytes) demonstrates that USG alone is not adequately indicative of hydration status during extended occupational stress.

INTRODUCTION: Despite a significant correlation between APFT performance and ACFT performance; however, APFT scores as a single explanatory variable only accounted for 4% of the variation in ACFT scores while gender accounted for 69% of the variation. Further analysis suggested a significant correlation (p<0.05) between BMI and ACFT performance, which led to the development of a strength-to-BMI ratio that accounted for 60% of the variation in ACFT scores. CONCLUSION: Despite a significant correlation between APFT and ACFT performance, the two tests appear to provide different assessments of fitness; the relationship between height, weight, gender and APFT performance is well-researched, researchers have not compared those physical traits to performance on the ACFT.

PURPOSE: To determine the relationship between performance on the APFT and ACFT; to establish the relationship between height, weight, gender, and ACFT performance.

METHODS: Researchers used data from 685 Cadets (age, 22±1.11; years; height, 1.77±0.09 m; weight, 80.3±12.8 kg) at the United States Military Academy recorded during the 2019 Academic Year. To determine the relationship between APFT and ACFT performance, researchers conducted an analysis of the variation in ACFT scores using overall APFT performance and gender. To determine the relationship between weight, height, gender, and ACFT performance, researchers conducted statistical analysis of Body Mass Index (BMI), overall ACFT performance, and performance on each singular ACFT event.

RESULTS: Pearson correlation showed a significant (p<0.05) correlation between APFT performance and ACFT performance; however, APFT scores as a single explanatory variable only accounted for 4% of the variation in ACFT scores while gender accounted for 69% of the variation. Further analysis suggested a significant correlation (p<0.05) between BMI and ACFT performance, which led to the development of a strength-to-BMI ratio that accounted for 60% of the variation in ACFT scores.

CONCLUSION: This data demonstrates the need for increased focus on improving physical activity levels to improve overall health and wellness in firefighters. As part of the NFPA’s Wellness Fitness Initiative, fire departments should strive to have at least one hour per day of dedicated time for physical activity.

C-34 Free Communication/Poster - Military/ Firefighters/Police

Thu, May 28, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

Board #25  May 28, 9:30 AM - 11:00 AM
Determinants Of Performance And Comparison Of Army Physical Fitness Test And Combat Fitness Test Scores

Andrew Tyler Innan, Sarah Ferreira, Andrew Plucker, Nicholas H. Gist, Diana Thomas. United States Military Academy at West Point, West Point, NY.

(No relevant relationships reported)

The Army Combat Fitness Test (ACFT) will replace the Army Physical Fitness Test (APFT) on 1 October 2020. The three-event APFT measures muscular and aerobic endurance, but is notably missing measurements of strength, power, and anaerobic endurance. The ACFT is designed to assess each of the aforementioned components of fitness, but the relationship between performance on the ACFT and APFT is unclear. Furthermore, while the relationship between height, weight, gender and APFT performance is well-researched, researchers have not compared those physical traits to performance on the ACFT.

PURPOSE: To determine the relationship between performance on the APFT and ACFT; to establish the relationship between height, weight, gender, and ACFT performance.

METHODS: Researchers used data from 685 Cadets (age, 22±1.11; years; height, 1.77±0.09 m; weight, 80.3±12.8 kg) at the United States Military Academy recorded during the 2019 Academic Year. To determine the relationship between APFT and ACFT performance, researchers conducted an analysis of the variation in ACFT scores using overall APFT performance and gender. To determine the relationship between height, weight, gender, and ACFT performance, researchers conducted statistical analysis of Body Mass Index (BMI), overall ACFT performance, and performance on each singular ACFT event.

RESULTS: Pearson correlation showed a significant (p<0.05) correlation between APFT performance and ACFT performance; however, APFT scores as a single explanatory variable only accounted for 4% of the variation in ACFT scores while gender accounted for 69% of the variation. Further analysis suggested a significant correlation (p<0.05) between BMI and ACFT performance, which led to the development of a strength-to-BMI ratio that accounted for 60% of the variation in ACFT scores.

CONCLUSION: Despite a significant correlation between APFT and ACFT performance, the two tests appear to provide different assessments of fitness; the inclusion of muscular strength, anaerobic endurance, and upper body pulling events in the ACFT likely contribute to the lack of ACFT variation described by the APFT.
study examined the influence of age on recovery following an acute bout of worksite resistance training. METHODS: Nineteen young and 19 older career firefighters (FFs) completed an acute bout of resistance exercise in addition to pre- and post-testing 24, 48, and 72 hours post-exercise. A work-related fatigue (WRF) survey was completed to assess daily fluctuations in work demands. Ultrasonography was used to assess cross-sectional area (CSA) and echo intensity (EI) of the vastus lateralis, in addition to muscle thickness (MT) and EI of the biceps brachii. To determine maximal jump height and associated ground reaction forces, participants completed a 30-s explosive power test while standing on a jump mat with a linear transducer attached at the waist. Upper-body peak force (PF) was measured during an isometric upright row task, using a calibrated tension-compression load cell. Lower body PF was examined with the participants seated in a custom-built, calibrated isometric dynamometer and their knee flexed at 60 degrees. Following 3 submaximal warm-up contractions, participants performed 3 maximal voluntary contractions for each strength assessment lasting 3–4 s. The FFs completed the circuit-style resistance exercise bout following pre-testing, which included 3 sets of 8–10 repetitions at 80% of their predicted 1-repetition maximum of the deadlift, shoulder press, lunge, and upright row. Linear mixed models, controlling for resistance exercise, were used to analyze all primary outcomes, with subject as the random effect and group and time as fixed effects. Alpha level was set a priori at 0.05.

RESULTS: There was a significant group by time interaction effect for WRF (P = 0.002) and was controlled for in subsequent analyses. There were no other significant group by time interactions (P > 0.171). Collapsed across time, young FFs showed greater lower body PF (P = 0.006), jump performance (P = 0.024), and lower back pain (P = 0.008) values. Across time points, upper-body PF (P = 0.023) and jump performance (P = 0.029) decreased as muscle size increased (P = 0.006) for both groups.

CONCLUSION: These results indicate that age may not influence the recovery from a bout of worksite resistance exercise in FFs.

**1435 Board #29 May 28 9:30 AM - 11:00 AM PHYSICAL FITNESS, PHASE ANGLE AND BODY FAT DISTRIBUTION OF YOUNG MALE ARMY CADETS**


Email: raquel.langer@gmail.com

(No relevant relationships reported)

A military career demands a routine of physical training to induce adequate levels of physical fitness (PF) and body composition. Body fat distribution (i.e. android and gynoid fat) are related to increase metabolic risk also observed in military populations. Phase angle (PhA) is used to evaluate nutritional status and is an indicator of cellular health. However, it is unclear if PhA is influenced by changes in PF induced by physical training. PURPOSE: (a) to verify the association between PF and PhA, android and gynoid fat, and (b) if PF changes have an association with changes in PhA, android and gynoid fat in the army cadets. METHODS: 385 young male army cadets (18.7±0.7 yrs) were evaluated before (M1) and after (M2) 6-mo of military training. PhA (º) was calculated by bioelectric impedance parameters. Dual-energy absorptiometry evaluated android fat in kg (A%F), in % (A,F), gynoid fat in kg (G,F) and % (G,F). PF was assessed with specific military test, in which participant must run 3000m distance as fast as he can. The PF test was measured in the day after the body composition measures, both in M1 and M2. Bivariate correlation was used to verify the association between PF and A%F, A,F and G,F. The FFs completed the circuit-style resistance exercise bout following pre-testing, which included 3 sets of 8–10 repetitions at 80% of their predicted 1-repetition maximum of the deadlift, shoulder press, lunge, and upright row. Linear mixed models, controlling for resistance exercise, were used to analyze all primary outcomes, with subject as the random effect and group and time as fixed effects. Alpha level was set a priori at 0.05.

RESULTS: Positive rank in the APFT increased from 8.3% at the first test to a 22.7% passing rate after four months with the 2-mile run having the highest failure rate of the three events (push-ups, sit-ups, 2-mile run). On average, subjects lost 2.6 ± 3.9 kg which was statistically significant (p = 0.05) and saw a mean reduction of 1.6 ± 2% body fat percentage. There was no change in BLOCK Fat Dietary scores (31.8 ± 11.4 vs. 31.2 ± 12.5, p = 0.05) or the Paffenbarger physical activity index (2,184 ± 1548 vs. 2,890 ± 1938 kcal/week, p = 0.05). Intrinsic motivation significantly increased pre to post-testing (12.9 ± 3.4 vs. 16.6 ± 4.6, p = 0.001).

CONCLUSION: The educational course was successful in increasing the passing rate of the APFT. More importantly, an increase in intrinsic motivation suggests a greater interest in the variety of training methods included in the curriculum which would decrease the monotony of the training and encourage their improvement in the APFT. Future studies need to explore the challenges of improving the two-mile run.

**1434 Board #28 May 28 9:30 AM - 11:00 AM ASSESSING INJURY SUSCEPTIBILITY AT MARINE CORPS RECRUIT DEPOT, SAN DIEGO, CALIFORNIA**


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(No relevant relationships reported)

Individuals enlisting at the Marine Corps Recruit Depot (MCRD) San Diego undergo a physically demanding training regimen. As such, musculoskeletal injury (MSKI) rates during training remain high and account for costly increases in attrition and delays in graduation, thereby impacting force readiness. Earlier injury detection is needed, and functional movement tests such as the functional movement screen (FMS), Y-balance test lower quarter (YBT-LQ) and ankle dorsiflexion range of motion (AD-ROM) can provide predictive value for MSKI incidence.
PURPOSE: To test the hypothesis that functional movement assessments are beneficial tools for movement analysis and injury prediction.

METHODS: MCRD recruits (N = 407; age = 18 ± 3 years, body mass index (BMI) = 24.4 ± 3.8 kg/m²) participated in this study. Participant movement ability was assessed using a screening tool which had a movement analysis of inferior lower body mobility and stability, weaker core stabilization, and poorer single limb stance and imbalance. The increase in ankle flexibility observed in the MSKI group may be a risk factor for overuse Achilles tendon injuries. Results not only apply to MCRD recruits, but could also apply to recruits in other military branches, athletic communities, and first responders seeking screening tools for movement analysis and injury prediction.

CONCLUSIONS: These results give us a better understanding of the cardiovascular and physical demands of the LRM versus the ULRM.

1349 Board #33 May 28 9:30 AM - 11:00 AM
The Physical Parameters Of Tactical Climbing And Performance Characteristics Of NSW Operators
Dallas Wood, David Swain, FACSM. Old Dominion University, Norfolk, VA. (Sponsor: David Swain, FACSM)
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PURPOSE: In tactical settings vertical elevation is critical for advantage to Special Operation Forces. Climbing proficiency in various settings (alpine, urban, and maritime) requires strength, power, endurance, and technique. This research seeks to 1) study differences in physical characteristics and anthropometrics of US SEAL lead climbers from non-lead climbers, and 2) catalogue the types and weights of the various climbing systems to assess total system mass to lead climber’s body mass. Our hypothesis is that there would be no differences in physical performance on Combine tests or anthropometrics between lead climbers and non-lead climbers as they are the same Special Operations population.

METHODS: Climbing surveys were collected from lead climbers. Retrospective Combine data (standing long jump, pro-agility test, 25-lb pull-up, body mass bench press, 1-RM deadlift, 300-yd shuttle, 3-mile run, and 800-m swim) were compared between 13 SEAL lead climbers (age: 30.9 ± 5.4 yr; height: 180.3 ± 11.6 cm; mass: 89.6 ± 10.3 kg; body fat: 15.8 ± 4.4% ) and 305 non-lead climbers (age: 28.4 ± 5.0 yr; height: 178.4 ± 6.2 cm; mass: 86.0 ± 9.1 kg; body fat: 17.3 ± 4.5%)

RESULTS: Lead climbers performed significantly better than non-lead climbers in the Pro Agility, 1-RM deadlift and the 800-m swim. There were no significant differences between lead climbers and non-lead climbers in anthropometrics and the remaining combine tests. The total mass reported for the climbing equipment for each tactical scenario was up to 5.8 kg for Urban climbing, up to 14.0 kg for Alpine climbing, and up to 8.0 kg for maritime climbing. With a typical combat load of 22 kg, adding this climbing equipment exceeds one-third of the lead climbers’ own body mass. This combined load is more than double that used in the weighted pull-up test.

CONCLUSIONS: Lead climbers were not significantly different than non-lead climbers in anthropometrics and the remaining combine tests. The total mass reported for the climbing equipment for each tactical scenario was up to 5.8 kg for Urban climbing, up to 14.0 kg for Alpine climbing, and up to 8.0 kg for maritime climbing. With a typical combat load of 22 kg, adding this climbing equipment exceeds one-third of the lead climbers’ own body mass. This combined load is more than double that used in the weighted pull-up test.

PURPOSE: The purpose of this study was to examine the differences between a loaded 6-mile ruck march (LRM) versus an unloaded 6-mile ruck march (ULRM).

METHODS: Nine cadets (5 male, 1 female) from the Leadership Development Program participated in this study. The two ruck marches studied occurred in the early morning hours ten days apart with the first ruck being a LRM, followed by the ULRM on the same course ten days afterwards. The 6-mile course consisted of two 3-mile paved loops of rolling hills on the campus of UNG. The subjects wore a TICKR X (Wahoo Inc.) which is a wearable device with advanced motion analytics using an accelerometer and heart rate monitor connected via Bluetooth to an iPhone application.

RESULTS: The average finish time for the weighed 6-mile LRM was 1 hr 15 min, 14 s ± 7 min, 7 s and for the ULRM was 56 min, 18 s ± 8 min and 13 s. These results were statistically significant at a p < .000, average HR for the LRM was 181.17 ± 13.32 bpm and 169.67 ± 10.35 for the ULRM, maximal HR for the LRM was 196.83 ± 7.5 min, 7 s and for the ULRM was 192.6 ± 8.67 bpm and 187.67 for the ULRM, total caloric expenditure for the LRM was 1341 ± 204.5 and for the ULRM was 922 ± 184.1 cal, average cadence for the LRM was 130.0 ± 7.4 steps per minute and 157.0 ± 11.7 steps per minute, maximal cadence for the LRM was 202.8 ± 16.8 steps per minute and the ULRM was 193.0 ± 16.8 steps per minute, average smoothness score for the LRM was 98.17 ± 2.29 and 94.83 ± 24.23 for the ULRM, oscillation score for the LRM was 3.425 ± 1.49 and 3.35 ± 31 for the ULRM and RPE for the LRM was 15.0 ± 1.7 and 11.78 ± 2.0 for the ULRM.

The principle findings from our study was that six of the nine metrics demonstrated significant differences between the LRM and the ULRM.

CONCLUSIONS: These results give us a better understanding of the cardiovascular and physical demands of the LRM versus the ULRM.

1440 Board #34 May 28 9:30 AM - 11:00 AM
Assessing Value Of Physical Training For Tactical Athletes
Kimbo E. Yee¹, Justin B. Moore, FACSM², George Grieve¹, Kasee Hucks¹, Daniel Bornstein¹. ¹The Citadel, Charleston, SC. ²Wake Forest School of Medicine, Winston-Salem, NC.
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PURPOSE: Population physical fitness (PF) levels have steadily declined over the past 20 yrs. PF is the strongest predictor of injuries among military personnel, after gender. Military and paramilitary organizations continue evaluating physical training (PT) methods to improve tactical athletes’ performance on physical fitness tests (PFT). Similarly, many tactical units are evaluating PFT standards to determine their ability to predict physical readiness for service. However, evidence on the efficacy and effectiveness of PT for passing a PFT and being fit for service remains equivocal.

The purpose of the current study was to develop and test the psychometric properties of an objective instrument for assessing attitudes towards PT as it relates to current PF, lifelong PF, and ability to pass a military PFT.

METHODS: Data were collected on 892 cadets from a senior military college who participate in military PT at least two d/wk. The sample was split into two sub samples for the purpose of establishing and confirming the psychometric properties of the scale. In sample one, coefficient alpha was calculated for six a priori subscales and a

Abstracts were prepared by the authors and printed as submitted.
It is well established that hypohydration negatively impacts physical and cognitive performance. Despite the importance of hydration, athletes frequently participate in training or competition hypohydrated. While data exists in athletes, there is a lack of data on Military servicemembers’ (SM) hydration status prior to field training exercises or combat. For our nation’s Warfighters, starting a mission hypohydrated can put their performance at risk.

METHODS: To describe the hydration status of Military SMs prior to a physically rigorous, multi-day field training exercise.

RESULTS: Of the 778 eligible SMs, 583 completed hydration assessments before the exercise. Using the NATA cutoffs, 18.3% (n=111) were euhydrated; 15.5% (n=92) were mildly hypohydrated; 40.9% (n=232) were hypohydrated; 13.8% (n=88) were moderately hypohydrated; and 16.8% (n=102) were severely hypohydrated. Overall, 54.2% (n=320) were hypohydrated.

CONCLUSIONS: Despite the Military’s emphasis on appropriate hydration strategies, just over half of the SM cohort were hypohydrated, which is concerning given their physically rigorous training. This study suggests that further education and research on hydration and its impact on performance are needed.

Board #35 May 28 9:30 AM - 11:00 AM
Prevalence Of Hypohydration In Military Servicemembers Before A Multi-day Field Training Exercise
Jeffery L. Heilesen, LesLee K. Funderburk. Baylor University, Waco, TX.

(No relevant relationships reported)

Board #36 May 28 9:30 AM - 11:00 AM
Differences In Fitness Between Law Enforcement Cadets And Officers: A Retrospective Study Of Two Agencies
Tyler L. Danielson1, Robin Orr2, Robert Lockie3, Kiyoshi Goad4, Ben Schram1, Charlie Kortenhuis1, Ryan Holmes1, Bert Jacobson1, Jay Davies1. 1Oklahoma State University, Stillwater, OK. 2Bond University, Gold Coast, Australia. 3California State University Fullerton, Fullerton, CA. 4Colorado State Patrol, Golden, CO.

(No relevant relationships reported)

INTRODUCTION: Research suggests that police officers progressively become less fit during their careers which may impact their ability to perform job-specific physical tasks. However, as tasks may vary between different law enforcement agencies (LEAs), there may be differences in both fitness levels and changes in fitness between different LEAs. PURPOSE: To identify differences in fitness parameters between cadets and incumbent police officers across two independent LEAs. METHODS: Retrospective analysis of data from two separate LEAs were analyzed. The study cohort consisted of 388 male incumbent police officers (LEA 1 n = 72; mean age = 39.43 ± 8.28 yrs; mean weight = 87.47 ± 11.60 kg; LEA 2 n = 316; mean age = 37.92 ± 7.71 yrs; mean weight = 88.80 ± 12.93 kg) and 157 cadets (LEA 1 n = 66; mean age = 29.95 ± 5.73 yrs; mean weight = 85.65 ± 11.92 kg; LEA 2 n = 91; mean age = 30.14 ± 6.93 yrs; mean weight = 86.50 ± 12.23 kg). Fitness measures included 1 min maximum push-ups repetitions (PU), and sit-up repetitions (SU), a vertical jump (VJ), and either a 5.2 mile run or a 20m multistage fitness test (20m MSFT), with the latter measures converted to VO2peak. Independent samples t-tests were used to compare, both combined and individual, LEA cadet cohorts against incumbent officer cohorts. Alpha levels were set at p≤0.05. RESULTS: When combined, cadets were found to be significantly younger (p<0.001) and lighter (p≤0.001) than their incumbent counterparts. When divided into respective LEAs only differences in age remained between cadets and officers. When comparing fitness measures, cadets achieved higher PU, SU, VJ, and VO2peak scores as a cohort (p<0.001 respectively) and as LEA 2 (p<0.001, p≤0.001, p<0.01 and p<0.001, respectively). However, only PU, SU and VO2peak (p<0.001 respectively) were significantly higher in LEA 1 with no differences in VJ between cadets and incumbent officers. CONCLUSIONS: Cadets were generally more fit than incumbent police officers, whose fitness may decrease over time due to job demands (e.g. shiftwork and stress), age-related declines, and changes in physical activity. Police officer fitness appears to peak during their time as cadets and decreases regardless of LEA. Maximizing fitness levels during cadet training and minimizing fitness loss after training is vital if incumbent officers are going to remain fit for duty.

Board #37 May 28 9:30 AM - 11:00 AM
Effects Of Non-mandated Physical Readiness Training On Fitness And Performance In Army Officers
Kate Early, Emily Garrett, Brian Tyo, Clayton Nickis. Columbus State University, Columbus, GA.

(No relevant relationships reported)

To prepare military personnel for occupational operations, Army captains are responsible for implementing, participating and mandating physical readiness training (PRT) for their respective units. However, the fitness of Army leadership is often not assessed, especially in periods where PRT is not mandated. PURPOSE: To observe body composition and fitness in United States Army captains after 5 months of non-mandated PRT. METHODS: Twenty-two captains volunteered to participate (age; 27±1 yrs; height; 1.76±0.06 m; weight; 83.1±11.1 kg). Eleven participants remained in active units with mandated training (PRT) while 11 participants were in positions where training was not mandated (NMT). Both groups logged exercise performed during the intervention. Body composition, cardiopulmonary fitness, anerobic power, and muscular endurance were measured before and after the intervention period (18±2 weeks). RESULTS: At pre-intervention, PRT and NMT were not different in body fat percent (22.0±4.6 vs. 20.3±4.4%), peak aerobic capacity (VO2peak; 45.7±2.4 vs. 48.8±3.8 mL·kg⁻¹·min⁻¹), mean power output (566±47 vs. 542±91W), sit-ups (72.5±17.1 vs. 70±16 reps) or push-ups (59±16 vs. 60±15 reps) (P>0.05). There was no time by group interaction in body fat percent (P=0.28), mean power output (P=0.17), or sit-ups (P=0.71). VO2peak (p=0.001) and push-ups (p=0.01) increased across both groups after the intervention. CONCLUSIONS: Captains maintained cardiopulmonary fitness, body composition and anaerobic power after 5 months regardless of PRT being mandated or not. Participants may have had freedom to perform exercise they found enjoyable as opposed to being confined to PRT which focuses on strength and endurance, thus leading to increased aerobic capacity. Duties related to the rank and combat experience as well as pressure of rank may influence Captains to maintain their fitness.

Board #38 May 28 9:30 AM - 11:00 AM
Associations Between Physical Fitness Characteristics And The Candidate Physical Ability Test (CPAT)
Reilly Girardot1, Jake Beiting1, Elizabeth Nagle, FACSMD2, Jacqueline Zena1. 1John Carroll University, University Hts, OH. 2University of Pittsburgh, Pittsburgh, PA. (Sponsor: Elizabeth Nagle, FACSMD)

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(No relevant relationships reported)

Firefighting is a physically demanding occupation, with significant physiological stresses well documented in the literature. The Candidate Physical Ability Test (CPAT) is a firefighting-task specific test designed to screen firefighter candidates. Previous research has correlated physical attributes with performance on individual tasks. However, few studies have examined the association between fitness characteristics and performance on a series of fitness tasks designed to mimic the demands of firefighting, such as the CPAT. PURPOSE: To examine the associations between physical fitness characteristics and performance on the CPAT. METHODS: Ten healthy male firefighters (age: 31.8 ± 11.3; Body Mass Index (BMI) = 30.0 ± 4.3; percent body fat (%BF) = 20.4 ± 7.1; VO2peak (ml·kg⁻¹·min⁻¹) = 42.1 ± 6.9) completed a fitness assessment which included: 1) a graded exercise test, 2) a vertical jump, 3) a sit-up test (height, weight, bioelectrical impedance analysis, circumference), 3) muscular fitness (pushup test, curl up test, hand grip strength), and 4) flexibility (sit and reach, back scratch). Additionally, each firefighter completed a CPAT, comprised of eight events (chair climb, hose drag, equipment carry, ladder raise and extension, forcible entry,
In this study were used five positional roles in soccer players (side-backs, full-backs, defensive midfielders, offensive midfielders, attackers) within the tactical scheme 4-4-2. The indicators of the intense actions were number of sprints, % of intense actions (speed of 14 to 25.1 km.h-1), amount of accelerations and decelerations, maximum speed in addition to the total distance of displacements. A repeated measures analysis of variance (Kruskal-Wallis) was performed for distances covered at different intensities between groups. **RESULTS:** Significant differences were found for the full-backs with side-backs, defensive, midfielders, offensive midfielders, attackers (H=53.52; p<0.01), referring to total distance traveled during a game. It was shown that the indicators of the intense actions between the side-backs and full-backs with defensive and offensive midfielders and attackers, was relative to the % intense actions (H=75.17; p<0.01), amount of decelerations (H=77.54; p<0.01) and accelerations (H=55.61; p<0.01). However, for the execution of the maximum speed were observed in side full-backs and midfielders (p<0.01).

Field-based sports training traditionally revolves around the “art of coaching,” where coaches use experience and educated guesses as a primary means of conditioning players. With the advent of GPS technology, field sports have the capability to monitor external training loads more accurately thus allowing the coaching staff to design better conditioning programs in order to match sport-specific demands seen during practices and competitions, potentially improving performance. NCAA rule limitations for Division III preseason training accentuates the need to determine the training loads of these practices.

**Purpose:** The purpose of the descriptive study was to examine the external training loads of elite NCAA Division III soccer players during preseason training. **Methods:** 17 NCAA female Division III soccer players (20.4±1.12 years; 64.4±6.76 kg; 166.0±6.74 cm) were a portable GPS device, operating at 10Hz and incorporated with a 10Hz triaxial accelerometer, prior to every practice (n=8) and incorporated with 10Hz triaxial accelerometer, prior to every practice (n=8) and scrimmage (n=1) during the season (Aug 19 - Aug 27) in central Virginia. To start the season, VO$_{2\max}$ was estimated via the YOYO test. GPS collected total distance (km), work rate (m/min), m), hard running (≥4.5 m.s⁻¹); m), m), top speed (km.h⁻¹), and intensity during practices and scrimmages during the Division III preseason. **Results:** Estimated VO$_{2\max}$ was reported to be 44.90±1.90 ml.kg⁻¹.min⁻¹. During practices, athletes covered 4.35±2.04 km, had a work rate of 42.31±10.05 m/min, covered 157.38±143.38 m of hard running, ran 33.19±56.70m in Zone 6, had a top speed of 24.54±4.59 km.h⁻¹, and had an intensity of 26.66±14.13. During the scrimmage, athletes covered 6.33±3.22 km, had a work rate of 38.13±17.32 m/min, covered 227.80±194.84 m of hard running, ran 28.47±4.15 m in Zone 6, had a top speed of 25.96±4.15 km.h⁻¹, and had an intensity of 40.33±17.69.

**Conclusion:** The external loads of elite Division III female soccer players were found to be similar to previously reported in-season loads of Division I and Division II athletes. The short preseason training period and high external loads present a number of concerns for Division III athletes as it pertains to preseason conditioning needs and the potential for overload injury risks.
CARDIORESPIRATORY FITNESS (CFR) is important for soccer players who need to sustain high intensity periods. The newly developed intermittent exercise protocol consisted of multiple stages of progressively high intensity 2-min intervals interspersed with low intensity 1-min intervals. High intensity intervals were kept at 6.5 mph, with inclination starting at 2.5% with increments of 2.5% with each stage. Low intensity intervals were kept at 4 mph with no inclination. Average VO2 and heart rate (HR) were determined during the final 15 seconds of the high and low intensity interval of the last 3 stages completed by all participants. Descriptive statistics (mean, standard deviation, proportions) were obtained for all study variables. RESULTS: A group of 11 soccer players training and competing in local teams under the Puerto Rico Soccer Federation (Age 23.0±3.7 yrs) completed the intermittent VO2 max protocol until volitional fatigue. Maximal duration of the intermittent protocol ranged from 13-19 min. Maximal values for VO2, HR, and respiratory exchange ratio (RE) were 511.6±55 ml kg⁻¹ min⁻¹, 186.6±6.6 bpm, and 20.7±1.9 respectively. Note that the average speed during the intermittent protocol ranged from 13-19 min. Maximal values for VO2, HR, and respiratory exchange ratio (RE) were 511.6±55 ml kg⁻¹ min⁻¹, 186.6±6.6 bpm, and 20.7±1.9 respectively. Note that the average speed during the intermittent protocol ranged from 13-19 min. Maximal values for VO2, HR, and respiratory exchange ratio (RE) were 511.6±55 ml kg⁻¹ min⁻¹, 186.6±6.6 bpm, and 20.7±1.9 respectively. The physiological profile of men’s soccer players has been well documented; however, there are limited data on women. Therefore, the physiological and performance differences between playing positions within a collegiate women’s team is not fully understood. PURPOSE: To compare physiological and performance characteristics between the four main soccer positions in a cohort of women. METHODS: S298 Vol. 52 No. 5 Supplement
Methods: A cross-sectional study was performed. The study participants consisted of 35 soccer players (age = 20.2 ± 0.9 years, height = 187.0 ± 6.5, body mass = 82.1 ± 3.3 kg) who played at top league at Czech professional male soccer league. The participants performed two trials of the agility 505 test, and each leg was used per trial. In addition to time to complete the agility 505 test, movement kinematics were also assessed using 2D kinematic analysis. Main outcome variables included: initial speed at which a player enters the measured section (v1); final speed at which a player leaves the measured section (v2); deceleration speed before the turn - speed in the third step before the turn (vd3), in the second step before the turn (vd2) and the first step before the turn (vd1); and acceleration speed after the turn in the first step (va1), second step (va2) and the third step (va3). We used Pearson correlation coefficient for analysing the data.

Results: In turning off the right and left leg the subjects' performance times revealed low correlation (r=-24 and r=165). Total time to complete the agility 505 test had significant correlations with following parameters when turning with DL: v1 (r=-.79, p<.00), va2 (r=-.38, p=.03), va3 (r=-.42, p<.01), vd2 (r=-.40, p<.02), vd3 (r=-.50, p<.00) and v2 (r=-.61, p<.00). Conversely, no significant correlation was found for the remaining variables. However, we found significant correlations between va2 vs vd2 (r=-.69, p<.00) and va3 vs vd3 (r=-.37, p<.03) when DL was used. Interestingly, higher correlations were detected on NL: va1 vs v3 (r=-.60, p<.00), va2 vs vd2 (r=-.69, p<.00) and va3 vs vd3 (r=-.61, p<.00) compared to DL.

Conclusions: Findings of this study revealed low correlation between compared sides. The better deceleration phase before 180 degree turn is a key for improving the acceleration phase following the cut. Supported by GAIR 19-1215085; UNCE HDMI2

1453 Board #47
May 28 9:30 AM - 11:00 AM
Tracking Athlete Wellness And Its Relationship With Activities During A Season In Female Soccer Players
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Performance analysis creates a foundation for performance staff to display findings to coaches and aid in understanding how training loads impact the wellness of each player. Applying an appropriate training load and allowing sufficient recovery will improve an athlete's performance, while reducing the risk of overtraining, injury, and illness. Monitoring individual load and recovery is a critical part of this process and not solely dependent on physical observations. Overtraining can manifest in an invariable characteristic, as a measure of performance, is detrimental to athletes and the sport. Purpose: The purpose of this study is to determine if differences in performance exist among players of different height, <165cm and >165cm. Methods: Age, height, position, number of assists, and number of goals for 288 female soccer players from the 2019 World Cup were recorded. Players were only included if they played an average of ≥60 minutes when entered into a match. Independent t-tests were used to examine differences between players <165cm and >165cm. Data are reported as mean difference [95% confidence interval] (MD [95%CI]). Statistical significance was set at p<0.05, a priori. Results: Of athletes <165cm, 31 of 109 (28.4%) defenders were forwards, and 14% of goals and 27.8% of assists were made by forwards <165cm. Thirty-four percent of goals were made by forwards <165cm, 31 of 109 (28.4%) were defenders, 18 of 66 (27.27%) were forwards, and 44 of 84 (52.38%) were midfielders. 20.4% of goals and 27.8% of assists were made by forwards <165cm. Among goalkeepers, 16% <165cm and 28% >165cm. Among number of goals scored by players <165cm, 31 of 109 (28.4%) were forwards, 18 of 66 (27.27%) were midfielders, and 44 of 84 (52.38%) were forwards. There were no significant differences between players <165 and >165 in regard to the number of assists made between forwards and defenders (MD [95%CI], forwards: 0.36[-0.54,0.28], p=0.36; Defenders: 0.41[-0.70,0.52], p=0.36). A statistically significant difference was found in the number of goals scored among forwards of the two height groups (MD [95%CI], 0.41[-0.71,0.53], p=0.01). Midfielders in the two height groups, a significant difference was found in the number of assists and the number of goals made (MD [95%CI], 0.41[-0.71,0.53], p<0.00). Conclusion: Height contributed to performance in number of goals scored by midfielders and forwards, but not in assists among forwards and defenders. 20.4% of goals and 27.8% of assists were less than 165cm.

1455 Board #49
May 28 9:30 AM - 11:00 AM
Height Is Not Predictive Of Starting Nor Playing Time In FIFA World Cup Female Athletes
McKenna R. Spaulding1, Yasuki Sekiguchi2, Courtney L. Benjamin1, Erin E. Dierickx3, Ciara N. Manning3, Jayson M. Spaulding1, Dayshia M. Davenport1, Jillian R. Picard-Busky4, Douglas J. Casa, FACSM1. 1Dickinson College, Carlisle, PA. 2University of Connecticut, Storrs, CT. 3Ithaca College, Ithaca, NY. 4Louisiana State University, Baton Rouge, LA. 5Sacred Heart University, Fairfield, CT. (Sponsor: Douglas J. Casa, FACSM)

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(no relevant relationships reported)

Purpose: At the present time, adolescent female athletes are being fed with misinformation on minimal height expectations for attaining elite level soccer success. This is particularly concerning because most adolescent athletes are yet to fully physically mature, and believing the validity of statements on minimal height expectations for elite level soccer success without evidence to substantiate these claims may negatively affect future aspirations of many adolescent females. This study determined if the minimal height criterion of 165cm (“5’4”), referenced from Next College Student Athlete (NCSA), is an important part of the female phenotype for playing soccer at the elite level.

Methods: Descriptive data were collected on the heights, matches played, and minutes played for 552 female 2019 World Cup athletes across 24 team rosters. The data were categorized into those below and those at or above the 165cm height criterion. Odds ratios were calculated to determine if differences existed in the likelihood of being a starter for those players on the team <165cm tall and those on the team ≥165cm tall.

Results: On average, 32.25% of players on the 2019 World Cup team rosters were <165cm, ranging from China with 4.35% to Thailand with 60.87%. Of the starters, 30.05% were under 165cm. For players on the team rosters, the odds of starting if they were <165cm (47.43%) were equivalent to the odds of starting if they were ≥165cm (47.58%), or 99.6:1. There were no differences in the number of matches
played (MD=0.09, ES=-0.05; p=0.59), minutes played (MD=15.60, ES=0.09; p=0.29), average minutes per game entered (MD=0.01, ES=0.46; p=0.53), nor average minutes per game played (MD=2.86, ES=0.08; p=0.38) in those <165cm and those ≥ 165cm.

CONCLUSIONS: This work provides clear evidence that being <165cm in height does not preclude reaching elite World Cup status as a professional female soccer player nor does it impact whether or not a player on the roster serves as a starter, the matches played, or the minutes played. The findings indicate that the 165cm minimal height standard is an ill-informed, biased criterion which has the potential to inhibit successful recruitment efforts for future female elite soccer players.

1456 Board #50  
May 28 9:30 AM - 11:00 AM  
Energy Availability In Association With Biomarkers During A Division I Soccer Season In Female Athletes  
Bridget A. McFadden1, Brittany N. Bozzini2, Michelle A. Aren1, Alan J. Walker2, Harry P. Cintineo1, Alexa Chandler1, Shawn M. Aren1, FACSM3. 1University of South Carolina, Columbia, SC. 2Lebanon Valley College, Annville, PA.  

Low energy availability (EA) is related to adverse physiological effects including hormonal disruption. PURPOSE: To evaluate in-season changes in EA and to assess biomarkers related to EA, macronutrient intake, body composition (BC), and exercise energy expenditure (EEE). METHODS: Prior to preseason and weeks 2, 4, 8, 11, female collegiate soccer players (N=11) underwent blood draws to assess thyroid hormones, leptin (LEP), growth hormone (GH), IGF-1, total cortisol (CORT) and prolactin (PRL), and BC tests to determine fat free mass (FFM) and percent body fat (%BF). Heart rate monitoring was used to assess EEE/kg during all training. Energy intake (EI), protein (PRO), carbohydrate (CHO) and FAT per kg were tracked via 3-day diet logs. EA was calculated as EI/AV EEE for each block of 7 days. MANOVAs with univariate follow-ups assessed change in energy status, BC and EEE. Area under the curve (AUC) was calculated for biomarkers, EA, macronutrients and BC. Pearson-product correlations assessed AUC relationships with significance set at P<0.05. Trends were considered P<0.1. RESULTS: Time main effects were seen for all macronutrients, EA, EI and EEE, with the highest values seen during preseason (P<0.05). Time main effects were seen with increases in FFM and declines in %BF (P<0.05). EA correlated with FFM (r=-.67), GH (r=-.63), PRL (r=-.65) and FreeT4 (r=-.69), %BF correlated with TC (r=.70) and LEP (r=-.71), with a trend for TG (r=.55). FFM correlated with PRO (r=.65), with trends for FAT (r=.57), IGF-1 (r=.58), FreeT4 (r=.53) and CORT (r=.57). PRO correlated with GH (r=.73), PRL (r=.75) and FreeT4 (r=.61), with a trend for EEE (r=.53). FAT correlated with GH (r=.65), PRL (r=.76) and FreeT4 (r=.60), with a trend for IGF-1 (r=.57). CHO correlated with LEP (r=.60) and PRL (r=.62). EEE correlated with LEP (r=.63) and trended with PRL (r=.56). CONCLUSIONS: EA was reportedly highest in preseason and declining as the season progressed, despite increases in FFM. Adherence and accuracy challenges with self-reported EI limits the feasibility of this method in teams. Associations between BC, EEE and markers of stress/metabolism point to the efficacy of biomarker monitoring as a method to assess metabolic status and recovery in athletes, thus enabling in-season adjustments to training and nutrition. Funding by Quest Diagnostics

1457 Board #51  
May 28 9:30 AM - 11:00 AM  
The Relationship Between Time-lagged Acute:Chronic Work Ratios And Physical Performance In Collegiate Soccer Players  
Travis Anderson, William M. Adams, Nathaniel T. Berry, Stacey L. Walton, Elieni M. Karras, Laurie Wideman, FACSM. University of North Carolina at Greensboro, Greensboro, NC. (Sponsor: Laurie Wideman, FACSM)  

Acute:chronic work ratios (ACWR) reflect the balance between fitness and fatigue. To allow for athlete recovery and preparation for match play, training load tends to decrease prior to a match. Training load and ACWR has been related to injury risk in elite athletes, but the relation with physical performance is not well defined. PURPOSE: To assess the relation between training load trends and ACWR in the three days prior to competitive matches and match-related physical performance. METHODS: Male (n=26) collegiate soccer players (Mean±SD; 20±1y; 75.8±5.90kg; 178.5±6.8cm) were GPS enabled heart rate monitors during training and match days over two consecutive seasons. Exponentially weighted moving averages were calculated from training load (TL) where acute (7 d), chronic (28 d), and ACWR (7/28 d) parameters were computed. ACWR was time-lagged by -1 (ACWR1), -2 (ACWR2), and -3 (ACWR3) days relative to each match. The linear trend of training load (TLtrend) was assessed by total distance (TD), and number of sprints (SP), maximal accelerations (AC), and maximal decelerations (DC). Conditional growth models assessed the relations between match performance and ACWR at each lag and TLtrend. RESULTS: ACWR, produced the most robust relations with physical performance. One SD above a given player’s mean ACWR, resulted in increased performance in the match relative to their mean within-match performance, with additional trended benefits. With a trended ACWR of 2.27 (p<0.01) additional SP, and 1.77 (p<0.01) more AC, TLtrend was independently and negatively associated with TD (p<0.001), SP (p<0.001), and AC (p<0.001). On average, players decreased training load by 17.80±64.90 units per day leading into a match. When applying this average, model results suggest players would complete 265.75±114.06 additional TP (p<0.001), 0.71 additional SP (p<0.001), and 0.53 additional AC (p<0.001) above their mean within match performance. CONCLUSIONS: The ACWR appears to be associated with additional within-match external load. Greater decreases in TL prior to a match may allow improved recovery, leading to increased physical capacity within the match. This study was funded in part by the National Collegiate Athletics Association.

1458 Board #52  
May 28 9:30 AM - 11:00 AM  
Monitoring Recovery Via Salivary Testosterone And Cortisol Changes In Collegiate Soccer Athletes  
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Changes in testosterone and cortisol have been evaluated as physiological markers of the transition from acute to chronic demands of a competitive sport. The testosterone to cortisol (T:C) ratio has been used as indicator of anabolic-catabolic imbalances, with a high T:C representing a positive anabolic state whereas a decline in T:C serving as a marker of overtraining. PURPOSE: To evaluate changes in salivary testosterone and cortisol immediately prior to pre-season training (PS), before (PreGame) and after (PostGame) a competitive game and at 12 (Recovery12hr) and 36 hours (Recovery36hr) following the competitive event in Division 1 men’s soccer athletes. METHODS: 19 male soccer athletes (age: 18±1yrs; body fat: 11±0.3%;). PS salivary samples were collected in August. PreGame and PostGame salivary samples were collected an hour before the start of the fourth game of the season and within 15 minutes after the game’s completion. Recovery12hr samples were collected 12 hours later, prior to next morning practice and Recovery36hr were collected prior to the subsequent day’s practice. Salivary samples were analyzed via ELISA to measure testosterone, cortisol and the T:C. ANOVAs were used for analysis with significance accepted at p<0.05. RESULTS: PostGame testosterone levels (244±108pg/mL) were similar to PreGame levels (174±49pg/mL; p=0.056). Recovery12hr (410±92pg/mL) and Recovery36hr (398±147pg/mL) were both significantly greater than PreGame (174±49pg/mL) and PostGame (244±108pg/mL) levels (p<0.001). When compared to PreGame levels (0.204±0.10 μg/dL) cortisol was significantly greater at PostGame (0.704±0.51μg/dL), Recovery12hr (0.510±0.21μg/dL), and Recovery36hr (0.484±0.21μg/dL) (p<0.005). There were no differences in cortisol levels between PostGame, Recovery12hr, and Recovery36hr. The T:C was significantly lower at PS than all other time points (p<0.001). T:C significantly declined from PreGame to PostGame (-501±140; p<0.028), but returned to PreGame levels at Recovery12hr, and Recovery36hr. CONCLUSIONS: The PreGame to PostGame decline in T:C suggests that the demands of the game placed the athletes in a catabolic state. However the rise in T:C back to PreGame levels at Recovery12hr, and Recovery36hr indicates the athletes were able to optimally recover in the days following competition.

1459 Board #53  
May 28 9:30 AM - 11:00 AM  
Fat Mass Index Is Associated With Lower Anaerobic Power In Professional Soccer Players  

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(No relevant relationships reported)

PURPOSE: To analyze the association between fat mass index (kg/m²) and anaerobic power. METHODS: We evaluated 24 professional male soccer players aged 18 to 35 y. We assessed their fat content with a whole-body dual-energy x-ray absorptiometry (DXA) scan, and then we adjusted their body mass (kg) by squared height in meters (m²) to calculate the fat mass index for the whole body, legs, and trunk. Anaerobic power was assessed with a 30s Wingate test to obtain three variables: peak power, average power, and power drop. All adjusted for body mass. The association between the fat mass index and anaerobic power was analyzed with linear regression. Descriptive statistics were reported as median (25th - 75th percentiles).

RESULTS: Fat mass index for the whole body, legs, and trunk were 2.9 (2.6 - 3.7), 1.1 (1.0 - 1.5) and 1.4 (1.2 - 1.9), respectively. For peak power, average power, and power drop, the participants showed 12.2 (11.6 - 13.2) W/kg, 9.2 (8.8 - 9.7) W/kg, and 0.21 (0.18 - 0.24) W/kg/s, respectively. The fat mass index was not significantly
CONCLUSIONS: Higher fat mass index is associated with lower average anaerobic power in professional soccer players. Nonetheless, the trunk fat mass index appears to be more relevant to explain this association.

Table 1. Association between fat mass index (kg/m2) and anaerobic power.

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<th>Slope</th>
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<td>0.189</td>
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Biometric And Performance Data In American Junior Nordic Combined And Ski Jumping Athletes

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(No relevant relationships reported)

Nordic Combined (NC) and Ski Jumping (SJ) require particular athletic abilities and physical attributes for optimal performance. For instance, SJ requires particular focus on jumping technique and explosiveness, whereas the cross-country ski portion of NC involves aerobic energy delivery, skiing efficiency, and power generation. Coaches and athletes monitor various performance metrics throughout the year to determine response to training and, hopefully, predict future performance. Normative data for these metrics has been analyzed in elite SJ and NC athletes but there is limited information regarding junior athletes. PURPOSE: Present normative biometric and performance testing data of American junior NC and SJ athletes and compare differences between age and sex.

METHODS: A retrospective cohort study was completed evaluating data collected on 299 NC and SJ athletes ages 7-19 tested as part of USA Nordic’s normal preseason evaluations between 2012-2018. Body mass index, static standing jump and countermovement jump height, various broad jump distances, timed agility testing, and 20 meter sprint times were collected and analyzed for differences between age and sex. RESULTS: Body mass index was greater in females than males. The interaction between age and sex was significant for static jump height, all broad jump metrics, time agility testing, and 20 meter sprint time. Jump power was greater in females than males. No difference was found between sex or across age in countermovement jump height. CONCLUSIONS: This was the first study to report biometric and performance data in junior American NC and SJ athletes. Our findings provide valuable normative information and identified several age and sex-related differences in these athletes. These findings can be used by other junior athletes and their coaches for comparison purposes and when developing training programs.

Practice And Game Internal Demands Of Men And Women Varsity Ice Hockey Players

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to quantify and compare internal load, using training impulse (TRIMP) and sessional rating of perceived exertion (sRPE), of men and women varsity ice hockey players during a practice and game. METHODS: Data (mean ± SD) were collected for 26 male (22.1 ± 1.1 yr, 85.9 ± 5.4 kg, 181.3 ± 5.1 cm) and 24 female (19.8 ± 1.4 yr, 68.0 ± 6.9 kg, 168.1 ± 5.9 cm) varsity ice hockey players. On-ice internal load was reported TRIMP (Arbitrary Units), measured using HR monitors worn on the upper arm, and sessional rating of perceived exertion (sRPE, AU), using the Borg 10 RPE scale with time on-ice during one practice and one home game of the regular season. RESULTS: During the 75 min practices, the mean HRmax values for males and females were 183 ± 8 and 177 ± 14 bpm, indicating a high intensity for both with no significant difference between sexes (p=0.124). During the games (15-min warm-up and 3 X 20-min periods), the mean HRmax values for males and females were 178 ± 24 and 190 ± 5 bpm, with the females significantly higher than the males (p=0.044). The TRIMP scores for the males were 109 ± 49 and 91 ± 57 AU for the game and practice and not significantly different (p=0.263) and the sRPE scores were significantly (p=0.044) higher during the game (457 ± 234) vs. practice (346 ± 222 AU). The TRIMP scores for the females were 79 ± 25 and 94 ± 56 AU for the practice and game and not significantly different (p=0.261) and the sRPE were also not significantly different (p=0.445) between the practice (348 ± 152 AU) and game (390 ± 225 AU). Males had a significantly greater TRIMP (p=0.012) and sRPE (p=0.029) compared to females during the practices but there were no significant differences in TRIMP (p=0.875) or sRPE (p=0.487) between males and females during the game. Overall, there was a significant positive correlation between TRIMP and sRPE (p=0.029) but when separated into males and females, there was a significant correlation for the males (p=0.032) but no significant correlation for the females (p=0.770). CONCLUSION: Preliminary data suggests no differences in internal loads between practices and games for females, but game loads exceeded training loads for males. Furthermore, training loads were higher for males compared to females, however game loads were similar. Supported by a grant from Mitacs and PepsiCo.

Physiological Demand Of Ice Hockey Officiating Across Competition Levels And Officiating Systems

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(No relevant relationships reported)

Ice hockey is an intense sport that requires a combination of anaerobic power and aerobic capacity. Traditionally, research has focused on the athletes, but on-ice officials are also subjected to a large physical demand during games. Across all hockey competition age levels, officials serve in various configurations (two-, three-, and four-official systems) and perform roles as a referee (REF) or linesman (LIN). Different systems and roles lead to varying physiological demands and responsibilities. Currently, no previous study has examined the demand placed on hockey officials across various competition levels. PURPOSE: To examine the demand on hockey officials across competition levels, officiating systems, and officiating roles.

METHODS: Ice hockey officials (n = 17, 37.7 ± 9.3 yr, 175.6 ± 4.9 cm, 86.1 ± 9.1 kg) were monitored during USA Hockey youth games, and collegiate hockey games. Chest-worn heart rate monitors with built-in accelerometry were used to record heart rate (HR), caloric expenditure (CE), speed, and distance during hockey games. Lower age classifications utilize a two-official system, while higher-level games utilize three officials (one REF, two LIN). The collegiate games in this study all utilized a four-official system (two REF, two LIN). Analyses of variance and t-tests were used to detect significant differences across competition levels, systems, and roles. Alpha of 0.05, 2-sided was set as a priori as a significance level. RESULTS: Significant differences were detected across competition levels for distance, training load, and CE (p ≤ 0.001). Mean values for each variable increased as competition level increased. Across officiating systems, distance, training load, and CE significantly increased (p ≤ 0.010) from two- to three-official systems. However, the four-official system had significantly lower values for average HR and CE (p ≤ 0.030). CONCLUSION: Hockey officiating is physiologically demanding and impacted by competition level and systems. Across competition levels, no significant differences were found for calories/hour (p = 0.498), indicating a similar rate of demand on officials in all levels of play. Demands on REF are greater in three-official systems compared to four-official systems, where demands are similar between REF and LIN, justifying its use in higher-level games.
LS. On-ice measures (mean ± SD) included accelerations, decelerations, accumulated acceleration load, distance travelled, and skating speed. RESULTS: The average number of accelerations per skater were not different for females (P = 0.7 ± 1.2 vs. G = 26.6 ± 10.3; p < 0.259) but were significantly greater in P than G for males (71.6 ± 26.7 vs. 48.0 ± 23.2; p = 0.004). The average number of decelerations followed a similar trend with P and G for females (38.9 ± 14.7 vs. 47.5 ± 18.6; p = 0.101) and males (79.6 ± 27.8 vs. 56.0 ± 24.8; p = 0.006). Average peak acceleration did not differ between P and G for females (3.2 ± 0.6 vs. 3.5 ± 0.5 m/s²; p = 0.586) or males (4.2 ± 0.5 vs. 4.3 ± 0.8 m/s²; p = 0.591), while accumulated acceleration load was higher for P vs. G only for females (138.4 ± 23.1 vs. 165.0 ± 40.5; p = 0.012). There was no difference in P or G distance travelled for females (4577.7 ± 1127.7 vs. 5332.6 ± 1614.5 m; p = 0.084) or males (6339.8 ± 1456.3 vs. 7485.3 ± 2492.5 m; p = 0.069). Although P and G peak skating speed was similar for females (29.3 ± 5.0 vs. 27.7 ± 3.9 m/s; p = 0.236) and males (3.6 ± 0.7 vs. 3.6 ± 0.5 m/s²; p = 0.002), peak skating speed was lower than G for both females (3.5 ± 1.9 vs. 7.0 ± 2.0 m/s²; p < 0.001) and males (5.4 ± 1.5 vs. 6.7 ± 1.6 m/s²; p < 0.005). Males had significantly greater accelerations (count and peak), accumulated acceleration load, distance travelled, and peak skating speed in P and G compared to females (p < 0.019). Peak decelerations and average speed in P and G did not differ between females and males (p > 0.05). Conclusion: Preliminary data captured using an LPS suggests that several components of external load are different between P and G for female and male ice hockey players. Furthermore, the external load of ice hockey appears to be greater in males than females. This research was funded by a grant from Mitacs and PepsiCo.

Ice hockey is a high-intensity sport that requires optimally performing energy systems to compete at an elite level. Typically, off-ice performance tests are used to evaluate player fitness, but little is known about their relationships to on-ice tests. PURPOSE: To compare performance, blood lactate (LAC), and heart rate (HR) obtained during off- and on-ice fitness tests in collegiate ice hockey players. METHODS: Nineteen male, collegiate ice hockey players, (age=18-24 y, ht=1.81±0.05m, wt=84.9±4.74 kg) were assessed off-ice using a discontinuous, incremental treadmill (TIM) protocol consisting of 2-minute stages separated by 90-sec rest until players reached volitional exhaustion. The on-ice test, in full gear, was a 20-minute test performed in a 2-week moving window. Fatigue decrement index (FDI) was calculated by subtracting fastest from slowest RSA stage times. During both tests, fingerstick LAC was obtained during rest intervals and HR was measured continuously. Spearman correlations were used to assess the relationship between TIM completion time and FDI, as well as the relationship in Stage4 LAC and HR recovery between off- and on-ice tests.

RESULTS: TM times to exhaustion averaged 19.8±1.1 min, and RSA times averaged 13.3±1.9mmol and reduction to 74±8%HRmax, respectively. For the RSA tests, Stage5 LAC and HR recovery averaged 10.2±2.8mmol and reduction to 76±8%HRmax, respectively. For the RSA tests, Stage5 LAC and HR recovery averaged 13.3±1.9mmol and reduction to 74±4%HRmax. Stage4 TM and RSA LAC values were significantly related (r=0.52, p<0.05); however no significant relationship existed between Stage4 TM and RSA values for HR recovery (r=0.34, ns).

CONCLUSION: The lack of relationship between TM time and FDI was expected given the two tests’ emphases on different energy systems and the homogeneity of the athletes’ overall fitness. Moderate to high correlation found between LAC measures, regardless of test modality, supports previous research from our lab indicating the predictive value of LAC measures on ice hockey player performance.

Ice hockey is a physiological challenge; stressing the metabolic systems, power, speed, agility, strength, and endurance. These components are commonly assessed with off-ice performance evaluations featured at the National Hockey League (NHL) combine. Purpose: Evaluate pre-season, off-ice combine assessments in major junior
ice hockey athletes. METHODS: During 2018 and 2019 pre-season training camps, prospective athletes participated in NHL combine style assessments. Tests included vertical jump via Vertec, broad jump via myoex, Countermovement Jump (CMJ) height was estimated with a Bosco mat. Stationary Bench Press (BP) was measured at the 6th shuttle. The maximal anaerobic skating test (MAST) consisted of skating back and forth on an 18.2m course at maximal speed with abrupt stops at each end for a total of 60 seconds of high-intensity effort per shift. RESULTS: Correlation analysis. Significance was set at p<0.05. Subjects characteristics are presented as means and standard deviations. SUMMARY OF RESULTS: Multiple significant (p<0.05) relationships were observed (r=0.47-0.81). Findings show that age (r=0.53-0.51), years of experience in resistance training (r=0.32-0.48), weight (r=0.33-0.47) and lean body mass (r=0.38-0.46) were significantly correlated with speed, time, and on-ice sprint performance (Speed, Time, [La+] and RPE). The CMJ seems to be more important than the BJ for on-ice sprint performance (r=0.53-0.50; r=0.19-0.28). Maximal HR is significantly correlated with fatigue index (r=0.41). The Borg scale seems to be a good tool to see if hockey players gave a maximal effort as it presents multiple significant correlations with sprint performance (r=0.37-0.43). SmO2 was significantly correlated with [La+] (r=-0.35). CONCLUSION: Results of the present study should be utilised by ice-hockey strength and conditioning coaches to improve their testing battery. Further research should include resistance training exercises in their analysis.

Although ice hockey is mainly considered as an anaerobic sport, oxygen consumption is a key aspect in hockey performance. In fact, several studies have shown a relationship between maximal oxygen consumption and repeated sprint ability for hockey players. PURPOSE: The purpose of the present study was to assess the relationship between peak oxygen consumption, skating speed and fatigue while performing on-ice repeated shifts. METHODS: Ten male elite ice hockey players [age: 20.20±1.81 years; height: 176.70±6.75 cm; weight: 76.20±11.48 kg] completed an on-ice repeated shift test (Peterson et al., 2015). The latter consisted of 5 maximal skating bouts including accelerations, crossovers and change-of-direction manoeuvres. Skating bouts occurred at 120 seconds intervals, which represented approximately 90 seconds of passive recovery between each bout. Total shift time and split durations were measured using four photocell timing gates (FusionSport, SmartSpeed Pro Timing System, Colorado, USA). Skating speed was then computed. Breath-by-breath analysis was performed in order to measure peak oxygen consumption (VO2 peak) and heart rate was monitored (K422, Cosmed, Italy). RESULTS: In average, VO2 peak varied from 35.76±5.00 ml/kg/min on the first shift to 32.04±4.49 ml/kg/min on the last shift whereas skating speed varied respectively from 5.98±0.31 m/s to 5.33±0.33 m/s. The average time to complete the skating bouts was of 23.70±1.22 seconds for the first sprint to 25.67±1.59 seconds for the last sprint. The average performance decrement (i.e. fatigue index) was of 4.81±2.47 percent. The coefficient of determination (r2) was 0.204 (r=0.451, p<0.001) for VO2 peak as a function of skating speed and r2=0.196 (r=-0.442, p=0.200) for VO2 peak versus the fatigue index. CONCLUSION: The aerobic capacity partially explains the players’ repeated sprint ability and shows that it is a fitness component that cannot be neglected in ice hockey. Our results are consistent with other studies that have investigated the link between aerobic capacity and linear repeated sprints, whereas, the approach herein used repeated sprints with direction changes.

Board #66
May 28 9:30 AM - 11:00 AM
Ice Hockey Repeated Sprint Ability: The Relationship Between Peak Oxygen Consumption, Skating Speed And Fatigue
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(No relevant relationships reported)
Cerebral blood flow (CBF) is sensitive to changes in the arterial partial pressure of carbon dioxide (CO2) with cerebrovascular reactivity an established risk factor for stroke and neurodegenerative disease. However, its interpretation can be complicated given subtle differences in cerebrovascular and central respiratory chemoreflex response transients.

**PURPOSE:** To examine to what extent exposure time to CO2 influences CBF response.

**METHOD:** We measured CBF response to hypercapnia (FICO2 = 5%) in five healthy participants for 10 min in the supine position. End-tidal partial pressures of CO2 (PETCO2), minute ventilation (VE), and middle cerebral artery blood velocity (MCAv) were assessed during both the early (3-4 min) and late phases (9-10 min) of exposure.

**RESULT:** We observed elevated VE larger during the late compared to the early phase of exposure (from 11 ± 2 to 29 ± 8 vs. 23 ± 4 L/min, P = 0.047) despite no differences in PETCO2 (P = 0.304). The corresponding increase in MCAv during the late phase was suppressed compared to the early phase (from 48 ± 11 to 58 ± 14 vs. 63 ± 13 cm/sec, P = 0.029). Thus, the response of CBF to change in PETCO2 at late phase was lower than that of early phase (1.1 ± 0.5%/minmg vs. 1.7 ± 1%/minmg, P<0.001).

**CONCLUSION:** These findings highlight the importance of considering the central respiratory chemoreflex transient during the clinical assessment of cerebrovascular reactivity.
Peripheral vascular dysfunction has been documented to progress with advancing age, and age itself is the greatest risk factor for developing dementia. However, the likely link between peripheral and cerebral vascular function with aging has yet to be clearly investigated. PURPOSE: Therefore, the purpose of this study was to assess peripheral and cerebral vascular function in both young and old healthy adults and examine the relationship between the responsiveness of these vascular beds. METHODS: Peripheral vascular function was assessed with passive leg movement (PLM: blood flow ∆ peak and AUC), and cerebral vascular function was assessed by the breath hold index (BHI) in 11 healthy adults (7 old: 68.3 ± 4 young: 23.3 yr). Doppler ultrasound was used to measure both common femoral artery blood flow and middle cerebral artery velocity. RESULTS: Peripheral vascular function was significantly attenuated in the old adults compared to the young (PLM AUC: 116±83 vs. 242±118 ml, p<0.001; PLM ∆ peak: 378±124 vs. 950±64 ml/min, p<0.001). Cerebral vascular function tended to be lower in the old compared to the young (PLM AUC: 116±83 vs. 242±118 ml, p<0.001; PLM ∆ peak: 378±124 vs. 950±64 ml/min, p<0.001). The coloroculation rate of AKAP15 and PKCs at the sarcolemma were lower in cerebral arterial myocytes from SHR than in SHRED (n=10; 0.4±0.1%; n=15; 0.7±0.1%; p<0.05). The protein expression of AKAP15 in cerebral artery was significantly up-regulated in SHR-SED (4.9±0.6) and down-regulated in SHR-EX (1.4±0.2, p<0.05). CONCLUSIONS: Chronic exercise inhibits AKAP15 channel activity and persistent Ca++ sparks in vascular smooth muscle via suppression of AKAP15/PKC signaling pathway, and ameliorates the dysfunction of cerebral arteries during hypertension.

Impact of 6-Month Exercise Training on Cerebrovascular Function in Persons With Spinal Cord Injury

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Purpose: To investigate the mechanism of AKAP15/PKC signaling pathway in exercise-mediated LTCC function of cerebral arteries during hypertension. METHODS: 12-week-old male spontaneously hypertensive rats (SHR) or their age-matched control rats (WKY) were used to investigate the cerebrovascular response to CO2 in the anterior and posterior circulation during isometric handgrip (IHG) exercise. METHODS: The cerebrovascular response to CO2 was evaluated in seven young healthy males via the two levels of hypercapnic stimulus (target end-tidal partial pressure of CO2 = 5 + 10 mmHg from individual baseline values) at rest and during a 2-min IHG exercise at 30% of maximum voluntary contraction. Middle and posterior cerebral arteries (MCAv and PCAv) were measured using a transcranial Doppler continuously throughout the experiment. RESULTS: During IHG exercise, PCAv increased (10.3 ± 9.0%, p = 0.025) but MCAv remained unchanged (6.9 ± 4.5%, p = 0.18). Interestingly, the cerebrovascular response to CO2 in both cerebral arteries increased during IHG exercise (p = 0.06) but there was no significant difference in the cerebrovascular response between the WKY-EX (p = 0.733). CONCLUSIONS: These findings suggest that cerebrovascular response to CO2 may not contribute to the heterogeneous CBF response to exercise between anterior and posterior circulation.

Peripheral And Cerebral Vascular Function With Advancing Age: Evidence Of A Link

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(No relevant relationships reported)
Cardiorespiratory fitness (CRF) is positively associated with cerebrovascular function and cognition. We have previously shown that proestaglandins play an important role in regulating the cerebral vasodilator response to hypercapnia, and that the magnitude of change in cerebral vasodilator responses during hypercapnoeic COX inhibition is associated with CRF in older adults. However, it is unknown if CRF also influences the cerebrovascular response to a metabolic stimulus in older adults. PURPOSE: To determine the effects of CRF on the cerebrovascular response to a metabolic stimulus before and during COX inhibition in older adults. METHODS: Thirty-five participants completed a maximal exercise test on a cycle ergometer. Participants were split into two groups, high CRF (10 men, 8 women, age = 65 ± 5y) or low CRF (7 men, 10 women, age = 66 ± 7y), based on the median VO2max (ml/kg/min). All participants completed two levels of the Stroop Color Word Test. Beat-to-beat mean arterial pressure (MAP) and middle cerebral artery velocity (MCAv) were measured at baseline and in response to each level of the Stroop test before and after administration of the COX inhibitor Indomethacin (INDO). The maximum MAP, MCAv, and cerebral pulsatility index (PI) responses were calculated as the highest 3-beat average during each cognitive challenge. RESULTS: There were no differences between high and low CRF groups in MCAv at rest or in response to the metabolic stimulus. There was a trend for lower PI at rest (p = 0.09) and in response to the Stroop test (p = 0.09) in the high CRF group compared with the low CRF group. During INDO, MCAv decreased (Low CRF: -29 ± 4%, High CRF: -27 ± 3%; p = 0.01) and PI increased (Low CRF: 22 ± 3%, High CRF: 17 ± 3%; p = 0.01). During INDO, MCAv at rest was not different between groups; however, PI was lower in the high CRF compared to low CRF group (Low CRF: 0.98 ± 0.05, High CRF: 0.87 ± 0.03; p = 0.05). Lastly, the change in MCAv and PI in response to the metabolic stimulus did not differ between groups. CONCLUSION: In older adults, elevated levels of CRF may lead to a lower PI at rest and in response to a metabolic stimulus. Additionally, COX inhibition did not alter the cerebrovascular response to a metabolic stimulus. Supported by NIH Grant HL111854.

Cerebrovascular hyperperfusion is associated with cognitive impairment in older adults. PURPOSE: To test the hypotheses that 1) patients with amnestic mild cognitive impairment (aMCI), a prodromal stage of Alzheimer’s disease, have higher cerebrovascular impedance than age-matched cognitively normal individuals; 2) 1-year endurance exercise training reduces cerebrovascular impedance in aMCI patients. METHODS: In the cross-sectional study arm, cerebrovascular impedance was estimated in 58 patients with aMCI (67±7 years) and 25 normal control subjects (65±6 years) with cross-spectral analysis between dynamic changes in cerebral blood flow velocity (CBFV) in the middle cerebral artery (via transcranial Doppler) and carotid arterial blood pressure (via applanation tonometry). In the longitudinal study arm, cerebrovascular impedance was estimated in randomly-assigned 37 aMCI patients who completed 1-year endurance (n=17) or stretching exercise (n=20). RESULTS: After adjustment for age and sex, aMCI patients exhibited higher impedance modulus in the range of the first harmonic oscillations (0.78±1.56 vs. 0.57±0.34 vs. 1.01±0.35 mmHg/cm/s, p=0.037). There was an inverse correlation between ZI and mean CBFV (r=-0.673, p<0.0001). Linear mixed model analysis of exercise training revealed that ZI was significantly decreased after 1-year exercise intervention irrespective of exercise modes (time effect: P=0.001; interaction between time and exercise modes: P=0.410). CONCLUSION: Our findings suggest that aMCI is associated with higher cerebrovascular impedance when compared to cognitively normal older adults, and that regular physical activity ameliorates cerebrovascular impedance in patients with aMCI. Supported by the NIH (SRO1AG033106-01, RZ) and JSPS (16K0011, JS).
was no correlation with cardiorespiratory fitness in very low frequency gain (r = -0.22, P = 0.92) or phase (r = -0.03, P = 0.87). There was no correlation with cardiorespiratory fitness and low frequency gain (r = 0.3, P = 0.13). Interestingly, low frequency phase was inversely correlated with cardiorespiratory fitness (r = -0.4, P = 0.04).

CONCLUSION: These preliminary data suggest that cardiorespiratory fitness may not impact cerebrovascular reactivity to hypercapnia. However, a relation may exist between cardiorespiratory fitness and dynamic cerebral autoregulation.

### 1486 Board #80 May 28, 10:30 AM - 12:00 PM Effect Of Different Exercise Modes On Cerebrovascular Shear In Humans

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(No relevant relationships reported)

PURPOSE: To what extent exercise impacts the cerebrovasculature is dependent on exercise mode. This difference may be attributable to shear stress in the cerebral vasculature that effects improvements in vascular endothelial function. For the first time, we determined if an acute bout of isovolume interval exercise compounds cerebrovascular shear rate. METHODS: Eleven young men were randomly assigned to perform continuous exercise (Continuous Ex) or interval exercise (Interval Ex) of semi-recumbent cycling. During the Continuous Ex, subjects performed continuous cycling at 80W for 12 mins. During the Interval Ex, subjects performed 3 bouts of interval exercise (2 mins at 60W and 2 mins at 100W) that was volume matched with Continuous Ex. Shear rate in the internal carotid artery (ICA) was determined using Doppler ultrasound. RESULTS: Time averaged ICA shear rate was higher during Int Ex compared to Continuous Ex (351±75 vs. 330±61 /s, P = 0.038) and the elevation was (MCA) pulsatility and cognitive performance in a group of young adults.

For resistance training, breath holding is prohibited to prevent an increase in arterial blood pressure (ABP) and consequently cerebral hyper-perfusion. However, it is unclear how breath holding during resistance exercise affects arterial blood pressure or cerebral blood flow. PURPOSE: The purpose of this study was to examine the effect of breath holding on the responses of ABP and cerebral blood flow (CBF) to isometric exercise. METHODS: Six young male adults performed 30-s isometric handgrip exercise at 40% of maximum voluntary contraction during normal breathing (control) or breath-holding condition (BH). ABP was measured using Finapres, and CBFs at internal carotid and vertebral arteries (ICA and VA, respectively) were continuously measured using Doppler ultrasonography at rest and during exercise. RESULTS: The change in MAP from rest to exercise was larger in BH compared with that in control (P < 0.05). The relative response of ICA blood flow to exercise was larger in BH (18.9 ± 16.6%) compared with that in control (8.1 ± 17.2%, P < 0.05), whereas the relative response of VA blood flow to exercise did not differ between both BH (31 ± 5.8%) and control (9.9 ± 10.9%, P > 0.05). CONCLUSIONS: These results indicated that during isometric exercise, breath holding enhances exercise-induced increase in arterial blood pressure and CBF. Therefore, it should be considered mode of respiration during isometric exercise, especially in rehabilitation for elderly and patients with hypertension.

### 1487 Board #81 May 28, 10:30 AM - 12:00 PM The Association Between Ambulatory Blood Pressure Monitoring, Cerebrovascular Pulsatility, And Cognitive Performance In Young Adults

Jacob P. DeBlois, Allison P. Kellner, Kevin S. Heffernan, Syracuse University, Syracuse, NY.

(No relevant relationships reported)

Ambulatory blood pressure monitoring (ABPM) is the gold standard for blood pressure (BP) assessment. In older adults, ambulatory pulse pressure (PP), mean pressure (MP), and BP dipping have been associated with altered cerebrovascular blood flow, increased cerebrovascular disease, and cognitive decline. Moderate-to-vigorous physical activity (MVPA) has favorable effects on BP and reduces cognitive decline in older adults. As hypertension rates increase in young adults, cerebrovascular pulsatility may damage white matter and accelerate cerebral aging; MVPA may combat these effects. PURPOSE: Determine if ABPM is associated with middle cerebral artery (MCA) pulsatility and cognitive performance in a group of young adults. METHODS: 68 adults (21±4 yrs; 26.6±8.0% fat; n = 53 women) underwent ABPM every 20 min between 0700 - 2200 hr and every 30 min from 2200 - 0700 hr. Transcranial Doppler measured MCA pulsatility at rest and during 3 min of cognitive stress (Stroop). MVPA was assessed over 9 days via accelerometry. Pearson correlations were run for PP, MP, variability, MP, BP dipping, BP variability ratio (BPVR = standard deviation of systolic/standard deviation of diastolic pressure), and the ambulatory arterial stiffness index (AAASI = 1 - regression slope of systolic and diastolic BP) with MCA pulsatility and cognitive performance in a group of young adults. RESULTS: The change in MAP from rest to exercise was larger in BH compared with that in control (8.1 ± 17.2%, P < 0.05), whereas the relative response of VA blood flow to exercise did not differ between both BH (31 ± 5.8%) and control (9.9 ± 10.9%, P > 0.05). CONCLUSIONS: These results indicated that during isometric exercise, breath holding enhances exercise-induced increase in arterial blood pressure and CBF. Therefore, it should be considered mode of respiration during isometric exercise, especially in rehabilitation for elderly and patients with hypertension.

### 1488 Board #82 May 28, 10:30 AM - 12:00 PM Effect Of Breath Holding On Cerebral Blood Flow Response To Isometric Exercise

Hironori Watanabe, Takuro Washio, Koki Kimura, Shigehiko Ogoh, FACSM. Toyo University, Kawaijo, Japan.

(No relevant relationships reported)

For resistance training, breath holding is prohibited to prevent an increase in arterial blood pressure (ABP) and consequently cerebral hyper-perfusion. However, it is unclear how breath holding during resistance exercise affects arterial blood pressure or cerebral blood flow. PURPOSE: The purpose of this study was to examine the effect of breath holding on the responses of ABP and cerebral blood flow (CBF) to isometric exercise. METHODS: Six young male adults performed 30-s isometric handgrip exercise at 40% of maximum voluntary contraction during normal breathing (control) or breath-holding condition (BH). ABP was measured using Finapres, and CBFs at internal carotid and vertebral arteries (ICA and VA, respectively) were continuously measured using Doppler ultrasonography at rest and during exercise. RESULTS: The change in MAP from rest to exercise was larger in BH compared with that in control (P < 0.05). The relative response of ICA blood flow to exercise was larger in BH (18.9 ± 16.6%) compared with that in control (8.1 ± 17.2%, P < 0.05), whereas the relative response of VA blood flow to exercise did not differ between both BH (31 ± 5.8%) and control (9.9 ± 10.9%, P > 0.05). CONCLUSIONS: These results indicated that during isometric exercise, breath holding enhances exercise-induced increase in arterial blood pressure and CBF. Therefore, it should be considered mode of respiration during isometric exercise, especially in rehabilitation for elderly and patients with hypertension.

### 1489 Board #83 May 28, 10:30 AM - 12:00 PM Impact Of Work Of Breathing On Cardiac Output In Patients With Incomplete Spinal Cord Injury

Monira Ibrahim Alldahli1, Lisa M.K. Chiu2, Andrew Giaccone3, Randall E. Keyser, FACSM3. 1Princess Nourah Bint Abdullahrahman University, Riyadh, Saudi Arabia. 2National Institutes of Health, Bethesda, MD. 3George Mason University, Fairfax, VA. (Sponsor: Randall E. Keyser, FACSM)

(No relevant relationships reported)

PURPOSE: The influence of alterations in the ventilatory response and work of breathing (WOB) on cardiac output (CO) during upper extremity exercise, resulting from Spinal Cord Injury (SCI) are not well understood. This study characterized the response of Qt and WOB during a maximal exercise arm-ergometer test in people with incomplete cervical SCI in contrast to able-bodied controls. METHODS: A 2-group convenience sample was used to compare respiratory muscle strength, WOB, and Qt during an incremental arm ergometer exercise test to volitional exhaustion. Subjects were 8 males with incomplete cervical SCI (icSCI: age 39±14yrs) and 8 able-bodied males (CON: age 38±13yrs). Maximal expiratory pressure (MEP) and maximal inspiratory pressure (MIP) were measured using a respiratory pressure meter, while breathing patterns were captured using breath-by-breath ventilatory gas exchange system. Qt was measured during exercise by bioimpedance cardiography. Data were analyzed using t tests to determine differences between group mean values. Linear regression analysis and Pearson’s correlation coefficient were used to examine the relationships among variables. RESULTS: All the variables were compared between groups at the average peak workload achieved by icSCI (30 watts). Both MIP (69.0±17.8mmHg vs. 89.7±15.4mmHg, P = 0.020) and MEP (59.4±16.4mmHg vs. 83.4±14.8mmHg, P = 0.008) were significantly lower in icSCI compared to CON. Minute ventilation (32.2±3.4L/min vs. 23.1±5.5L/min, P < 0.001) and WOB (2.8±0.5 vs. 1.6±0.8kg/ml/m, P < 0.05) were significantly higher in icSCI compared to CON, respectively. A significant difference in tidal volume (icSCI: 1.03±0.3L vs. CON:1.4±0.3L, P=0.800) was not observed. Qt was lower in those with icSCI compared to CON (8.3±3.6L/min vs. 11.1±1.8L/min, P = 0.003), and correlated significantly with WOB in icSCI (r = 0.73, P = 0.006).

CONCLUSIONS: A concurrent decrease in respiratory muscle strength and an increase in WOB relative to metabolic demand may be reflective of impaired respiratory performance. In people with icSCI, a potential moderating effect of WOB may partially explain the decline in Qt during arm exercise.
Adult survivors of preterm birth (PRE) have arrested lung development resulting in lower pulmonary function compared to their counterparts born at full term (CON). PRE have normal lung volumes, but lower expiratory airflow, which could be caused, in part, by a lesser driving (alveolar) pressure. During forced expiration alveolar pressure is the sum of pleural pressure, a function of respiratory muscle effort/strength, and lung recoil pressure. Whether or not PRE have normal respiratory muscle strength and/or lung compliance (CL) has not yet been explored. **Purpose:** The purpose of this study was to quantify respiratory muscle strength and CL in PRE and CON. Based upon the existing literature, we hypothesized that PRE and CON will have equivalent respiratory muscle strength and CL. **Methods:** To date, n = 8 PRE and n ≈ 5 CON, visited the lab on two occasions. First, subjects performed standard spirometry (e.g. fast and slow vital capacity maneuvers). Next, to assess respiratory muscle strength, subjects performed maximal inspiratory and maximal expiratory pressure maneuvers (MIP and MEP, respectively). For MIP, subjects inhaled maximally against an occluded mouthpiece at residual volume. For MEP, subjects exhaled exhaled maximally against an occluded mouthpiece at total lung capacity. Each maneuver was performed 3-5 times. On the second visit, CL was measured. To do so, subjects were instrumented with an esophageal balloon catheter and performed quasi-static expiratory deflation curves (i.e., very slow exhalations from total lung capacity to residual volume). To test for differences in MIP, MEP, and CL between groups we computed multiple independent samples t-tests with significance set to p<0.05. **Results:** We found no difference in MIP between PRE and CON (t = -0.2, p = 0.6). MIP was correlated with birth weight (ρ = 0.35, p = 0.03). **Conclusion:** Our data suggests no effect of birth status on the ability to generate expiratory pressure during forced expiration. Likewise, results suggest that the lower pulmonary function in PRE is not the result of a lesser driving pressure, but instead may be the result of excessive airflow resistance. Support: Hooper Undergraduate Research Award from NAU.
Purpose: Exercise-induced bronchoconstriction (EIB) has been associated with BMI in asthmatic children, while increased body fat contributes to a reduction in post-exercise pulmonary function in non-asthmatic children. Obesity-related adipocytokines such as leptin and adiponectin correlate with EIB severity in asthma, however, the role of these hormones on EIB in non-asthmatic children remains unclear. The purpose of this study is to investigate the relationship between leptin and adiponectin and EIB in non-asthmatic children. Methods: Twenty-five non-asthmatic presupubertal children (9-10 yr) completed pulmonary function tests (FEV1, FVC, FEF25-75) pre- and post-exercise. Each participant completed an incremental, cycle-ergometer exercise test to exhaustion (VO2peak). The maximum percentage fall in FEV1 and FEF25-75 from pre- to post-exercise was calculated, participants were subsequently classified as EIB positive (EIB+) with drop in FEV1 ≥ 10%. The change in airway function from pre- to post-exercise was assessed as the area under the curve (AUC) of the percentage fall in post-exercise FEV1 and FEF25-75 plotted against time for 15 min (AUC_post). Using trapezoidal integration, serum leptin and adiponectin levels were determined from a finger prick capillary blood sample taken before and after exercise. Results: BMI was significantly correlated with leptin (r = 0.473, p<0.05), but not adiponectin in the overall group. When participants were categorized as EIB+ or EIB-, there was a significant correlation between: leptin and %drop in FEV1 (r = -0.917, p < 0.05) and FEV1 AUC0-15 (r = -0.780, p < 0.05); and adiponectin and %drop in FEF25-75% (r = 0.780, p < 0.05) and FEF25-75% AUC0-15 (r = 0.803, p < 0.05) for the EIB+ group. In the EIB- group, there was no significant correlation between leptin or adiponectin and pulmonary function. Conclusion: There was a significant correlation between leptin and adiponectin and decreased airway function in EIB+, but not EIB- non-asthmatic children. The causality of this relationship warrants further investigation, but could provide insight to potential intervention strategies for the management of EIB.
RESULTS: HFrEF patients, compared to CTL had greater % BF (HFrEF: 36.7 vs. CTL: 29.7 %) and body mass index (HFrEF: 31.4 ± 4 vs. CTL: 30.4 ± 4 kg/m²) and lower VO₂peak (HFrEF: 21.6 ± 6 vs. CTL: 27.6 ± 6 mL/kg/min) (all, p < 0.01). There were no differences between HFrEF and CTL in forced vital capacity (FVC), forced expiratory volume in one second (FEV₁), forced expiratory flow rates between 25 and 75% of FVC (FEF₂₅₋₇₅), residual volume (RV), or total lung capacity (TLC) (all, p > 0.05); however, HFrEF had smaller expiratory reserve volume (ERV) than CTL (HFrEF: 0.08 ± 0.4 vs. CTL: 1.1 ± 0.8 L, p < 0.05). In HFrEF, % BF was significantly related to FVC (r = -0.60), FEV₁ (r = -0.59), ERV (r = -0.72), and TLC (r = -0.54) (all, p < 0.05). In CTL, % BF was significantly related to FEV₁ (r = -0.45) and FVC (r = -0.45) (both, p < 0.05). Lastly, % BF was significantly related to VO₂peak in HFrEF (r = -0.78, p < 0.05), but not CTL (p = 0.05).

CONCLUSIONS: These data demonstrate that static lung volumes (i.e. FVC, ERV, and TLC) and FEV₁ are negatively related to % body fat in patients with HFrEF. Future studies are necessary to determine the impact of body composition on ventilatory constraints during exercise in HFrEF.

1500 Board #94 May 28 10:30 AM - 12:00 PM Target Workload For Exercise Challenge Tests Exceeds Achievable Workload In Children With Mild Asthma Victoria I. De La Hoy1a, Ya-Yin Hu1b, Michael W. H. Wong1, Nicholas A. Ross1, Ani L. Kechkar1ian, Donna J. Gould1, Craig Nakamura1, Dharni M. Bhammar1,1a. University of Nevada Las Vegas, Las Vegas, NV. 1Children’s Lung Specialists, Las Vegas, NV. (Sponsor: Tony G. Babb, FACSVM)

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[No relevant relationships reported]

PURPOSE: Exercise challenge tests are bronchoprovocation tests used to diagnose exercise induced bronchoconstriction. The American Thoracic Society (ATS): Exercise challenge tests are bronchoprovocation tests used to diagnose exercise induced bronchoconstriction. The American Thoracic Society (ATS) recommends calculating the target workload for exercise challenge tests using predicted forced expiratory volume in 1s (FEV₁) to calculate target workload, measured workload during the exercise challenge test (64 ± 18 W; 66 ± 9%; Range: 40 - 78% of predicted target workload) was significantly lower than predicted target workload (96 ± 18 W; P < 0.001). Workload during the exercise challenge test was 67 ± 8% (Range: 60 - 80%) of maximum workload from the maximal exercise test. In the current project, we used measured FEV₁ to calculate target workload for exercise challenge tests. However, even when predicted FEV₁ was used to calculate target workload, measured workload during the exercise challenge test was below target and ranged from 43 - 112% (66 ± 22%) of target workload.

CONCLUSIONS: The predicted workload for exercise challenge tests based on ATS guidelines may be difficult to achieve for children with mild asthma. However, target ventilation can be achieved at a workload that is between 60 - 80% of maximum workload.

1501 Board #95 May 28 10:30 AM - 12:00 PM Inspiratory Muscle Fatigue Is Not Different In Response To Long Vs. Short-duration High-intensity Exercise Matt R. Chadwick, Tim A. Hardy, Bryan J. Taylor, Carrie Ferguson. University of Leeds, Leeds, United Kingdom.

[No relevant relationships reported]

Maximal isotonic power (Pmax) at the limit of short duration (<6 min) high-intensity constant-power exercise (TlimSHORT) is not different from task power. Conversely, Pmax at the limit of long duration (>7 min) high-intensity constant-power exercise (TlimLONG) exceeds task power. This suggests that while TlimSHORT is predominantly limited by locomotor neuromuscular fatigue, other physiological mechanisms contribute to exercise limitation in TlimLONG. One possibility for this difference in the mechanism of exercise intolerance is that the severity of exercise-induced inspiratory muscle fatigue is greater in TlimLONG vs. TlimSHORT due to a greater cumulative work of breathing in the longer-duration task. PURPOSE: To determine whether the magnitude of exercise-induced inspiratory muscle fatigue is greater in TlimLONG vs. TlimSHORT.

METHODS: Ten healthy adults (3 females; 25 ± 3 yr) completed a maximal ramp-sprint test (RIT) to determine critical power (CP), VO₂peak, and peak ramp power (RITpeak). Maximal constant-power exercise was then performed at 1) 50% (TlimSHORT) and 2) 25% (TlimLONG) of the difference between CP and RITpeak. %Pmax (6 s effort at 80 r/min) was measured at intolerance. Inspiratory muscle fatigue was assessed as the pre- to post-test reduction in magnetically evoked transdiaphragmatic (Pdm) twitch pressure. RESULTS: TlimSHORT was longer than TlimLONG (30 ± 2 vs. 25 ± 1.1 min; P < 0.001), but VO₂peak was not different between tests (3.7 ± 0.8 vs. 3.7 ± 0.8 L/min; P > 0.05). Pmax at intolerance was not different from task power in TlimSHORT (594 ± 101 vs. 241 ± 58 W; P = 0.11). Conversely, Pmax at intolerance was greater than task power in TlimLONG (341 ± 106 vs. 215 ± 53 W; P = 0.008). Cumulative diaphragm pressure-time product was higher in TlimLONG vs. TlimSHORT (5945 ± 1956 vs. 2729 ± 1004 cmH₂O.s; P < 0.001). Both TlimLONG and TlimSHORT induced a reduction in Pdm (< 15% ± 13% vs. < 15% ± 13%, respectively; P < 0.05). However, the magnitude of exercise-induced inspiratory muscle fatigue was not different between tests (P > 0.05). CONCLUSIONS: Despite Pmax at intolerance being greater than task power in TlimLONG but not TlimSHORT, inspiratory muscle fatigue was not different between tests and therefore may not contribute to differences in exercise limitation in TlimLONG vs. TlimSHORT.
Purpose: Aging related loss in muscle mass (sarcopenia) is major contributor to functional disability and all-cause mortality. Resistance exercise training (RT) is an established treatment for age-related losses in muscle mass, strength, and power. However, we have previously found that 3 d/wk of heavy RT in older adults may blunt the hypertrophic response to progressive resistance training. We postulate that this effect is mediated by skeletal muscle inflammation, indicated by heightened expression of TNFRI and TWEAK-R. Typically, acute exercise induced inflammation is beneficial to muscle hypertrophy, and this regimen has been shown to be well tolerated by young adults. However, impaired exercise tolerance and adaptability sometimes demonstrated in older adults may be mediated by increased basal muscle inflammatory burden, coupled with an exaggerated inflammatory response to muscle loading. We hypothesize that this phenomenon in the aging cohort may impair hypertrophic responses to RT if intensive loading occurs too frequently (i.e. 3 d/wk).

Methods: This study builds on a previous clinical trial conducted by our lab (NCT02442479), analyzing muscle hypertrophy in a four-arm, randomized dose-response trial to determine optimal exercise treatment for aging individuals (60-75 y). Twenty-nine healthy, non-smoking women (75 ± 7 y) were randomized to either 3 d/wk, low-intensity training (LH, n = 9) or only one low-intensity, concentric only day (HLH, n = 9) or 3 d/wk high-intensity training (HHH, n = 9) or control (CON, n = 21). Skeletal muscle biopsies were collected before and after 35 weeks of training in either LH, HLH, or HHH. We measured muscle mass, strength, muscle hypertrophy markers (Myostatin (growth and differentiation factor (GDF) 8) inhibits skeletal muscle growth, whereas follistatin (FST) can inhibit GDF8 to promote skeletal muscle growth. GDF15 may be a biomarker of stress, and also impact skeletal muscle growth. The purpose of this study was to determine the association between these measures and physical function.

Results and Conclusion: We expect that results from this study will advance our understanding of the role of inflammation in blunting muscle hypertrophy in aging adults, including a better understanding of both dose optimization and inter-individual response heterogeneity. Supported by T32HD071866 and UAB Center for Exercise Medicine.

CONCLUSIONS: Our findings suggest that rapid neuromuscular measures may be differentially influenced by age, and only particular parameters are associated with physical function.

Falls are the leading cause of fatal and nonfatal injuries among older people, although its association with handgrip strength is less characterized.

Methods: The cohort included 204 women (68.1 ± 6.2 years) who were assessed for handgrip strength (Jamar Dynamometer) at baseline and followed up for 18 months. FNHI Sarcopenia threshold of handgrip strength adjusted for body mass index (BMI) (<0.56) was used for clinical determination of muscle weakness. Multivariable Cox hazard models were analyzed in the total cohort and stratified by postural balance (near tandem stand test cuttof: 10 s) status.

Results: During the follow-up, 56 (27%) women experienced at least one event of falls. Compared to women with normal handgrip strength, women who had poor handgrip strength adjusted for BMI exhibited significantly higher risk for falls [Hazard Ratio (HR): 3.2, 95% Confidence Interval (CI)(1.1 - 4.6), p = 0.031]. The risk was even greater in a stratified analysis among women with impaired balance [HR: 3.2, 95% CI: (1.3 - 7.7), p = 0.011] but not significant (p = 0.440) in women with normal balance.

Conclusions: Poor handgrip strength adjusted for BMI is associated with higher risk of falls in older women and particularly in those with impaired postural balance. These results suggest potential prognostic value of handgrip strength testing in risk stratification for falls.

CONCLUSIONS: Regular exercise training decreases circulating Myostatin In Older Overweight Women At Rest And In Response To Acute Exercise

Methods: Overweight, older women (64.0±1.3 years; BMI=32.8±1.0 kg/m²; n=18) participated in an acute bout of cardiorespiratory and resistance exercise before and after a 2-week training intervention. The training intervention consisted of 3 d/wk of progressive supervised treadmill walking and resistance exercise at a moderate to vigorous intensity. Blood was collected before acute exercise (PRE), immediately after (POST), 1 hour recovery (1HR), and 2 hour recovery (2HR). Serum GDF8, FST, and GDF-15 were measured with commercially available ELISA kits.

Results: BMI did not change (p=0.05). GDF8 was higher (p=0.05) at PRE, 1HR, and 2HR before the exercise training intervention. Both before and after the training intervention, an acute bout of exercise increased (p=0.05) GDF8 at POST, 1HR, 2HR compared to PRE. FST increased (p=0.05) from PRE to 1HR and 2HR both before and after the intervention. GDF15 increased (p=0.05) from PRE to POST before the intervention, but PRE to POST, 1HR, and 2HR after the intervention.

Conclusion: Regular exercise training can reduce the acute exercise effect on circulating GDF8. Further, acute exercise will increase FST before and after an exercise training intervention. These results were independent of a change in BMI. Together, this may be a potential mechanism for exercise to help maintain skeletal muscle mass during aging.

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Results: BMI did not change (p=0.05). GDF8 was higher (p=0.05) at PRE, 1HR, and 2HR before the exercise training intervention. Both before and after the training intervention, an acute bout of exercise increased (p=0.05) GDF8 at POST, 1HR, 2HR compared to PRE. FST increased (p=0.05) from PRE to 1HR and 2HR both before and after the intervention. GDF15 increased (p=0.05) from PRE to POST before the intervention, but PRE to POST, 1HR, and 2HR after the intervention.

Conclusion: Regular exercise training can reduce the acute exercise effect on circulating GDF8. Further, acute exercise will increase FST before and after an exercise training intervention. These results were independent of a change in BMI. Together, this may be a potential mechanism for exercise to help maintain skeletal muscle mass during aging.
Muscle power is critical for older people to independently and safely perform the activities of daily living. Physical activity in general and resistance training, in particular, are essential for the prevention of muscle power loss with ageing. PURPOSE: To analyze the associations between moderate-vigorous intensity physical activity (MVPA) and functional fitness in older women, including the role of muscle power in mediating these associations. METHODS: Participants were 54 older women with a mean age 73.5±6.8yrs. MVPA (min day⁻¹) was measured by accelerometry. Lower limb peak muscle power (W/kg) was assessed using a mechanography ground reaction force platform. Functional fitness (lower body strength, agility/dynamic balance, and aerobic endurance) was objectively assessed through physical fitness tests from the Senior Fitness Battery, respectively: 30s chair stand (repetitions), 8-foot up-and-go (s), and 6-minute walk (m). Functional fitness was also subjectively evaluated via the 12-item Composite Physical Function Scale Questionnaire which gives a global score of physical function (points). Direct and indirect mediation model effects were estimated using the PROCESS macro developed by Preacher and Hayes, and 95% bootstrap confidence intervals were constructed to test the hypothesis that muscle power mediated associations. Age was examined as a covariate. RESULTS: A significant portion (40-78%) of the total effect of MVPA on functional fitness in older women was explained by muscle power. The indirect effects were observed on physical function global score (β=0.040 95% CI [0.010, 0.099]) and in each of the functional fitness parameters: lower body strength (β=0.048 95% CI [0.013, 0.117]), agility (β=0.009, 95% CI [-0.024, -0.002]) and aerobic endurance (β=0.656, 95% CI [0.146, 1.694]). There were no direct effects of MVPA on functional fitness. CONCLUSION: To improve functional fitness in older women, physical activity interventions should consider the mediating role of muscle power and include activities that require force to be rapidly generated.

Sarcopenia is characterized by age-related loss of skeletal muscle mass and function, and is associated with increased risk of falls, fractures, and mortality. Physical inactivity and inadequate protein intake are lifestyle factors that may contribute to the development and progression of sarcopenia. Weight-adjusted skeletal muscle index (sSMI), grip-strength (GRIP) and gait-speed (GAIT) are utilized clinically to diagnose sarcopenia. Phase-angle (PhA), obtained via bioelectrical impedance, is predictive of muscle strength and may also be predictive of sarcopenia. The PURPOSE of the study was to evaluate the relationships among indicators of sarcopenia, habitual physical activity, protein intake, and PhA in older adults. METHODS: In 96 subjects (68W/28 M, 68±6years) gait speed, grip strength (dynamometer), body composition (bioelectrical impedance), and habitual physical activity (7-day accelerometer) were measured. sSMI [skeletal muscle mass (SMM)/body mass (BMI)] was also calculated. In a subset of 34 subjects, habitual dietary intake was determined (3-day diet recall). Partial correlations (controlling for age and sex) were utilized to examine the relationships among variables of interest. Significance was set to p<0.05. RESULTS: Mean values were: sSMI: 26.6±kg; wSMI: 0.41±0.1; GRIP: 28.6±kg; GAIT: 1.5±0.4 m/s; PhA: 4.9±0.7°; moderate-intensity PA (MOD PA): 58±31 min/day; sedentary time (SED): 707±82 min/day; relative protein intake (RPI): 0.8±0.2 g protein/kg body mass. MOD PA was significantly (p<0.05) correlated with wSMI (r=0.28), GAIT (r=0.25), and RPI (r=0.42). RPI was additionally correlated with PhA (r=0.37) and body mass (r=-0.84). There was a trend towards a significant correlation between RPI and wSMI (r=0.29, p=0.11). GAIT was significantly correlated with activity counts per minute (r=0.23), PhA (r=-0.47), and wSMI (r=0.45). GRIP was significantly correlated with sSMI (r=0.40). CONCLUSIONS: These data show that greater PA and RPI are associated with better scores for some of the clinical indicators of sarcopenia. Thus, increased PA and RPI intake may represent effective strategies for decreasing the risk of sarcopenia.

PURPOSE: Metabolic abnormalities and increased sedentary time in maintenance hemodialysis (MHD) patients lead to unfavorable skeletal muscle adaptations and reduced exercise tolerance. Muscle function is affected by the proportion of “pure”-myosin heavy chain (MyHC) fiber type isoforms (Type I, IIa, and IIx) and prevalence of co-expressing “hybrid” fibers (Type I/IIa, I/IIx, IIa/IIx, and I/IIa/IIx) which display unique functional/metabolic properties associated with disease and disability. Previous investigations have utilized APase fiber typing methods in MHD patients, but this technique lacks fidelity to identify hybrid fibers. The purpose of this study was to 1) more accurately measure MyHC fiber type distribution in older men undergoing MHD and 2) compare the MyHC fiber type profile of these MHD patients to the literature. METHODS: Seven subjects (6 males and 1 female) receiving MHD treatment (age: 68±6years) were compared to the literature. Individual muscle fibers were mechanically isolated (696 total fibers) for mechanical analysis and MyHC fiber typing via SDS-PAGE. RESULTS: MyHC fiber type distribution was 31% I, 4% I/IIa, 23% IIa, 27% IIa/IIx, 3% I/IIa/IIx, 2% I/IIx, and 11% Ix. Rarely identified MyHC I/IIx fibers were found in two MHD patients.
INTRODUCTION: Statin medications are widely used to reduce major cardiovascular risk factors and events, but have also been reported to reduce cardiopulmonary and mitochondrial adaptations expected with aerobic exercise training. The current study evaluated the influence of statin therapy on aerobic exercise training adaptations in older adults. METHODS: Twenty-eight healthy, sedentary older adults (67±5 yrs old, BMI=30±5, mean:SD, 5 males) participated in a 12-week randomized graded treadmill walking intervention (EX) with roughly half the group on statin therapy (+statin), 15% of models) on MCarn.

-5.6 – 0). Repeating the model with men only identified no relevant associations (-1.8, 95%CrI: -5.2 – 0)), while each 2SD increase in the sum of MCarn. The LASSO model estimated women to have a median reduction of ~two percentage inclusion in 10000 bootstrap samples.

The glmnet package in R with associations described by regression coefficients and relationships between MCarn and a range of demographic, performance and training-time-trial).

Carnosine is a dipeptide formed from the amino acids β-alanine and L-histidine, which contributes toward a number of essential processes in skeletal muscle metabolism. A number of modifiable (e.g., sex and age) and non-modifiable factors (e.g., training status) purportedly influence muscle carnosine content (MCarn), but little is known about the relative contribution of these factors. PURPOSE: To investigate the influence of modifiable and non-modifiable determinants of MCarn in a group of cycling-trained men and women.

METHODS: 73 trained cyclists (54 men and 19 women, age 18 - 60) participated. Whole muscle MCarn was determined using high-performance liquid chromatography, from a biopsy taken from m. vastus lateralis. All participants completed a self-report questionnaire of their current and previous training habits, and an exercise test battery (aerobic capacity testing, wingate test and a 4km time-trial). Body composition was assessed using the sum of 7 skinfolds. To describe relationships between MCarn and a range of demographic, performance and training-related factors, penalized regression in the form of LASSO (least absolute shrinkage and selection operator) analysis was completed. Models were generated using the glmnet package in R with associations described by regression coefficients and percentage inclusion in 10000 bootstrap samples. RESULTS: Sex (91% of models) and sum of skinfolds (69% of models), but not age (52% of models), training habits (13-30% of models), nor exercise test performance (4-45% of models), predicted MCarn. The LASSO model estimated women to have a median reduction of ~two units compared to men (-1.8, 95%CrI: -5.2 – 0)), while each 2SD increase in the sum of skinfolds resulted in an MCarn decrease of approximately 1 unit (-0.8; 95%CrI: -5.6 – 0). Repeating the model with men only identified no relevant associations (≤37% of models) on MCarn.

CONCLUSION: Sex and body composition, but not age nor performance outcomes, had very small associations with whole muscle MCarn in a group of trained cyclists. These results imply that habitual training may reduce previously reported impacts of age on MCarn content (at least across the 4 decades investigated in this study). In contrast, women had lower MCarn content than men, even though their type and volume of training was similar.
Comparison Of Parent Self-reported Physical Activity And Accelerometry Among Racially/ethnically Diverse Young Children

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1516 Board #109 May 28 10:30 AM - 12:00 PM

Activity Monitor Step And Heart Rate Accuracy During Overground Walking And Stair Climbing

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(NO relevant relationships reported)

Wrist-worn activity monitors incorporate various inputs, most notably movement counts and heart rate, to provide an aggregate of daily physical activity. PURPOSE: To assess the accuracy of wrist-worn activity monitors during over-ground walking, and ascending and descending stair flights. METHODS: Forty-six American participants (age = 26.7±5.9 yrs, ht = 169.9±10.4 cm, wt = 77.0±17.8 kg) wore a chest-strap heart rate monitor (HR) (monitor), a wrist-worn activity monitor (GV and MF) on the left wrist, and a pedometer on the right waist. Participants were filmed as they walked for 200m across a level surface, up four flights of stairs, and down four flights, with full recovery between each. After each of the three trials, HR from CS, GV and MF were recorded. Video was later reviewed for actual counts (AC) to be compared with the monitors. Repeated measures ANOVA was used to determine significant differences between the counts (Alpha set at .05). Pedometer accuracy was calculated as ((monitor counts-AC)/AC) * 100.

RESULTS: 200m walk counts: GV (282.8±27.1 counts), PL (265.1±41.4 counts), and AL (254.7±52.4 counts) were significantly lower than AC (294.0±22.4), p<.05, with error greatest in the PL (265.1±41.4 counts). Pedometer error was calculated as ((monitor counts-AC)/AC) * 100.

Age: F(1,26) = 3.86, p = .064

Factors Associated With Daily Physical Activity In Children

Julie A. Young1, James Onate1, Amy Valasek2. 1The Ohio State University, Columbus, OH. 2Nationwide Children’s Hospital, Columbus, OH.

(NO relevant relationships reported)

Purpose: The purpose of this study was to examine which factors were related the number of days per week of physical activity in children. Methods: Patients presenting to sports medicine clinics between the ages of 5-18 were asked “On average, how many days per week did you participate in MVPA?” and “On average, how many minutes per day did you participate in MVPA?” Age, sex, BMI percentile, as well as the history of asthma, attention deficit hyperactivity disorder, depression and diabetes were recorded. A linear regression was utilized to determine which factors were associated with increased days of physical activity. Results: Data were recorded on 14,440 subjects. Average age of was 13.9±1±2.49 years, average BMI percentile was 65.50±7.74, and 54.1% were female. A total of 2340 (16.2%) reported asthma, 818 (5.7%) reported ADHD, 308 (2.1%) reported depression, and 92 (6%) reported diabetes. Average days per week of MVPA was 4.31±1.68. Approximately 5% of patients reported 0 days of MVPA/week, whereas only 6% of patients reported daily MVPA. Females reported .48 less days of MVPA per week (p<.001). Those with a history of depression reported .59 less days of MVPA than those without a history of depression (p<.001). Those with a history of ADHD reported .23 days less of MVPA when compared to those without ADHD (p<.001). Older children completed more days of MVPA (p<.001).

Discussion: The current MVPA recommendations require 60 minutes of daily MVPA for all school aged children. The vast majority of children in our study were not participating in MVPA 7 days per week. All children should be screened for MVPA to identify and counsel those who are not active daily
Wearable fitness devices have risen in popularity for athletes and the general population, and are increasingly integrated into smartwatch technology. Optical heart rate measurement by photoplethysmography provides data to monitor and track training intensities and progress. PURPOSE: To determine the validity of optical HR measurement in 3 fitness devices while resting, walking, and running. METHODS: Ten subjects (5 male, 5 female) completed 4 testing protocols based on the ANSI/CTI standards for sedentary (Sed), and treadmill walking (Wlk), running (Run), and dynamic running/walking (Dyn). Subjects wore 3 optical heart rate devices: Polar OH1 on the right forearm (OH1), Garmin Forerunner 945 (FR945) on the left wrist and Apple Watch 4 (AW4) on the right wrist. The Polar H10 (H10), a chest strap device, was the criterion HR measurement device. Sed, Wlk, and Run were all 7-minute protocols with 1 minute of standing. Sed: Subjects wore 20 minutes of prescribed intensity, and 1 final minute of standing. Dyn protocol was a 12-minute protocol with 1 minute of standing, 5 minutes of variable intensity walking, and 1 minute of standing. Raw HR data was extracted from each device and temporally aligned with the H10 for data analysis. RESULTS: Mean descriptive statistics for the subjects were: age = 26.8 ± 7.6 years, height = 1.70 ± 0.12 m, weight = 73.0 ± 14.3 kg, BMI = 25.1 ± 2.8 kg/m² and body fat 22.6 ± 11.2%. Mean Absolute Deviation (MAD), and Mean Absolute Percentage Deviation (MAPDE) were calculated for each device for each protocol (Table 1). CONCLUSIONS: At rest and during both steady-state and variable-speed treadmill walking and running, the Polar OH1, Garmin Forerunner 945, and Apple Watch 4 optical HR monitors demonstrated a level of accuracy well within that required by the ANSI/CTI Standard (2018) for physical activity monitoring devices for heart rate measurement (<10% Mean Absolute Percent Error). Supported by the Dr. David E. Martin Sport Science Research Fund and The Atlanta Track Club.

### Table 1: Mean Absolute Deviation [Mean (Per Minute)] and Mean Absolute Percentage Error (%) for the Heart Rate Devices

<table>
<thead>
<tr>
<th>Device</th>
<th>OH1</th>
<th>FR945</th>
<th>AW4</th>
<th>OH1</th>
<th>FR945</th>
<th>AW4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedentary</td>
<td>1.56</td>
<td>2.29</td>
<td>1.48</td>
<td>2.00</td>
<td>3.02</td>
<td>2.02</td>
</tr>
<tr>
<td>Walk</td>
<td>2.95</td>
<td>4.74</td>
<td>2.00</td>
<td>3.15</td>
<td>4.96</td>
<td>2.34</td>
</tr>
<tr>
<td>Run</td>
<td>4.11</td>
<td>7.48</td>
<td>5.04</td>
<td>3.31</td>
<td>5.12</td>
<td>3.99</td>
</tr>
<tr>
<td>Dynamic</td>
<td>2.58</td>
<td>7.99</td>
<td>3.15</td>
<td>1.92</td>
<td>6.73</td>
<td>2.39</td>
</tr>
</tbody>
</table>

Qualitative measures of activity have traditionally been described utilizing MET values. Notably, activity intensity is categorized as moderate if MET values range from 3.0-5.9; activities with 6.0+ METs are categorized as vigorous-intensity. Recently, the Youth Compendium of Physical Activities was released by an NCCOR workgroup in response to concerns that adult MET energy expenditure values may not accurately account for age differences in basal metabolic rates. However, the Youth Compendium does not currently provide adjusted MET, moderate-vigorous activity (MVPA) cut-points for youth, resulting in potential research errors such as over-reporting of a child’s MVPA. PURPOSE: To determine if average MVPA energy expenditure values would significantly differ when two youth scoring protocols (the traditional Three-Day Physical Activity Recall (3DPAR) vs. new NCCOR Youth Compendium) were compared across repeated measures in a sample of pre-adolescent girls. METHODS: Study participants completed detailed 7-day PA logs at study baseline (BL), 1-week follow-up (FU1), and 3-month follow-up (FU2). All self-reported activities were coded with MET (3DPAR) or MET (NCCOR Youth Compendium) energy expenditure (EE) values from each protocol’s respective activity repository. Conservatively, if multiple EE values were available per activity, the lowest value was selected. Activities were considered MVPA if MET/MET values exceeded 3.0. RESULTS: At all data collection times, mean volume of MVPA was greatest when utilizing the NCCOR protocol. Group differences between the scoring protocols were significant when examining both weekday (BL/FU1/FU2: p < .001) and weekend activity (BL/ FU1/FU2: p < .001). CONCLUSION: To our knowledge, this is the first study which provides comparisons of two qualitative MVPA scoring protocols utilizing repeated measures analyses of EE values in youth. Thus, findings may be important to future research using self-report activity data. In the current study, adult cut-points for MVPA were applied to the Youth Compendium scoring protocol, although literature suggests that EE of similar activities is higher for children than adults. Consequently, we urge that higher MVPA cut-points for the Youth Compendium be explored to more accurately capture measures of PA epidemiology in youth.
Purpose: To cross-validate PAQ, a validated physical activity (PA) recall questionnaire, for the Chinese college students.

Methods: 166 (99 males & 67 females; Age = 18.6 ± 1.1 yr., Height = 170.6 ± 8.4 cm, Weight = 63 ± 12.4 kg, BMI = 21.6 ± 3.1) Chinese college students’ 7-day energy expenditure (EE) data were estimated using ActiGraph wGT3x-BT accelerometers. They were also asked to recall their PA using PAQ before and after the accelerometer data collection. Total EE, wearing steps, light, moderate, vigorous, very vigorous and moderate-to-vigorous PA (MVPA) time, estimated by ActiGraph were compared with EE derived from PAQ and test-retest reliability was computed also for PAQ.

Results: All subjects wore the accelerometer for at least 10 hr. a day and over 4 days in one week. The correlation between the accelerometer total EE and that reported by PAQ is r = 0.308 (p < 0.001), accelerometer walking and that reported by PAQ is r = 0.361 (p < 0.001), which were low, but consistent with the validity reported for the questionnaire method. The test-retest reliability coefficient of PAQ is 0.761. In average, the Chinese college student’s PA are: Weekly Total EE = 1778.41 ± 1033.76 (kcal), Daily EE = 142.93 ± 85.85 (kcal), Weekly walking Steps = 38730.02 ± 15506.72 (steps), Weekly total MVPA = 347.2 ± 144.4 (minutes), Daily MVPA 28.06 ± 14.71 (minutes), Weekly Average PA intensity METs = 1.14 ± 0.07 (METs), according to the ActiGraph.

Conclusion: Similar validity and reliability of PAQ were confirmed for the Chinese college student sample and they met the PA guideline.

Physical education requirements in the United States vary and are often left to local districts in each state to decide. Considering the relationship between physical activity and obesity and physical fitness with mortality, requirements relating to national recommendations appear important. Long term implications of participation in physical education are contradictory at best with the limited studies performed concluding conflicting results. Purpose: To examine the relationship between years of participation in physical education at a high school level and levels of physical activity and fitness in college students and adults. Methods: Forty-one participants ranging in age from 18-65 (mean age 33.6) were recruited utilizing an inter-collegiate mailing system. Participants completed a self-administered IPAQ long-form questionnaire as well as additional physical education related questions. Participants also completed a YMCA Step Test. Results: When comparing participant results to national recommendations for physical activity 6 of 41 met vigorous physical activity guidelines (14.6%), and 0 met guidelines for moderate physical activity. When adding in vigorous outdoor housework those meeting vigorous guidelines went up to 11 of 41 participants (26.8%), and when adding in moderate outdoor and indoor housework those meeting moderate guidelines went up to 4 of 41 (9.7%). Mean score of 4.5 on the YMCA Step Test for all participants was between below average and poor with a standard deviation of nearly two scoring levels. No significant relationships were found when comparing time spent in physical education classes (required or total) to recalled moderate physical activity and fitness levels in college students and adults, while a significant relationship was seen when comparing the time spent in physical education classes (required and total) to recalled vigorous physical activity and fitness levels in college students and adults (p < 0.02).

Conclusion: Further study is needed. A significant relationship between physical education and long-term physical activity is needed with particular attention being paid to physical education requirements and their variances.
Comparison of Sleep Pattern Estimates Of Different Monitor Methods

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No relevant relationships reported

PURPOSE: Sleep quality and quantity are associated with an increased risk for chronic diseases, but many studies rely on self-report logs to assess sleep. Wearable devices estimate sleep quantity and quality, but it is not clear how these device classifications relate to sleep estimates collected by self-report logs. The purpose of this study was to examine these relationships.

Methods: A total of 1,144 college students (M±SD of Age: 20.57±3.42 yr.; Males = 53.8%) from a major Chinese university were recruited for the study and their waist circumference (WC) and hip circumference (HC) were measured. In addition, daily online time (DOT), weekly online time (WOT), weekly PA time (WPAT), daily PA time (DPAT), weekly PA time (WPAT) were measured by a self-report survey. WHR was computed and its relationship with online and physical activity time was analyzed using the Spearman’s correlation analyses.

Results: The relationships among WC, HC, WHR, DOT, WOT, WPAT, DPAT, and WPAT were summarized below:

<table>
<thead>
<tr>
<th>DOT</th>
<th>WOT</th>
<th>WPAT</th>
<th>DPAT</th>
<th>WPAT</th>
<th>WC</th>
<th>HC</th>
</tr>
</thead>
<tbody>
<tr>
<td>WOT</td>
<td>1.00**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WPAT</td>
<td>-0.64**</td>
<td>-0.64**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DPAT</td>
<td>-0.403**</td>
<td>-0.403**</td>
<td>0.538**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WPAT</td>
<td>-0.609**</td>
<td>-0.609**</td>
<td>-0.502**</td>
<td>-0.829**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WC</td>
<td>-0.618**</td>
<td>-0.618**</td>
<td>-0.677**</td>
<td>-0.454**</td>
<td>-0.641**</td>
<td></td>
</tr>
<tr>
<td>HC</td>
<td>0.013</td>
<td>-0.173**</td>
<td>-0.042</td>
<td>-0.115**</td>
<td>-0.578**</td>
<td></td>
</tr>
<tr>
<td>WHR</td>
<td>0.754**</td>
<td>0.754**</td>
<td>-0.696**</td>
<td>-0.511**</td>
<td>-0.686**</td>
<td>0.825**</td>
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</tbody>
</table>

**p < 0.01

Conclusions: College students’ WC and WHR were positively correlated with DOT and negatively related to DPAT, WPAT, and WAFT. Their WOT and DOT were negatively related to WPAT, DPAT, and WPAT. Thus, it is very important and urgent to develop interventions to reduce their online time and increase their PA time.

Sedentary behaviors are persuasive in all societies. According to the 2018 American Time Use Survey, nearly 96% of adults spend 4-5 hours/day in sedentary behaviors that include watching TV, reading, computer use, relaxing and thinking. Since sedentary behaviors increase chronic disease risks, interest is high in knowing the energy costs of sedentary behaviors to help populations to reduce time spent in sedentary behaviors. PURPOSE: To update the energy costs of sedentary behaviors in the 2011 Adult Compendium of Physical Activities. METHODS: Energy cost in ml.kg⁻¹.min⁻¹ and heart rate in bpm⁻¹ were measured by Cosmed K4b² portable indirect calorimetry system in 10 males and 9 females (20-59y), mean age (31.6 ± 7.5 y), weight (63.4 ± 8.9 kg), and height (167.1 ± 5.8 cm). The subjects completed 17 randomly assigned behaviors in lying, reclining, sitting, standing, and walking. For sitting and standing they used mobile devices estimate sleep quantity and quality, but it is not clear how these device classifications relate to sleep estimates collected by self-report logs. The purpose of this study was to examine these relationships.

Methods: A total of 1,144 college students (M±SD of Age: 20.57±3.42 yr.; Males = 53.8%) from a major Chinese university were recruited for the study and their waist circumference (WC) and hip circumference (HC) were measured. In addition, daily online time (DOT), weekly online time (WOT), weekly PA time (WPAT), daily PA time (DPAT), weekly PA time (WPAT) were measured by a self-report survey. WHR was computed and its relationship with online and physical activity time was analyzed using the Spearman’s correlation analyses.

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<th>WPAT</th>
<th>WC</th>
<th>HC</th>
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</thead>
<tbody>
<tr>
<td>WOT</td>
<td>1.00**</td>
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<tr>
<td>WPAT</td>
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</tr>
</tbody>
</table>

**p < 0.01

Conclusions: The measured mean MET values ranged from 1.0 to 2.0 METs, classified as inactive (1.0-1.49 METs) and light activity (1.5-2.9 METs). Duplication of measured MET values to those in the Compendium confirm the energy cost of common sedentary behaviors. Of the four behaviors with lower measured MET values, three had been estimated in the Compendium (Sit: read, text; Stand: text). Four behaviors not in the 2011 Compendium were measured (Recline: write, text; Stand: text). Supported by the Shanghai University of Sport.
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Physical Activity Questionnaire-Short Form (IPAQ-SF) in an OSA population.

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According to the 2018 American Time Use Survey, nearly 78% of US adults spend from 2.0-2.5 hours/day in housework activities that include cleaning, laundry, straightening up, cooking, washing dishes and other activities. Another 11% of adults spend nearly 1.0 hour/day caring for older household adults. As many adults do household activities, there is interest in knowing the energy costs of such activities. PURPOSE: To update the MET values in the 2011 Adult Compendium of Physical Activities (Compendium) with measured oxygen uptake MET values for selected household physical activities (PAs) in adults. METHODS: The energy costs of six meal-related, five household cleaning, and two other care PAs were measured in 20 adults ages 25-69 (males, 10 females). Each simulated PA was performed in a laboratory setting for 8-min with a 4-min rest between PAs. Submaximal VO2 (mL/kg/min) and heart rate (beats/min) were measured with a Cosmed K4b2 portable indirect calorimeter system. METs were computed as VO2 in mL/kg/min divided by 3.5 mL/kg/min. Subjects self-rated their PA and physical fitness level as low, middle or high. RESULTS: Subject characteristics were averaged for age (33.7 ± 11.2 yrs.), weight (67.9 ± 12.0 kg), and height (166.1 ± 7.4 cm). MET values were averaged up or down to reflect terminal digit values as presented in the 2011 Compendium (0, 3, 5, 8, MET values: carrying groceries on level surface (3.5), putting away groceries (2.5), food prep and cooking while standing (1.8), food prep and cooking while sitting (1.8), setting the table (2.1), putting away laundry (2.0), putting away household items (3.0), major cleaning (3.0), sweeping sidewalk (3.0), watering plants (1.8), other care feeding/grooming (1.8), other care bathing/dressing (2.8). Heart rates ranged from 74 to 92 beats/min across all PAs. PA and fitness levels were rated as middle. CONCLUSIONS: Measured MET values were generally lower (on the order of 0.3 to 1.2 METs) than estimated MET values presented in the 2011 Compendium. Measured MET values were the same as the 2011 Compendium for putting away groceries and putting away household items. Overall, measured MET values for frequently performed household activities are rated as low to moderate intensity. Supported by the Shanghai University of Sport.

1531 Board #125 May 28 10:30 AM - 12:00 PM

Validity And Reliability Of Two Brief Physical Activity Questionnaires In Adults With Obstructive Sleep Apnea

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Efforts to encourage the medical community to prescribe exercise for disease prevention and management have increased significantly in recent years. In patients with obstructive sleep apnea (OSA), it is encouraging that exercise has been shown to improve sleep efficiency, daytime sleepiness, and disease severity. However, in order to better understand the dose-response relationship between exercise and OSA-related outcomes, accurate and reliable methods for assessing physical activity habits are needed. PURPOSE: To determine the validity and reliability of two self-report physical activity questionnaires [Physical Activity Vital Sign (PAVS); International Physical Activity Questionnaire-Short Form (IPAQ-SF)] in an OSA population. METHODS: 39 (40 males with moderate-severe OSA [64% female], mean age (SD)=51.5 (9.5) yr; body mass index (BMI)=39.1 (8.8) km/kg; apnea hypopnea index (AHI)=40.2 (29.4) were an accelerometer for 7 consecutive days and completed the PAVS and IPAQ-SF twice within 10 days. Criterion validity was evaluated using Pearson (r) correlation coefficients comparing the total number of minute/week of moderate-vigorous physical activity (MVPA) from PAVS and IPAQ-SF to accelerometer. Spearman rank correlation coefficients (rho) were calculated to determine construct validity against self-reported measures (quality of life, daytime sleepiness, and treatment adherence) and BMI. RESULTS: PAVS and IPAQ-SF scores were reported as total minute/week of moderate-vigorous physical activity (MVPA). Test-retest reliability for MVPA was excellent for PAVS (ICC=0.98, p<0.01) and good for IPAQ-SF (ICC=0.77, p<0.01). Levels of MVPA from accelerometer strongly correlated with PAVS (r = 0.80; p<0.001) and moderately with IPAQ-SF (r = 0.57; p=0.001). Both PAVS (r = 0.273; p=0.05) and IPAQ-SF (r = -0.268; p<0.05) were significantly related to BMI, but no other variables. CONCLUSIONS: This study provides preliminary evidence that the PAVS and IPAQ-SF questionnaires have acceptable reliability and validity to assess physical activity levels in adults with OSA.

1532 Board #126 May 28 10:30 AM - 12:00 PM

Validity Of Accelerometry In Ambulatory Children And Young Adults With Cerebral Palsy

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PURPOSE: This study aimed to validate five published ActiGraph (AG) cut-off points for the measurements of physical activity (PA) and sedentary time (ST) in ambulatory children and young adults with cerebral palsy (CP). Additionally, four energy expenditure (EE) prediction equations based on AG counts and activity (AP) steps were examined in this population, using oxygen uptake (VO2) as the criterion. METHODS: Four male and six female participants with CP (GMFCS levels I-III, ages 9-21 years) completed seven activities while simultaneously wearing an AG, AP monitor and indirect calorimeter unit. VO2 was measured on a breath-by-breath basis using the indirect calorimeter and was converted into EE using metabolic equivalents. AG counts were classified as sedentary, light PA (LPA) or moderate-to-vigorous PA (MVPA) using five cut-off points: Puyau, Evenson, Romanzini, Clancy and Baque. The predicted EE was computed using three AG-based equations (Freedson, Trost and Treuth) and an AP step-based equation. The classification accuracies of the five AG cut-off points were assessed using Spearman correlation (r) and kappa (κ) coefficients. Between measured and predicted EE values were assessed using paired-t tests, mean differences (95% confidence interval) and Bland-Altman plots. RESULTS: Of the five AG cut-off points, Baque (r = 0.896, κ = 0.773) and Clancy (r = 0.935, κ = 0.721) classified PA and ST most accurately. All the equations overestimated EE during sitting activities and underestimated EE during rapid walking. Across all activities, the mean bias and 95% limits of agreement for the Freedson, Trost and AP prediction equations were -0.05 METs (-2.15, 2.05), -0.28 kcal·min-1 (-2.18, 2.74), -0.54 METs (-2.37, 1.29) and 0.04 METs (-2.60, 2.69), respectively. The Freedson, Trost and AP equations exhibited systematic bias during rapid walking, as their differences from the criterion measure increased progressively with increasing activity intensity. CONCLUSION: The AG accurately classified PA and ST when the Baque and Clancy cut-off points were used. However, none of the available AG or AP equations accurately predicted the EE during PA and ST in children and young adults with CP. Further development is needed to ensure that both devices can estimate EE accurately in this population.

1533 Board #127 May 28 10:30 AM - 12:00 PM

Posture And Metabolic Syndrome Among Law Enforcement Officers

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Law enforcement officers job duties require high physical demands but also place them at greater metabolic syndrome risk due to frequent bouts of on-duty sedentary behavior. PURPOSE: To examine posture and metabolic syndrome risk among law enforcement officers. METHODS: Thirty-one participants aged 33.10 ± 9.78 years participated in the study. Law enforcement officers were asked to wear activity monitoring devices for 7-consecutive days during on-duty and off-duty times while also maintaining an activity log. At the end of monitoring period, participants had their metabolic risk factors measured using a finger-prick test after fasting for at least 10 hours prior. Metabolic syndrome was determined if participants had 3 of the 5 following criteria: waist circumference ≥ 35 centimeters for men or > 102 centimeters for men; serum triglycerides ≥ 150mg/dL; high-density lipoprotein < 50mg/dL for women and 40mg/dL for men; blood pressure ≥ 130/≥85mmHg; and fasting glucose ≥ 100mg/dL. The ActivPal device measured posture for 18 participants who adhered to wearing the device for at least four days of the seven consecutive-day monitoring period. Descriptive statistics were used to determine means for all metabolic risk factors and to determine time spent in postural positions (sitting, standing, and stepping). RESULTS: 16.1% (n = 5) had three or more metabolic risk factors and 35.5% (n = 11) had two or more metabolic risk factors. Average on-duty sitting time was 6.77 ± 1.29 hours compared to off-duty sitting time of 5.20 ± 2.64 hours. Average on-duty standing time was 2.02 ± 0.70 hours compared to off-duty standing time of 1.65 ± 0.76 hours. CONCLUSIONS: Law enforcement officers may be at risk of developing metabolic syndrome and have unfavorable posture during a typical day.
Adults with Down syndrome (DS) have altered movement patterns. Especially during walking, their altered mediolateral and anteroposterior body motion predicts their elevated energy cost. Triaxial accelerometers provide a metric of three-dimensional acceleration—Vector Magnitude (VM) counts—which may better estimate the rate of oxygen uptake (VO2) during physical activities and sedentary behaviors than the traditionally used Vertical Axis (VA) counts. PURPOSE: To examine if VM counts are more accurate than VA counts in estimating VO2 across different physical activities and sedentary behaviors in adults with DS. METHODS: Sixteen adults with DS (10 men; age 31 ± 15 years) performed 12 tasks: sitting; playing app; drawing; folding clothes; sweeping; fitness circuit; moving box; basketball; standing; and walking at the preferred speed and at 0.8 and 1.4 m/s. We measured VO2 with a spiroMeter (k4b2, Cosmed) and VA and VM with an accelerometer (wGT3X-BT, Actigraph) on the non-dominant hip. We used two separate multi-level regression models to predict VO2 from VA or VM. We evaluated the fit of models with the R2 and accuracy with Bland-Altman plots and absolute percent error which was compared between models across tasks using within-subject (method-by-task) ANOVA and follow-up paired-samples t-tests. RESULTS: Both VM and VA significantly predicted VO2 in separate models (p < 0.001; R2 = 0.74 and 0.65, respectively). Across all tasks combined, absolute percent error was lower for the VM than the VA model (23.7 ± 26.2 and 33.6 ± 35.9, respectively). A significant method-by-subject interaction in ANOVA and follow-up t-tests indicated that absolute error was lower for the VM than the VA model for sitting, playing an app, and drawing, and standing (p ≤ 0.004), but did not differ for other tasks. Bland-Altman plots indicated zero mean error for both models; however, the limits of agreement were narrower for the VM than the VA model (−6.4 to 6.44 and −5.57 to 5.57 ml·kg−1·min−1, respectively). CONCLUSION: Both VA and VM counts predict VO2 in adults with DS; however, prediction is more accurate for a VM than a VA model during sedentary behaviors. VM counts should be used in developing accelerometer-based prediction of physical activity and sedentary behavior in adults with DS. Supported by NIH Grant R15HD098660.

Introduction: The 2008 Physical Activity Guidelines for Americans recommended adults engage in ≥150 min/week of moderate-to-vigorous intensity physical activity (MVPA) in bouts of ≥10 minutes to elicit numerous health benefits. However, the 2018 Physical Activity Guidelines recommends that all MVPA, regardless of bout length, contribute to the desired MVPA goal as this also elicits health benefits. PURPOSE: This study examined whether the number of adults meeting the public health recommendation of 150 min/week of MVPA differed based on the criteria that considered all minutes or minutes that were only accumulated in bouts of ≥10 minutes. METHODS: Baseline data from 377 adults with obesity (age = 45.5 ± 8.0 years; BMI = 32.2 ± 3.8 kg/m2) who enrolled in a behavioral weight loss program were analyzed. Participants reported not engaging in regular structured exercise that exceeded 60 min/week. Participants were instructed to wear an activity monitor (SenseWear Armband) for 7 days while maintaining their regular activity protocol, and self-reported with arthritis were included in this analysis. Subjects completed a seven-day monitoring period that included wearing a thigh worn activPAL (AP) accelerometer during all waking hours and completing a wear-time log. At the end of the monitoring phase individuals completed the PASIPD. Accelerometer data was processed with PALstudio (v8.9.1.24) and raw data was manipulated using the activPAL processing package in RStudio (1.2.1335) to calculate hours in stepping, light (1.5-2.9 METs) PA (LPA), and moderate-vigorous (>3.0 METs) PA (MVPA). Items were taken from the PASIPD to calculate hours of LPA and MVPA, and to derive a total activity score. Spearman correlations comparing AP stepping and total PASIPD, AP LPA and PASIPD LPA, and AP MVPA and PASIPD MVPA were computed. Wilcoxon Signed Rank tests were computed for differences between AP and PASIPD LPA and AP and PASIPD MVPA. RESULTS: Twenty-seven subjects (16 male, 7 female) ([mean±SD] age 75.8±6.2 yrs; height 168.4±9.5 cm; mass 83.8±17.6 kg) were analyzed. AP Stepping was significantly correlated with total PASIPD score with a Spearman’s rho of 425; p = 0.14. AP LPA and PASIPD LPA, and AP MVPA and PASIPD MVPA were significantly correlated, Spearman’s rho of 436; p = 0.12, and 435; p = 0.12 respectively. On average, PASIPD underestimated AP LPA by 1.38 hours (p = 0.024) and overestimated AP MVPA by 1.34 hours (p = 0.001). Conclusion: Differences between PASIPD and AP measures of LPA and MVPA were apparent, but the PASIPD was moderately correlated to PA levels in this sample of arthritis individuals. Future work on examining the precision and accuracy of PA surveys in heterogenous populations with varying disease and disability is warranted. This work was partially supported by NIH 1R21HD080828 and NIH IR01CA215318.

Purpose: To examine the association between hourly air pollution on hourly physical activity (PA) among college students in Beijing, China. METHODS: A total of 340 participants (70.58% male) were recruited from the Tsinghua University, in Beijing, China. Accelerometers provided PA measures, including moderate-to-vigorous physical activity (MVPA), walking steps, energy expenditure for 7 consecutive days. Corresponding air pollution data by the Beijing Municipal and Ecological Environmental Bureau in the closed site (Wan Lui site) in Tsinghua University were collected including average hourly air quality index (AQI) and PM2.5 (μg/m3). Associations were estimated using linear individual fixed-effect regressions. RESULTS: A one level increase in hourly air quality index (AQI) was associated with an reduction in one-hour PA of 0.083 (95% confidence interval [CI] = -0.137, -0.029) minutes of MVPA, 8.822 (95% CI = -15.028, -2.617) walking steps, 0.653 (95% CI = -1.033, -0.273) kCal of energy expenditure. A 10µg/m³ increase in air pollution concentration in hourly PM2.5 was associated with a reduction in one-hour PA by 0.021 (95% confidence interval [CI] = -0.033, -0.010) minutes of MVPA, 2.232 (95% CI = -3.548, -0.916) walking steps, 0.170 (95% CI = -0.250, -0.089) kCal of energy expenditure. CONCLUSIONS: Although there is a negative trend between air pollution and PA, their impact on college students in Beijing seems limited.
Physical activity compensation (PAC) has been studied in populations ranging from children to older adults participating across a range of mixed exercise interventions yielding equivocal results. Although physical activity is the highest predictor of weight loss success in post-bariatric (PB) individuals, it has not been reported if compensatory physical activity is also exhibited in PB individuals during exercise intervention. PURPOSE: To determine if PAC occurs on days following different types supervised exercise sessions in obese and post-bariatric individuals as measured by step count. METHODS: Ten obese individual [7 female, 3 male; BMI = 38.99 ± 6.5] and 8 PB individuals [7 female, 1 male; Body Mass Index (BMI) = 34.95 ± 7.6] participated in a supervised 12 week three days per week treadmill exercise training program. The obese continuous moderate intensity group exercised for 20 minutes at 60% HRR for weeks 3 through 6 and 20 minutes at 65% HRR for weeks 7 through 12. The PB high intensity interval group exercised at 80% of their age adjusted heart rate reserve (HRR) for 4 one minute intervals interspersed with 4 minute recovery bouts at 50% of the HRR for weeks 3 through 6. Exercise was increased to 6 one minute bouts at the same HRR intensity and recovery time for weeks 7 through 12. Both exercise interventions included a 2-week run-in to avoid injuries. Total weekly and daily steps were measured using micro activPALs for the pre-exercise week and weeks 3, 9 and 12. RESULTS: Paired post hoc tests (P > 0.05) found both obese and PB groups average daily steps were lower on days following supervised sessions. Average steps on days for exercise in week 3 for the Obese and PB groups were 9,840 and 10,797 respectively. For week 9, the average step count on days following supervised exercise was 7,567 for the obese group and 7,731 for the PB group. In both groups regardless of exercise mode, daily step counts increased and plateaued for weeks 3 through 9 and approached pre-study levels in week 12. CONCLUSIONS: Despite different types of exercise intervention methods and near matching step volume, both obese and PB groups demonstrated lower levels of physical activity on the following day. The step count on those days was closely aligned with counts measured prior to exercise training and reflects a habitual and familiar activity pattern.

1539 Board #133 May 28 10:30 AM - 12:00 PM Does Reactivity To Accelerometer Occur In A Single Swimming Trial? A Randomized, Crossover Study
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PURPOSE: Recent research has suggested that awareness of being monitored can influence the habitual physical activity behaviour of participants. This reactivity effect appears to also occur in single bouts of physical activity. However, it is presently unknown whether this acute reactivity effect exists in aquatic environments. The purpose of this study was, therefore, to test the hypothesis that reactivity would also occur in water-based studies. METHODS: Fifty-six healthy, recreational swimmers (31 men, age 22 ± 2 yr; 25 women, age 22 ± 1 yr) volunteered to participate in this ethically approved study. On two separate occasions, the participants randomly completed a 20-min swimming bout at a self-selected pace wearing (A) or not wearing (NA) a head-mounted accelerometer. Evidence of reactivity was defined as a statistically significant change in swimming distance covered (in m) in the A condition compared with the NA condition. Situational motivation, perceived performance, and perceived exertion were also assessed in both A and NA conditions. RESULTS: Swimming distance covered was longer (829 ± 202 vs. 811 ± 204 m) and perceived exertion was more strenuous (13.0 ± 2.4 vs. 12.2 ± 2.1) during the A condition compared with the NA condition (P < 0.05). Perceived performance and situational motivation were not significantly different between conditions (P > 0.05). CONCLUSIONS: These results indicate that the acute reactivity effect is likely to be present in aquatic environments and may threaten the internal validity of physical activity assessments in water-based studies.

1540 Board #134 May 28 10:30 AM - 12:00 PM A Tailored Multiple Imputation Approach To Handle Arbitrarily-Missing Accelerometer Data In A Randomized Controlled Trial
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(No relevant relationships reported)

Common applications of Multiple Imputation (MI) are too generic, yielding highly variable and nonrepeatable results. PURPOSE: Evaluate a tailored MI approach for handling missing physical behavior (PB) outcome summaries (e.g., sitting time) due to accelerometer non-wear in an RCT and its impact in estimating time spent in PBs. METHODS: A missing data simulation was conducted from a complete subsample (N=39) of accelerometer data collected for 7-days at the start and end of a yearlong RCT. Data from 3 PB variables (sitting, standing and stepping time) were randomly deleted for 3 study groups at each timepoint to generate 10 datasets per group × timepoint with arbitrarily missing data (8-77%) in increments of 8%. A tailored MI approach was used for missing data where: i) each variable was imputed separately using unique correlated auxiliary variables, and ii) the number of imputations necessary to produce replicable and stable parameter estimates and standard errors were computed for each imputation model. Statistical differences in parameter estimates from univariate timepoint and repeated measures mixed model analyses between imputed and complete datasets were tested with paired sample T-tests and two-tailed Z scores, respectively. Errors (%) in parameter estimates relative to the complete dataset were calculated to quantify the magnitude and variability of the bias. RESULTS: The tailored MI approach produced unbiased parameter estimates and standard errors in both univariate timepoint and change analyses in sample sizes as small as N=13 with up to 54% missing data. Error and variability in parameter estimates increased exponentially above the 54% threshold in both univariate (mean error ± SE: above threshold = 31 ± 10%, below threshold = 11 ± 4%) and change analyses (mean error ± SE: above threshold = 465 ± 98%, below threshold = 175 ± 55%). CONCLUSIONS: To our knowledge, this tailored approach is the most robust MI methodology to date for imputing incrementally missing accelerometer-based summary PB data in an RCT. Prior PB MI simulations yielded lower acceptable missing data thresholds (≤30%) in larger sample sizes (N ≥ 20), and did not test the impact on analyzing change between repeated measures. Tailoring MI to restore lost statistical power may prevent conservative estimates of the treatment effects in PB RCTs.
CONCLUSION: There was limited evidence for the validity and accuracy of proxy-measured PA and sedentary time using the IPAQ-SF in adults with ID. This suggests that device-based measurement may be a preferred method in studies of PA in adults with ID.

1542 Board #136 May 28 10:30 AM - 12:00 PM Physical Activity And Sedentary Time In Adults With Down Syndrome Estimated By Different Cut Points
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(no relevant relationships reported)

Physical activity (PA) and sedentary time in persons with Down syndrome (DS) have been previously examined with accelerometry using intensity cut points developed for the general population. These cut-points may not be valid for persons with DS due to altered biomechanical and physiological responses to PA.

PURPOSE: To examine if DS-specific cut-points and cut-points developed for the general population differ in estimating sedentary time and PA levels in persons with DS.

METHODS: Eleven adults with DS (4 women & 7 men; age 37 ± 14 years) wore for 7 days an accelerometer (wGT3X-BT, Actigraph) on their right hip. Times sedentary and in light, moderate, and vigorous PA were assessed with three cut-point sets: (a) Troiano; (b) Freedson; and (c) DS-specific. The first two sets of cut-points were developed for the general population based on vertical axis counts. The third was developed by our group based on vector magnitude counts in 16 adults with DS. We compared sedentary time and PA variables between methods using 3×4 (method-by-intensity) within-group ANOVA. A significant interaction was analyzed with follow-up within-group ANOVA at each intensity level and post-hoc tests between methods if needed. RESULTS: A significant method-by-intensity interaction (p = 0.002) indicated that the estimates of times in sedentary and light, moderate, and vigorous PA generally differed between methods. Follow-up analysis showed that: (a) sedentary time was lower by our DS-specific cut points than the Troiano and Freedson (457 ± 131, 505 ± 149, and 517 ± 111 min/day, respectively, p ≤ 0.04); (b) light PA did not differ between methods (345 ± 37, 336 ± 85, and 346 ± 73 min/day, respectively, p = 0.782); moderate PA was higher by our cut points than the Troiano and Freedson (85 ± 44, 28 ± 24, and 25 ± 23 min/day, respectively, p < 0.001); and (d) vigorous PA was higher by our cut points than the Troiano and Freedson (9.9 ± 9.2, 0.3 ± 0.8, and 0.1 ± 0.2 min/day, respectively, p ≤ 0.007). There were no differences between the Troiano and Freedson.

CONCLUSIONS: Compared to cut-points for the general population, DS-specific cut-points estimate lower levels of sedentary time and higher levels of moderate and vigorous PA. Supported by NIH Grant R15HD098660.

1543 Board #137 May 28 10:30 AM - 12:00 PM Accelerometer Cut Points For Adults With Down Syndrome
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(no relevant relationships reported)

Past research has indicated that the relationship between energy expenditure and accelerometer output is different between adults with and without Down syndrome (DS). This suggests a need for DS-specific cut-points for determining levels of sedentary behavior and physical activity from accelerometer output for adults with DS.

PURPOSE: To develop accelerometer output cut points for sedentary behavior and moderate and vigorous intensity physical activity for adults with DS.

METHODS: Sixteen adults with DS (10 men & 6 women; age 31 ± 15 years) performed 12 tasks each lasting 6 min: sitting; playing app on tablet; drawing; folding clothes; sweeping; fitness circuit; moving a box; basketball; standing; and walking at the preferred speed and at 0.8 and 1.4 m/s. We measured the rate of oxygen uptake with portable indirect calorimetry (K4b2, Cosmed) and expressed it in Metabolic Equivalents (METs). Output from a triaxial accelerometer (wGT3X-BT, Actigraph) worn on their right hip was determined total sedentary time, percent of wear time spent sedentary, number and duration of sedentary bouts, and breaks in sedentary time. We examined sedentary bouts with thresholds of ≥1, ≥10, ≥30, ≥60 and ≥90 min and breaks for bouts ≥10 min.

We used t-tests and 2×2 (sex by day) ANOVA to evaluate the effects of sex and day of the week. The total sedentary time did not differ between men and women (533 ± 139 and 496 ± 140 min/day, respectively, p = 0.35; for both sexes combined, p = 0.017). Most variables did not differ between week and weekend days, except for: duration of sedentary bouts ≥1 min was longer during weekend than weekdays in women (5.5 ± 1.8 and 5.18 ± 1.07 min, respectively, p = 0.048); duration of sedentary bouts ≥60 min was longer during week than weekend days in men (56 ± 42 and 47 ± 44 min, respectively, p = 0.037); number of sedentary bouts ≥1 min was greater during weekdays than weekend days in men (87 ± 21 and 83 ± 25 bouts/day, respectively, p = 0.045); and duration of breaks was greater during the weekdays than weekend days in men (138 ± 126 and 81 ± 67 min, respectively, p < 0.001). CONCLUSION: U.S. adults with ID spend a large portion of the day in sedentary behavior primarily of short duration. There are small differences between sexes and between days of the week, suggesting near-uniform sedentary behavior levels and patterns for men and women with ID throughout the week.

1545 Board #139 May 28 10:30 AM - 12:00 PM Validation Of Previous-day Recalls Of Screen-based Sedentary Behavior In Young Male Adults
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(no relevant relationships reported)

PURPOSE: Previous-day recall (PDR) has been suggested as a valid measurement of type, purpose and amount of sedentary behaviors in youth and adults. However, no studies have explored the feasibility and validity of using PDR to estimate sedentary behaviors in various bouts. This study examined the validity of a self-administered PDR in evaluating the total screen based sedentary behaviors (SSB) and SSB by types and bouts using the activPAL as a criterion measure.

METHODS: One hundred young male adults aged 18-35 years volunteered to participate in the validation study. They completed a web-based PDR over 7 consecutive days, in which three categories of SSB (computer work & surf internet, TV/video, and computer games) were required to be reported to the nearest 15 minutes. Participants wore an activPAL over the 7 days to determine the daily sedentary time and the sedentary time during each 15-min segment. The activPAL-based SSB were calculated based on the start point and endpoint of sedentary behavior from PDR. Total SSB, SSB by type of activities and by duration of bouts were drawn from PDR. Bivariate correlations between PDR- and activPAL-assessed outcomes were conducted. Bland-Altman Plots were performed to determine the agreement between two methods by type of activities and by the duration of bouts.

RESULTS: Total SSB assessed by PDR was associated with activPAL-determined sedentary time (r = 0.37). The absolute mean difference between PDR and activPAL moderate-intensity physical activity ≤2167 counts·min⁻¹ (sensitivity 0.99; specificity 0.82; Yooden’s index 0.81); and (c) vigorous-intensity physical activity ≥2400 counts·min⁻¹ (sensitivity 1.00; specificity 0.84; Yooden’s index 0.84). CONCLUSION: This study offers the first DS-specific accelerometer output cut-points for classifying sedentary behavior and intensity of physical activity in adults with DS. Overall classification accuracy was excellent. Supported by NIH Grant R15HD098660.
Traditionally, device non-wear time is determined by examining periods of consecutive zero counts, however, zero counts may also indicate periods of non-movement or sleep. In infants, evaluating non-wear is challenging due to their sporadic nature of movement and sleep frequency. These unique behavior characteristics make a zero counts approach prone to misclassification of non-movement and sleep as non-wear. Thus, an infant-specific method to identify device non-wear time is necessary. **Purpose**: To compare a novel method for identifying device non-wear to consecutive zero counts in infants. **Methods**: Fifteen infants (mean±SD; age, 8.7±1.7 wk; 5.1±0.8 kg, 56.2±2.1 cm) wore an Actigraph wGT3X-BT on the hip and ankle. Criterion data (minutes of wear and non-wear) were collected during two, 2-hour periods of direct observation during which infants spent time in an infant bouncer, including sleeping and waking time. A vector magnitude and the inclination angle of each individual axis were calculated from raw 30 Hz acceleration data before being averaged into 1-min epochs. Using the 1-min data, a 4-min rolling coefficient of variation (CV) of each axis was calculated for each minute. Three decision tree models were developed using data from the 1) hip, 2) ankle, and 3) hip and ankle combined. For the consecutive zero counts method, two or more minutes of consecutive zero counts were considered non-wear; this was examined for the hip, ankle, and hip and ankle combined (i.e. if one site indicated “wear” the combined label was “wear”). **Results**: There were 3,506 total min of observation with 1,987 min of sleep and 1,519 min of waking time with zero criterion non-wear minutes during the observation periods. The decision tree approach resulted in lower misclassification of wear as non-wear (5.1±6.0%); 178-212 min) compared to the zero counts method (43.8±51.7%; 1,534-1,813 min). Of the misclassified minutes for the decision tree, 5.3-8.8% (106-175 min) was sleep time compared to 66.8-77.3% (1,328-1,535 min) for the consecutive zero counts method. **Conclusions**: Overall, using movement variability (i.e. CV) and device position (i.e. inclination angle), device non-wear can be more robustly identified when worn during periods of non-movement and sleep compared to consecutive zero counts approach. Supported by NIH P30DK072476-10.
MotionSense HRV (MS-HRV) is a wrist-worn accelerometry-based sensor that is paired with a smartphone to examine health behaviors such as stress response, heart rate, and physical activity (PA). However, little information is available on the validity of MS-HRV in estimating PA.

**PURPOSE:** To evaluate the accuracy of MS-HRV for assessing PA and sedentary behavior (SED) in adults, using the most widely used commercial accelerometer-based activity monitor, ActiGraph GT9X (GT9X), as a criterion measure, during free-living conditions.

**METHODS:** 19 adults (Female: 58%; Age: 30.9 ± 13.7 years, BMI: 30.3 ± 4.1 kg/m²) wore the MS-HRV on non-dominant wrist and AG on dominant hip simultaneously for seven consecutive days. The MS-HRV is composed of a smartphone and wristband that is accelerometer and LED biometric sensor to measure PA unobtrusively. Raw acceleration data from both MS-HRV and GT9X were processed using RUGIR package that summarizes multiday raw acceleration data to the amount of time (min/day) spent in SED and moderate-to-vigorous PA (MVPA) using Euclidean Norm Minus One (aka. ENMO). Pearson correlations and Bland-Altman (BA) plots were used to examine the relationship and agreement between MS-HRV and GT9X. Equivalence test was used to compare the 90% confidence intervals (CI) of the estimates from the MS-HRV with the respective equivalence zone (EZ; ± 10% of the mean estimates) from the GT9X.

**RESULTS:** The correlations between MS-HRV and AG were high for both SED (r = 0.95, P < 0.01) and MVPA (r = 0.89, P < 0.01). BA plots illustrated no variance difference in SED estimates (Pimman’s test: r = −0.16, P > 0.05), but significantly different variance in MVPA (r = −0.91, P < 0.02) from two devices. The estimates of SED and MVPA from the MS-HRV (SED Mean (90% CI): 237.6 min/day [198.5 - 276.8]); MVPA: 21.5 min/day [16.4 - 26.6] were not significantly equivalent to those from the GT9X (SED Mean (EZ)): 257.6 min/day [231.8 - 283.4]; MVPA: 8.7 min/day [7.8 - 9.5]).

**CONCLUSIONS:** The MS-HRV accelerometer yielded comparable estimates of SED, but significantly higher estimate of MVPA when compared with the GT9X accelerometer. The observed difference in MVPA estimate could be due to the difference in device placement location (wrist vs. hip). Therefore, subsequent research that compares the estimates from two devices worn at the same location is warranted.

**ACCURACY OF MOOTIONSENSE HRV FOR ASSESSING SEDENTARY BEHAVIOR AND PHYSICAL ACTIVITY**

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No relevant relationships reported.

**RESULTS**

There were significant differences in body composition in body weight, BMI, waist circumference and X3DC according to self-perception health, the Likert scale Diet and Lifestyle questionnaire was used. There were significant differences in body composition in body weight, BMI, waist circumference and X3DC according to self-perception health. This phenomenon was not found in regards to physical activity and sedentary behavior. **Conclusion:** According to students self-perception health, differences in body composition were found when compared to self-rated health, and body composition values were lower in students who reported a positive score.**
Interrater Reliability Of Movement And Activity In Physical Space (maps) Scores

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(No relevant relationships reported)

The Movement and Activity in Physical Space (MAPS) System is a unique assessment combining data from accelerometers and the global positioning system (GPS) to provide patient-centered data from 13 activity-environment-related variables. Processing MAPS data is time-consuming and requires the use of multiple raters to ensure data are analyzed in a timely process and reduce potential risk of bias; however, it is unknown if the scores obtained from multiple raters are consistent which could significantly influence results. PURPOSE: Evaluate the interrater reliability of MAPS system variables obtained from 2 independent raters. METHODS: Twenty-six days of data from 3 participants were processed by 2 independent raters. Participants were instructed to wear an Actigraph GT3X Link accelerometer on their dominant hip and a LandAirSea Flashback 2 GPS for 7 days during waking hours. Outcome variables included: physical activity counts (PAC), physical activity counts at home (PAH), physical activity counts at locations other than home (PAL), step counts (SC), step counts at home (SH), step counts at locations other than home (SL), time at home (TH), time at locations other than home (TL), travel time (TT), number of locations visited (NL), number of instrumental trips (NIT), number of discretionary trips (NTD), MAPS intensity (MAPSi), and MAPS volume (MAPSv). To determine the interrater reliability of MAPS system variables obtained from separate raters intraclass correlation coefficients (ICCs,) were calculated for each MAPS system outcome. An ICC of 0.7 was considered acceptable and an ICC of .8 or greater considered good.

RESULTS: The ICCs for most of the MAPS variables were considered good with a PAC= .92; PAH=.75; PAL=.25; SC=.99; SH=.80; SL=.26; TH=.96; TL=.97; TT=.94; NL=.92; NIT=.78; NTD=.72; MAPSi=.49; MAPSv=.61. CONCLUSIONS: Overall, interrater reliability between raters was good for 7 MAPS variables with acceptable ICCs for 3 variables. Evaluation of GPS data can be challenging particularly when trying to determine departure and arrival times which are necessary for calculation of MAPS scores and activity counts at locations. Using a team of raters, rather than a single rater, would help to reduce potential bias from evaluation of GPS data; which is consistent with the currently recommended MAPS protocols.

1556 Board #150 May 28 10:30 AM - 12:00 PM

A Better Approach To Improve Cardiovascular Function in Middle-aged, Inactive Human

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(No relevant relationships reported)

PURPOSE: Investigate whether different aquatic aerobic exercise intensity modalities yield differential effects on vascular and endothelial function in middle-aged, inactive human

METHODS: A randomized, controlled trial of middle-aged with inactive recipients 6 weeks of sprint interval training (SIT) or 6 weeks of moderate-intensity continued training (MICT). Outcomes included arterial stiffness, endothelial function, lipid metabolism, body composition and aerobic capacity.

RESULTS: Twenty-six middle-aged with inactive human (mean age 41 years, 73% male) completed the study. The decrease (P<0.05) of AIXat75 (augmentation index at HR of 75 beat/min) in SIT group was greater than MICT group. On the contrary, subendocardial viability ratio (SEVR) was elevated in the MICT (P<0.01) groups but not after SIT. Brachial artery BP decreased (P<0.01) by -8.1±1.5 mmHg after MICT exercise with no change in SIT. Both groups could significantly reduce fasting blood glucose (P<0.001), but only the decrease of total cholesterol was found in SIT (P<0.01). Brachial artery Flow-mediated vasodilation (FMD) was improved in both group, MICT only showed marginal significance(P<0.07) compared with SIT (P<0.05). SIT’s relative VO2max and O2 pulse increased (P<0.05) by 8.4% and 8.6%, respectively, with no change in MICT. Both groups of interventions could reduce BMI (P<0.05), but SIT was mainly by increasing lean body mass (P<0.01) and decreasing fat mass (P<0.001), while the lean body mass of MICT did not change.

CONCLUSIONS: The results of the present study demonstrate that short-term low-volume aquatic SIT is a time-efficient strategy to induce changes in arterial vascular stiffness, endothelial function, lipid metabolism and body composition during exercise that are comparable to changes induced by water-based traditional high-volume MICT.
382 children (aged 6-11 years). RESULTS: For Study 1, four overarching themes were identified for the intrinsic facilitators - sense of competence/accomplishments, cognitive motivation, sensations and socialisation/social facilitation. Four main themes for the intrinsic barriers were lack of competence, fear of negative experiences, external constraints and lacking a sense of purpose. For Study 2, results from Rasch analysis demonstrated that PARSC possessed sound internal validity and consistency, and test-retest reliability. Self-perceived PA (p = 0.004) and avoidance coping (p = 0.01) were predictive of PA-specific rumination tendencies with 15% of variance explained. CONCLUSION: The themes identified from the current study can inform future PA interventions and PE curriculum for UK children. Also, PARSC can be a useful tool to assess children’s PA-specific rumination tendencies and to advance our understanding of the role of rumination in PA behaviour.

**Board #152**  
May 28 10:30 AM - 12:00 PM  
An IT-based Health Behaviour Change Program To Increase Physical Activity: Evaluation Of Successes And Challenges  
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IT interventions initially used to promote health used static platforms, often only as a repository of health-based educational material. Such Web 1.0 technologies failed to promote longer-term user engagement, and rarely allowed the interactivity required for more effective health promotion impact. With more interactive Web 2.0 technologies, greater engagement and retention is often evident, with the participation architecture encouraging interactive user-focused tools and interfaces that allow individuals to determine how information is generated, modified, and shared collaboratively.

**PURPOSE:** To identify successes and challenges of an RCT and real-world trial of an IT-based physical activity (PA) promotion intervention.

**METHODS:** The WALK 2.0 study used a Web 2.0-based platform to engage and retain participants in health behaviour change to increase PA. The program included 2 trials: (1) an RCT comparing a Web 2.0 intervention with a less interactive Web 1.0 intervention, and (2) a real-world randomised ecological trial (RET) comparing a Web 2.0 and Web 1.0 intervention.

**RESULTS:** The RCT showed that, compared to the Web 1.0 group, the Web 2.0 group improved PA in the short-term (p<0.02), that the effect diminished over time, despite higher engagement of the Web 2.0 group. The RET showed that Web 2.0 intervention was more effective in improving PA (p<0.005), and that while the Web 2.0 website was visited significantly more (p<0.002), both groups displayed high non-usage attrition and low intervention engagement. Whilst the RCT and RET showed that using a more interactive Web 2.0-based approach was more effective in improving PA, several challenges were identified in designing, implementing, and evaluating such interventions. These include IT-based intervention development in a research context, the ability to establish a self-sustaining online community, the rapid pace of change in web-based technology and implications for trial design, the selection of best outcome measures for ecological trials, and managing engagement, non-usage and study attrition in real-world trials.

**CONCLUSIONS:** Future research must look to broader research designs that allow for the ever changing IT-user landscape and behaviour, and greater reliance on development and testing in real-world settings.

**Board #153**  
May 28 10:30 AM - 12:00 PM  
Satiation And Participant Adherence In A Family Healthy Lifestyle Intervention For Children With ADHD  
Jared D. Ramer, Maria Enid Santiago-Rodriguez, Eduardo E. Bustamante, FACSM. FACSM. University of Illinois at Chicago, Chicago, IL. (Sponsor: Dr. Eduardo E. Bustamante, FACSM)  
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Consistent evidence demonstrates that healthy lifestyle behaviors (i.e., sleep, nutrition, physical activity, and recreational screen time) are related to neurocognitive development and daily functioning of children with Attention-Deficit/Hyperactivity Disorder (ADHD). However, adopting and sustaining healthy home routines can be difficult for families. Interventions that effectively alter healthy home routines have potential to influence physical and mental health among children with ADHD.

**PURPOSE:** To develop and beta-test the Building Unstopable families through Intergenerational Lifestyle Transformation (BUILT) program; and assess fidelity, adherence, and satisfaction via attendance rates and post-intervention semi-structured interviews.

**METHODS:** BUILT was offered at the University of Illinois at Chicago campus for six consecutive Saturdays. Two families from a Comprehensive ADHD Clinic, three children with ADHD, were enrolled and participated in sleep, physical activity, and nutrition activities during Family Fun Days and were also provided weekly home challenges related to cooking, physical activity, sleep, and screen time. Children earned tickets for completing home challenges, and these were redeemable for prizes. Attendance was taken at each session and semi-structured interviews were conducted with parents at post-intervention. Interviews were audio-recorded, transcribed, and coded using a thematic analysis approach.

**RESULTS:** Participating families each attended 5 out of the 6 total sessions (83.3%). Thematic analysis of interviews showed positive aspects of the program included: improving routine structure, showing children their ability, keeping kids active, pursuing goals, relating accelerometer measures to activity, and associating nutrition with being strong and sports performance.

**CONCLUSION:** Providing equipment, between session goals, and PA/nutrition-based physical activity between sessions were beneficial to participant adherence. These findings will inform refinement of the intervention in a second iteration.
Utilizing a multi-faceted recruitment approach to enlist potential research volunteers can help overcome financial, staffing and time burdens. Recently, our Duke Health and Exercise Research Trials team created an online registry to connect with individuals interested in clinical research participation.

**Purpose** To examine our registry’s ability to engage a diverse pool of volunteers in the greater Durham, NC area.

**Methods** We developed our IRB-approved registry in REDCap, a secure tracking database. Our registry allows us to recruit volunteers without cold-calling in one of two ways. First, we can contact individuals who are current or former participants from one of our research studies. Second, we can recruit from the general public by directing individuals to our registry’s web link via flyers, social media posts, and word-of-mouth. By volunteers consenting to join the registry, we are able to collect basic contact, demographic, and health-related information. Then, we screen for initial qualification by study-specific inclusion/exclusion criteria. For those who appear to be qualified for a particular study, we contact them to provide study-specific overviews and conduct the full screening process.

**Results** Since our registry launch in July 2018 to October 2019, 357 volunteers consented to join the registry. Because personal health information entry is optional, our registry includes 289 subjects who provided their birth year (1938 to 2001), 306 reported their gender (62% females), and 312 reported their race/ethnicity (77% Caucasian, 14% Black or African American; 93% not Hispanic/Latino). We have self-reported height/weight on 306 subjects. In addition, 29% reported having a chronic disease diagnosis (n=8 disease categories).

**Conclusion** To date, as the majority are non-Hispanic Caucasian females, there appears to be a racial and gender disparity amongst our registry sample. However, our registry includes a significant proportion of volunteers who self-reported a chronic disease diagnosis. Based on initial implementation, our registry has successfully linked volunteers with 5 ongoing studies, ranging from healthy to diseased populations. Importantly, our findings highlight the need to improve our recruitment strategies to appeal to a more diverse population of future registry volunteers.

Compliance with physical activity (PA) prescription is a key component to maximizing desired health outcomes. For instance, health improvement may be diminished or may not even occur without prescription compliance. Due to the practical limitations of prescribing activity intensity in a free-living setting, a precise and practical prescription method is necessary, and using a wearable device could be the gateway to address the issue. Several methods using wearable technologies are already available for this purpose, but few have determined the extent of prescription compliance when using the devices.

**PURPOSE:** To determine the compliance rate of the device-based intensity prescriptions and to identify individual preference for the methods.

**METHODS:** Seventy-three adults (age 18-65 years; 20 females) were supervised. Self-reported daily diet records were assessed using an automated web-based program. The Canadian Healthy Eating Index (C-HEI) was averaged from 3-day diet records obtained at baseline, 8, 16, and 24 weeks. C-HEI is calculated using 8 adequacy (total vegetables and fruit, whole fruit, dark green and orange vegetables, total grain products, whole grains, milk and alternatives, meat and alternatives) and 3 moderation (saturated fats, sodium, other food) components. The components were summed to produce a single score between 0 and 100, with higher scores reflecting greater adherence to 2007 Canada’s Food Guide, and hence better diet quality.

**RESULTS:** Mean ± standard deviation C-HEI in all participants at baseline was 58.4 ± 13.4, with no difference between groups (P = 0.40). There was no change in C-HEI at 24 weeks vs baseline in any of the groups assigned to increased amounts of exercise or

Lifestyle-induced reduction in health risk is thought to be the result of improvement in both exercise and eating behaviour. Whether increasing exercise is associated with a corresponding improvement in eating behaviour is unclear.**PURPOSE:** To determine if the adoption of exercise consistent with consensus recommendations influences diet quality in previously sedentary adults and hence better diet quality.

**RESULTS:** Significant differences were found between boys and girls for total SBT (239.3±74.6 min/days vs. 296.2±128.4 min/days, respectively, p=0.024). Also, a significant difference in SBT by gender was observed. Boys whose parents expressed that they already limit their child’s TV time spend less SBT than girls (241.3±65.3 vs. 291.5±127.4, respectively, p=0.002). No significant differences in daily SBT was reported when considering PP. **CONCLUSIONS:** Boys whose parents already limited their TV time spent significant less time on SBT than girls. Findings support the inclusion of goals related to PI in PA and/or SBT interventions, particularly when minimizing sedentary time among children.

**REFERENCES**


**RESULTS**

**REFERENCES**


**RESULTS**

**REFERENCES**

intensity (p=0.5). Collapsed across all groups, the mean change in C-HIE at 24 weeks was (3.9 ± 1.6). CONCLUSION: The diet quality of the participants, as reflected by the C-HIE, was positively affected by the intervention, and is in agreement with previous research. RAISED: There was a significant increase in the use of exercise consistent with consensus recommendations. Contrary to expectations, a structured exercise program is not paralleled by favorable changes in dietary behaviour.

1566 Board #160 May 28 10:30 AM - 12:00 PM HiIT As An Effective Method To Reduce Visceral Fat Area In Short Term
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The lack of time for physical activity is a position that prevails in sedentary people. The low level of physical activity, coupled with factors such as poor diet has been related to the development of metabolic syndrome. HIIT is a modality that increases the level of physical activity with positive effects on cardiorespiratory variables, however, there is insufficient evidence of the effect on body composition. PURPOSE: to analyze the effect of a HIIT on body composition in sedentary adults. METHODS: twelve sedentary adults (50% women) 31.5 ± 5.4 years old, participated in 16 sessions (three per week) treadmill HIIT. Height (163 ± 8.6 cm), body weight (BW) (80.8 ± 18.8kg), muscle mass (MM) (301.1 ± 69.9kg), body fat percentage (BF%) (33.2 ± 4.3%), and visceral fat area (VFA) (126.3 ± 39.5 mm²) were measured. An initial measurement (M1), after session eight (M2) and 16 (M3) were made. HIIT consisted of three minutes warmup at 40% of your maximal aerobic speed (MAS), five one-minute intervals with MAS, and three minutes cool-down. RESULTS: a mixed two-way ANOVA without significant variation between sex and measurements (p = 0.942) was applied. In the same way, with a one-way ANOVA of related samples, no differences were found in BW (% ∆ = -0.4; p = .237; ƞ² = 0.007), a 1.3 kg loss in BW was recorded. MM (% ∆ = 1.3; p = .142; ƞ² = 0.002) and STF (% ∆ = -1.2; p = .444; ƞ² = 0.007) among the three measurements. Differences in VFA (126.3 ± 39.5mm²) were not significant. CONCLUSIONS: these results indicate that 16 sessions of high intensity interval training, lasting 17 minutes per session, decrease the visceral fat of sedentary people.

1567 Board #161 May 28 10:30 AM - 12:00 PM Validity & Reliability Of A Self-Report Modified Sitting Time And Physical Activity Questionnaire
P. Brian Kiessling II. Indiana University, Bloomington, IN. (Sponsor: Carol Kennedy-Armbruster, FACSM)
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Self-report questionnaires are important tools for public health because of their ability to reach large populations at relatively low costs. Given recent scientific findings which highlight the risks of too much sitting time as well as the importance of physical activity throughout the entire day, new self-report instrumentation is needed which can effectively measure both sitting time and physical activity throughout the entire day. PURPOSE: To determine the validity and reliability of a modified physical activity (PA) and sitting time (ST) questionnaire during work-time (WT) and leisure-time (LT). METHODS: Full-time workers aged at least eighteen years (n=26) kept time logs and wore Actical Physical Activity accelerometers during the workweek for 4 days during work-time and leisure-time, while simultaneously completing a modified Occupational Sitting and Physical Activity Questionnaire (OSPAQ) two times 7-10 days apart. RESULTS: Using intraclass correlation coefficient calculations, test-retest reliability ranged from 0.661-0.901, with WT Sedentary Time (0.901), WT PA (0.869), and LT Sedentary Time (0.818) showing excellent test-retest reliability. LT PA also showed good test-retest reliability (0.824), and was higher than the rho correlation coefficients were calculated, resulting in two categories of the modified OSPAQ with significant p-values, WT Sedentary (p=0.001) and LT PA (p=0.04). Self-report WT sitting time showed a moderate correlation (r=0.583) to accelerometer data, while self-report LT PA showed a small correlation (r=0.394). Neither WT PA nor LT Sedentary Time showed significance. CONCLUSIONS: The modified OSPAQ instrument showed excellent to good test-retest reliability and moderate to small correlation of WT sedentary time and LT PA with accelerometer. The modified OSPAQ instrument could be used as a public health tool to measure both PA and ST behaviors throughout the entire day.

1568 Board #162 May 28 10:30 AM - 12:00 PM Retention Strategies For Incentive-free Exercise Interventions: Importance Of Enrollment Timing
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Nearly half of all US adults have a chronic disease diagnosis; these individuals are more likely to be sedentary than age-matched controls. When exercise programs incentivize their participation, attrition may be reduced for the duration of the trial, but the results lack applicability outside of the clinic. Thus, there remains a need to identify cost-free predictors of exercise adherence among sufferers of chronic diseases. PURPOSE: To determine the effect of enrollment timing on retention in an incentive-free, community exercise program. METHODS: 224 previously inactive patients with chronic diseases (cancer, diabetes, pulmonary and cardiovascular disease) were enrolled in an intervention involving 10 weeks of aerobic, resistance, and flexibility training. Independent-samples t-tests and chi-squared tests compared the profiles of patients who did and did not complete the trial. Logistic regression tested the effect of enrollment timing on program completion holding constant potential confounders. RESULTS: Across 62 continuous months of admission, 43.3% of patients completed the trial. Retention differed throughout the year with the highest rate occurring in January and February; 55.8% of participants enrolled in these months were retained compared to 39.5% during later months (p=0.038). Patients exhibited no differences in health history, cardiometabolic risk factors, anthropometric measurements, functional assessments, or quality of life scores between months of enrollment. Holding constant sex, age, and diagnosis, initiatives training for the first 2 months of the year predicted a 2.1-fold increase in program completion (p=0.023; 95% CI of OR: 1.107-4.053). CONCLUSIONS: Incentive-free exercise interventions for patients with chronic diseases have high attrition. Fewer than half of our patients were retained for 10 weeks. However, those who enrolled at the start of the year were more likely to complete the program, indicating possible value seasonal recruitment.

1569 Board #163 May 28 10:30 AM - 12:00 PM Qualitative Study On The Perceived Barriers Of A Physical Activity Program In Toddlers: Classroom Teacher Perspective
Luke M. Sudarsky, Melanna Cox, Christine St. Laurent, Sarah Burkart, Sofiya Alhassan, FACSM. University of Massachusetts Amherst, Amherst, MA. (Sponsor: Sofiya Alhassan, FACSM)

Toddler children (18 months-2.8 years) spend a significant portion of their day at childcare settings, where they spend most of their time engaged in sedentary activity. Toddler classroom teachers have a considerable influence on toddlers’ physical activity (PA) levels. Due to the toddler classroom environment, teachers may encounter unique age and ability related barriers to the implementation of PA programs. PURPOSE: The purpose of this qualitative study was to determine the perceived barriers that toddler classroom teachers may face in implementing PA programs to toddlers. METHODS: Toddler classroom teachers from 3 environmentally matched childcare centers from the Springfield MA area participated in this qualitative study. Focus group meetings (n=3) were conducted separately at each center. At each meeting, a semi-structured focus group format and questionnaire were used to guide the sessions. All focus groups were audio-recorded and later transcribed by a primary, secondary, and tertiary trained researchers. Researchers used open coding to identify themes. Representative quotes were selected for each theme to demonstrate saturation of ideas. RESULTS: A total of 15 teachers participated in this study (age = 38.4 ± 12.5; BMI (self-reported) = 26.1 ± 4.3 kg/m²). Teachers had an average of 9.5 ± 8.7 years of experience as toddler classroom teachers may face in implementing PA programs. Toddler classroom teachers have a considerable influence on toddlers’ physical activity (PA) levels. Due to the toddler classroom environment, teachers may encounter unique age and ability related barriers to the implementation of PA programs.

THURSDAY, MAY 28, 2020

San Francisco, California

ACSM May 26 – May 30, 2020
Cognitively older normal carriers of the Apolipoprotein E-e4 (ApoE-4) allele have a greater rate of memory decline over time than do noncarriers of this allele. However, the potential neurophysiological mechanisms and the role of physical fitness have not been examined in the elderly with a family history of Alzheimer’s disease (ADHF) and ApoE-4 genotype. PURPOSE: To investigate the brain event-related potential (ERP) performance and the interactive effects on physical fitness in the ADHF individuals with the ApoE-4 heterozygotes. METHODS: Forty-four older adults with ADHF were recruited and divided into an ApoE-4 group (n=22; 71.68±5.84 yrs) and a non-ApoE-4 group (n=22; 72.09±7.50 yrs) according to the ApoE genotype. They performed a senior functional physical fitness (SFPP) test and completed a visuospatial working memory task with low and high cognitive load while simultaneously recording electroencephalographic signals. RESULTS: Although there were no significant between-group differences with regard to reaction time and ERP P3 latency across conditions, the ApoE-4 relative to non-ApoE-4 group showed significantly lower accuracy rates (ARs) (72.15±11.39% vs. 78.72±6.60%, p<0.01) and smaller ERP P3 amplitudes (4.02±1.50μV vs. 6.41±1.70μV, p<0.001) only in the high working-memory load condition. Cardiorespiratory fitness was significantly correlated with the neurophysiological performance (i.e., ARs) in the ApoE-4 group (r=0.52, p<0.04). CONCLUSION: ADHF individuals with the ApoE-4 genotype only showed poorer neurocognitive performance (i.e., ARs & ERP P3 amplitudes) when performing a cognitive task with high working memory load. The potential neurophysiological mechanism could be attributed to poorer cognitive processes associated with the updating of the contents of working memory. Regular physical exercise aimed at enhancing cardiorespiratory endurance may ameliorate the negative impact of visuospatial working memory declines and further delay the onset of Alzheimer’s disease in ADHF individuals with the ApoE-4 genotype.

Supported by the Ministry of Science and Technology in Taiwan under grant numbers MOST 105-2410-H-006-050-MY3.

CONCLUSION: The Painless Flexibility is an effective program to increase flexibility and reduce lower back pain.

Although the literature clearly demonstrates that exercise benefits people with osteoporosis, it is a challenge to initiate and adhere to an exercise program for most individuals. Currently there is little evidence on exercise preferences of people with osteoporosis yet these factors may contribute to reduced exercise adherence. PURPOSE: Therefore, this project surveyed patients with osteoporosis in a physician’s clinic to understand their exercise preferences, barriers, needs, and goals. METHODS: The Personalized Exercise Questionnaire (PEQ) was used to gain insight into the barriers, facilitators, and goals related to exercise. Participants were recruited from a subspecialty metabolic bone disorder clinic with a large population of osteoporotic patients. RESULTS: Data on a total of 287 surveys were collected. The sample was 90% female with a mean age of 67 (SD: 10.7) years. Most participants preferred to exercise in the morning (n=208, 75%), on their own time (n=180, 65%), with exercise that they could do without a personal trainer (n=241, 84%) and the least important goal was to reduce falls (n=129, 45%). A higher proportion of men (64%) said that they had barriers that stopped them from exercising compared to 54% of women. Time was the most common barrier reported in 30% of participants and pain was the second most common barrier in 23% of the participants. CONCLUSION: This study provides insight into participant preferences for exercise. Future studies should take these results into account when designing an exercise program for people with osteoporosis.
**PERSPICUOUS PAGES**

**S330 Vol. 52 No. 5 Supplement**

**1574 Board #168 May 28 10:30 AM - 12:00 PM**

**Randomized Face-to-face Vs. Remote Exercise Interventions in Overweight And Obese Subjects**

Bowen Li¹, Yunqing Liu², Haiyan Zhu³, Ruifang Gao³, Lian Xue¹, Lining Yang¹. ¹Nanjing Sport Institute, Nanjing, China. ²Changzhou Research Institute of Medical Treatment, Changzhou, China. (Sponsor: Zhengheng Wang, FACSM) Email: libowen_syy@ sina.com 

(No relevant relationships reported)

**PURPOSE:** To compare the effect of face-to-face exercise intervention and wearable activity tracker-based remote intervention on anthropometry and metabolism in overweight and obese subjects. **METHODS:** All 50 overweight and obese subjects were selected: (43.81±9.75) yrs, body mass index: (27.29±2.61) kg/cm², 30 males). CF was measured with a graded exercise test by cycle ergometer. Body composition was measured by bioelectric impedance analysis (BIA). Other indicators include anthropometric and biochemical characteristics (FBG, TC, TG, LDL-C, HDL-C). Exercise intervention program: 3 times/week, 60 min per session at 45%-65%VO2max, 12 weeks. Two supervision modes: a traditional face-to-face group intervention, and an wearable activity tracker-based remote intervention with social networking platform (WeChat). **RESULTS:** After 12 weeks exercise training, BMI, fat%, neck circumference, waist circumference, FBG and TG were significantly improved in both face-to-face and remote groups. However, LDL-C and TC decreased significantly only in the face-to-face group (decreased by 32.32±19.38%, 4.47±19.48%, respectively). The changes of neck circumference (-1.77±2.92 vs. -0.87±5.09 cm) and waist circumference (-3.76±5.52 vs. -0.39±4.37 cm) were more significant in the face-to-face intervention group than in the remote intervention group. **CONCLUSIONS:** 12 weeks of face-to-face and wearable activity tracker-based remote intervention can improve the body composition and glycolipid metabolism of overweight and obese subjects, but face-to-face intervention may have more significant effect on improving the circumference, LDL-C and TC. Supported by Social Science Foundation of Jiangsu Province (BE2018782), Science and Technology Support Plan (Social Development) of Changzhou (CE20190504).

**1575 Board #169 May 28 10:30 AM - 12:00 PM**

**Act-Belong-Commit Framework For A Mentally Healthy College Campus: Campus Recreation And Exercise Science Partnership**

Caroline J. Ketcham¹, Emily Beamon², Scarlett Rupert³, Larry Mellingner¹, Eric E. Hall, FACSM. ¹Elon University, Elon, NC. ²University of North Carolina Greensboro, Greensboro, NC. (Sponsor: Eric E. Hall, FACSM) Email: ketcham@elon.edu 

(No relevant relationships reported)

A growing concern for universities is the state of mental health with a clear need for positive mental health campaigns and strategies to shift the culture surrounding mental well-being. Our campus has adopted a holistic framework, Act-Belong-Commit, to improve mental health through positive intentional engagement in activities. **PURPOSE:** The purpose of this study was to examine the mental health climate and to improve mental health through positive intentional engagement in activities. **METHODS:** 176 students (21-22 yrs, 162 female, 19 male, 2 gender non-binary) participated in the campus-wide survey. There was equal representation of the students across years in school with little ethnic/racial diversity: (Caucasian=93%; African American=2%; Hispanic/Latinx=3%; Asian=2%) and some diversity in sexual orientation (heterosexual=87%; homosexual=2%; bisexual=8%, or other=2%). Measures included: Satisfaction With Life (SWL), Multidimensional Scale of Perceived Social Support (MSPSS), Self-Stigma of Seeking Help Scale (SSSHS), Depression Anxiety Stress Scale (DASS), Resilience and the Meaning of Life Questionnaire (MLQ). A small subset (n=55) completed an ABC self-assessment. **RESULTS:** Social Support was significantly correlated (r=0.05) with many positive mental health outcomes: SWL (r=.62); Resilience (r=.59); Meaning of Life (r=.34); Depression Subscale (r=.36); Anxiety Subscale (r=.34); Stress (r=-.35). High perceived social support and positive mental health were also seen in people high on ACT (Social Support r=.32; resilience r=.37, depression r=-.32, anxiety r=-.26, and stress r=-.26) and BELONG (SWL r=.35, resilience r=.39, depression r=-.29, stress r=-.26). **CONCLUSION:** Social support and a sense of belonging was integrally tied to measures of positive mental health and improved satisfaction with life measures. Belonging comes from being engaged in an active life with people and activities that bring meaning and purpose. Campus recreation and exercise science programs will lead the implementation of the ACT framework, promoting physical activity, mindfulness/mediation, and play as activities to engage in a various levels as part of this positive mental health campaign.

**1577 Board #171 May 28 10:30 AM - 12:00 PM**

**Using Fruits And Vegetables To Motivate Adherence To Walk With Ease, An Arthritis Focused Walking Program, In Low-income African American Women**

Winifred Cameron Parrell, Abdullah Maman, Andrea Harris, Heather Kitzmess Creek, Michael, Donald Wesson. Baylor Scott & White, Dallas, TX. Email: winfredparrell@gmail.com 

(No relevant relationships reported)

**PURPOSE:** To explore whether foods and vegetables prescriptions were associated with increasing physical activity engagement in low income African American populations. Arthritis can be an obstacle to physical activity, and inactivity is often associated with chronic conditions such as cardiovascular disease, diabetes, and obesity. African American women are less likely to engage in recommended amounts of physical activity, and experience higher levels of chronic disease than other ethnicities. **METHODS:** Individuals from low income areas, and who are African American, are less likely to engage in physical activity, and often lack access to fresh fruits & vegetables (F&V). To motivate adherence to Walk with Ease (WWE), an Arthritis Foundation evidence-based walking program, we paired weekly walks with a F&V prescription called “veggie scripts”. A total of 277 adults (mean age 64 years, 86% female, and 75% African American) participated in WWE. Currently, the program is implemented in 17 sites in the Dallas area, 7 sites have completed WWE (N = 152) and 10 sites are currently active. Participants from two sites received $15 veggie script vouchers redeemable at community farm stands. WWE consisted of a weekly walking group and self-directed learning module for 6 weeks. A community health worker (CHW) leads the weekly walking groups at each site. Participants complete a pre and post-survey that collects demographics, comorbid conditions, and walking habits. Weekly minutes of walking are self-reported each week. **RESULTS:** On average, participants reported a total of 112.7 minutes of walking per week. The majority of the participants (54%) attended three or more weekly group walks and 22.3% attended all six walks. Participants who received veggie prescriptions (n = 25) were slightly more active than those who did not (122.2 minutes vs. 110.8 minutes per week). Additionally, veggie script recipients were more likely to attend three or more weekly walking sessions than their counterparts (64% vs. 52%). **CONCLUSIONS:** The data offers a novel approach to community health: that possibly offering fruits and vegetables incentives may increase physical activity
Walking is a popular choice of exercise in many populations. It is especially utilized in older populations and those recovering from cardiovascular injuries. The ACSM equations are a resource for clinicians to use as a way to estimate intensity levels using VO\textsubscript{2} or MET as the outcome measure. The accuracy of these calculations are important to ensure those individuals are working at the prescribed intensity level. 

The equations allow for a more rapid and cost effective way to measure intensity levels than expensive and cumbersome equipment. **Purpose:** The purpose of this study was to compare the predicted and measured VO\textsubscript{2} of a population of untrained college age individuals. **Methods:** 21 healthy untrained college age individuals with an average BMI of 29.1 kg/m\textsuperscript{2}, completed 3 x 3 minute treadmill walking tasks. These consisted of walking at 1.5 m/s at both a level and a 5% incline and then an incline of 5% at an iso efficient pace compared to the level 1.5 m/s. Iso efficient pace was calculated using the ACSM equations and individual correction factors. **Results:** During level walking, the measured VO\textsubscript{2} (14.4±1.1 mlO\textsubscript{2}/kg/min) was 14.5% greater (p=0.001) than predicted (12.5 mlO\textsubscript{2} /kg/min) from the ACSM walking equation. All 21 of the participants measured values were greater than predicted by the equation. During the 5% incline at iso efficient pace, participants walked at an average velocity of 1.1±0.25 m/s, and the measured VO\textsubscript{2} (15.3±1.2 mlO\textsubscript{2} /kg/min) was 7% different (p=0.001) than predicted (16.1±0.3 mlO\textsubscript{2} /kg/min) from the ACSM equation. Of the 21 participants, 16 of them had measured VO\textsubscript{2} values that were smaller than predicted. During the 5% incline at the pace of 1.5 m/s, measured VO\textsubscript{2} (19.9±1.2 mlO\textsubscript{2} /kg/min) was 5.7% different (p=0.01) than predicted (20.6 mlO\textsubscript{2} /kg/min). Seventeen of the participants had measured values that were less than the predicted value. **Conclusion:** For a group of untrained college age individuals with BMI on the edge of the overweight/obese range, the ACSM equations fail to capture the measured values of oxygen consumption. Clinicians and researchers who are using this equation as a prescription for exercise should be cautious when using these equations to calculate exercise intensity.

C-42 Free Communication/Poster - Physical Activity and Health
Thursday, May 28, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

**CONTINUOUS METABOLIC SYNDROME SCORE AND PHYSICAL ACTIVITY AMONG METABOLIC SYNDROME POSITIVE INDIVIDUALS**

Robert Booker, Megan E. Holmes. Mississippi State University, Mississippi State, MS. (Sponsor: Rebecca A. Battista, FACSM) (No relevant relationships reported)

Metabolic syndrome (MetS) is a clustering of cardiometabolic factors increasing risk of morbidity and mortality. Traditionally, MetS is assessed dichotomously; however, new techniques allow for consideration of the severity of MetS using gender- and race-specific, continuous z-scores. **Purpose:** This study aimed to identify how self-reported daily minutes of physical activity (PA) by intensity (sedentary, moderate, and vigorous) predicted degree of severity of MetS among MetS positive individuals (12 to 80-years-old). **Methods:** Using 2015-2016 National Health and Nutritional Examination Surveys data, individuals with no missing cardiometabolic data were classified as MetS positive using ATP III criteria (obesity, dyslipidemia, dysglycemia, and hypertension). Subsequently, MetS z-scores were derived for each individual (<0.50 vs. ≥0.50), BMI (<25 kg/m\textsuperscript{2} vs. ≥25 kg/m\textsuperscript{2}), and WHtR (<0.50 vs. ≥0.50). Cox proportional hazards models were established to assess the association between fitness and MetS tertiles or dichotomous variables of MetS. This may be due to PA being self-reported and/or the exclusion of non-MetS individuals. Future research may be able to elucidate a relationship using a more sensitive, objective measure of PA to better understand its relation with MetS.

1580 Board #174
May 28 10:30 AM - 12:00 PM
**Abstract Withdrawn**

1581 Board #175
May 28 10:30 AM - 12:00 PM
**UNDERSTANDING PHYSICAL ACTIVITY BEHAVIOUR IN CANADIANS LIVING WITH CHRONIC DISEASE: A RETROSPECTIVE COHORT STUDY**

David McHugh, Piotr Wilk, Saverio Stranges, Harry Prapavessis, Marc Mitchell. Western University, London, ON, Canada. (No relevant relationships reported)

Regular physical activity (PA) can reduce the incidence of many chronic diseases. Rural-dwelling Canadians are at a higher risk of developing chronic diseases than their urban counterparts – potentially due to higher rates of inactivity. There is a scarcity of literature describing PA in these high-risk groups. Smartphones and mHealth apps such as Carrot Rewards (reward-based app downloaded by 1.3+ million Canadians) provides a unique opportunity to measure free-living PA amongst Canadians living with chronic disease. **Purpose:** To determine (1) daily step count averages (data collected by Carrot Rewards) for participants who self-report at least one chronic disease vs. those self-reporting none, and (2) whether these averages vary with living environment. **Methods:** In this retrospective cohort study, 12,327 Ontarians (age: M=34.72, SD=13.63, gender: female 62.9%, male 35.1%, other 1.8%) completed a ‘chronic disease’ Carrot Rewards survey adapted from the Canadian Community Health Survey. In this survey, participants could self-report chronic disease diagnoses including: diabetes, cardiovascular disease, chronic obstructive pulmonary disease, cancer and mood/anxiety disorders. Smartphone accelerometers, (HealthKit (iOS), Google Fit (Android) or FitBit) collected step count data which was retrieved by the Carrot Rewards app. Self-reported demographic information indicated participant rural/urban status. **Results:** 37.7% of survey respondents reported being diagnosed with at least one chronic disease and 33% identified as rural-dwelling. Participants with at least one chronic disease had a significantly lower (p<0.001) daily step count average (M=5136.29, SD=3732.83) than those with no diagnosis (M=5724.24, SD=3960.47). Rural-dwelling persons (M=5442.40, SD=3943.49) had lower mean daily step count averages than their urban counterparts (M=5542.61, SD=3588.32), though not statistically significant (p=.123). **Conclusions:** This study provides an objective lens into the PA behaviours of all Canadian populations. Individuals living with chronic disease had significantly lower daily step counts when compared to their ‘healthy’ counterparts. A fundamental understanding of PA behaviours for at-risk Canadians may help inform the design of targeted PA interventions in the future.
higher risk for those in the unfit/BMI < 25 (HR = 1.54 CI = 1.07, 2.20) and unfit/WHIR < .50 (HR = 1.48, 95% CI0.06, 2.08) categories. Being unfit did not further increase the risk of incident prediabetes in those with higher levels of general or central adiposity.

CONCLUSIONS: Fitness not fitness was associated with incident prediabetes in women. Public health efforts should especially emphasize promoting exercise and physical activity to improve CRF for the prevention of prediabetes in women.

Supported by JSPS KAKENHI Grant 19K19437

**RESULTS:** 999 participants had perceived occupational stress. Using the lowest daily step count group (<6,000 steps/day) as reference the multivariable-odds ratios and 95% confidence intervals were 0.77 (0.63−0.94) for 6,000−7,999 steps/day group, 0.91 (0.70−1.18) for 8,000−9,999 steps/day group, and 0.94 (0.69−1.29) for ≥10,000 steps/day group, respectively.

CONCLUSIONS: In this cross-sectional analysis, the results suggest that there is a J-curve relationship between daily step counts and the prevalence of perceived occupational stress among Japanese workers.

There is limited evidence examining the association between physical fitness and hearing loss. Although the precise mechanisms are not fully understood, it may include beneficial changes to cochlear blood circulation, central nervous system, and oxidative stress.

**PURPOSE:** To investigate the association between muscular and performance fitness (MPF) and the incidence of hearing loss among Japanese people in the Niigata Wellness Study.

**METHODS:** Participants included 21,907 people (13,992 men [median interquartile range] age 49 (43–54) years) free of hearing loss who underwent physical fitness tests in 2001. MPF index was calculated using a summed z-score for strength, vertical jump, single-leg balance, and whole-body reaction time. The participants were divided into quartiles according to the MPF index and each physical fitness test. During 2002-2007, participants were followed for development of hearing loss, which was defined as > 30 dB at 1 kHz and/or > 40 dB at 4 kHz in the worse ear on pure-tone audiometry. Hazard ratios (HRs) and 95% confidence intervals (95% CIs) for the incidence of hearing loss were estimated using Cox proportional hazards models after adjusting for age, sex, body mass index, cigarette smoking, alcohol intake, hypertension, dyslipidemia, and diabetes.

**RESULTS:** During the follow-up, 2,765 participants developed hearing loss. The HRs (95% CIs) for developing hearing loss across quartiles of MPF index (lowest to highest) were 1.00 (reference), 0.88 (0.79-0.97), 0.83 (0.75-0.93), and 0.79 (0.71-0.88) (P for trend < 0.001). Vertical jump, single-leg balance, and whole-body reaction time were significantly inversely associated with incident hearing loss (P for trend < 0.001, < 0.001, and 0.043, respectively).

**CONCLUSIONS:** MPF may be associated with lower risk of incident hearing loss. Further studies are required to consider other confounding factors such as noise exposure.

**METHODS:** Participants were 4,768 Japanese men [median (interquartile range) age 45 (36–56) years] and 1,137 women [median (interquartile range) age 42 (33–50) years] who completed a self-administered questionnaire on their health habits, including daily step counts (≥6,000 steps/day, 6,000−7,999 steps/day, 8,000–9,999 steps/day, and ≥10,000 steps/day) in 2017. Participants were classified into 4 groups based on their daily step counts. The prevalence of perceived occupational stress was obtained using the Brief Job Stress Questionnaire. Multivariable-adjusted odds ratios and 95% confidence intervals for the prevalence of occupational stress were obtained using logistic regression models while adjusting for age (continuous variable), sex (men, women), smoking (current-smoker, former-smoker, and never-smoker), drinking (never, < 3 times/week, 3−5 times/week, and ≥ 6 times/week), sleep time (< 6 hour and ≥ 6 hour), and some non-communicable diseases (yes, no).
relationship between the length of residence and obesity based on Baran and Kenny’s (1966) approach. All statistical analyses were conducted using SURVEY procedures in SAS version 9.4 to account for the complex sampling design of the NHANES.

RESULTS: Participants with living in the US for more than 10 years were significantly more likely to be at high risk of obesity (c; β = 3.01, p < .001), and less likely to spend time participating in PA (a; β = -6.6, p < .05), compared to those who living in the US for less than 10 years. Also, the relationship between PA and obesity was significant (b; β = 0.07, p < .001). Length of residence indirectly affected obesity (ab; β = 0.47, p < .05), further supporting partial mediation effect of PA (cβ; β = 2.54, p < .001).

CONCLUSIONS: These findings may encourage long-term immigrants to participate in PA for lowering the risk of obesity.

1587 Board #181 May 28 10:30 AM - 12:00 PM
Physical Activity In The Early Postpartum Period In Primiparous Women
Ali E. Wolfpren1, Tyler R. Bardsley2, Timothy A. Brusscau1, Wonoo Ryu1, Marlene J. Eggen1, Ingrid E. Nygaard1, Jiqiang Wu1, Janet M. Shaw, FACSMB, 1University of Utah, Salt Lake City, UT. 2University of Utah Health Center for Clinical and Translational, Salt Lake City, UT. 3University of Utah School of Medicine, Salt Lake City, UT. (Sponsor: Janet M. Shaw, FACSMB)
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Purpose: Little is known about physical activity (PA) during the early (≤ 6 weeks) postpartum period. Therefore, the purpose of this study was: 1) to describe the amount and type of PA done during early postpartum, and 2) to compare minutes/day of moderate-vigorous PA (MVPA) at 12-25 days (T1) and 33-46 days (T2) postpartum.

METHODS: Participants were primiparous women that delivered vaginally. The amount and type of PA women did was measured using wrist-actometer (≤ 4 days) and completing an activity checklist (N (%)) by questionnaire at T1 and T2. Median (IQR) was calculated for minutes/day of light, moderate, and vigorous PA and MVPA at T1 and T2. PA data reflect total minutes and 5- and 10-minute bouts. The Wilcoxon Signed Rank test was used to compare daily minutes of MVPA in women at T1 and T2. PA data reflect total minutes and 5- and 10-minute bouts. The Wilcoxon Signed Rank test was used to compare daily minutes of MVPA in women at T1 and T2. PA data reflect total minutes and 5- and 10-minute bouts.

RESULTS: Sixty four (9.0%) participants were discordant with high LDL-C/low LDL-P, 61 (8.5%) were discordant with low LDL-C/high LDL-P. Both concordant groups (low LDL-C/low LDL-P, high LDL-C/high LDL-P) were composed of 259 participants each (41.3%). Main effects (p<.05) of LDL discordant group were found for the following outcomes: triglycerides, HDL-C, HDL-P size and small and large HDL-P concentration, percent body fat, maximal oxygen uptake, fasting insulin, lipoprotein lipase activity, testosterone, GILCA, and C-reactive protein. In general, groups with lower LDL-P had more favorable CVD risk factor profiles relative to high LDL-P groups. CONCLUSIONS: In general, low LDL-P levels were associated with favorable CVD risk factor profiles regardless of LDL-C levels.

Table 1: CVD risk factor profiles in participants with discordant/concordant levels of LDL-C compared to LDL-P

<table>
<thead>
<tr>
<th>LDL-C/LDL-P Group</th>
<th>Total Cholesterol (mg/dL)</th>
<th>Triglycerides (mg/dL)</th>
<th>HDL-C (mg/dL)</th>
<th>HDL-P (nmol/L)</th>
<th>LDL-C (mg/dL)</th>
<th>LDL-P (nmol/L)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discordant</td>
<td>190.3 (166.7-217)</td>
<td>161.0 (134-193)</td>
<td>47.6 (41.6-64)</td>
<td>2.5 (2.0-3.0)</td>
<td>108.1 (92.2-131)</td>
<td>91.8 (78.8-107)</td>
<td>&lt;.001</td>
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<td>Concordant</td>
<td>184.5 (163-204)</td>
<td>169.2 (144-195)</td>
<td>51.6 (45.4-64)</td>
<td>2.3 (1.9-2.7)</td>
<td>102.5 (91.3-120)</td>
<td>98.1 (85.8-112)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

1588 Board #182 May 28 10:30 AM - 12:00 PM
Discordance Between Ldl Cholesterol Versus Particle Concentration And The Cardiovascular Risk Factor Profile
Jonathan Joseph Ruiz-Ramie, Abbi D. Lane-Cordova, John T. Wilkins, Claude Bouchard, FACSMB, Mark A. Sarzynski, FACSMB. 1University of South Carolina, Columbia, SC. 2Northwestern University Feinberg School of Medicine, Chicago, IL. 3LSU-Pennington Biomedical Research Center, Baton Rouge, LA. (Sponsor: Mark A. Sarzynski, FACSMB)
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Although low-density lipoprotein cholesterol (LDL-C) levels have been associated with low-density lipoprotein cholesterol disease (CVD) risk, subjects with well controlled LDL-C are still at considerable residual risk for CVD. Alternative measures such as particle concentration of LDL (LDL-P) may be clinically useful for fully characterizing LDL associated risk.

Table 1: CVD risk factor profiles in participants with discordant/concordant levels of LDL-C compared to LDL-P

<table>
<thead>
<tr>
<th>LDL-C/LDL-P Group</th>
<th>Total Cholesterol (mg/dL)</th>
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1589 Board #183 May 28 10:30 AM - 12:00 PM
Changes In Health Behaviors And Anxiety Prevalence Among College Students: 2012-2017
Karissa L. Peyer, Burch Oglesby, Charlene E. Schmidt. 1University of Tennessee at Chattanooga, Chattanooga, TN. (Sponsor: Gregory W. Heath, FACSMB)
Email: karissa.peyer@utc.edu

No relevant relationships reported.

College presents unique challenges, including independent development and control of health behaviors (physical activity (PA), and mental health). PURPOSE: To evaluate relationships among these variables and changes in these variables over the course of two repeated administrations of the National College Health Association (NCHA) survey at a mid-sized Southern university. METHODS: Data were combined from two administration of the NCHA campus survey (2012 < 2017) (n = 792 and 2017 > 2012) (n = 408). No individual student identifiers were collected. It is unlikely that any student participated in both years given the five year spacing between administrations. Moderate (Mod), vigorous (Vig), and strength training exercise (ST); fruit and vegetable (F&V) consumption; and anxiety within the last year were self-reported. From the exercise questions, students were classified as meeting the PA guidelines or not. Descriptive statistics, Chi-Square analyses and Odds Ratios with 95% Confidence Intervals (CI) were calculated for 2012 and 2017 for Anxiety based on PA.

Abstracts were prepared by the authors and printed as submitted.
RESULTS: Students were at lesser odds of reporting 3+ servings of F&V per day in 2017 (20.1%) than in 2012 (21.7%) (OR: 0.94, CI: 0.87-1.02). Days of Mod PA (past 7 days, 30 minutes) did not change significantly, but there were decreases in Vig PA (past 7 days, 20 minutes) and ST. Students were at lesser odds of reporting 3+ days of Vig PA in 2017 (23.8%) than in 2012 (35.1%) (OR: 0.58, CI: 0.44 - 0.76). Students were at lesser odds of reporting 3+ days of ST in 2017 (20.8%) than in 2012 (29.8%) (OR: 0.62, CI: 0.47-0.82). Students were also at lesser odds of meeting the PA guidelines as a whole in 2017 (39.8%) than in 2012 (48.7%) (OR: 0.70, CI: 0.57-0.87). Students were at greater odds to report “overwhelming anxiety” in the last month in 2017 (50.4%) than in 2012 (39.4%) (OR: 0.56, CI: 1.2-2.0). In both surveys, there were significantly lower odds of Anxiety in the last month for students who met the PA guidelines compared to those who did not. This protective effect was stronger in 2017 (OR: 0.50, CI: 0.33 - 0.74) than in 2012 (OR: 0.71, CI: 0.53 - 0.94). CONCLUSIONS: Decreases in PA and increases in Anxiety are concerning. Future work is needed to determine whether there is a causal relationship between these variables.

1590 Board #184 May 28 10:30 AM - 12:00 PM
Associations Of Objectively-measured Floor Climbing With Type 2 Diabetes
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Purpose: Self-reported floor climbing (FC) significantly predicts major health outcomes, including mortality. There are no data on objectively-measured FC, independent of total physical activity, with health outcomes in older adults. We examined the associations between FC and the prevalence of type 2 diabetes mellitus (DM) in older adults. Methods: This cross-sectional study included 488 older adults (56% women; mean age 72 years) who were without heart attack, stroke, or cancer in the past 5 years. FC was assessed with an accelerometer (FitBit Charge 2) worn on the non-dominant wrist for seven days. Average daily steps were assessed using a pedometer (Omron HJ-321). Participants were categorized into tertiles of FC or steps. In a joint analysis, compared with the inactive and low climbers, the ORs (95% CIs) of having DM were 0.42 (0.29-0.63) and 0.40 (0.26-0.62) for the 2nd and 3rd tertiles of FC, respectively. Compared with the lower step tertiles, the ORs (95% CIs) of having DM were 0.45 (0.20-0.99) and 0.47 (0.19-1.20) for the middle and upper step tertiles, respectively, after adjusting for the full model including steps/day. Compared with the lower FC tertile, the ORs (95% CIs) of having DM were 0.42 (0.18-0.94) and 0.31 (0.11-0.87) for the middle and upper FC tertiles, respectively, after adjusting for the full model including steps/day. Compared with the lower FC tertile, the ORs (95% CIs) of having DM were 0.42 (0.18-0.94) and 0.31 (0.11-0.87) for the middle and upper FC tertiles, respectively, after adjusting for the full model including steps/day. Compared with the lower FC tertile, the ORs (95% CIs) of having DM were 0.42 (0.18-0.94) and 0.31 (0.11-0.87) for the middle and upper FC tertiles, respectively, after adjusting for the full model including steps/day. Compared with the lower FC tertile, the ORs (95% CIs) of having DM were 0.42 (0.18-0.94) and 0.31 (0.11-0.87) for the middle and upper FC tertiles, respectively, after adjusting for the full model including steps/day. Compared with the lower FC tertile, the ORs (95% CIs) of having DM were 0.42 (0.18-0.94) and 0.31 (0.11-0.87) for the middle and upper FC tertiles, respectively, after adjusting for the full model including steps/day. Compared with the lower FC tertile, the ORs (95% CIs) of having DM were 0.42 (0.18-0.94) and 0.31 (0.11-0.87) for the middle and upper FC tertiles, respectively, after adjusting for the full model including steps/day.

1591 Board #185 May 28 10:30 AM - 12:00 PM
Abstract Withdrawn

1592 Board #186 May 28 10:30 AM - 12:00 PM
Relationship Between Cardiorespiratory Fitness Level And Hypertension In Japanese Olympic Athletes In Tokyo 1964; A Cohort Study.
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Introduction: Few cohort studies have assessed the relationship between cardiorespiratory fitness and incidence of hypertension among top athletes.

Purpose: To examine the relationship between cardiorespiratory fitness level and the incidence of hypertension in Japanese Olympic athletes in Tokyo 1964.

Methods: This was a retrospective cohort study of Japanese Olympic athletes. The participants were 156 Olympic athletes who took physical fitness tests in 1964 and followed up until 2016. A cardiorespiratory fitness level was evaluated by the Harvard Step Test (tertile). We determined the incidence of hypertension in self-reported questionnaires in 2005, 2008, 2012 and 2016. Odds ratios and 95% confidence intervals (95%CI) for the incidence of hypertension were obtained using logistic regression models while adjusting for age, sex, and body mass index. In addition, a trend test was conducted to examine the relationship between cardiorespiratory fitness level and hypertension.

Results: There were 156 participants (135 men, 21 women) with a median age of 23 years old (range: 15-33 years) in 1964. During the follow-up period, 68 participants developed hypertension. Using the lowest cardiorespiratory fitness (1st tertile) group as a reference, odds ratios and 95% CIs for the 2nd and 3rd tertiles were 0.75 (0.34-1.67) and 0.59 (0.27-1.31), respectively (p trend = 0.19).

Conclusion: These results suggest that a low cardiorespiratory fitness level is a risk factor for the incidence of hypertension in Japanese Olympic Athletes.
step-based recommendation greatly varied between the 34 examined optical cut-point
methods (mean = 10.318; median = 9.898; minimum = 3.262; maximum = 14.899;
P25 = 8.656; P75 = 13.581). CONCLUSION: The optical cut-off methods to determine
the optimal steps/day cut-point threshold based on current MVPA recommendation
for adolescents may drastically affect the step-based recommendation. Further studies
should examine the daily step-based thresholds adopting the best evidence-based
decisions regarding the optical cut-point method.

PURPOSE: Considering the benefits of VR-based exercise on sports and health
compared to traditional exercise alone, this review synthesized the literature examining
the effects of VR-based exercise on physiological, psychological, and rehabilitative
outcomes in various populations. METHODS: Hundreds of articles were retrieved
using key words such as “VR”, “exercise intervention”, “physiological”, “psychology”,
and “rehabilitation” through multiple databases including Google Scholar, Academic
Search Premier, and PubMed. Articles which met the following criteria were included
in the review: (1) peer-reviewed; (2) published in English; (3) randomized controlled
trials (RCTs) or controlled trials (4) intervention used VR devices; and (5) examined
effects on physiology, psychology, and/or rehabilitation. Descriptive and
thematically analyses were used. RESULTS: In total, 14 studies (10 RCTs, 4 controlled
trials) met the criteria across various ages. Most articles observed a cross-influence
on physiological, psychological, and rehabilitative outcomes. Of the 11 articles
examining physiology, 63.6% showed a positive effect on physical fitness, muscle
strength, balance, and extremity function. Only four articles examined the effects
on psychological outcomes, 75% of which showed positive effects such as VR exercise
could ease fatigue, tension, and depression, induce calmness, and enhance quality
of life. Eight articles investigated the effects of VR-based exercise on rehabilitative
outcomes with physiological and/or psychological outcomes, 62.5% of which showed
significant positive changes. In detail, patients who suffered from chronic stroke,
hemodialysis, spinal-cord injury, cerebral palsy in early ages, and cognitive decline
were included in the review. The positive effects were consistent across various
populations. CONCLUSIONS: Findings suggested VR exercise has potential to exert positive impact on individuals’
physiological, psychological, and rehabilitative outcomes compared with traditional
exercise. However, the quality, quantity, and sample size of existing studies are far
from ideal. Therefore, more rigorous studies are needed to confirm the positive effect
and more efforts should be made on this aspect in future studies.

PURPOSE: Risky behaviors have significantly impacted on youth physical and
psychological health among adolescents, which can result in a tremendous public
health issue. The purpose of this study is to examine the association clustering of risk
behaviors with physical activity and mental health and identify what extent the
clustering of various risk behaviors is associated with psychological health and
physical activity in Chinese adolescent. METHODS: Participants were randomly chosen from 30 high school of 10 regions
that consisted of 4630 students, male 2199 (47.5%), female 2431 (52.5%), aged 16-18
years, male 16-21.03, female16.31±1.56. A structured questionnaire was developed to
examine the association of physical activity and all-cause mortality after controlling for
age, socioeconomic status, smoking and chronic diseases.

RESULTS: We studied 16,573 adults aged ≥20 years. Both obesity and physical
inactivity were independent risk factors of all-cause mortality. The prevalence of
obesity in this group was 22.3%. We then studied the relationship between frequency
of physical activity and all-cause mortality among obese persons. Obese individuals
who exercised during leisure time habitually (5+ times/wk) had significantly lower risk
(HR=0.74, 95% CI: 0.62,0.89) of all-cause mortality than the physically inactive obese
group.

CONCLUSION: For obese individuals, exposure to habitual physical activity 5+
times/wk is associated with lower all-cause mortality. All people should engage in
habitual physical activity regardless of body weight.
RESULTS: Two-step cluster analysis (TCA) identified four clusters in risk behaviors that details are presented. Logistic regression demonstrated the relationship between risk behaviors and mental health based on the different clustering. In somatization, compared with cluster1 in factor1, the odds ratios (ORs) and 95% confidence intervals (CIs) were 0.97 (0.83-1.13), 1.01 (0.91-1.11) and 0.99 (0.85-1.16) for cluster 2, cluster 3, and cluster 4, respectively. In the hostility, compared with cluster 3 in factor 5, the odds ratios (ORs) and 95% confidence intervals (CIs) were 1.61 (1.10-1.33), 1.12 (0.98-1.29), 1.06 (0.99-1.24) for clusters 1, 2, and 4. The results found that physical activity affects significantly sedentary behavior and screen time and bully behavior.

CONCLUSION: This study found that the specific cluster behaviors influence significantly on mental health and physical activity among Chinese adolescents. This study suggest that more effective and feasible clustering-based intervention programs may be designed to prevent adolescent risk behaviors and mental health.

Physical activity (PA) is known to contribute to improvements in cardiometabolic risk (CMR) factors, but doses of PA necessary to achieve healthy CMR profiles are not well understood.

PURPOSE: To quantify the relationships among various expressions of PA and CMR profiles in adults. METHODS: Between 6:00 and 9:00 am, participants arrived at the laboratory having fasted for at least 10 hours. Height and body mass were measured, and 4-component body composition (percent body fat [%BF], fat mass [FM] and fat-free mass [FFM]) was measured using data derived from bioelectric impedance analysis and dual energy X-ray absorptiometry. Resting heart rate, systolic and diastolic blood pressure were measured, and mean arterial pressure (MAP) was calculated. Blood samples were collected and plasma lipids (total, HDL, and LDL cholesterol [TOT-C, HDL-C, LDL-C]), triglycerides (TG), insulin (INS), and glucose (GLU) were measured. Quantitative insulin sensitivity check index (QUICKI) and TOT-C: HDL-C ratio were calculated. Accelerometers were then provided and were worn for 21-28 days. Thereafter, associations between markers of PA and CMR factors were analyzed. RESULTS: A total of 21 females (age = 31.3 ± 4.1 years, weight = 80.3 ± 22.7 kg, height = 167.4 ± 8.0 cm, BMI = 28.6 ± 7.5 kg·m²) and 20 males (age = 32.2 ± 5.4 years, weight = 93.7 ± 19.1 kg, height = 180.4 ± 7.2 cm, BMI = 28.8 ± 5.3 kg·m²) participated. STEPS expressed in absolute terms (STEPS·day⁻¹) was not associated with any CMR factors. STEPS expressed relative to body mass (STEPS·kg⁻¹·day⁻¹) was correlated with %BF (r² = 0.44), MAP (r² = 0.48), HDL-C (r² = 0.41), TG (r² = 0.33), TOT-C:HDLC ratio (r² = 0.36), INS (r² = 0.56), and QUICKI (r² = 0.59). STEPS relative to FM (STEPS·kgFM⁻¹·day⁻¹) was correlated with %BF (r² = 0.72), MAP (r² = 0.32), HDL-C (r² = 0.38), TOT-C:HDLC ratio (r² = 0.42), GLU (r² = 0.39), INS (r² = 0.37), and QUICKI (r² = 0.47). STEPS expressed relative to FFM (STEPS·kgFFM⁻¹·day⁻¹) was correlated with INS (r² = 0.32). Power regression analysis showed that STEPS·kgFM⁻¹·day⁻¹ was the best predictor of %BF (r² = 0.85), QUICKI (r² = 0.47) and TOT-C:HDLC ratio (r² = 0.29).

CONCLUSIONS: These findings suggest that STEPS expressed relative to FM are strongly associated with CMR factors, and that expressing STEPS relative to FM may be efficacious for improving CMR profiles in adults.

RESULTS: A positive trend was observed for PA across ordered 25(OH)D categories, as well as for 25(OH)D across ordered PA categories (p<0.01 for both). Using normal weight women as the reference, OR for 25(OH)D deficiency was significantly higher for women in the upper category of each adiposity measure. When examining joint associations, 25(OH)D was higher across ordered PA groups within each stratum of BMI, WC, WHt, and %Fat (p trend <0.007 for all). When utilizing PA and BMI as continuous variables, OR for vitamin D deficiency was 0.95 (95% CI:0.93-0.96) per 250 MET-minutes/week increment in PA and 1.20 (95% CI:1.17-1.23) per 2 kg/m² increment in BMI.

CONCLUSIONS: 25(OH)D levels are positively associated with PA and negatively associated with various measures of adiposity. 25(OH)D levels are also positively associated with PA within each category of adiposity measure. Prospective studies are needed in order to further examine the associations among these variables.

Physical inactivity is one of the most important public health problems of the 21st century, being a key contributor to the increased risk of several chronic conditions. However, the number of people failing to achieve the minimum recommended amount of physical activity (PA) is still too high. In this context, leisure centers could play a potential positive role supporting inactive individuals to achieve PA recommendations.

PURPOSE: To compare physical activity levels among leisure centers' members, and evaluate the largest operator of leisure centers' GO fit, against the 2018 Physical Activity and Sport Special Eurobarometer data from Spain. METHODS: Data from the seven questions of the International Physical Activity Questionnaire (IPAQ) were collected from all consenting GO fit members’ annual survey (n = 4,062). Data were analyzed and compared through Z-Score tests for two population proportions comparing the Spain’s 2018 Eurobarometer data (n = 1,001) regarding physical inactivity for the whole sample, and men and women separately. Additionally, sex differences were also analyzed through Z-Score tests for two population proportions comparing women and men in each sample. RESULTS: Prevalence of physical inactivity of leisure centers’ members (14.9%) was lower in
comparison with the general Spanish population (34%) for the whole sample (Z-score: 13.88; p-value < 0.001) and women (17.4%, 37.2%; Z-score: 10.06; p-value < 0.001) and men (12.1%, 30.0%; Z-score: 9.42; p-value < 0.001). Additionally, higher prevalences were observed in in women in comparison with men in both samples (GO fit: Z-score: 4.77; p-value < 0.001; Spanish population: Z-score: 2.39; p-value = 0.0017), but these differences were lower in GO fit (7.5% point compared) than in the Spanish sample (7.2 percentage points).

CONCLUSIONS: GO fit members showed a lower prevalence of physical inactivity for both women and men and higher levels of PA in comparison with the general Spanish population. These findings indicate the suitability of Spanish leisure centers in promoting an active lifestyle, so policymakers should consider leisure centers when searching for effective partners tackling physical inactivity to introduce specific actions to support women active behaviors during leisure time.

1604 Board #198 May 28 10:30 AM - 12:00 PM
Association Of Physical Activity With Physical Functioning In Adults With Intellectual Disability
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Adults with intellectual disability (ID) have very low levels of physical functioning. They also have low levels of physical activity (PA), high levels of sedentariness, and high rates of obesity. Together, these factors may account for the low physical functioning levels of adults with ID. PURPOSE: This research examined if PA and sedentariness levels, age, and body mass index (BMI) are associated with physical functioning in adults with ID. METHODS: The sample included 58 adults with ID (29 women & 29 men; age 44 ± 14 years; BMI 34.2 ± 8.4 kg/m²). We measured physical functioning with the Short Physical Performance Battery (SPPB) and PA and sedentariness time with a Body Mass Index (BMI) accelerometer (Actigraph) worn on the dominant hip for 7 days. We determined time in light, moderate, and vigorous, PA, and sedentary behavior. We explored bivariate associations among these variables with Pearson’s correlation coefficients. We entered variables significantly associated with the SPPB score into a hierarchical regression model; order of entry was based on the magnitude of correlations. RESULTS: Mean ± SD for measured variables were: SPPB score 7.7 ± 2.4; sedentary time 492.8 ± 130.0 min/day; light PA 351 ± 8.105 min/day; moderate PA 18.8 ± 20.1 min/day; and vigorous PA 0.2 ± 0.6 min/day. Moderate PA and age were significantly associated with the SPPB score (r = 0.39 and 0.34, respectively; p < 0.01). Sedentary time, light PA, vigorous PA, and BMI had non-significant associations with the SPPB score. In the hierarchical regression model, moderate PA significantly predicted SPPB (p < 0.001; R² = 0.153). Adding age to the model increased explained variance (R² = 0.162; R² change = 0.01), but moderate PA remained a significant predictor (p = 0.027). CONCLUSIONS: Moderate PA predicts SPPB score even after accounting for age among adults with ID. Moderate PA may be an important factor for improving the functional performance and health profiles of adults with ID.

1605 Board #199 May 28 10:30 AM - 12:00 PM
Yoga, Health-Related Quality Of Life And Mental Well-Being: A Meta-Analysis Using The Quality Effects Model
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Robust and practically relevant information regarding the association between yoga, health-related quality-of-life (HRQOL) and mental well-being (MWB) in older adults has not been established. PURPOSE: Provide robust and practically relevant information regarding the association between yoga, health-related quality-of-life (HRQOL) and mental well-being (MWB) in older adults. METHODS: Data were derived from a meta-analysis of 12 randomized controlled yoga trials representing 752 adults ≥60 years of age. Standardized mean difference effect sizes (ES’s) were pooled using the recently developed quality effects model and 95% confidence intervals (CI). Small-study effects were examined using the Brambor-Looney-Kanarre (LFK) index. Sensitivity and cumulative meta-analyses were conducted as well as percentile improvement, number needed to treat (NNT), and number to benefit. The GRADE instrument was used to assess the strength of the evidence. RESULTS: Yoga was associated with improvements in both HRQOL (ES = 0.51, 95% CI, 0.25 to 0.77, I²=63.1%) and MWB (ES = 0.39, 95% CI, 0.15 to 0.63, I²=56.2%). Percentile improvements were 19.5 for HRQOL and 15.3 for MWB while the NNT was 4 for HRQOL and 5 for MWB. An estimated 378,222 and 302,578 US yoga-practicing adults ≥65 years of age could potentially improve their HRQOL and MWB, respectively. Major asymmetry suggestive of small-study effects was observed for MWB (LFK = 2.23) but not HRQOL (LFK = 0.27). Overall strength of evidence was considered “high” for HRQOL and “moderate” for MWB. CONCLUSIONS: Yoga is associated with improvements in HRQOL and MWB among older adults. Studies to determine the dose-response effects of different types of yoga on HRQOL and MWB and minimally important thresholds for improvement are needed.

1606 Board #200 May 28 10:30 AM - 12:00 PM
A Meta-analysis Of The Acute And Chronic Effects Of Exercise Training On Paraoxonase-1 (PON1)
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Paraoxonase 1 (PON1) is a high-density lipoprotein (HDL) - associated enzyme primarily responsible for the anti-atherogenic properties of HDL. However, a lack of consensus exists regarding the effects of exercise training on PON1 concentration and activity. PURPOSE: Determine the acute and chronic effects of exercise training on PON1 concentration and activity. METHODS: A literature search was performed in 123681 and Spanish language using 16 keywords: “exercise”, “training”, “exercise training”, “PON1”, “paraoxonase”, “paraoxonase-1”, “paraoxonase 1”, “aerobic”, “resistance”, “training”, and “concurrent”. Experimental studies in adults 18 years of age and older were included. Dual selection and data abstraction were conducted. Results were pooled using the random-effects model. Effect sizes (ES) were computed and two-tailed alpha values <0.05 and non-overlapping 95% confidence intervals (95CI) were considered statistically significant. Statistical heterogeneity (Q) and inconsistency (I²) were examined as well as small-study effects using the Doi plot and LFK index. RESULTS: Seventeen studies representing 360 participants met the criteria for inclusion. The acute effects of exercise on PON1 concentration were trivial and non-significant (ES = −0.03, 95% CI, −0.39 to 0.36, p>0.05), but moderate change (I² = 17.22, p=0.05), moderately inconsistent (I² = 48%), with minor asymmetry (LFK index = 1.34). The chronic effects of exercise on PON1 concentration were also trivial and non-significant (ES = −0.04, 95% CI, −0.53 to 0.45, p>0.05), homogeneous (Q = 0.85, p=0.05), displayed low inconsistency (I² = 0%), and minor asymmetry (LFK index = -1.14). The acute effects of exercise on PON1 activity were trivial and non-significant (ES = 0.11, 95%CI = −0.02 to 0.24, p>0.05), homogeneous (Q = 18.58, p=0.05), showed low inconsistency (I² = 0%), and no asymmetry (LFK index = 0.82). The chronic effects of exercise on PON1 activity were small but significant (ES = 0.39, 95%CI = 0.23...
0.01 to 0.77, p<0.05), homogenous (Q = 6.43, p = 0.17), moderately inconsistent (I² = 38%), with no asymmetry (LEF index = 0.94). CONCLUSION: Exercise training, overall, exerted a trivial effect on PON1 while chronic exercise had a small but more pronounced effect on PON1 activity. Additional research is needed before any firm conclusions can be drawn.

1607 Board #201 May 28 10:30 AM - 12:00 PM The Economic And Social Impact Of Leisure Centre Membership Across Spain: A Preliminary Analysis Xian Mayo1, Jesus J. De Soto-Cardenal2, Pablo Bascones-Illundai3, Maria Ayuso1, Alejandro Lopez-Valenciano1, Gary Liguori, FACSMM, Alfonso Jimenez2. 1King Juan Carlos University, Madrid, Spain. 2PVc Spain, Madrid, Spain. 3GO fit LAB, Alicendans, Spain. 4University of Rhode Island, Kingston, RI. Email: xian.mayo@urjc.es (No relevant relationships reported)

An active behavior is associated with a range of positive social outcomes. Accordingly, the Global Action Plan on physical activity 2018-2030 (World Health Organization, 2008) indicates that the guiding principle of the implementation of the policy action should be based on the active evaluation of impact. PURPOSE: To analyze the 2017 economic and social impact in international Dollar (INTS) of GO fit, the largest leisure center operator in Spain, with 18 facilities and more than 200,000 members.

METHODS: The Social Return on Investment (SROI) was estimated from 114,000 active members, with data collected through the access control of each individual. The SROI is a framework for measuring and understanding non-market economic and social values produced by an organization. For this analysis, reductions in physical and mental health spending, absenteeism costs, disability-adjusted life years avoided, and increases in subjective wellbeing were studied, considering the prevalence of main illnesses and quantifying the annual healthcare cost of an inactive Spanish person.

RESULTS: For the year 2017, GO fit generated more than $378 million of social impact. This includes $27 million on health care savings spending ($23 million in physical illness and $4 million in mental illness), $9 million in savings related to reducing workplace absenteeism, and $87 million derived from the maintained productivity capacity as a result from the disability-adjusted life years prevented. Additionally, $255 million were generated due to improvements in subjective wellbeing among GO fit members. As a positive consequence of this, GO fit contributes to generating benefits among its members valued at $3.17 for every INTS of turnover.

CONCLUSIONS: An extensive economic and social impact is attributable to the active behavior of GO fit members, indicating the critical role that leisure centers have in improving wellbeing and tackling a myriad of community-level social threats. Examples of this are helping to reduce health care spending, increasing subjective wellbeing, and increasing years without disability. Considering these findings, policymakers should account for leisure centres as an ally in the public health agenda.

1608 Board #202 May 28 10:30 AM - 12:00 PM The AHA’S 7 Health Metrics And Chronic Disease Mortality In Patients With CHD, Stroke, And Cancer Chong-Do Lee, FACSMM, Samuel Lee2. 1Arizona State University, Phoenix, AZ. 2Arizona State University, Tempe, AZ. (No relevant relationships reported)

PURPOSE: The impact of the AHA’s 7 health metrics on mortality risks from chronic disease in patients with CHD, stroke, and cancer remains less explored. We investigated the association between AHA’s 7 health metrics and chronic disease mortality in patients with CHD, stroke, and cancer.

METHODS: We followed 8,021 men and women, aged 20 to 85 years, who participated in the National Health and Nutrition Examination Survey (1988-1994 and 1999-2014). All participants completed baseline health factors, lifestyle behavior questionnaires, and a personal history of CHD, stroke, or cancer at baseline. The AHA’S 7 ideal health metrics were defined as untreated blood pressure, untreated total cholesterol, untreated fasting glucose, physically active, never smoked, a healthy diet, and normal body weight. We further categorized these variables as having 0, 1, 2, 3, 4, or 5 or greater combined ideal health metrics. We also categorized patients as having 1, 2, or 3 combined history of CHD, stroke, and cancer at baseline. Cox proportional hazards regression was used to investigate the associations of a combined number of ideal health metrics across persons who suffer from CHD, stroke, or cancer.

RESULTS: During an average of 6.6 years of follow-up (53,179 person-years), there was a total of 1,420 chronic disease deaths. After adjustment for multiple risk factors, a total of 1,420 chronic disease deaths. After adjustment for multiple risk factors, the hazard ratios (95% CI) across 0 (reference), 1, 2, 3, 4, or 5 or greater combined ideal health metrics. Men and women with 2 or 3 combined CHD, stroke, or cancer at baseline had 1.48 (1.30, 1.68) and 2.08 (1.57, 2.75) times the risk of chronic disease mortality compared with men and women with 1 combined CHD, stroke, and cancer at baseline (p for trend <0.001).

CONCLUSIONS: The AHA’S 7 ideal health metrics are associated with a lower risk of chronic disease mortality in men and women with a personal history of CHD, stroke, or cancer. The AHA should recommend maintaining AHA’S 7 ideal health metrics across persons who suffer from CHD, stroke, or cancer.

1609 Board #203 May 28 10:30 AM - 12:00 PM Cardiometabolic Characterization Of People Living With HIV Seeking Treatment In The South Texas Region Norberto Quiles1, Alexis Ortiz, FACSMM, Christian Lira2, Helen Fleck3. 1Queens College of the City University of New York, Flushing, NY. 2University of The Incarnate Word, San Antonio, TX. 3University of Texas Health San Antonio, San Antonio, TX. (Sponsor: Alexis Ortiz, FACSMM)

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PURPOSE: To characterize the cardiometabolic profile of people living with HIV (PLWH). We hypothesized that a majority of PLWH would have 3 or more cardiometabolic risk markers. METHODS: A large dataset from electronic medical records (EMR) of PLWH seeking care at several public health care institutions was used for this investigation. 200 PLWH from the South Texas Region were included. We identified cardiometabolic risk markers from the EMR system to characterize the cardiometabolic profile of PLWH in the region. The cardiometabolic variables considered were: cholesterol (≥ 200 mg/dL), triglycerides (TG) (≥ 150 mg/dL), glycated hemoglobin (HbA1C) (≥ 6.5%), body mass index (BMI) (≥ 30 kg/m²), and blood pressure (SBP ≥ 140 mmHg / DBP ≥ 90 mmHg). Demographic variables retrieved from the EMR were: height (in), weight (lbs), age (yrs), gender (M/F), race, viral load (copies/mL), and CD4+ T-cell percentage (%CD4). We identified the first encounter as representation of the initiation of care. Descriptive statistics such as percentages, means, standard deviations (SD) or ranges were calculated for all variables.

RESULTS: The sample was comprised of 35% Hispanics and 65% Non-Hispanics, primarily Caucasians (75%) and Black (19%). Approximately 77% classified themselves as men. Age, weight, and height were 49.88 ± 12.2 y; 171.9 ± 44.3 lbs; 67.4 ± 3.8 in, respectively. %CD4 and viral load were 28 ± 10.5 % and 27,102 ± 102,813 copies/mL, respectively. On average, the values of the cardiometabolic risk markers were borderline high: HbA1C=6.7 ± 1.84% (range: 4-13); TG=190 ± 156 mg/dL (range: 37-1,099); cholesterol=177 ± 42.7 mg/dL (range: 80-362); SBP=129.9 ± 17.2 mmHg (range: 92-187); DBP=78.2 ± 11.8 mmHg (range: 52-117); BMI=29.5 ± 7.4 kg/m² (range: 21-53). However, after evaluating the range of values of the sample, close to 50% of PLWH had elevated values in at least 3 of the cardiometabolic risk markers. CONCLUSIONS: PLWH in the South Texas region exhibit an elevated cardiometabolic risk profile. Due to the greater morbidity and mortality in PLWH with cardiometabolic disease, early intervention is imperative. Exercise professionals should be included as part of the healthcare team at the initiation of care to improve the cardiometabolic profile of PLWH.

1610 Board #204 May 28 10:30 AM - 12:00 PM Effect Of Traditional And Non-traditional Pre-sporting Activities On Perceived And Actual Motor Competence Pamela Salazar-Cruz1, Judith Jiménez-Díaz2,3, María Morera-Castro1, Manrique Rodríguez-Campos1, Universidad de Costa Rica, Heredia, Costa Rica. 3Universidad Nacional de Costa Rica, Heredia, Costa Rica. (Sponsor: Luis Fernando Aragón-Vargas, FACSMM, FACSMM)

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Previous research has analyzed the effect of motor interventions (MI) on perceived motor competence (PMC) and actual motor competence (AMC) on children and adolescents. No research had focused on pre-sporting activities (PSA) as part of MI. PURPOSE: To analyze the effect of traditional and non-traditional PSA on PMC (perceived locomotion [PL], perceived object control [POC], perceived gross motor [PGM], and global PMC [GPMC]) and AMC skills (locomotion [L], object control [OC], gross motor [GM]) on elementary boys and girls. METHODS: 72 children from fourth grade of elementary school (mean age 9 ± 0.6 yrs. old) had their parents’ authorization and volunteered to participate in the study. Four treatments were randomly assigned to four intact classes: traditional PSA (T), non-traditional PSA (NT), combined PSA (C), and control group (CG). The intervention consisted of 7 sessions of 60 minutes each, once per week. T group (n=18) received track and field and gymnastics PSA; NT group (n=18) received track and field and gym PSA; C group (n=15) received PSA of the four sports, and CG (n=18) had no physical education. PMC was assessed with the Pictorial Scale for Perceived Movement Skill Competence for Young Children; while AMC was assessed with the Test of Gross
RESULTS: A two-way ANOVA (groups by measurements) showed no significant results for POC (M±SD values for pretest: T: 3.3±0.4, NT: 3.3±0.5; C: 2.99±0.6, CG: 3.1±0.4, and posttest: T: 3.3±0.5, NT: 3.2±0.6, C: 3.2±0.4, CG:3.2±0.4) nor PGM (M±SD values for pretest: T: 3.1±0.4, NT: 3.1±0.4, C: 3.0±0.5, CG: 3.0±0.3) and posttest [T: 3.2±0.5, NT: 3.2±0.3, C: 2.99±0.4, CG: 3.1±0.3]. PL, GPMC, L, OC, and GM did not show normal distribution, therefore a one-way ANCOVA (4 groups; pretest as co-variable) was used. The ANCOVA revealed that the three experimental groups (T: 3.9±1.8, NT: 3.5±2.0, C: 4.3±2.1) had significantly higher scores at posttest than the CG (1.1±0.4) in OC. No significant differences were found between groups at posttest for L (T: 4.9±1.7, NT:4.9±1.7, C:4.4±1.9, CG:2.3±1.3), GM (T: 8.6±1.9, NT: 7.8±1.3, C: 9.0±1.3, CG: 3.5±1.4), PL (T: 3.2±0.6, NT: 3.1±0.5, C: 3.0±0.5, CG:3.2±0.4), and GPMC (T: 3.0±0.5, NT: 3.0±0.3, C:3.0±0.4, CG:3.0±0.3). CONCLUSION: Traditional and non-traditional PSA can be used to enhance OC in fourth graders.

Purpose: Recognized by law in 2016, the prescription of PA for people with NCDs is promoted and implemented by the regional state sports and health offices. The “Prescri’forme” plan aims to increase the use of PA as non-drug therapy for NCDs. Based on the implementation of the Ile-de-France program and its surrounding context, the objective of this evaluation was to identify the obstacles and benefits related to the integration of PA into the healthcare system of patients with NCDs. Methods: Through the review of the scientific literature, institutional reports, and grey literature on the recognition and development of PA within public health policy, 21 semi-directed interviews identified challenges and difficulties in the implementation of the “Prescri’forme” plan. Particular attention was given to the changes currently happening within the organisation of the healthcare system, in order to propose a method to integrate PA into the healthcare system for patients with NCDs. Results: The deployment of the plan is still in progress, with its advances varying based on location, affected largely by the maturity of the PA prescription-practice systems already in place and the strength of the links established between the actors. For example, a program to provide support and guidance for the prescription and supervision of adapted PA. In Ile-de-France, local coordination is gradually being established. At a regional level, there is a lack of support for steering the system, particularly to gather data from patient follow-up visits in order to demonstrate more robustly the value of integrating PA into the care of these patients. In addition, a regional level of coordination would provide a space for exchange between actors involved in promoting PA as part of the healthcare system. Conclusion: To strengthen the legitimacy of PA in the care of patients suffering from NCDs, it is necessary to link PA prescription systems with organizational changes already in progress in the healthcare system. The desire to provide a flat-rate coverage for NCDs represents an opportunity to propose models of a healthcare system that integrates PA. These models must demonstrate the benefits of these programs in terms of public health, medicine, and economics, whilst also responding to the challenges around prescription pricing and PA dispensation.
concentrations. Glucose concentrations were measured with the colormetric glucose assay (CV = 6.22% ± 3.36). Insulin concentrations were measured with an ELISA, CV = 5.21% ± 3.19. Insulin resistance was calculated utilizing the homeostatic model assessment of insulin resistance (HOMA-IR). RESULTS: Participants averaged 8.6 ± 1.6 h/day of SB, had a fasting glucose concentrations 80.6 ± 10.2 mg/dL, fasting insulin of 1.8 ± 2.1 μU/L, HOMA-IR of 0.5 ± 0.9, and an average PWV of 7.8 ± 1.38 m/s. Two regression analyses were conducted: SB did not significantly predict IR, F(1, 57) = 949.9, R² = 0.89, nor PWV, F(1, 57) = 2.597, p = 0.044. CONCLUSION: Healthy individuals who meet PA guidelines of at least 150 minutes of moderate-vigorous intensity per week is not expected to develop insulin resistance or excessive arterial stiffness even when averaging 8.6 ± 1.6 h of SB/day. The benefits of PA remain intact even when healthy, middle-aged adults have sedentary jobs or spend more than half of their wakeful day in a reclined or seated position. PA guidelines, therefore, should remain a solid benchmark goal for those who participate in 8 or more hours of sedentary behaviors per day and may be the negating catalyst for the development of type 2 diabetes and/or cardiovascular diseases.

### Table 1: Multivariate linear regression with PAL as continuous variable (METs/min/week)

<table>
<thead>
<tr>
<th>Variable</th>
<th>β</th>
<th>SE</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
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<td>9.9</td>
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</tr>
<tr>
<td>BMI (kg/m²)</td>
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<td>17.6</td>
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<td>Gender</td>
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<td>191.4</td>
<td>0.19</td>
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<td></td>
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<tr>
<td>Rank</td>
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<td>5.1</td>
<td>0.15</td>
</tr>
<tr>
<td>Educational level</td>
<td>381.1</td>
<td>134.7</td>
<td>0.005</td>
</tr>
<tr>
<td>QoL, Physical domain</td>
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<td>5.8</td>
<td>0.33</td>
</tr>
<tr>
<td>QoL, Psychological domain</td>
<td>12.8</td>
<td>5.6</td>
<td>0.02</td>
</tr>
</tbody>
</table>

| Role: | field or administrative; | rank: | officer or enlisted; | educational level: | ≤secondary or ≥higher; | QoL: | quality of life |

Police officers (PO) need to engage in training and duty activities in which one’s performance might be affected by their physical activity level (PAL).

**Purpose:** To evaluate predictors of PAL among Brazilian military law enforcement personnel.

**Methods:** We performed a cross-sectional study of 418 volunteers, recruited by convenience in a state of the PAL was calculated using the IPAQ-questionnaire as the sum of total min/week of walking (3.3 METs), moderate (4.0 METs), and vigorous (6.0 METs). The effect of independent variables on the PAL, as a continuous outcome, was first assessed using simple linear regression. Variables that had a p-value between 0.2, namely, BMI, gender, role, rank, partner status, educational level and the 4 domains of quality of life (QoL) assessed by WHO QoL questionnaire, were included in the final multivariate regression model.

**Results:** The majority of the volunteers were men (88%) with an average age of 38.6 ± 6.6 years. Average BMI was 26.5 ± 3.4 kg/m² with 16% of the participants being obese (BMI ≥ 30 kg/m²). Two regression analyses were conducted: SB did not significantly predict IR, F(1, 57) = 949.9, R² = 0.89, nor PWV, F(1, 57) = 2.597, p = 0.044. CONCLUSION: Healthy individuals who meet PA guidelines of at least 150 minutes of moderate-vigorous intensity per week is not expected to develop insulin resistance or excessive arterial stiffness even when averaging 8.6 ± 1.6 h of SB/day. The benefits of PA remain intact even when healthy, middle-aged adults have sedentary jobs or spend more than half of their wakeful day in a reclined or seated position. PA guidelines, therefore, should remain a solid benchmark goal for those who participate in 8 or more hours of sedentary behaviors per day and may be the negating catalyst for the development of type 2 diabetes and/or cardiovascular diseases.

The physical activity (PA) guidelines for Americans 2 Ed. recommend children and adolescents (6-17 years old) to engage in at least 60 min/day of moderate-to-vigorous PA (MVPA). However, it is common to report that participants meet guidelines when they average 60 min/day of MVPA instead of 60 min daily as recommended. PURPOSE: To determine if there were differences in health status (high-density lipoprotein cholesterol (HDL), total cholesterol (TC), triglycerides (TRG), BMI, and diastolic and systolic blood pressure (DBP, SBP) between children and adolescents that engage in MVPA for an average of 60 min/day (group 1) or 60 min daily (group 2). METHODS: Data from 724 (Group 1 = 371, Group 2 = 353) children and adolescents (aged 6-17 yrs) that had ≥6 valid days of accelerometer data from the 2003-2006 National Health and Nutrition Examination Survey (NHANES) were included in this analysis. One-Way ANOVA was used to compare mean values between the 2 groups for all measures and ANCOVA was used to control for covariates.

**Results:** Mean MVPA (82±20 and 128±37 min/day, age (10.3 and 8.2 years) and BMI (19.4 and 17.3 Kg/m²) were significantly different between groups (p<.001). However, HDL (57±12 and 59±13 mg/dL, p=0.10), TC (165±30 and 162±29 mg/dL, p=0.23), TRG (77±31 and 78±47 mg/dL, p=0.89), SBP (103±10 and 101±10 mmHg, p=0.08), and DBP (53±14 and 53±14 mmHg, p=0.70) were not different. When variables were adjusted for age and gender, no significant mean differences were found for BMI (p=0.21), and other health measures. CONCLUSION: Although there were mean differences in MVPA between children and adolescents that engage in MVPA an average of 60 min/day or 60 min daily, there were no significant health differences. More studies are needed to confirm these initial findings leading to a possible change in the wording of the guidelines.

**Purpose:** To compare physical activity, sedentary behavior, BMI, and anxiety in “gamers” versus “non-gamers.”

**Methods:** College students (N=337, 20.9±1.81 years old) at a public university in the American Midwest completed a questionnaire that assessed demographics, gaming habits (reported whether or not they identified as a “gamer” and min/week of video game play), physical activity and sedentary behavior (via the International Physical Activity Questionnaire), and anxiety (via Beck’s Anxiety Inventory). A Multivariate Analysis of Variance (MANOVA) was conducted comparing these aforementioned variables in “gamers” versus “non-gamers.”

**Results:** As expected, “gamers” (n=60, 19.9±1.81 min/week) allocated significantly (p<0.001) more time to gaming than “non-gamers” (n=226, 67±124 min/week). “Gamers” also participated in significantly (p<0.042) less vigorous (217±282 min/week), light
(634±704 min/week) and total physical activity (4938±4111 MET min/week) than “non-gamers” (296±325 min/week vigorous, 980± 012 min/week light, and 6849±5260 MET min/week total). “Gamers” (4296±1854 min/week) allocated significantly (p=0.001) more time to sedentary behavior than “non-gamers” (3316±1581 min/week). Lastly, there were no differences (p=0.29) between “gamers” and “non-gamers” for BMI, moderate intensity physical activity, or anxiety. CONCLUSION: College-aged individuals who self-identified as “gamers” had a >13 fold greater amount of weekly video game play than “non-gamers.” This robust difference in time allocated to gaming was associated with lower vigorous, light, and total physical activity and greater sedentary behavior in “gamers” versus “non-gamers.” This is concerning as inadequate physical activity and elevated sedentary behavior are independent risk factors for cardio-metabolic disease.

1618 Board #212 May 28 10:30 AM - 12:00 PM
The Associations Of Objectively Measured Physical Activity With Exercise Capacity And Health-related Quality Of Life In Patients With Congenital Heart Disease
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Although self-reported moderate to vigorous physical activity (MVPA) levels and exercise capacity are associated with various health parameters, the relative contributions of objectively measured MVPA levels and exercise capacity to health-related quality of life (HRQoL) remain unclear in patients with congenital heart disease (CHD). PURPOSE: This study examined the independent associations of objectively measured MVPA and exercise capacity with HRQoL in patients with CHD.

METHODS: Eighty-two Korean patients with CHD (19.3±1.9 years, 21.7±3.7 kg/m²) who visited an outpatient clinic were consecutively recruited to participate in this study. Objectively measured MVPA levels were assessed using the accelerometer (GENEActiv) worn on the wrist for seven consecutive days. Exercise capacity (EC) was directly measured by peak oxygen uptake (VO2peak) using progressive, symptom-limited maximal treadmill exercise testing to volitional fatigue. HRQoL was evaluated using the PedsQLTM 4.0 Generic Core Scale questionnaire.

RESULTS: In a univariate correlational analysis, objectively measured MVPA was positively correlated with EC (VO2peak) (r=0.31, p=0.024) and HRQoL (r=0.21, p=0.048). When both variables were entered into the same regression models, EC, but not objectively measured MVPA (r=0.08, p=0.553), was independently associated with HRQoL (r=0.348, p=0.016). In the mediation analysis, exercise capacity showed a mediating effect in the association between objectively measured MVPA and HRQoL (z=1.973, p=0.048). CONCLUSIONS: These findings suggest that objectively measured MVPA levels and EC were associated with better HRQoL, but the association between objectively measured MVPA and HRQoL was fully mediated by EC, highlighting the importance of improving exercise capacity to potentially enhance quality of life in patients with CHD.

1619 Board #213 May 28 10:30 AM - 12:00 PM
Abstract Withdrawn

1620 Board #214 May 28 10:30 AM - 12:00 PM
Impact Of Sports Participation On Healthcare Costs: Findings From A Brazilian Longitudinal Study
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PURPOSE: To identify the potential impact of sports participation on healthcare costs among Brazilian adults. METHODS: The sample was composed of 620 adults (166 males and 454 females) aged 50 years or older followed from 2010 to 2014 in the city of Bauru, Sao Paulo, Brazil (FAPESP Research Project). Physical activity was assessed using a questionnaire (Baekke et al. Am J Clin Nutr, 1982 [face-to-face interview]) and subjects were stratified according to the engagement in sports in leisure-time (180 minutes/week over the last four months) as: Engaged (n= 99) and Non-engaged (n= 521). Annual healthcare costs covered by the Brazilian National Health Service were assessed from 2010 to 2014 (in US dollar [US$]), including expenditures with medicine, appointments and exams. Analysis of covariance (ANCOVA) adjusted by sex, age and body mass index compared monetary values between the two groups, while statistical significance (p-value) was set as p-value lower than 0.05 and effect-size was expressed using eta-squared values. RESULTS: From 2010 to 2014, the amount of money spent by these 620 adults accounted US$ 207,175.00. Adults engaged in sports spent less with healthcare services (US$ 260.61 [95%CI: 184.09 to 337.14]) than their counterparts (US$ 348.12 [95%CI: 315.01 to 381.23]). The magnitude of the difference was small (eta-squared= 0.007 [0.7%]), but significant (p-value= 0.040). CONCLUSIONS: Sports participation was a determinant factor on decreasing the expenditure with healthcare services among Brazilian adults. This finding highlight the importance of public health actions promoting healthy behaviors aiming the prevention of harmful health outcomes and reduced healthcare costs, especially in countries with unified health systems.

1621 Board #215 May 28 10:30 AM - 12:00 PM
Limitations In Knowledge And Practice Of Healthy Lifestyle Guidelines In A Sample Of Australian Adults.
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(Purpose related notes)

PURPOSE: Cardiovascular disease (CVD) is the leading cause of death in Australia. Physical activity (PA), optimal sleep, ample fruit/vegetable consumption, reduced screen time, limited alcohol consumption and not smoking are all protective against CVD, however, evidence shows that knowledge of Australian health guidelines and engagement in healthy behaviors is less than sufficient. We aimed to identify knowledge and engagement in 6 lifestyle behaviors in a convenience sample of Australian adults.

METHODS: Australian adults (>18 years) were invited through social media to complete an online anonymous survey via Survey Monkey assessing healthy lifestyle behavior choices and knowledge of Australian health guidelines. Data were reported as means and standard deviation or percentages. Simple linear regressions were performed to identify any significant associations between knowledge and practice.

RESULTS: Australian adults (n=219; 69% female; M=30±14; range 18-73) completed the survey. Only 26% of the sample knew and self-reported BMI (M=23.00±5.7) and only 32% of the sample reported their health as very good or excellent. Correct knowledge of individual health guidelines was 67% PA, 61% sleep, 42% fruit and 41% vegetable consumption, 30% screen time, and 29% alcohol, of which 30%, 84%, 23%, 16%, 21%, 53% met the guidelines respectively. Eighty percent of the sample reported smoking as harmful; however, only 28% of the sample had not smoked in the prior 6 months. Alarming, on average participants reported spending 8.6±4.2 hours/day watching a screen and sat for 8.4±3.6 hours/day. Knowledge of the guidelines was associated with adherence to the guidelines for moderate PA (r=0.22, p<0.01), sleep (r=0.15, p=0.04) and fruit (r=0.41, p<0.01) and vegetable (r=0.38, p<0.01) intake.

CONCLUSIONS: On average, less than 50% of this sample of the Australian adult population are aware of the national guidelines for 4 out of 6 healthy lifestyle behaviors and less than 30% meet the national health guidelines for PA, screen time and fruit/vegetable consumption. Moreover, greater than 70% of the sample have smoked or tried smoking in the past 6 months. More research is needed to identify ways to not only increase Australians become more aware of the individual health behavior guidelines but also to improve healthy lifestyle choices.

1622 Board #216 May 28 10:30 AM - 12:00 PM
Barriers To The Practice Of Physical Activity Among Adults According To Socioeconomic Status In Chile
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(Purpose related notes)

PURPOSE: to identify personal and environmental barriers for physical activity practice and the stage of change in residents of communities with three different socioeconomic status (SES)

METHODS: Cross-sectional analytical study. Three communes of the city of Santiago de Chile with high, medium and low SES were selected. The stage of behavior change was determined with the “Physical Activity Stages of Change Questionnaire” and the barriers for physical activity practice through the “Barriers to Being Active Quiz”. The precontemplation, contemplation and preparation stages were grouped as inactive state, and the action, maintenance as active state. The barriers were compared between communes and associated with the inactive state with a multivariate regression.

RESULTS: 296 participants were surveyed, age 49 (P= 0.47, 75–77) years 60.1% women. In an inactive state, 48.5% in high SES, 60% in medium SES and 63.1% in low SES. The most prevalent barrier to physical activity according to SES was: lack of...
time for high SES (74.2%); lack of will for medium SES (62%) and lack of resources for low SES (59.2%). The lack of skills is the only barrier that presents a significant difference p < 0.05 among the communes. 31.8% high SES, 46% medium SES and 19.2% low SES. The lack of skills presented an OR 1.15 (1.02-1.31) p = 0.025 for the inactive state in a multivariate analysis.

CONCLUSIONS: the barriers to practice physical activity differ according to SES and can be a guide for personal and environmental interventions. Overcoming the lack of skills barrier could increase the active subjects.

1623 Board #217 May 28 10:30 AM - 12:00 PM
Associations Of Occupational And Leisure-time Physical Activity With Cardiovascular Disease
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(No relevant relationships reported)

PURPOSE: Emerging evidence describes opposing effects of occupational and leisure-time physical activity (LTPA) on cardiovascular health although little research has been done in the U.S. This analysis examines cardiovascular disease (CVD) prevalence associated with occupational physical activity and LTPA in a nationally representative U.S. sample. METHODS: This is a cross-sectional analysis of the 2015 National Health Interview Survey (NHIS) data and its occupational health supplement from the National Institute for Occupational Safety and Health (NIOSH) (n=19,429). Logistic regression estimated the odds of self-reported composite CVD (coronary heart disease, heart attack, stroke, or angina) with self-reported total occupational activity (TOA), occupational exertion (OE), occupational standing (OS), and LTPA. Occupational activity was measured using two questions: "How often does your job involve repeated lifting, pushing, pulling, or bending?" (OE) and "How often does your job involve standing or walking around?" (OS) where participants responded to a 5-item Likert scale (0=Never, 4=Always). Total occupational activity (TOA) was categorized similarly after summing the individual OE and OS scores. LTPA was defined as three categories: 0, 1-149, or ≥150 minutes/week of reported moderate-to-vigorous activity. Additional analyses were stratified by sex, smoking status, and LTPA level. All models were adjusted for age, sex, race/ethnicity, smoking status, alcohol consumption, family income, body mass index, education, U.S. nativity, LTPA, and TOA. RESULTS: "Always" performing TOA, OE, and OS was associated with higher odds of CVD, compared to "never" (OR=1.65, p=0.026, OR=1.63, p=0.003, and OR=1.56, p=0.031, respectively). LTPA level was not associated with odds of CVD (p=0.05). Associations of high OE with CVD outcomes were equally apparent in females and males and stronger in lower LTPA levels. Associations between TOA, OE, and OS with CVD were stronger in the sample restricted to never smokers. CONCLUSIONS: While LTPA was not associated, individuals with higher TOA, OE, and OS had higher rates of CVD. While uncontrolled confounding is still possible even after adjustment, the seemingly paradoxical associations with occupational activity and CVD should be investigated further.

1624 Board #218 May 28 10:30 AM - 12:00 PM
Menstrual Cycle Symptoms In 6,812 Exercising Women And The Development Of A Novel Symptom Score
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(No relevant relationships reported)

PURPOSE: More than half of athletes report detrimental effects on exercise caused by their menstrual cycle. However, the specific menstrual cycle symptoms experienced by exercising women, and a means to quantify occurrence and prevalence of symptoms is lacking. Therefore, we aimed to: identify the most common menstrual cycle symptoms experienced; devise a way to quantitate symptoms; and to ascertain the impact of that they have on both exercise and work behaviours. METHODS: 6,812 women using an exercise tracking app of a reproductive age who were not using combined hormonal contraception from 7 geographical regions (Brazil, n=1,288; France, n=1,911; Germany, n=1,178; Spain, n=1,204; UK & Ireland, n=2,311; and USA, n=2,479) completed a 39-part questionnaire, translated and localised to each geographical region. The questionnaire captured current and previous exercise behaviours; current menstrual status; the presence of, and frequency of symptoms; use of medication for symptoms; effects of the menstrual cycle on exercise and work behaviours; and hormonal contraception use. A menstrual cycle symptom score (MCSS) was defined based on the presence and frequency of 18 commonly experienced menstrual cycle symptoms. RESULTS: The most frequent symptoms reported included mood changes/anxiety (90.6%), tiredness/fatigue (86.2%), stomach cramps (84.2%), and breast pain/tenderness (83.1%). Participants in Germany and France had a significantly lower MCSS and reported fewer MCSS than those in Spain, the UK & Ireland, the USA and Brazil (p<0.05). After controlling for BMI, training volume and age, those participating in running (p=0.038), swimming (p=0.033), cycling (p=0.001), team sports (p=0.027), racket sports (p=0.010), and dance (p=0.001) had a lower MCSS. While participation in gym-based activities (p=0.023) and weight training (p=0.005) were associated with a higher MCSS. Total MCSS was correlated with a greater need to miss or change training (r=−0.44, p<0.0001) and work/academic absences (r=−0.31; p<0.0001). CONCLUSIONS: Menstrual cycle symptoms are common in exercising women and can have a detrimental effect on elements of health and wellbeing. The derivation of a MCSS enables an easy way to quantify menstrual cycle symptoms. Future research needs to investigate risk factors and non-pharmacological treatment options.

1625 Board #219 May 28 10:30 AM - 12:00 PM
Gender As A Determinate Of Exercise Type Preference
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(No relevant relationships reported)

Regular physical activity decreases the risk for many diseases such as obesity, stroke, osteoporosis, type 2 diabetes, and certain types of cancer. Garber and colleagues (2011) found that the health benefits from exercise depend not only the duration and amount of exercise but also on the type of exercise, indicating that cross training athletes experience the most benefits. Despite health benefits of cross training many athletes tend to stick to either aerobic or weight training regimens. To investigate the predictability of gender differences on type of exercise equipment preference at one university gym. Methods: A small gym with both cardiovascular and weight training equipment, easily observable from a single concealed location, was selected. Two pairs of observers each collected data, participants were assigned as the first 25 people (n females, n males) to walk into the exercise area from the locker rooms or stairwell. Participants were coded as participating in either cardiovascular exercise, strength training exercise, or both and were observed until they left the gym. This process was repeated on different days at varying times for a total n=150. A Chi-square analysis was used to determine correlation of gender and exercise type. Results: Pairs of observers demonstrated inter-rater reliability on the “exercise type” measure; Pair 1, gamma=1; Pair 2, gamma=1. The overall sample size for this study was N=150 (female n=68, male n=82). The female participants showed a preference for cardiovascular exercise with n=40 participating in cardiovascular exercise only. Male participants showed a preference for strength training exercise with n=48 completing exclusively strength training while n=15 participated in cardiovascular training only. Both males and females had similar amounts of cross training with 19 of the men and 14 of the women participating in this type of exercise. The study revealed a significant predictive relationship between gender and exercise type completed p = 5.13x10^-6 Conclusion: Gender is a predictive factor of the type of exercises and equipment individuals use in a college campus gym setting. This information may be beneficial when prescribing exercise regimes and educational programs on health benefits of exercise and further investigating social determinants of health.

1626 Board #220 May 28 10:30 AM - 12:00 PM
Associations Of Lifestyle Behaviors With Body Mass Index In Adolescents: A Quantile Regression Analysis
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(No relevant relationships reported)

PURPOSE: The purpose of this study was to examine the associations between lifestyle behavior variables such as physical activity, television watching, computer use, and school night sleep duration with Body Mass Index percentile (BMI%) using quantile regression within a representative sample of adolescents who completed the 2017 US National Youth Risk Behavior Survey (YRBS). METHODS: A multi-stage cluster sampling procedure obtained a representative sample of US adolescents. The target population consisted of public and private high schools from grades 9 through 12. The number of sampled adolescents submitting questionnaires with BMI% data was 13,146. To examine the associations between lifestyle behaviors and BMI%, simultaneous quantile regression was employed. Relationships were modeled at 10 percentile increments and examined independent variables on the continuous measurement scale to determine how the parameter estimates (b-coefficients) vary across percentiles. Post hoc analysis involved modeling the relationships across BMI%’s interquartile range, specifically at the 25th, 50th, and 75th percentiles, in addition to using independent variables treated on the categorical measurement scale.
RESULTS: When relationships were modeled at every 10 percentile, more precise parameter estimates were observed at higher percentiles. Across the interquartile range, physical activity associated with lower BM% at the 50th and 75th percentiles \( (b_\text{50th} = -2.27\% \text{ to } -5.24\%, p<0.05) \), television watching associated with higher BM% at the 25th to 75th percentiles \( (b_\text{25th} = -2.92\% \text{ to } 4.16\%, p=0.05) \), sleep durations less than 8 hours per school night associated with higher BM% at the 25th and 50th percentile \( (b_\text{25th} = -2.81\% \text{ to } 8.26\%, p<0.05) \), and 10 or more hours of school night sleep associated with higher BM% at the 50th and 75th percentile \( (b_\text{50th} = -3.43\% \text{ to } 7.53\%, p<0.05) \). CONCLUSIONS: Higher levels of physical activity associated with lower BM% and longer time watching television, school night sleep durations less than 8 hours, and school night sleep durations of 10 hours or more at higher quantiles associated with higher BM% in adolescents. Estimates of association were more precise within higher percentiles.

1627 Board #221 May 28 10:30 AM - 12:00 PM Occupational Sitting And Work Engagement Among University Faculty And Staff Raymond Jones, Daniel P. Credeur, Stephanie M. McCoy. University of Southern Mississippi, Hattiesburg, MS.

Email: raymondjones@usm.edu (No relevant relationships reported)

Acute periods of sedentary behavior, particularly uninterrupted sitting, can negatively affect physiological outcomes (e.g., reduction in blood flow, endothelial dysfunction, and arterial stiffness) related to cardiovascular disease development. This is of importance, given that many occupations require their employees to sit for extended periods of time (i.e., 6-8 hours). For example, evidence suggests that university employees spend a majority of their time sitting; however, little is known about the relationship between sedentary behavior and work engagement in this population. PURPOSE: To determine the relationship between occupational sitting and work engagement among university employees. METHODS: Participants included 103 university employees (mean age 48.5±10.4 years, 80% female, 77% staff), who completed an online survey based on the Urrecht Work Engagement Survey (UWES) and the Occupational Sitting and Physical Activity Questionnaire (OSPAQ). The UWES assessed elements of work engagement (vigor, absorption, dedication) and workplace well-being. The OSPAQ assessed time spent sitting, standing, walking, and in heavy labor during a typical workday in the previous 7 days. RESULTS: Compared to staff members, faculty members self-reported less time seated during the workday (373.8±109.7 min/day vs. 321.1±97.3 min/day, p=0.03). Elements of work engagement were comparable among faculty and staff members (vigor: \( p=0.71 \), absorption: \( p=0.68 \), dedication: \( p=0.71 \)). After adjusting for covariates, associations of work engagement and occupational sitting were not significant. CONCLUSIONS: These pilot findings suggest that university staff members tend to engage in more occupational sitting compared to faculty members. However, being absorbed and engaged at work is not associated with occupational sitting.

1628 Board #222 May 28 10:30 AM - 12:00 PM Physical Activity And Bullying In Adolescents With Overweight And Obesity Stephanie M. McCoy1, Kristie Rupp1. 1University of Southern Mississippi, Hattiesburg, MS. 2Southern Connecticut State University, New Haven, CT.

(No relevant relationships reported)

Adolescents with overweight and obesity, are more likely that their healthy weight peers to experience bullying behaviors; including, being a bully victim and both a bully perpetrator and victim. However, it is unknown whether engagement in physical activity (PA) is associated with bullying behaviors in this population. PURPOSE: To examine associations between bullying behaviors (perpetrator, victim, both, or neither) and PA. METHODS: Analyses included 9,114 (50% male) adolescents classified as overweight or obese, ages 10-17 years (mean 13.6±2.3 years), from the 2016-17 National Survey of Children’s Health. Adolescents who engaged in PA on 100th percentile based on PA frequency (≥60 minutes): none, 1-3 days/week, 4-6 days/week, or daily. Outcomes included bullying behaviors: neither perpetrator nor victim of bullying, bully perpetrator, bully victim, or both bully perpetrator and victim. Logistic regression models, adjusted for age, sex, household income, education, and comorbid ADHD assessed the odds of each outcome comparing PA categories. RESULTS: Overall, approximately 13% of adolescents with overweight and obesity engaged in no PA throughout the week, 45% engaged in 1-3 days, 28% engaged in 4-6 days, and 14% engaged in daily PA. Compared to their inactive peers with overweight and obesity, adolescents with overweight and obesity that engaged in PA were less likely to be victims of bullying: 30% less likely for 1-3 days/week, 58% less likely for 4-6 days/week, and 61% less likely for daily PA \( (p<0.05) \). Further, adolescents who engaged in PA were less likely to be both a bully perpetrator and victim compared to their inactive peers with overweight and obesity. Adolescents who engaged PA were 46%, 65%, and 71% less likely to be both a bully perpetrator and victim for 1-3 days/week, 4-6 days/week and daily PA, respectively in comparison to their inactive peers (\( p<0.05 \)). CONCLUSIONS: Adolescents with overweight and obesity, who engage in PA, are less likely to experience bullying behaviors than their inactive peers with overweight and obesity. This suggests that PA may be protective against engagement in bullying victimization as well as co-occurring bully perpetration and victimization.

1629 Board #223 May 28 10:30 AM - 12:00 PM Association Between Chronic Diseases, Sports Participation And Obesity: Findings From A Brazilian Longitudinal Study Bruna C T Lynch1, Jamile S. Codogno2, Romulo A. Fernandes2, Henrique L. Monteiro3, 1Lander University, Greenwood, SC. 2Sao Paulo State University - UNESP, Presidente Prudente, Brazil. 3Sao Paulo State University - UNESP, Bauru, Brazil.

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(No relevant relationships reported)

PURPOSE: To analyze the association between leisure-time physical activity (specifically sports participation), obesity and the incidence of chronic diseases among Brazilian adults. METHODS: The sample was composed of 620 adults (166 males and 454 females) aged 50 years or older followed from 2010 to 2014 in the city of Bauru, Sao Paulo, Brazil. Physical activity was assessed using a questionnaire (Baecke et al. Am J Clin Nutr, 1982 [face-to-face interview]) and subjects were stratified according to the engagement in sports in leisure-time (180 minutes/week over the last four months) as: Engaged (n=99) and Non-engaged (n=521). Body mass index (kg/m²) was used as diagnosis of obesity (BMI ≥30). Sports participation and obesity were combined and participants were stratified as follows: Obese/Non-sport (n=30), Obese/Sport (n=33), Non-obese/Non-sport (n=291) and Non-obese/Sport (n=66). The incidence of new cases of arterial hypertension, dyslipidemia and diabetes mellitus were verified through medical records. Chi-squared test for linear trend analyzed associations and statistical significance was set at p-value <0.05. RESULTS: The incidence of arterial hypertension was not associated with the combination of sports participation and obesity \( (p=0.853) \). However, the incidence of new cases of dyslipidemia (Obese/Non-engaged [37.8%], Obese/Engaged [30.3%], Non-obese/Non-engaged [27.8%] and Non-obese/Engaged [22.7%]; \( p=0.004 \)) and diabetes mellitus (Obese/Non-engaged [15.2%], Obese/Engaged [12.1%], Non-obese/Non-engaged [8.6%] and Non-obese/Engaged [6.1%]; \( p=0.008 \)) were associated with the lack of sports participation and obesity. CONCLUSION: There was an association between non-engagement in sports, obesity, and the incidence of dyslipidemia and diabetes mellitus among Brazilian adults. This finding highlight the importance of public health actions promoting healthy behaviors aiming the prevention of chronic diseases, especially in countries with universal health systems.

Supported by the Sao Paulo Research Foundation (FAPESP), process number: 2018/01744-7 and CAPES.

1630 Board #224 May 28 10:30 AM - 12:00 PM Relation Between Physical Activity, Sedentary Behavior And Chronic Disease Risk Factors Using Principal Component Analysis. Fiona Skelly1, Brona Furlong2, Lisa Loughney3, Noel McCaffrey2, Kieran Dowd2, Leslie Daly2, Catherine Woods2, Andrew McCarren1, Niall Moyna1, 1Dublin City University, Dublin, Ireland. 2Waterford Institute of Technology, Waterford, Ireland. 3Athlone Institute of Technology, Westmeath, Ireland. 4University College Dublin, Dublin, Ireland. 5Athlone Institute of Technology, Westmeath, Ireland. 6Dublin, Ireland. 7Limerick, Limerick, Ireland. Email: Fiona.skelly2@mail.dcu.ie (No relevant relationships reported)

INTRODUCTION: The overall health status of individual’s with chronic disease (CD) is affected by both positive and negative physical activity (PA) and sedentary behavior (SB), respectively. The purpose of this study was to examine the relation between PA, SB and selected indices of health in a diverse CD population using a principal component analysis (PCA). METHODS: Participants \( (n=237, 54.4\% \text{ female}, \text{ age (mean±SD) 62.2±11.1 yr}) \) were recruited at induction to a community-based exercise program for CD. Primary CD included cardiovascular \( (n=101) \), respiratory \( (n=48) \), cancer \( (n=80) \), diabetes \( (n=34) \), arthritis \( (n=26) \) and unclassified \( (n=78) \). BMI and waist to hip ratio (WHR) were measured and calculated using standard procedures. Upper and lower body strength, flexibility and cardiorespiratory fitness were assessed using a hand-grip test, sit-to-stand test (STS), sit and reach test (SRT), and 6-min time trial (6MTT), respectively. PA and SB were recorded using an activPAL micro accelerometer. QoL was assessed using the EQ5D V AS and the PHQ. Fasting serum levels of glucose, triglycerides, HDL-C, LDL-C and CRP were measured. Blood pressure (BP) was measured using a 24-hour ambulatory BP monitor. ActivPAL generated PA and SB variables were analyzed using PCA. General linear models were used to investigate the association between PA and SB and indices of health. RESULTS: PCA analysis of sedentary time, standing time, stepping time, ...
LIPA, MVPa, step count, sedentary bout lengths and total number of sedentary bouts generated three distinct factors: i) prolonged sedentary behavior (PSB), ii) physical activity (PA), and iii) broken sedentary behavior (BSB). The three derived variables accounted for 86% of the total variance in PA and SB. There was a significant main effect for PSB on LDL-C (F(1,189) = 9.06) and PIQH scores (F(1,162) = 6.82). There was a significant main effect for PA on BMI (F(1,199) = 14.48), WHR (F(1,199) = 5.77), STS (F(1,222) = 77.08), 6 MITT (F(1,222) = 77.08), EQSD VAS (F(1,162) = 14.13), triglycerides (F(1,188) = 4.65), CRP (F(1,155) = 2.89), and systolic BP (F(1,99) = 2.17). There was a significant main effect for PSB on HDL cholesterol (F(1,188) = 6.25).

CONCLUSIONS:
The PCA derived factors PSB, PA and BSB are associated with established disease risk factors in patients with CD.

1631 Board #225 May 28 10:30 AM - 12:00 PM Personal Social Capital And Health: Exploring The Role Of Physical Activity And Socioeconomic Status
Tim Schneider1, Eric Faß2, Marc Lochbaum1, Youngdeok Kim3.
1Ruhr-University Bochum, Bochum, Germany. 2Texas Tech University, Lubbock, TX. 3Virginia Commonwealth University, Richmond, VA.
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(No relevant relationships reported)

Personal social capital (PSC), which refers to the scope and quality of individual’s social networks within a community, has received an increasing attention as a potential sociological factor associated with better individual health. Yet, the mechanisms relating PSC to health is still poorly understood. PURPOSE: This study examined the associations between PSC and self-rated health (SRH) while exploring the mediating and/or moderating roles of leisure time physical activity (LTPA) and socioeconomic status (SES) among middle-aged and older adults. METHODS: Cross-sectional data were collected from 677 adults aged ≥40 years old using the Qualtrics survey panel. PSC scale was used to measure bonding and bridging SC and SRH was assessed along with 95% confidence interval (CI). Odds ratio (OR) predicting the likelihood of reporting good SRH was reported.

RESULTS: Overall, a greater bonding score was significantly associated with greater odds for reporting good SRH before and after controlling for LTPA and other covariates (OR=1.14; 95% CI = 1.05, 1.24). The inclusion of HI and HO attenuated the association of PSC with SRH, implying modest evidence for mediation effects; yet, no such effect was found for EL. However, LTPA was still independently associated with SRH in the full model. The additional moderation analyses indicated varying mediation effects according to EL (i.e., part mediation was found among low- and medium-level of SES variables included education level (EL), household income (HI), and home ownership (HO)). Hierarchical multiple logistic regression models were established in which a set of independent variables was sequentially added in order to examine the independent, mediating and moderating effects of PSC, LTPA, and SES. Odds ratio (OR) predicting the likelihood of reporting good SRH was reported along with 95% confidence interval (CI). RESULTS: Overall, a greater bonding score was significantly associated with greater odds for reporting good SRH before and after controlling for LTPA and other covariates (OR=1.14; 95% CI = 1.05, 1.24). The inclusion of HI and HO attenuated the association of PSC with SRH, implying modest evidence for mediation effects; yet, no such effect was found for EL. However, LTPA was still independently associated with SRH in the full model. The additional moderation analyses indicated varying mediation effects according to EL (i.e., part mediation was found among low- and medium-level of education groups, whereas no mediation appeared among upper-level of education group). CONCLUSIONS: Findings suggest that PSC and LTPA are associated with better SRH. However, depending on the EL, the beneficial influences of PSC are partly mediated by HI and HO. Hence, health policymakers can address both SC and PA for enhancing health but may need to consider SES background.

C-43 Free Communication/Poster - Physical Activity Interventions I
Thursday, May 28, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

1632 Board #226 May 28 10:30 AM - 12:00 PM Sustainability Strategies Of A 3-week Preventive Measure In Patients With Knee Osteoarthritis
Aki Pietsch1, Jan Schroeder2, Rüdiger Reer2, Helge Riepenhoff2.
1BG Trauma Hospital Hamburg, Hamburg, Germany. 2University of Hamburg, Hamburg, Germany.
(No relevant relationships reported)

Knee osteoarthritis as a degenerative joint disease is particularly relevant for occupational groups whose activities are associated with high loads or unfavorable postures over long periods of time. In the sense of effective secondary prevention, the BG Trauma Hospital of Hamburg uses a multimodal therapy concept, the so-called Kniekolleg. Data are now available for a two-year follow-up so that not only acute effects of the three-week start-up intervention, but also sustainability effects for long-term exercise adherence after two refresher courses, each after 12 month, can be reported.

PURPOSE: In the U.S. and globally, adults independently seek out online advice to support their personal health and fitness goals. In this study, we examined web articles specific to physical activity promotion. Our objectives were to determine the rate of PA-related articles at least 20% consistent with national physical activity guidelines (PAGs) and determine if consistency with PAGs varied on the basis of production source (i.e., commercial, governmental, professional association, or voluntary health agency). METHODS: The Google search engine was used to locate free-to-access web articles focused on physical activity promotion, written in English, and used text as the main communication medium. Valid lay search strategies independently reviewed by three experts were used. The 2008 Physical Activity Guidelines for Americans 18 to 64 years of age were used to appraise the credibility of messages. Seventeen potential PAGs were referenced. RESULTS: A sample of 72 web articles published or updated between 2008 and 2018 was obtained (M = 2016.34, SD = 2.02). All web articles that comprised the sample presented PAG-related messages. The percent of the sample that lacked at least one consistent message ranged from 61.1% to 100% across the 17 PAGs. The level of inconsistency was significant for 15 PAGs, all p < .05. Production source was associated with consistency for five PAGs, all related to aerobic (endurance) physical activity, p ≤.05, Cramer’s V ≥ .30. For the remaining 12 PAGs, the rate of consistency was equivalent across the production source groups, p ≥ .05, Cramer’s V ≤ .11-.26. Message consistency was lowest with guidelines for adults who have sedentary or modestly active lifestyles, M ≤ 3% of the study sample. CONCLUSION: Knowledge translation of physical activity guidelines is low in free online resources that lay adults may independently locate. This observation was irrespective of production source. The implications of this study’s results will be discussed, including ways that they pertain to ACSM’s National Roadmap to Improve Equity in Physical Activity Participation. In consideration of this study’s findings, as well as broader knowledge translation issues that have been raised by others, including in other countries (e.g., Canada), recommendations for future research will be provided.
Goal setting is a common motivational behavior change technique used by individuals trying to increase their current physical activity levels. However, it can be difficult for people to set realistic goals based on their current and past activity experiences. PURPOSE: To examine if adherence to goal setting recommendations differ between active versus inactive individuals. METHODS: Adult participants (N=38) enrolled in a four-week worksite walking intervention completed a demographic and stage of change questionnaires. Active (n=14) and inactive (n=24) participants wore blinded accelerometers for 7 days to obtain baseline average daily step counts. Participants reviewed baseline numbers with a researcher to determine daily step goals for each week of the intervention. First, participants were informed that setting daily goals to increase 10% each week from baseline is recommended for safe and effective step increases. Then participants were able to choose their daily step goals for each week of the intervention. Goals set by participants in Week 1 were used to examine the effect of activity status on Week 1 goal setting in active and inactive participants. There was a significant effect of activity status on Week 1 goal setting at the p < 0.05 level for the two conditions [F(1, 36) = 4.83, p = 0.034]. Post hoc comparisons using the Tukey HSD test indicated that the mean score for active participants (M = 70.94, SD = 139.71) was significantly different than active participants (M = -24.59, SD = 1029.58). CONCLUSION: Participants who were currently inactive set their goals higher than the recommended 10% increase from baseline for Week 1 while participants currently active set their goals lower than the recommended goal. Goal setting should be realistic but challenging and activity status may impact a client's goals higher than the recommended 10% increase from baseline for Week 1 while activity status may be valuable to consider when advising during the goal setting process and can be applied for a beneficial rehabilitation or exercise program.

CONCLUSIONS: In middle-aged and older adults, 12 weeks of Tai Chi exercise improved both static and dynamic balance ability, which is essential in reducing the risk of falls. Tai Chi exercise also significantly improved TUG scores, which indicates advantageous effects on gait and strength. Both the MIDS and Tai Chi interventions improved self-perception of health status, suggesting beneficial effects on the quality of life. Overall, both MIDS and Tai Chi can be beneficial to physical function and quality of life in older adults. Supported by Shaklee Corporation Research Grant.
transformed to units of energy expenditure, and then converted to METs using standard algorithms. A one-sample t-test was used to compare each mean predicted MET value (WU = M1-M7) to the 3.0 MET threshold and a Bonferroni corrected alpha of 0.006 (0.05 overall alpha). RESULTS: Average MET values for the WU (Mean±SE: 4.3±0.06 METs), as well as all seven matches (M1: 4.3±0.09, M2: 4.1±0.07, M3: 4.2±0.09, M4: 4.4±0.10, M5: 3.9±0.12, M6: 3.9±0.14, M7: 4.1±0.10 METs, respectively) exceeded the 3.0 MET threshold (p<0.001). CONCLUSIONS: The results of this study support previous research with competitive walking football typically meets or exceeds the 3.0 MET threshold for promoting positive changes in both metabolic fitness and cardiovascular health risk. Support provided by Edith Cowen University to the lead author.

Introduction: Chronic lower back pain (CLBP) is defined as pain, muscle tension, or stiffness localized at the lumbar region that persists for 12 weeks or more (Chou, R. 2011). It can be caused by tight hamstrings in both active and inactive people. Studies suggest that stretching the hamstrings improves pain and flexibility in adults (Lee, 2014, Sattar, 2015, Gordon, 2016). It is not known if a flexibility training intervention would have similar effects in faculty, staff, and students in a Midwestern University.

Purpose: To investigate the effects of a 6-week static stretching intervention on perceived pain and sit and reach scores, as surrogate measurements of hamstring flexibility and CLBP risk in faculty, staff, and students at an Urban Midwestern University.

Methods: Participants (n=41) were recruited and consented to participate in this study. Males had an average age of 31 years (n=12, SD=13.8) and females 33 years (n=29, SD=13.4). At the initial visit, flexibility was tested by performing the sit and reach test. Perceived pain was assessed using a pain scale between 1-10. Participants were then taught an at-home hamstring flexibility protocol to complete 3 days a week for 6 weeks. Check-ins for reassessment occurred at 3 and 6 weeks.

Results: Baseline mean score in sit and reach of CLBP group was 28.9 cm (SD=10.1) and control group was 27.3 cm (SD=10.5). At week 3, CLBP scored a mean of 29.3 cm (SD=11.2) and controls scored 26.9 cm (SD=7.5), indicating 8.9% and 5.9% flexibility increases, respectively. At week 6, only 9 individuals from CLBP continued and scored a mean of 32.2 cm (SD=10.8), representing a 6.85% flexibility increase, but it was not significant (p=0.07). Mean baseline pain score for CLBP group was 3.3 (SD=1.2) and for controls was 1 (SD=0.7). At week 3, participants in the CLBP group scored a 3 (SD=1.6) - a 10% reduction in pain - and the controls scored 1 (SD=0.5). At week 6, only 9 individuals from CLBP continued and scored 1.88 (SD=0.64), representing a decrease in pain by 47%. Changes were not significant (p=0.06). Conclusion: Following a 6 week stretching protocol, participants in the CLBP group tended to have reduced perceived pain and increased flexibility, as assessed by the sit and reach test, suggesting that static stretching protocols may be an important part of CLBP management.

Cardiopulmonary endurance was a crucial part of health in people. The physical activity benefited the cardiopulmonary endurance, while both active smoking and passive smoking made it decrease. PURPOSE: To determine whether there existed the interaction effects between cigarettes smoking and physical activity on cardiopulmonary endurance.

METHODS: 420 male adults were recruited in Beijing and Hezou, Guanzui. The investigation on cigarette smoking and physical activity were carried out by the international PA questionnaire and the health P.E. questionnaire, according to the smoke, all the subjects were divided into two main groups(CS group and nCS group), and then each main group were further divided into three sub-groups(CS/CSM/CSH group and nCS/nCSM/nCSH group) depending on their individual daily light, moderate or heavy physical activity. The subjects numbers of each group(CS/CSM/CSH group and nCS/nCSM/nCSH group) in turn were 45, 69, 74 and 38, 92, 102 respectively. The peak VO2 max were measured by GXT protocol on cycle ergometer.

RESULTS: (1)Cardiopulmonary endurance of the smokers were lower than that of the nonsmokers significantly(25.9±6.11ml/kg/min VS 27.8±7.17ml/kg/min,p=0.003), and smoke index(Number of daily smoking multiply years of smoking) had negative relation with cardiopulmonary endurance(r=-0.395,p<0.01). The study found that the higher smoke index led to the lower cardiopulmonary endurance in men. (2)Cardiopulmonary endurance of the nCSH group showed significantly different with nCSM or nCS group(p<0.01), but no statistical difference were not found between nCSM group and nCS group(p>0.05). (3)Smoking and physical activity showed no interaction effect on cardiopulmonary endurance(r=0.05).

CONCLUSIONS: (1)The cardiopulmonary endurance of the male adults who smoke cigarettes were lower than that of nonsmokers. (2)The high level of physical activity displayed greater effect on cardiopulmonary endurance.(3)The interaction effects were not found between smoke cigarettes and physical activity on the cardiopulmonary endurance in this study.Acknowledgements:National Key Research and Development Program (2016YFC1300202).

Results: There was significant weight loss in all intervention conditions across the 12-months (DIET=9.8 kg; DIET+MOD=10.2 kg; DIET+HIGH=10.3 kg) (p<0.05). Total barriers and CLBP group decreased significantly across the 12 months (2.67 to 2.44; p<0.0001), with no difference between groups. A similar pattern was observed for obstacle barriers (2.11 to 2.01; p=0.037). Effort barriers decreased significantly across the 12 months (p<0.001), with a Group X Time interaction (p=0.0133) also observed (DIET: 3.04 to 2.76; DIET+MOD: 3.00 to 2.51; DIET+HIGH: 2.97 to 2.32).

Conclusion: Perceived barriers to PA decreased across a 12-month behavioral weight loss intervention, and this was observed regardless of the amount of PA that was prescribed within the intervention. It does not appear that prescribing a higher amount of physical activity within the context of a behavioral intervention negatively impacts perceived barriers to PA participation. However, time barriers appear to persist, which may have implications for interventions to promote PA in adults with obesity.
participants exercised unsupervised on their own in free-living conditions for 6 months. A ramp increase cycle ergometer test to exhaustion was conducted by the same technician pre- and post-testing to determine VO2 peak. Missing data was accounted for using linear interpolations generated with SPSS v. 20.0. RESULTS: ANCOVA results with baseline CRF as a covariate revealed no significant differences between increases in absolute VO2 peak (CHOICE: 0.38, 95% CI: 0.20; 0.55, vs. IM-HIIT: 0.56, 95% CI: 0.37, 0.74 vs. IM-MICT: 0.30, 95% CI: 0.12, 0.48; L/min, F2,67 =1.99, P<.14), with similar findings for relative VO2 peak (CHOICE: 0.32, 95% CI: 0.16, 0.48; IM-HIIT: 0.38, 95% CI: 0.20, 0.56; IM-MICT: 0.31, 95% CI: 0.13, 0.49). Within group changes over time indicated small effect sizes (Hedges’ g) for increases in absolute (CHOICE= 0.00; HIIT = 0.26; and MICT=0.01) and relative VO2 peak over time (CHOICE = 0.11; HIIT = 0.33; and MICT=0.15). CONCLUSION: Changes in CRF between groups were not significantly different at 6-months post-intervention. Providing choice for selecting HIIT or MICT did not appear to enhance the benefits of exercise for improving fitness in low active adults. Supported by the Research Endowment from the American College of Sports Medicine Foundation.

Participation in physical activity (PA) in the US is low, as less than 50% of adults achieve at least 150 min/wk of moderate-intensity continuous training (MICT) or 75% of vigorous-intensity exercise (CDC, 2017). Low participation in PA is a problem because inactivity is one of the leading causes of premature mortality (Mokdad et al., 2004). The current recommendations including high volume MICT and resistance training require about 4 h/wk which is unrealistic for adults, as “lack of time” is cited as the primary reason for low PA (Trost et al., 2002). REHIT is a form of sprint interval training that requires only 10 minutes per session and elicits similar health related adaptations as chronic MICT (Cuddy et al., 2019). However, there are concerns that it may be too aversive (Ekkakalis et al., 2011). PURPOSE: To compare changes in affective valence and enjoyment to a single session of REHIT in adults with varying fitness level. METHODS: 85 healthy non-obese subjects participated in the study. Baseline testing consisted of incremental cycling to VO2max during which participants were familiarized with reporting Rating of Perceived Exertion (RPE) and affective valence. The VO2max results were used to group subjects into above and below average cardiopulmonary fitness (CRF). Subsequently, they completed a REHIT session consisting of two 20-second sprints interspersed with 3 minutes of active recovery. During the session, heart rate (HR), RPE, affective valence, blood lactate concentration (BLA), and enjoyment were assessed. RESULTS: RPE increased and was highest after sprint 2 (p < 0.001), but BLA was not significant in group X time interaction (p = 0.41). Affective valence decreased but remained positive in both groups (p < 0.001), and there was no significant difference between groups (p = 0.86). Enjoyment was high in both groups (93.2 ± 20.8 vs. 91.1 ± 16.4 in above and below average CRF, respectively), and there was no significant difference between groups (p = 0.64). BLA increased 9-fold during REHIT (p = 0.001); however, there was no significant difference between groups (p = 0.64). CONCLUSION: There was no effect of CRF on perceptual changes in response to REHIT, indicating that low-volume SIT may be suitable for individuals with below average CRF.
MEDICINE & SCIENCE IN SPORTS & EXERCISE®

Each participant completed sessions of either an accumulation of 45 min at 80%HR
month under clinical supervision, and three times/week for two months unsupervised.
months after exercise initiation. Exercise was completed two times/week for one
89±1%HR
one month of supervised exercise, the STAIR versus TRAD group achieved a higher
bout) separated by recovery periods of walking (~90s) (STAIR).
(TRAD) or 3 bouts of 6 flights of 12 stairs at a self-selected vigorous intensity (~90s/
programs: traditional moderate-intensity exercise (TRAD) or high-intensity interval
training, using stair climbing as the modality, in standard cardiac rehabilitation care. METHODS: Twenty participants with CAD (61±7 y, 18M/2W) were randomly assigned to one of two exercise
with CAD (61±7 y, 18M/2W) were randomly assigned to one of two exercise
(No relevant relationships reported)
Engagement in exercise-based cardiac rehabilitation following cardiac procedures
reduces the risk of secondary coronary artery disease (CAD) events. Interval training
can be a time-efficient and effective alternative to traditional moderate-intensity
exercise in cardiac rehabilitation programming, and an accessible way to deliver
interval training is through stair climbing. PURPOSE: To assess the feasibility
and effectiveness of high-intensity interval training intervention, using stair climbing as the
modality, in standard cardiac rehabilitation care. METHODS: Twenty participants with
(61±7 y, 18M/2W) were randomly assigned to one of two exercise programs: traditional moderate-intensity exercise (TRAD) or high-intensity interval
training stair climbing (STAIR). VO2peak was assessed at baseline, one month and
three months after exercise initiation. Exercise was completed two times/week for one
month under clinical supervision, and three times/week for two months unsupervised.
Each participant completed sessions of either an accumulation of 45 min at 80%HR
(TRAD) or 3 bouts of 6 flights of 12 stairs at a self-selected vigorous intensity (~90s/
minute separated by recovery periods of walking (~90s) (STAIR). RESULTS: Eighteen participants (90%)
completed the intervention without any adverse events. Following one
month of supervised exercise, the STAIR versus TRAD group achieved a higher
peak HR 131±9 vs. 111±13 bpm (p=0.002, means±SD), and exercise intensity 106±11
vs.89±1%HRpeak, across a shorter time 3±1.0 vs. 36±7.5 min (p=0.001). Peak
VO2, increased in both TRAD and STAIR, (23.3±5 to 25±4 and 21±5 to 24±6 mL/kg/min) respectively. VO2peak (2mo) was significantly lower
(p=0.04). Additional unsupervised training (2mo) the STAIR group achieved a higher peak HR 126±13 vs. 111±9 bpm (p=0.018) and less time at prescribed intensity 6±5.9 vs. 24.2±17 min (p=0.012), when compared to
the TRAD group. There was no difference in exercise intensity 96±8 vs. 87±8 %HRpeak
(p=0.055) or adherence 3.0±3.2 vs. 3.2±2.2 (p=0.70) exercise sessions/week, between
the STAIR and TRAD groups. CONCLUSIONS: High-intensity interval training using
stair climbing as the modality, is safe and effective within cardiac rehabilitation
programming.

Board #240
May 28 10:30 AM - 12:00 PM
Is High-Intensity Stair Climbing An Effective Alternative To Traditional Cardiac Rehabilitation Exercise?
Emily C. Dunford1, Sydney E. Valentino1, Jonathan Dubberley2, Sara Y. Oikawa1, Christopher McGlorey1, Eva Lonnt1, Mary E. Jung1, Martin J. Gibalab, Stuart M. Phillips, FACSM1, Maureen J. MacDonald1. 1McMaster University, Hamilton, ON, Canada. 2Hamilton Health Sciences, Hamilton, ON, Canada. 3University of British Columbia, Okanagan, BC, Canada. Email: dunforde@mcmaster.ca

Board #241
May 28 10:30 AM - 12:00 PM
Functional Fitness Is An Effective Training Modality In Firefighters
Annmarie Chizewski1, Allyson G. Box1, Steven J. Petruzzello, FACSM2. 1Benedictine University, Lisle, IL. 2University of Illinois Urbana-Champaign, Urbana, IL. (Sponsor: Dr. Steven J Petruzzello, FACSM) Email: chizewski.annmarie@gmail.com

Board #242
May 28 10:30 AM - 12:00 PM
Boxing Training Effects On Cardiorespiratory Fitness In Individuals With Prehypertension
Janeth Berenice Juarez Aguilara, Rosa E. Lara Fuentes, Francisco Morales-Acuna, Karla Iriyoyen, Manuel Gomez, Alvaro Gurovich, FACSM. University of Texas at El Paso, El Paso, TX. (Sponsor: Alvaro N. Gurovich, FACSM) Email: jhjuarnez@utep.edu

Board #243
May 28 10:30 AM - 12:00 PM
Effect Of Ethnicity On Changes In Cardiorespiratory Fitness In Response To High Intensity Interval Training
Jamie DeRevere1, Rasmus Clausen2, Sean Walsh, FACSM, Todd Astorino, FACSM2. 1California State University San Marcos, San Marcos, CA. 2Central Connecticut State University, New Britain, CT. (No relevant relationships reported)

Prior data show that ethnicity does not mediate responsiveness to moderate intensity
continuous training (Skinner et al. 2001; Slentz et al. 2004), although populations used in
these studies were primarily Caucasian (C) and African-American (A), while Hispanics (H), who face elevated health risks and are reported to be less active
than C (CDC 2017), exhibit a similar response to exercise training versus other
populations. PURPOSE: To determine if ethnicity alters physiological responses to
short-term HIIT in sedentary C versus H women. METHODS: Eleven C and seven
H women ages 18 - 35 years who were healthy, non-obese, and inactive (<150 min/wk
of physical activity in the last 12 mo) participated in the present study. Over a 3 week
period, they completed nine sessions of progressive HIIT on a cycle ergometer at
work rate equal to 85 %PPO. Maximal oxygen uptake (VO2max) was measured twice
at baseline using incremental exercise followed by verification testing. Participants
ycled for 2 min at 15 or 20 W/kg. Each 15 - 20 W/min increases in power output
until fatigue, during which an impedance cardiograph device was used to evaluate
measures of hemodynamic function including stroke volume (SV) and cardiac output
(CO). Habitual physical activity was assessed during the study using accelerometer.
RESULTS: Training elicited a heart rate equal to 84 % HRmax, and 99.4% of sessions
were done for 60 minutes each day during the 7-week Academy. The HIIT program
gradually incorporated movements and equipment commonly used during fire-ground
activities (e.g., hoses, sledgehammers, stairs, weighted objects), while also
utilizing interval training, group runs, and partner workouts. RESULTS: Significant
improvements were seen in parameters of physical fitness and FF ability following a
7-week HIIT program. Specifically, fitness (weight, cardiovascular fitness, muscular
endurance) yielded significant improvements from Week 1 to Week 7 [Hotelling’s
T2=8.96, F(5, 84)= 150.57, P<.000]. Overall HIIT program significantly improved
as well [Hotelling’s T2=3.95, F(7, 82)= 46.26, P<.001, ηp2=0.80]. CONCLUSION: A
7-week Basic FF Academy that included daily HIIT resulted in significant improvements in physical fitness and FF ability. This suggests that HIIT, in conjunction with the 7-week Basic FF Academy, appears to be an effective means of
improving fitness and FF ability in recruit FFs. Further research is needed to examine
the effects of HIIT training on fitness and FF ability in FFs who are not simultaneously
enrolled in a physically demanding FF Academy.
were completed. Results showed a significant main effect of training for VO2 max in C and H (30.7 ± 3.7 to 33.6 ± 3.9 mL/kg/min and 30.1 ± 2.6 to 32.4 ± 1.8 mL/kg/min, F = 11.6, p = 0.004), but there was no group by training interaction (p = 0.69). Significant increases were also exhibited in PPO (p < 0.001), SV (p = 0.02), and CO (p = 0.018), but there was no group by training interaction for any variable (p = 0.13 - 0.66). Physical activity did not change during the study (p = 0.33) and there was no group by training interaction (p = 0.60). CONCLUSION: Our data show no effect of ethnicity on the cardiorespiratory and hemodynamic response to HIIT, although longer studies in similar populations are needed to verify this result.

The health benefits of cardiac rehabilitation (CR) and sustained physical activity (PA) post-CR are well known; yet, CR graduates often fail to adhere to their exercise prescriptions post-program. Financial incentives have shown promise in increasing PA in adults but have been rarely evaluated in a CR context. PURPOSE: To examine the impact of adding financial incentives to a multi-component eHealth (MCE) intervention on moderate-vigorous physical activity (MVPA) amongst CR graduates. Second, to determine whether financial incentives increased eHealth platform engagement compared to non-incentive controls. METHODS: In this 24-week pilot randomized controlled trial participants were recruited from a large outpatient CR program and randomized to control (CT) or intervention (FI) conditions. CTs were instructed to track their exercise daily using a MCE website that included self-monitoring, individual and group-level feedback, and virtual (non-monetary) rewards for exercise session completion. Only FIIs could earn $1.00 CAD per day when exercise was tracked and completed. Group differences in MVPA minutes per day (min/d) during the final intervention month were made using a one-way ANOVA. Participants with five or more ‘valid’ days during the final month (days with objectively measured step counts between 500 and 4000) were included in the analysis. RESULTS: Seventy-four CR graduates (63% male; mean age 69±11 years) were randomized to CT (n=38) or FI (n=36) groups, and 34 participants (15/38 CT, 19/36 FI) had at least five valid days (mean 19.7±6.4 days). No significant group difference in mean MVPA min/d in the final intervention month was observed (CT: 21.90±18.56; FI: 27.18±15.52; p=0.41), nor between the mean number of eHealth website logins over the six month intervention (CT: 101.2±129.5; FI: 109.7±91.5; p=0.75). CONCLUSION: While this pilot trial was not powered to detect group differences, our initial results suggest that adding modest financial incentives (1$ per day) to a MCE intervention may not boost engagement (a main driver of eHealth program effectiveness), nor MVPA in a sample of Canadian CR graduates. However, higher study retention, mean MVPA min/d, and total logins in the FI compared to the CT shows intervention promise. These data will inform the design of a fully powered study.

Pilot Randomized Controlled Trial
Madison S. Hiemstra1, Sean K. Spilsbury1, Marc S. Mitchell2, Paul Oh3, 1Western University, London, ON, Canada. 2University Health Network, Toronto, ON, Canada. (Sponsor: Dr. Michelle Mottola, FACSM) (No relevant relationships reported)

1650 Board #244 May 28 10:30 AM - 12:00 PM Can Financial Incentives Promote Exercise Adherence Amongst Cardiac Rehabilitation Graduates? A 24-week Pilot Randomized Controlled Trial
Bethany Forsyth1, Ianis Eells1, Jeri-Anne Lyons1, Stacy Hunter2, Michele Polpus3, 1University of Wisconsin - Milwaukee, Milwaukee, WI. 2Texas State University, San Marcos, TX. (Sponsor: Paula Papanek, FACSM) (No relevant relationships reported)

There is conflicting research regarding the impact of yoga on cardiovascular disease (CVD). Research supports the augmentation of stress and stress related physiology of CVD. Yoga is purported to improve stress, but there is no clear indication of the relationship between yoga and inflammation. PURPOSE: To investigate the feasibility and impact of an 8-week yoga intervention on stress and inflammation, to provide insight on the relationship between yoga and the pathology of CVD.

METHODS: The study included healthy yoga-naive adults, 18-44 years. Participants had no recent mental health diagnosis, CVD, or limitations to performing yoga. The study design was a single-arm 8-week intervention with pre and post intervention data collection. During the visits participants were asked to complete the Perceived Stress Scale, collecting information on their level of stress, and to also provide a small blood sample to assess inflammation via erythrocyte sedimentation rate (ESR). Between the visits, participants were asked to attend two 60-minute flow style yoga classes each week. To be deemed feasible, >85% of participants had to attend >75% (12 of the 16) of the yoga classes.

RESULTS: A total of 32 individuals were screened and 14 were eligible for the study. Of those eligible, nine participants were enrolled in the study (25±4.8 years; 78% female). Eight of the nine participants completed the study; one participant dropped out due to a surgery not related to the study. Six participants (67%) attended >75% of the classes. Wilcoxon Signed Rank Tests showed that ESR was significantly reduced after the intervention (27±0.18 mm to 17±0.17 mm; p=0.03), perceived stress scores were reduced by 13.9% (19.75±6.7 to 17.01±8.9), however this was not significant.

CONCLUSIONS: Despite the small sample size our findings provide preliminary evidence that an 8-week yoga intervention reduced the perception of stress in the participants and significantly reduced ESR, an established indicator of systemic inflammation. Further studies are needed to confirm and extend findings and find methods to improve feasibility in yoga interventions.

Effects Of A 13-week Physical Education Class On College Aged Student’s Exercise Motivation, Body Image, And Mood
Suet Hon. The Chinese University of Hong Kong, Hong Kong, Hong Kong. (Sponsor: Stanley Hui S.C, FACSM) Email: hon1102suet@gmail.com (No relevant relationships reported)
motivation. The majority students desired to participate in more exercises in the future. CONCLUSIONS: This study suggests that a 13-week physical education class showed increasing positive change and enhancing after participating in physical education classes. Health was a very important concern of students when choosing to exercise. Since the participants in this study were all girls and future study can examine the gender difference on the topic.

**1654 Board #248 May 28 10:30 AM - 12:00 PM**

**Combination Of High-intensity Interval Training And Moderate-intensity Continuous Exercise On Cardio-metabolic Responses In Physically Inactive Middle-aged Adults**

Eric Tsz-Chun Poon, Waris Wongpipit, Sinead Sheridan, Stephen Heung-Sang Wong, FACSM, The Chinese University of Hong Kong, Hong Kong, Hong Kong

(NO relevant relationships reported)

High-intensity interval training (HIIT) has been proposed as a time-efficient exercise protocol to improve metabolic health. However, its combined training effects with traditional moderate-intensity continuous exercise (MICE) remains unclear. PURPOSE: This study evaluated the effects of 16-week MICE-HIIT combined training on cardio-metabolic and psychological responses in physically inactive middle-aged males. METHODS: Forty participants (mean age: 40.2 ± 5.3 years) were randomly assigned to four groups: HIIT (12 x 1-min run at 80-90% HRpeak interspersed with 1-min active rest), MICE (40-min brisk walk at 65-75% HRpeak), combined (COMB) (alternate between HIIT and MICE) or control (CON). Exercise sessions were conducted three times per week for 16 weeks. Cardiopulmonary fitness, VO2peak, and body composition (percentage body fat and waist circumference) were measured at baseline and after the 16-week intervention. Enjoyment and self-efficacy were also assessed at the end of the intervention. RESULTS: All exercise groups showed substantial (~15%) and similar increases in VO2peak (HIIT: 34.3 ± 4.4 to 39.1 ± 5.4 MCE: 34.9 ± 5.0 to 39.4 ± 7.2; COMB: 34.1 ± 5.0 to 40.3 ± 4.6 mL kg⁻¹ min⁻¹; p = 0.05) compared to CON over the 16-week intervention. There was a similar reduction in weight, BMI, % BF and waist circumference in all groups compared to CON (p < 0.05). Compared to baseline, total cholesterol and LDL cholesterol decreased only following COMB intervention, while fasting insulin level significantly decreased and insulin sensitivity improved in the HIIT group. Enjoyment, self-efficacy and adherence were similar among the exercise groups. CONCLUSION: These findings suggested that combined MICE-HIIT training can elicit comparable improvements in cardiovascular fitness and adherence under free living conditions as performing HIIT and MICE alone in physically inactive middle-aged males, serving as an alternative exercise strategy for health promotion.

**1655 Board #249 May 28 10:30 AM - 12:00 PM**

**Rehabilitation With High Intensity Interval Training Before Major Abdominal Surgery**


Email: john.woodfield@otago.ac.nz

(NO relevant relationships reported)

PURPOSE: Improving cardiopulmonary reserve, or peak oxygen consumption (VO2peak), measured during cardiopulmonary exercise testing (CPET), may reduce complications after surgery. This feasibility study determined the effectiveness of a supervised, preoperative High Intensity Interval Training (HIIT) program in increasing VO2peak by 2ml/kg/min. Clinical outcomes were documented to determine the endpoint most sensitive to improved fitness. METHODS: In this prospective study, participants aged 50-85 undergoing major abdominal surgery were randomised to standard care or a 13-week HIIT program. VO2peak was assessed during a graded exercise test to exhaustion on a cycle ergometer. RESULTS: Fourteen participants (n=11 men; mean age 62±10 years; range of 50-85) were enrolled. The HIIT program involved three sessions per week of 10 x 1-minute high-intensity interval training interspersed with 1-minute active recovery. VO2peak increased from 36.0±8.6 mL kg⁻¹ min⁻¹ at baseline to 38.5±7.1 mL kg⁻¹ min⁻¹ after intervention (p<0.05). VO2peak increased by 7.1% (p=0.03) at 9-month follow-up. CONCLUSION: HIIT may improve VO2peak, which may reduce complications after surgery.
intervention. This study may inform future PA interventions to examine changes to temporal patterns (e.g. how much PA youth are getting during specific times of the day) in addition to total overall PA.

1658 Board #252 May 28 10:30 AM - 12:00 PM Socioeconomic Status And The Quality And Accessibility Of Community Health Resources Maggie Babcock, Eric Medenblik, Savannah Chrissco, Christina Johnson. Cornell College, Mount Vernon, IA. Email: mbabcock20@cornellcollege.edu  
(No relevant relationships reported)

Health is multidimensional and can include aspects of physical, social, emotional, and spiritual wellness. Social Ecological Models (Sallis et al., 2012; Van Dyck, et al., 2010) suggest that health behaviors are influenced by community resources and built and natural environments. Inequalities exist in access to and quality of resources across socioeconomic status and other social strata, which, in turn, impact health behaviors (Byrne, 2012; Gordon-Larsen, et al., 2006). PURPOSE: To demonstrate differences in quality and accessibility of community health resources across neighborhoods of varying levels of household income in both rural and urban communities. METHODS: The Community Health Resources Checklist (CHRC) was used as a guide to structure observations of parks, trails, grocery stores, clinics, banks, and other health resources that represented various dimensions of health (physical, emotional, social, spiritual). Resources (rural n=27; urban n=51) in Iowa communities (2 rural; 1 urban) were evaluated, mapped, and labeled as high or low based on household income to create a graphical representation of community resource quality between and within high-income and low-income neighborhoods in both rural and urban settings. RESULTS: Mapping analysis demonstrated less access to high-quality health resources in both low-income rural and urban settings. In particular, qualitative analysis of the data indicated that high quality resources clustered near the margins of higher-income neighborhoods, but were often scattered, absent entirely, or of significantly lower quality in lower-income neighborhoods. CONCLUSIONS: This preliminary study examined community health resources representing multiple dimensions of health and demonstrated notable disparities across household income in rural and urban communities. These disparities should be addressed through targeted, focused health promotion interventions.

C-44 Free Communication/Poster - Physical Activity Interventions II

Thursday, May 28, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

1659 Board #253 May 28 10:30 AM - 12:00 PM High-Intensity Interval Low-volume Vs Moderate-intensity Continuous Training On Exercise Enjoyment And Quality-of-life In Metabolic Syndrome Jorge L. Petro1, Laura Pérez1, Daniel Restrepo1, Daniel Aguirre-Acvedo1, Camila Trillos1, Manuela Yepes-Calderon1, Luis Valbuena1, Yesica L. Sánchez2, Juan C. Arstizabal1, Raul Narvaez-Sanchez1, Juan C. Calderon1, Jaime Gallo-Villegas1. 1University of Antioquia, Medellin, Colombia. 2Indeporos Antioquia, Medellin, Colombia. Email: jlpetros@hotmail.com  
(No relevant relationships reported)

Exercise improves quality of life in patients with metabolic syndrome (MS). However, some people may not benefit because do not to meet the recommended amounts of exercise. The most argued reasons for that are lack of time and poor enjoyment. PURPOSE: to evaluate the efficacy of high-intensity interval training low-volume (HIIT-low volume) compared to moderate intensity continuous aerobic training (MICAT) on exercise enjoyment and quality of life in adults with MS. METHODS: a controlled, randomized, clinical trial using the minimization method, with two parallel groups for the purpose of showing superiority. Sixty patients with MS, of both genders, 40-60 years old, were included. A clinical evaluation, biochemical tests, Physical Activity Enjoyment Scale test for enjoyment (PACES), and Medical Outcomes Study Questionnaire Short Form 36 Health Survey version 2 (SF-36v2) test for quality of life were carried out, before and after a treadmill exercise program of 12 weeks, 3 sessions/week. Participants assigned to the intervention (n=29) received HIIT-low volume in 22 min sessions that included six intervals at a load of 90% of maximum oxygen consumption (VO2 max) for 1 min followed by 2 min at 50% of VO2 max. The control group (n=31) received MICAT at an intensity of 60% of VO2 max for 36 min. RESULTS: patients had a mean age of 50.8±6.0 years, body mass index of 30.6±4.0 kg/m2, body fat percentage of 38.7±7.0% and VO2 max of 29.0±6.3 mL O2 kg-1 min-1; 70% were women. Compared to MICAT, HIIT-low volume was not superior in increasing LS of PACES test score (marginal mean difference: 0.041 [95% CI -0.015; 0.095]; Cohen’s d: 0.043 [-0.095; 0.008]; Cohen’s d: 0.043 [-0.095; 0.008]; Cohen’s d: 0.043 [-0.095; 0.008]; Cohen’s d: 0.043 [-0.095; 0.008]) but only HIIT-low volume increased PACES test score (Glass’ Δ: 0.41 to 0.43) but only HIIT-low volume increased PACES test score (Glass’ Δ: 0.30) and mental component of SF-36v2 (Glass’ Δ: 0.64). CONCLUSION: HIIT-low volume, compared to MICAT, is not superior in increasing exercise enjoyment and quality of life in adults with MS. Supported by Colciencias 111562638757. Interinstitucional 2016-13041. Colciencias Doctoral scholarships 727-2015.

Exercise improves quality of life in patients with metabolic syndrome (MS). However, some people may not benefit because do not to meet the recommended amounts of exercise. The most argued reasons for that are lack of time and poor enjoyment. PURPOSE: to evaluate the efficacy of high-intensity interval training low-volume (HIIT-low volume) compared to moderate intensity continuous aerobic training (MICAT) on exercise enjoyment and quality of life in adults with MS. METHODS: a controlled, randomized, clinical trial using the minimization method, with two parallel groups for the purpose of showing superiority. Sixty patients with MS, of both genders, 40-60 years old, were included. A clinical evaluation, biochemical tests, Physical Activity Enjoyment Scale test for enjoyment (PACES), and Medical Outcomes Study Questionnaire Short Form 36 Health Survey version 2 (SF-36v2) test for quality of life were carried out, before and after a treadmill exercise program of 12 weeks, 3 sessions/week. Participants assigned to the intervention (n=29) received HIIT-low volume in 22 min sessions that included six intervals at a load of 90% of maximum oxygen consumption (VO2 max) for 1 min followed by 2 min at 50% of VO2 max. The control group (n=31) received MICAT at an intensity of 60% of VO2 max for 36 min. RESULTS: patients had a mean age of 50.8±6.0 years, body mass index of 30.6±4.0 kg/m2, body fat percentage of 38.7±7.0% and VO2 max of 29.0±6.3 mL O2 kg-1 min-1; 70% were women. Compared to MICAT, HIIT-low volume was not superior in increasing LS of PACES test score (marginal mean difference: 0.041 [95% CI -0.015; 0.095]; Cohen’s d: 0.043 [-0.095; 0.008]; Cohen’s d: 0.043 [-0.095; 0.008]; Cohen’s d: 0.043 [-0.095; 0.008]; Cohen’s d: 0.043 [-0.095; 0.008]). CONCLUSION: HIIT-low volume, compared to MICAT, is not superior in increasing exercise enjoyment and quality of life in adults with MS. Supported by Colciencias 111562638757. Interinstitucional 2016-13041. Colciencias Doctoral scholarships 727-2015.

The life quality, namely among aged population, has been widely studied. Observational data on behavioral context, especially regarding physical activity epidemiology, has shown efficiency in improving physical fitness with an impact on the dimensions of well-being. However, little research has been made regarding the impact of exercise on cardiorespiratory, strength, agility and quality of life, across different European contexts. PURPOSE: we aimed to investigate the impact of exercise intervention on life quality, among elderly from 4 different European countries [Portugal (PT), Italy (IT), Bulgaria (BL) and Hungary (HU)]. METHODS: 364 (87 PT, 121 IT, 76 BL and 80 HU) older adults (68.9±6.3 yrs, 73.6±12.7 Kg, 1.61±0.08 m) male (26%) and female (74%), were recruited from local populations. Intervention program was based on 2 sessions/week (90 minutes each), supported on aerobic activities (40min), muscle strength (20min), body balance (10min), technical skill (10min) and stretching specific exercises (10 min). Pre (baseline assessment) and post one year intervention assessments were done on anthropometric measures, senior Fitness Test and EQ-SD-5L questionnaire, applied by trained technicians. ANOVA was performed to describe country’s group differences and the adaptations observed among different determinants, in pre and post intervention. When a significant effect was detected post-hoc comparisons were performed with Bonferroni adjustment to identify the locations of the difference. Significance was set at p<0.05. Results: The effect of the time (one year intervention) were found to be significant, indicating changes on health determinants (hip-to-waist ratio, F = 13.895, p<0.001; chair to stand, F = 20.314, p<0.001; and handgrip muscle force, F = 21.023, p<0.001), in all groups. However, Post-hoc analysis with Bonferroni adjustment indicated that the effect over the time was similar between countries. The significance was maintained. Conclusions: Context, country environment, seems have not influence on intervention output. Rather than country or geographical location, the intervention features may be the most important factor in increasing health status, by the associations with health determinants.

Community exercise programs have been used to increase physical activity and reduce cardiovascular risks. PURPOSE: To investigate the effectiveness of a personalized community-based exercise program based on intensities personalized to individual ventilatory thresholds (VT) on decreasing metabolic syndrome (MetS) risk factors. METHODS: One hundred and fifty inactive community members were physician referred to a 12-week community exercise program between June 2016 and May 2019. Participants were separated into two groups: non-exercise control (age: M=43.6±12.5 yrs) and exercise intervention (age: M=46.6, SD=16.7 yrs) prescribed via VT index. For intervention groups the threshold was determined by performing treadmill test talks. MetS risk factors, abdominal obesity as measured by waist circumference (WC), hypertension, obesity as measured by systolic blood pressure (SBP) and diastolic blood pressure (DBP), and fasting blood glucose (BG), were analyzed retrospectively using MetS z-score. Parallel and independent sample t-tests were used to compare within-group changes from pre- to post-intervention and between-group changes for all outcomes, respectively. Significance was set at p<0.05. Results: The non-exercise group experienced unchanged WC, triglycerides, and BG and had a statistically significant worsening in HDL-C (M±SD): (pre: 50.7 ± 18.2, post: 49.4 ± 16.5), SBP: (pre: 119.0 ±

Abstracts were prepared by the authors and printed as submitted.
Estimated Versus Calculated Time from Home to Squares/Parks, in Three Different Socioeconomic Status Neighborhoods

Rocio Nuche Salgado1, Maria Fernanda Sanhueza1, Barbara Munizaga2, Jaime Leppe3, Sandra Macheva-Matsudo4
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No relevant relationships reported

PURPOSE: Depression model building in rats on 4 weeks of CUMS (Chronic Unpredictable Mild Stress) and the investigation of the effect of aerobic exercise intervention on hippocampal VEGF expression and spatial learning and memorizing ability in depressive model rats.

METHODS: 50 male SD rats randomly divided into 3 groups: the Control group (C), the Exercise group (E) and the model group (M). The model group was subjected to CUMS stimulation. In addition, aerobic exercise can rescue and significantly up-regulate the expression of VEGF in hippocampus which suppressed by CUMS stimulation. The correlation between the VEGF expression level and depressive behaviors in rats suggests that the enhanced expression of VEGF in hippocampus might be one of the neurobiological mechanisms mediating the effects of aerobic exercise on depression and spatial learning and memorizing ability.

1664 Board #258 May 28 10:30 AM - 12:00 PM

Influence Of Affective Valence And High Intensity Intervention On Exercise Engagement

Riley Galloway1, Sara Powell1, Robert Bookser1, Megan E. Holmes1, Elena Fomina2, Natalia Didkovskaya2, Uwe Hoffmann3
1German Sport University, Köln, Germany. 2Charité-Universitätsmedizin Berlin, Berlin, Germany. 3Johannes Gutenberg-University Mainz, Mainz, Germany. 4Institute of Exercise and Sport Science, Moscow, Russian Federation. 5Carl von Ossietzky Universität Oldenburg, Oldenburg, Germany.
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No relevant relationships reported

PURPOSE: This study aimed to determine the influence of affective valence and a structured high intensity exercise intervention on exercise habits and future participation at increased intensity than what one is accustomed to. METHOIDS: Participants (N=34; age=22.3±2.1 years) were assigned an accelerometer for a 7-day period to determine average exercise intensity. Affective responses were collected during voluntary exercise sessions using a smartphone app (self-efficacy=1-5 (5=confident), enjoyment scale 1-7 (7=most enjoyable), mood scale 1-7 (7=positive mood)). An aerobic exercise intervention at 70%-85% of heart rate reserve was then administered. Accelerometers were then worn for an additional 7-day period. Participants logged information related to voluntary exercise engagement. RESULTS: The pre-intervention 7-day period consisted of 75.7±9.4% sedentary and 4.0 ± 2.3% MVPA (3.5±1.6% moderate intensity, 0.5±1.7% vigorous intensity) while affective responses were positive as seen by self-efficacy (4.2±0.9), enjoyment (6.3±1.8), and mood (6.0±1.1). Participants maintained positive affective valence during the exercise intervention, although it was a significantly higher intensity than their daily average (self-efficacy=4.4±0.9, enjoyment=5.5±1.9, mood=5.9±1.2). Post-intervention 7-day period consisted of significant decrease in sedentary to 61.4±5.2% (p<0.001) while MVPA significantly increased to 9.1±2.1% (p=0.001) of the day (8.0±1.4% moderate intensity, 1.1±0.7% vigorous intensity). MVPA per day significantly increased from pre- to post-intervention (34.0±19.3 minutes and 44.4±15.8 minutes, respectively, p=0.04) while a positive affective valence was maintained (self-efficacy=4.7±0.4, enjoyment=6.6±0.5, mood=6.5±0.8). CONCLUSION: The high-intensity exercise intervention elicited only a minimal decrease in exercise enjoyment during the session which allowed participants to maintain an overall positive affective valence. This potentially influenced the decrease in sedentary behavior and increased MVPA. These results indicate recreational exercisers may misinterpret exercise intensity. To reduce this misinterpretation, it may prove beneficial for practitioners to further explain and demonstrate activities categorized as different intensities.
Sensorimotor control exercises (SCE) increase trunk stability by enhancing neuromuscular activity and strength, perhaps preventing low back pain (LBP). A trunk-specific intervention based on 4 exercises improved trunk stability, however, a reduced set of 1 exercise may have similar effects and increase compliance concurrently.

**Purpose:** To assess the response of a standard training (SG) and a low volume set of sensorimotor control exercises (EG) on trunk function and compliance.

**Methods:** 29 healthy subjects were randomly allocated to SG (n=15) or EG (n=14).

A trunk-specific SCE protocol (3 weeks) was completed which differed in training volume (SG: 4 exercises; EG: 1 exercise). Training intensities were identical (1 set to 8 reps; 3 sets). Pre-intervention (MI; M2) isokinetic mean peak torque was measured for trunk extension (30°/s) and rightward rotation (30°/s) in concentric (CON), eccentric (ECC) and perturbed eccentric (PECC) mode. During testing neuromuscular activity of Mm. erector spinae, latissimus dorsi, external/external obliquus and rectus abdominis were recorded by sEMG and summarized subsequently: dorsolateral (DL), dorsorotatory (DR), ventral right (VR) and ventral left (VL). Mean peak torque was normalized to body weight (N/m/kg), EMG data was normalized to concentric MVC (%). Compliance was assessed using a training diary (sessions per week). Data was analyzed descriptively (mean±SD) and by using a repeated measures ANOVA (α = .05).

**Results:** Mean peak torque in CON/ECC extension and rotation showed no group differences. During PECC rotation, MI (M1: 23.3±0.3, M2: 25.1±0.2) showed a significant larger increase of mean peak torque compared to EG (M1: 25.0±0.3, M2: 27.1±0.3) (p=0.035). Both groups showed a significant increase in EMG activity of DR muscles for unperturbed ECC rotation (SG M1: 93±18, M2: 118±19; EG M1: 83±9, M2: 121±17) (p<0.001). In SG, DL (M1: 95±13, M2: 113±16) (p=0.011) and VR (M1: 83±14, M2: 110±29) (p=0.010) muscle activity improved significantly during ECC rotation. Overall compliance was 73±3 (SG) and 72±2 (EG) sessions.

**Conclusion:** Both protocols enhanced trunk function in terms of neuromuscular activity and mean peak torque in trunk rotation. LBP patients might benefit from a low volume approach due to improved time-efficiency.
undergraduate and postgraduate medical level. It will involve: adequate mentoring and support by clinical supervisors, understanding of the role of other health professionals in PA promotion and creating an enabling policy that will ensure doctors have time to stay physically active.

1669 Board #263 May 28 10:30 AM - 12:00 PM
Physiological Responses To Animated Narrative Vs. Nonnarrative Videos In Active Video Gameplay
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PURPOSE: Active video games (AVG) can induce similar physiological responses to physical activities in children. Narratives could be an alternative for increasing players’ engagement due to their unique motivational properties. We investigated the effects of an animated narrative video (NV) vs. an animated non-narrative video (N-NV) on heart rate (HR) and rate of perceived exertion (RPE) during AVG play sessions.

METHODS: After consent/assent, anamnesis and anthropometrics assessment, we randomly assigned 21 children aged 8-12 years old with no previous AVG experience to watch either an NV N-NV (duration: =11min). They played the AVG for as long as they wanted. HR was monitored pre, during and after the play using a Polar® HR band ActiGraph Link. RPE was measured pre and post AVG session with Borg’s scale. Participants reported their narrative immersion and game engagement via questionnaires. We applied independent samples t-test and repeated measures ANOVA to compare between and within groups. We used Pearson correlation coefficients for association analysis.

RESULTS: The NV and N-NV group did not differ significantly (age: 9.5±1 vs. 10.3±1.3, p=0.14; BMI: 4.2±5.2 vs. 57.2±16.2, p=0.28). The NV group had significantly higher narrative immersion (3.5±0.6 vs. 2.9±0.6, p=0.03) and game engagement (4.0±0.4 vs. 3.2±0.3, p=0.01) than the N-NV group. Both HR and RPE had a within-group interaction (Time: p<0.01), but not a between-group (p>0.33) or interaction (Time x Group: p=0.35). Narrative immersion was moderately correlated with HR post NV vs. N-NV (r=0.53; p=0.01) and game engagement (r=0.46; p=0.03).

CONCLUSIONS: We are the first to test the effect of NV-NV vs. NV on physiological responses to AVG play. Although the narrative group did not show higher physiological response (HR and RPE) than the non-narrative group, those with higher immersion during the AVG session also had a higher HR post AVG, suggesting higher game engagement and play motivation.

1670 Board #264 May 28 10:30 AM - 12:00 PM
Effectiveness Of The Foreverfit Weight Loss Program
Charles E. Robison, Sarah Adcock. George Mason University, Manassas, VA.

INTRODUCTION: Overweight and obesity is an increasing health concern amongst US adults, as 68% of the adult population are currently classified as such. Several health issues, including cardiovascular health, are associated with increased adiposity. The ForeverFit Program was designed to promote weight loss and cardiovascular fitness via behavior change and structured exercise sessions. Programs that demonstrate weight loss and improved health variables are essential for societal health.

PURPOSE: The purpose of this study was to assess the effectiveness of the ForeverFit Weight Loss Program.

METHODS: Ten overweight and obese (BMI=31.4 kg/m² ± 4.8) women (49.4 years ± 11.4) were assessed for body composition, cardiovascular health, and exercise and nutrition self-efficacy prior to and following the ten week program. Bioelectrical impedance analysis (InBody 270, California, USA) measured body composition and weight, VO2 max was measured via the Ebbeling treadmill protocol, and resting heart rate and blood pressure were measured by an oscillometric automated device (Omron 10 series, Illinois, USA). Self-efficacy was measured via Eating and Exercise Habits Confidence Surveys. The participants underwent a ten week exercise and education program in which they exercised in small groups led by a personal trainer twice each week and given weekly behavior challenges. Variables were analyzed pre and post via paired t-test (p < 0.05).

RESULTS: Participants showed significantly decreased body weight (2.54 kg ± 3.36, p=0.041), BMI (0.84 kg/m² ± 1.11, p=0.040), fat mass (2.47 kg ± 0.2, p=0.024), and water (-0.72 kg ± 0.17, p=0.002). Diet (0.70 ± 0.58, p=0.025) and exercise (0.66 ± 0.87, p=0.040) self-efficacy demonstrated significant increases over the 5-month Likert scale. Percent body fat approached significance (-1.59% ± 2.36, p=0.059). Skeletal muscle mass, resting heart rate, blood pressure, and VO2 max did not change significantly.

CONCLUSION: Twice weekly exercise sessions combined with weekly behavior change challenges were effective at reducing body weight and improving self-efficacy in overweight and obese individuals. Future iterations of the ForeverFit Weight Loss Program should augment the supervised exercise sessions to more effectively target cardiovascular changes.

1671 Board #265 May 28 10:30 AM - 12:00 PM
Trajectories Of Physical Activity In Adults After TKR: A Comparison Of Functional And Psychosocial Measures
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Despite improvements in pain and function, adults after total knee replacement (TKR) remains largely inactive on average and subsequently are at risk for cardiovascular disease, diabetes, and other lifestyle-related chronic diseases. However, there is large variability of change, and little is known about what distinct physical activity (PA) trajectories may exist. PURPOSE: To explore trajectories of objectively-measured PA in adults after TKR and describe baseline (BL) functional and psychosocial measures of the trajectory groups. METHODS: We used data from an ongoing PA intervention study in adults after TKR. Daily steps/day were collected via Fitbit and averaged across 7 days. We identified trajectory groups of PA via a group-based trajectory model. We selected the optimal number of trajectory groups by requiring the smallest group to include ≥ 5% of the subjects in the sample. We used posterior probabilities of group membership from each individual to assess model fit. BL differences for functional [6 Min Walk, Timed Up & Go, 30 Sec Chair Rise] and self-reported [Pain Catastrophizing Scale (PCS), Tampa Scale of Kinesiophobia (TSK), Self-Efficacy for Exercise (SEE), SF-36] measures between the groups were assessed using independent t-tests and Cohen’s d effect sizes. RESULTS: 27 subjects were allocated to two trajectory groups: high PA (n=12) and low PA (n=15) (Figure 1). The high PA group had more males (8 vs 3) and better scores on the PCS (13.4 ± 10.5 vs 5.6 ± 6.2, p = 0.049), TSK (33.2 ± 6.7 vs 27.6 ± 4.1, p = 0.027), and SF-36 (34.3 ± 18.6 vs 40.2 ± 29.2, p = 0.037), but were not different on age, functional measures, or pain, compared to the low PA group. CONCLUSIONS: We identified two potential trajectories of change in PA after TKR. Both groups showed improvement in PA after 15 weeks of intervention. Greater improvement may be influenced by psychosocial factors, such as pain and movement perception, rather than functional ability. Supported by NIH R21 AR07709

1672 Board #266 May 28 10:30 AM - 12:00 PM
Quantifying Physical Activity After Concussion: The Relationship Between Sleep Quality, Symptoms, And Steps.
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BACKGROUND: Concussion management guidelines have evolved over recent years to include earlier introduction of physical activity. Determining optimal post-concussion physical activity levels with objective methods will further aid clinicians in counseling patients on the role of physical activity in concussion recovery. PURPOSE: Our aim was to investigate the relationship of physical activity, as measured by daily step count, with post-injury sleep quality, symptom rating, and dual-task performance in children among young athletes with concussion. METHODS: We conducted a longitudinal investigation of youth athletes who sustained a concussion and were randomized to a no activity group and an activity group. TheForeverfit Weight Loss Program should augment the supervised exercise sessions to more effectively target cardiovascular changes.

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Dual-task gait, Post-Concussion Symptom Inventory, and Pittsburgh Sleep Quality Index values were collected at both visits. We compared outcomes between those who recorded an average of ≥10,000 steps/day (high physical activity) and <10,000 steps/day (low physical activity) between initial and return-to-play clearance visits.

RESULTS: Six concussed athletes were classified as having high physical activity (33% female; 14.9±2.0 years of age; 13,900±3,390 steps/day), and five were classified as having low physical activity (40% female; 15.8±1.7 years of age; 8,415±1,775 steps/day). There were no significant differences found at initial visit for total symptom severity (44.3±30.8 vs. 52.2±28.4; p=0.46), sleep quality (6.8±4.4 vs. 8.8±2.0; p=0.38), or dual-task gait cost (22.4±7.9 vs. 25.0±13.3; p=0.73) between the high and low physical activity groups. At the time of return-to-play clearance, however, the high physical activity group reported significantly better sleep quality (1.3±1.9 vs. 6.7±1.5; p=0.009) and lower symptom severity (0.3±0.8 vs. 3.0±2.0; p=0.02) than the low physical activity group.

CONCLUSIONS: Adolescents with a concussion who participated in more physical activity after their initial clinical visit reported better sleep quality and lower symptom severity at return-to-play clearance than the low physical activity group. These preliminary results further support the utility of physical activity in concussion management.

1675

Board #269
May 28 10:30 AM - 12:00 PM
Employees With Metabolic Syndrome And Increased Depression Severity Profit Most From Exercise For Work Ability.

Sven Haufe1, Kai G. Kahl1, Arno Sander1, Pauline Bayerle1, Hedwig T. Stenner2, Arno Kerling1, Kai G. Kahl1, Sven Haufe1, Kai G. Kahl1, Arno Sander1, Pauline Bayerle1, Hedwig T. Stenner2, Arno Kerling1

11675-1

PURPOSE: Major depressive disorder is associated with less productivity, earlier retirement, and more sick-days at the workplace. These associations also exist for patients with metabolic syndrome. For both, exercise is a generally recommended part of multimodal treatments. However, for individuals with metabolic syndrome, in which depression is more prevalent and severe, evidence for the efficacy of exercise interventions is limited.

METHODS: Company employees with diagnosed metabolic syndrome (n=314, age: 48 ± 8 yrs) were randomized to a 6-month exercise intervention (150 min per week) or wait-list control. Participants received individual recommendations for exercise activities by personal meetings, telephone or via a smartphone app. Physical activities were supervised and adapted using activity monitor data transferred to a central database. Work ability (work ability index), depression severity (hospital anxiety and depression scale [HADS]), and health-related quality of live (short form 36 [SF-36]) were assessed.

RESULTS: We included 318 subjects from which 287 finished the intervention. After baseline stratification for normal (HADS scores 0-7) and increased depression scores (HADS scores 8-21) individuals with increased severity scores had similar age, body composition, blood lipids, and cardiorespiratory fitness compared to those with normal scores, but lower total work ability (33.1 ± 5.4 vs. 38.2 ± 4.9 points, p<0.05) and component sum scores of health-related quality of life. After 6 months total work ability increased in the exercise group compared to controls with the magnitude of the observed increase being significantly greater for subjects with increased depression severity at baseline (3.7 ± 3.4 points) compared to those with normal severity scores (1.2 ± 2.4 points) (p=0.021).

CONCLUSIONS: A 6-month exercise intervention for company employees with metabolic syndrome showed strongest effects on self-perceived work ability in individuals with mild to severe depression severity. This suggests exercise programs offered to workers with metabolic syndrome not only reduces individual disease risk but may also reduce healthcare and employers costs arising from metabolic syndrome and mental disease conditions.

1676

Board #270
May 28 10:30 AM - 12:00 PM
Effect Of Hatha Yoga And HIIT On The Psychological Status Of Female University Students With High Risk Of Eating Disorder

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PURPOSE: By using Hatha Yoga (Yoga) and High Intensity Interval Training (HIIT) to intervene the female university students at high risk of eating disorder (ED), this study was purposed to get better understanding of the effects of exercise on the reduction of ED risk and improvement of psychological status.

METHODS: A total of 384 female university students (20.40 yrs) were involved in the EDI-3 estimate, and 92 of them were judged to have high risk of ED. Eventually
63 of the 92 students participated in the eight-week intervention study after filling the informed consent form. They were randomly divided into three groups: the Yoga group (Y), HIIT group (H) and control group (C) (n=21, per group). During the experiment, the subjects were asked to record their daily diet logs and wear accelerometers to measure physical activities. The exercises were as follows: (1) Y: 60 min/outing (including 5 min of regulated breathing, 45 min of Yoga Asana training and 10 min of relax), 3 times/ wk. (2) H: treadmill exercise, 5 min of warm-up, 4+3 min of 90% VO2max exercise +5 min of 60% VO2max exercise, 5 min of relax, 3 times/wk. (3) C: daily physical activity without extra exercise. At the end of 8-week experiment, EDI-3 was conducted again.

RESULTS: (1) In reducing the value of Drive for Thinness (ΔDT=−2.74), Y was significantly better than H (p<0.05); however in reducing the value of Body Dissatisfaction (ΔBD=−2.95), H was significantly better than Y (p=0.05). (2) In reducing the value of Bulimia (ΔB), both Y (ΔB=−3.32, p<0.05) and H (ΔB=−5.7, p<0.01) were effective in contrast to C. (3) In reducing Perfectionism value (ΔP=−2.95), Y was very significantly better than H (p<0.01). (4) The subscales of DT and B were positively correlated with the subscales of Interceptive Deficits (ID) and Emotional Dysregulation (EDy) (r=0.005).

CONCLUSIONS: (1) 23.96% of female university students were at high risk of ED. (2) Both Yoga and HIIT could effectively reduce the risk of ED. (3) Yoga were more effective in reducing the DT behavior and improving the mental status in terms of EDy and P. (4) HIIT were more effective in reducing the BD and B behaviors. (4) The risks of DT and B were correlated with the psychological status such as ID and EDy.

Acknowledgment: This study was supported by 2018 Education Reform Project of BSU.

1677 Board #271 May 28 10:30 AM - 12:00 PM
EXERCISE METHOD AND EFFECT EVALUATION OF HIGH INTENSITY INTERVAL EXERCISE INTERVENTIONNAFLD IN EXERCISE AND MEDICAL INTEGRATION
Hantarun Li, Chao Luo, Liangyi Hu, Yuhao Cao, Yiqing Lan, Qingjia Song, Zhiping Zhen. Beijing Normal University, Beijing, China.

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No relevant relationships reported

PURPOSE: Based on the analysis of the detection rate of fatty liver in the physical examination of the faculty in Beijing Normal University from 2017 to 2018, this study designed and implemented a high-intensity interval centered on improving exercise intensity, imparting motor skills, comprehending sports value, and experiencing exercise effects.

METHODS: (1) Intervention: The exercise mode is high-intensity intermittent exercise, and the specific exercise forms cover resistance and aerobic content. HIIT exercise intensity is 85%-95% Hmax, exercise time is 50 minutes each time, the number is 3 times a week for 12 weeks. (2) Physical and medical routine monitoring indicators of comprehensive health response NAFLD population, including body shape, quality index, heart rate, blood pressure, maximal oxygen uptake, blood biochemical index.

RESULTS: (1) The detection rate of fatty liver in faculty and staff was higher in males than in females (P<0.01); it was characterized by increasing age (P<0.01) and obesity being higher than normal (P<0.01). (2) After 12 weeks of HIIT intervention, the body weight, waist circumference and waist-to-height ratio of the exercise group decreased significantly, which decreased by 1.9%, 0.9% and 1.9%(P<0.01), respectively. (3) In the exercise group, the four physical quality indicators increased significantly (P<0.01). (4) The HDL-C of the exercise group increased significantly (P<0.05), LDL-C increased slightly, FBG, TC, TG decreased slightly. (5) AST and ALT in the exercise group decreased significantly (P<0.01). (6) The effective rate of exercise on NAFLD was 57.7% in the exercise group, which was significantly higher than that of NAFLD subjects, and it can significantly improve the liver sonogram of NAFLD subjects. (7) 12-week HIIT can significantly improve the liver sonogram of NAFLD subjects, and it can effectively promote the improvement of motor skills of NAFLD subjects.

CONCLUSIONS: (1) From 2017 to 2018, the detection rates of fatty liver in physical examination of teachers were 32.2% and 25.3% respectively. (2) 12-week HIIT can significantly reduce the body weight, waist circumference, AST and ALT of NAFLD subjects, and it can significantly improve the lung capacity, physical fitness indicators, HDL-C of NAFLD subjects. (3) 12-week HIIT can significantly improve the liver sonogram of NAFLD subjects, and it can effectively promote the improvement of motor skills of NAFLD subjects.
CONCLUSION: Despite having found significant moderate to low correlations in both men and women, it seems that both Motor Competence and Fitness status has important influence on physical functioning.

Objective: Clinical practice recommendations issued by the American Diabetes Association in 2019 include the health status and quality of life of people with diabetes as part of their daily care, and believe that it’s important to strengthen physical exercise for diabetic patients. Previous studies have shown that the Baduanjin, a traditional Chinese sport, can regulate blood glucose and blood lipids, weight loss and improve immunity. This study aimed at investigating the effects and safety of Modified Baduanjin on patients with type 2 diabetes.

Methods: Forty patients were divided into the Modified Baduanjin group (A group, n=22) and the control group (B group, n=18) for 12 weeks according to their individual motivation. On the basis of conventional hypoglycemic treatment, Group A practiced Baduanjin for 30 minutes per day, 4 times per week, while no exercise intervention was given in group B. The main study outcomes included changes in fasting blood glucose, blood lipids, glycosylated hemoglobin, Quality of Life score (Qol score, 100 in total), muscle endurance, and flexibility after 12 weeks. Results: There were no significant differences in patient characteristics between the two groups at baseline. Group A in glycosylated hemoglobin (pre 6.56±0.70 vs post 6.28±0.70), Qol score (pre 80.18±9.02 vs post 86.64±9.91), muscle endurance (pre 3.76±4.38 vs post 6.91±5.73) and flexibility (p=0.26±9.69 vs post 5.88±9.75). All the above results were statistically significant (P<0.05). There were no statistical significance in group B (P>0.05). 2) Few changes were found in fasting blood glucose and lipid parameters both in two groups (P>0.05). 3) All patients completed the exercise programme with no adverse effects. Conclusion: Chinese traditional exercise is effective and safe in regulating and controlling the level of blood glucose, enhancing physical fitness and improving the quality of life.

Falls are established as the leading cause of hospitalization amongst older adults leading to institutionalization and premature mortality. Peer-led exercise has been recognized as a powerful intervention for reducing the risk of falls. However, it is unclear if current community programs are attracting individuals at risk of falling.

Purpose: To examine the characteristics of participants enrolled in a community-based peer-led fall prevention exercise program.

Methods: Between 2012-2018, 912 older adults participated in this program. The 12-week peer-led fall prevention exercise program was offered to older adults 50+ twice per week for a total duration of 120 minutes. The program consisted of endurance, strength and balance exercises. At baseline, sex, age, falls, injuries due to falls, balance, hospital visits and medications were self-reported. Five times sit-to-stand (S-St) tests and 8ft up and go (8UG) tests were also measured to assess lower extremity strength and dynamic balance in relation to risk of mobility loss and falls.

Results: A total of 87.5% were women with an average age of 68 years old. Sixteen percent of participants reported falling in the past year, 58% of which resulted in injury. One-third of the participants reported having issues with balance, 9% had been to hospital in the past year and we prescribed an average of three medications. On average, females completed the 8UG test in 9.18 seconds and the S-St test in 13.10 seconds while males completed the tests in 10.25 seconds and 14.35 seconds, respectively. According to norms, all test means classified participants as at risk for mobility loss and falls. Females performed significantly better than males in the 8UG test (p = 0.001) and S-St test (p = 0.040).

Conclusion: The peer-led fall prevention program is attracting mainly women participants with various physical capacities and risks of falls.

Funding: NHHRF and GNB-Wellness

Adolescent physical health is associated with the behaviour of physical activity (PA). To date, the intervention studies on improving adolescent PA emerge in an endless stream, however, those put few emphasis on the generation process of PA, especially in the psychological effects of PA. Purpose: This current study is to examine the intervention impacts of psychological effects on adolescent PA behaviour based on the Theory of Planned Behaviour (TPB) and the Self-efficacy Theory (SET).

Methods: Participants (n=51, 12±0.3y) in seventh grade from a Chinese junior middle school were assigned to two groups: the intervention group (n=24) and the control group (n=27). Both groups were pre and post tested with the related psychological effects questionnaires which were selected according to the TPB and SET, and PA behaviour measured by PA Scale and ActiGraph accelerometer (Model: wGT3X-BT). The intervention group took part in 8 times 45-minutes classes during 8 weeks, including 5 courses related to health, nutrition and PA, and 3 outdoor interesting basketball matches. The control group was not asked to make any change to their normal school day. A 2×2 repeated measure ANOVA was mainly conducted. Results: In terms of psychological effects of PA, the intervention group showed significant increases in perceived behavioral control (F=5.279, p=0.024), self-efficacy intention (F=10.662, p=0.002) and self-efficacy (F=6.427, p=0.013) over the control group, but in not exercise attitude, subjective norms and outcome expectancy. Furthermore, with regard to PA behaviour, the intervention group presented significant improvement in the duration of PA per time (F=5.406, p=0.022) and percentage of light intensity in 7 days (F=6.443, p=0.013) as well as the reduction in percentage of sedentary behaviour in 7 days (F=3.934, p=0.048) compared to the control group. No significant change in the rest of PA behaviour parameters were found between two groups. Moreover, the chi-square test indicated that the number of intervention group students participating in MVPA significantly increased compared to the control group after the eight-week intervention (=6.21, p=0.036). Conclusion: It was concluded that the psychological effects intervention towards PA based on TPB and SET can improve adolescent PA over the eight-week specific courses.
The nature of office work promotes a sedentary lifestyle associated with an increased risk of obesity. Many interventions have attempted to combat physical inactivity among sedentary office workers. The sit-to-stand (STS) workstation is a modality aimed at improving workers’ physical health.

**PURPOSE:** Therefore, the purpose of this study is to evaluate the effects of using a STS workstation on body composition measures of overweight sedentary women over the course of 12 months. **METHODS:** All participants were volunteer faculty and staff of the University of Central Oklahoma randomly assigned to a control (n = 19) or STS workstation intervention (n = 13) group. Participants of both groups consented to a pre-test, 6-month, and 12-month dual-energy X-ray absorptiometry (DXA) scan to assess variables of body composition including, but not limited to; body fat percentage (BF%), total fat mass, total lean mass, total bone mineral density (BMD), and the ratio of android to gynoid (A/G) fat. The STS intervention group was tasked with standing at least two hours per work day, while the control group was instructed to continue their day as normal without incorporating the use of a STS workstation.

**RESULTS:** Multiple 2 x 3 mixed-design ANOVA tests were conducted to examine the effects a STS workstation has on body composition over time (pre-, 6mos., and 12mos.). There were no significant interactions between time and group for total BF% ($F_{(2, 60)} = 11.6$, $p < .05$), total fat mass ($F_{(2, 60)} = 26$, $p > .05$), total lean mass ($F_{(2, 60)} = .51$, $p > .05$), total BMD ($F_{(2, 60)} = 15$, $p > .05$), and A/G ratio ($F_{(2, 60)} = .37$, $p > .05$). Additionally, there was not a significant main effect found for groups among any of the five body composition variables. A significant main effect was found for total $BMD (F_{(2, 60)} = 11.6$, $p < .001$) and A/G ratio ($F_{(2, 60)} = 3.2$, $p = .046$), but not for BF%, total fat mass, and total lean mass.

**CONCLUSIONS:** The implementation of a STS workstation did not significantly improve body composition when compared to the control group. Future research is needed to determine if utilizing a STS workstation improves other body composition variables.

**ACKNOWLEDGEMENTS:** This study was funded by the University of Central Oklahoma, Research and Sponsored Programs office.

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**The Effects Of A Sit-to-stand Workstation On Body Composition Over 12 Months**

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(No relevant relationships reported)

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The metabolic inflexibility (limitation to respond or adapt to conditional changes in metabolic demand due to dietary patterns, energy availability, or circulating energy substrates) may be associated with variations in estrogen concentrations observed during the monthly ovarian cycle, whereas that apparently healthy women observed during the monthly ovarian cycle, whereas that apparently healthy women

**PURPOSE:** The aims of this study were to verify and compare the influence of eight treadmill high-intensity interval training (HTT) sessions on carbohydrate and lipid oxidation rates (CHOox and LIPox, respectively) and intensities of ventilatory anaerobic thresholds (VATs) of women in different phases of monthly ovarian cycle. **METHODS:** Eleven irregularly active women performed incremental treadmill exercise testing followed by submaximal work-rate running for 45min to determine VATs, VO2max peak velocity ($V_{\text{peak}}$), and substrate oxidation rates, before and after training period, in different phases of their monthly ovarian cycle (“Follicular” phase group, FPG, $n=6$; “Luteal” phase group, LPG, $n=5$). The training period consisted of eight HTT sessions, composed each one of eight sets of 60s running at 100% $V_{\text{peak}}$ interspersed by 75% recovery. Our results showed no significant differences in VATs intensities between groups. The comparison between groups showed significant differences in relative energy derived from CHOox pre-post training of the -61.4% and LIPox pre-post training of the -59.3% respectively, and LIPox pre-post training of the 27.5% and 34.4% respectively. The relative energy derived from CHOox after the training period were 18.9% and -59.3% respectively, and LIPox pre-post training of the 27.5% and 34.4% respectively. Additionally, there was not a significant main effect found for groups among any of the five body composition variables. A significant main effect was found for total $BMD (F_{(2, 60)} = 11.6$, $p < .001$) and A/G ratio ($F_{(2, 60)} = 3.2$, $p = .046$), but not for BF%, total fat mass, and total lean mass.

**CONCLUSIONS:** The implementation of a STS workstation did not significantly improve body composition when compared to the control group. Future research is needed to determine if utilizing a STS workstation improves other body composition variables.

**ACKNOWLEDGEMENTS:** This study was funded by the University of Central Oklahoma, Research and Sponsored Programs office.

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**The Effect Of Yoga On Body Fat And Cardiorespiratory Fitness Of Sedentary Overweight Female Students**

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**PURPOSE:** To observe the effects of 8-week yoga on body fat and cardiorespiratory fitness of sedentary overweight female students. **METHODS:** 25 healthy overweight female students were recruited online or in classroom. They were randomly divided into the yoga (n=13) and control (n=12) group. 8-week Hatha yoga, 4 times/week, 60 minutes/time. After each session, subjects were asked about their feelings to adjust the intensity. During the intervention, all subjects maintained their daily diet and physical activity. Control group can join our yoga practice if they wanted to after the experiment. Before the experiment, the height was measured twice with a height meter. Body composition was measured by DXA, cardiorespiratory fitness was tested with the Bruce Protocol in pre- and post- experiment, body weight, fat mass, Fat% and VO2max were automatically identified by the computer. All operations were done by same person. All the data were compared between groups with independent sample t-test, and within groups with paired sample t-test, SPSS was used for statistics.

**RESULTS:** (1) In pre-experiment, there were no significant difference in age, height, weight, BMI, body Fat, Fat%, android and gynoid Fat mass, absolute and relative VO2max. (2) In post-experiment, the relative VO2max (38.5±4.41 VS 38.4±3.77, p < 0.05) in the yoga but not the control group was significantly increased; (3) Compared with the pre-experiment, Fat% (34.3±2.41 VS 33.63±2.64, p < 0.05) in yoga group decreased significantly, absolute VO2max (1.95±0.33 VS 2.19±0.27, p < 0.01) and relative VO2max (33.85±3.41 VS 38.54±4.01, p < 0.01) increased significantly in the post-experiment, All indicators in the control group showed no significant difference in pre- and post-experiment; (4) Significant differences in the changes of Fat% (0.73%±0.98% VS 0.06%±0.68%, p < 0.05), absolute VO2max (0.2±0.21 VS 0.06±0.13, p < 0.05) and relative VO2max (4.69±3.45 VS 1.17±1.96, p < 0.01) existed between the two groups.
How children perceive their physical ability and body image can impact their involvement in physical activities. Teaching children basic mechanics and exposing them to new activities may increase the likelihood of selecting a physically active option versus a passive option. Purpose: The purpose of this research was to examine the relationship between body mass index (BMI) and self-perception of adequacy in and enjoyment of physical activity following implementation of a six-week physical literacy (PL) intervention. Methods: Students (n = 92) in grades 2-5 completed the Children’s Self-Perceptions of Adequacy and Predilection for Physical Activity (CSAPPA) scale pre- and post- PL intervention. The PL intervention program consisted of a once weekly, 30-minute program conducted by trained individuals during the school day. This program was designed to focus on the mechanics of running, jumping, and throwing. Height and weight were measured pre- intervention to calculate BMI using the Center for Disease Control’s Youth and Teen calculator. Results: A significant interaction between CSAPPA score and BMI category was found, (F (1,82) = 4.948, p < 0.05). Further evaluation of the interaction indicated that students in the unhealthy BMI category were more likely to choose an active over a passive physical activity option following the PL intervention. Conclusion: Based on the aforementioned results, PL programming seems favorable in improving self-perception of physical activity selection in children with abnormal BMIs. Previous research has shown that students who do not feel confident performing a task are less likely to participate. Following the trend of decreased exposure to physical activity during school, students with unhealthy BMIs are not getting proper exposure to the mechanics of movement. This may lead to less physical activity participation and increases in unhealthy BMI ranges. By teaching children that they can move proficiently, children are making more active choices possibly leading to improvements in self-perception.

CONCLUSIONS: 8-week yoga can reduce the Fat% and improve cardiorespiratory fitness of sedentary overweight female students. Acknowledgment: this study was supported by 2018 Education Reform Project of BSU and The Laboratory of the Ministry of Education.

PAPER TITLES

1688  Board #282  May 28 10:30 AM - 12:00 PM
IMPROVEMENT IN ELEMENTARY STUDENTS PREFERENCE FOR PHYSICAL ACTIVITY ENGAGEMENT FOLLOWING PHYSICAL LITERACY PROGRAMMING
Abigail Daugherty, Brandi Eveland-Sayers, Alyson Chroust, Andrew Dotterweich, Brianna Steffey. East Tennessee State University, Johnson City, TN. (No relevant relationships reported)

PURPOSE: The purpose of this research was to examine the relationship between body mass index (BMI) and self-perception of adequacy in and enjoyment of physical activity following implementation of a six-week physical literacy (PL) intervention. Methods: Students (n = 92) in grades 2-5 completed the Children’s Self-Perceptions of Adequacy and Predilection for Physical Activity (CSAPPA) scale pre- and post- PL intervention. The PL intervention program consisted of a once weekly, 30-minute program conducted by trained individuals during the school day. This program was designed to focus on the mechanics of running, jumping, and throwing. Height and weight were measured pre- intervention to calculate BMI using the Center for Disease Control’s Youth and Teen calculator. Results: A significant interaction between CSAPPA score and BMI category was found, (F (1,82) = 4.948, p < 0.05). Further evaluation of the interaction indicated that students in the unhealthy BMI category were more likely to choose an active over a passive physical activity option following the PL intervention. Conclusion: Based on the aforementioned results, PL programming seems favorable in improving self-perception of physical activity selection in children with abnormal BMIs. Previous research has shown that students who do not feel confident performing a task are less likely to participate. Following the trend of decreased exposure to physical activity during school, students with unhealthy BMIs are not getting proper exposure to the mechanics of movement. This may lead to less physical activity participation and increases in unhealthy BMI ranges. By teaching children that they can move proficiently, children are making more active choices possibly leading to improvements in self-perception.

1689  Board #283  May 28 10:30 AM - 12:00 PM
Effects Of Different Types Of Exercise Programs And/ or Nutritional Guidance On Body Fat And Muscle Mass Distribution In Overweight Adults: A Secondary Analysis Of A Randomized Controlled Trial
Mikel Izquierdo1, Katherine Gonzalez-Ruiz2, Carolina Medrano-Mena3, Jorge E. Correa-Bautista1, Robinson Ramirez-Velez. 1Public University of Navarra, Pamplona, Spain. 2Unidad de Investigación del Desarrollo del Niño, Universidad del Norte, Barranquilla, Colombia. 3Universidad Autónoma de Nuevo León, Nuevo León, Mexico. (No relevant relationships reported)

PURPOSE: Both exercise training and diet are recommended to prevent muscle mass loss and excessive fat accumulation. The aim of the present study was to investigate whether 12 weeks of high-intensity interval training (HIIT), resistance training (RT), or combined training (CT = HIIT + RT) can induce differences in body composition and result in improved physical performance. Methods: Subjects (n=128) were randomly assigned to HIIT, RT, or CT groups and trained 3 times per week for 12 weeks. Outcome measures were assessed at baseline and the end of the intervention. Results: Significant differences were observed between groups in body fat percentage (HIIT vs. RT, HIIT vs. CT; p<0.05), trunk fat mass (HIIT vs. RT, HIIT vs. CT; p<0.05), waist circumference (HIIT vs. CT, RT vs. CT; p<0.05), and resting heart rate (HIIT vs. RT, HIIT vs. CT; p<0.05). Conclusion: HIIT and CT are more effective in improving body composition and physical performance compared to RT.]

1690  Board #284  May 28 10:30 AM - 12:00 PM
A Short-term Longitudinal Study Of The Effectiveness Of Kids Get Fit Fitness And Nutrition Curriculum
Pranav Gupta1, Benjamin Hoag2, José Miguel Malaspina3, Ana Mafalda Martins1, Toyin Ajasafe1, Jon Roberts1. 1Driscoll Children’s Hospital and Texas A&M College of Medicine, Corpus Christi, TX. 2Texas A&M College of Medicine, Corpus Christi, TX. Email: pranav.gupta@dhstx.org (No relevant relationships reported)

PURPOSE: This study investigated the effects of the Kids Get Fit (KGF) fitness (promised on integrative neuromuscular training) curriculum and nutritional education on measures of movement competence, muscular endurance, and dietary behavior in elementary school age children. METHODS: Participants were 4th graders at two local schools (94±2% Hispanic/Latino) in Corpus Christi, Texas, i.e., experimental (n = 69; 31 males; 85 ± 0.5 years; 132.6 ± 6.3 cm; 36.3 ± 10.7 kg) and control (n = 40; 14 males) (8.4 ± 1.2 years; 131.7 ± 17.1 cm; 35.7 ± 11.5 kg). KGF instructors delivered an engaging curriculum that included fitness, dance, yoga, and nutritional education to children at the intervention school, while the control school had traditional physical education classes across 12 weeks. Movement competence (standing long jump, sit and reach, cumulative endurance (90% push-up, sit-up), and throwing distance) and dietary behavior (EFNEP 3rd Grade Survey) were assessed at baseline and within a week of concluding the intervention. A series of factorial ANOVA and Mann-Whitney U Test was used to explore differences within and between groups. Statistical significance was set at P < 0.05. RESULTS: There was a significant interaction of time and intervention (F(1,108) = 7.973, P = .006); the control group had greater resting heart rate increase compared to the experimental group. There was a significant interaction of time and intervention (F(1,96) = 8.579, P = .004); the experimental group showed greater increase in standing long jump performance compared to the control group. There was a significant main effect of the intervention (F(1,107) = 6.192, P = .014); the experimental group showed increased 90o push-up performance compared to the control group. There were no significant differences in sugar-sweetened beverage (U = 1311.500, P = .505), vegetable (U = 1399.500, P = .924), and fruit (U = 1341.500, P = .629) consumption between groups after 12 weeks. CONCLUSIONS: Findings suggest the intervention improved muscular endurance and movement competence. Improved stability of resting heart rate suggests favorable cardiovascular effects attributed to enhanced fitness. Lack of differences in dietary behaviors further underscore the importance of involving entire families in nutritional education and addressing access to healthy foods in elementary school age children.

1691  Board #285  May 28 10:30 AM - 12:00 PM
Maternal Fitness And Physical Activity Levels Decrease Infant Adiposity Up To 1 Year Of Age
Jacob K. Rasey, Jeanine Mincher, Sara F. Michaliszyn. Youngstown State University, Youngstown, OH. Email: jkrasey02@student.ysu.edu (No relevant relationships reported)

Maternal obesity and excess gestational weight gain (GWG) are associated with increases in infant birth weight and childhood obesity. While greater levels of physical activity are associated with lower GWG and may contribute to reduced infant birthweight and infant adiposity, this remains to be substantiated. Purpose: The objective was to examine the relationships between aerobic physical activity during pregnancy, maternal cardiorespiratory fitness, GWG, and infant adiposity from birth to one year of age. Methods: Nineteen pregnant mothers with singleton pregnancies were randomized into either aerobic intervention (N=9) or control (N=10) groups and followed for 12 months postpartum. At 12 weeks, 12 weeks, 20.2 weeks and 36.2 weeks, maternal cardiorespiratory fitness (VO2max, ml/min) was assessed using cycle ergometer (CCM), percent body fat (range r = -.59 to -.82; p<0.02) and GWG (range r = -.32 to -.40; p<0.05). Multiple linear regression analysis with energy expenditure, MVPA, step count and MET level were associated with lower maternal and percent body fat (range r = -.90 to -.52; p<0.02) and GWG (range r = -.30 to -.35; p<0.05). Results: Higher total energy expenditure, moderate to vigorous physical activity (MVPA) and step count, and MET level were associated with lower GWG and percent body fat (range r = -.90 to -.52; p<0.02) and GWG (range r = -.30 to -.35; p<0.05). Conclusion: Total time spent in physical activity during pregnancy did not associate with infant adiposity at birth or during follow-up. However, women with higher cardiorespiratory fitness participated in greater MVPA throughout pregnancy compared to those who were less fit (67.1 ± 38.3 vs. 23.8 ±...
MVPA may benefit bone health in middle-aged and older patients with CKD. Sectional findings suggest that replacing sedentary behavior with the same amount of moderate-intensity continuous training (MICT) showed positive associations when replacing time from one behavior to another, while keeping total time and other behaviors constant. [PURPOSE] The purpose of this study was to determine the associations of sedentary behavior and physical activity with bone mineral density in patients with CKD, using isometric substitution approach. [METHODS] A total of 108 middle-aged and older patients with CKD (65 ± 9 years) participated in this study. The time spent in sedentary behavior, light-intensity physical activity (LPA), and moderate- to vigorous-intensity physical activity (MVPA) were assessed using triaxial accelerometers. As indices of bone mineral density, speed of sound (SOS), broadband ultrasound attenuation (BUA) and stiffness index were used. SOS and BUA were measured using ultrasound bone-densitometer. Stiffness index was calculated from SOS and BUA. [RESULTS] The time spent in MVPA was significantly and positively associated with SOS (B = 1.328, 95% CI; 0.094, 2.652), BUA (B = 0.837, 95% CI), 0.046, 0.609) and stiffness index (B = 0.926, 95% CI; 0.091, 1.762) after adjusting for age, sex, body mass index and kidney function. However, the time spent in sedentary behavior and LPA were not significantly associated with bone mineral density measurements. Isometric substitution approach showed that replacement of 10 min/day of sedentary behavior with equivalent MVPA time was beneficially associated with SOS (B = 1.455, 95% CI; 0.224, 2.686), BUA (B = 1.015, 95% CI; 0.289, 1.742) and stiffness index (B = 1.088, 95% CI; 0.311, 1.864). [CONCLUSION] These cross-sectional findings suggest that replacing sedentary behavior with the same amount of MVPA may benefit bone health in middle-aged and older patients with CKD.

The cardiometabolic benefits of resistance training in senior populations are well documented however, adoption and adherence remain low. Rigorously structured resistance-training interventions and lack of quality, personalized instruction may be to blame. [PURPOSE] We tested the hypothesis that a community-based, personalized, resistance-training program offered to senior citizens would improve cardiometabolic health and positively influence exercise adherence by accommodating a wide range of fitness levels. [METHODS] Five senior citizens (2M/3F, 74 ± 5 years) completed a personalized resistance-training program that consisted of meeting with a trainer twice a week, for 60-minutes, over the course of six weeks. Pre and post exercise intervention, physical fitness and body composition were determined with the Senior Fitness Test and anthropometric measures, respectively. Metabolic health was assessed by measuring circulating plasma lipids (total cholesterol, high-density lipoprotein, low-density lipoprotein, and triglycerides) and glucose, and determination of blood pressure. Adherence was calculated as the percentage of resistance-training sessions attended. Semi-structured interviews were conducted on a weekly basis to grasp detailed approaches trainers utilized in each exercise session to promote adherence. [RESULTS] In support of our hypothesis, a six week, community-based, personalized, resistance-training program offered to senior citizens was an effective method to improve cardiometabolic health while encouraging adherence.

C-45 Free Communication/Poster - Nutrition and Metabolism: Meta-Analyses

BACKGROUND: Use of high-fat diets to support physical performance has grown in popularity over recent years. While this strategy allows for enhanced fat oxidation and reduced reliance on carbohydrate for fuel during exercise, its ability to improve physical performance has not been consistently shown. [PURPOSE] Determine effect of high-fat diets (FAT) on physical performance compared to control carbohydrate diets (CHO). [METHODS] Meta-analysis was conducted on studies with healthy (BMI < 30) trained or untrained men or women consuming isocaloric FAT (> 50% total energy intake) compared to control CHO diets for > 2 days, followed by a physical performance test. Performance outcomes were grouped as endurance (time to exhaustion, time trial, and VO2max) and power/strength. Data presented as effect size [ES (95% CI)] using Hedges’ g with random effects. Analysis was conducted on crossover and parallel study designs separately. [RESULTS] A total of 31 studies (21 crossover, 10 parallel) containing 51 subgroups (31 crossover, 20 parallel) were identified. Overall, FAT had no effect on physical performance in crossover [-0.13 (-0.36, 0.11)] or parallel [-0.18 (-0.53, 0.17)] studies compared to CHO. Stratified by training status, FAT had no effect on trained individuals in crossover [-0.08 (-0.26, 0.09)] or parallel [0.05 (0.17, 0.26)] studies compared to CHO. In untrained individuals, FAT had a negative effect [-1.14 (-2.01, -0.28), P < 0.05] in parallel studies compared to CHO, and no effect [-0.32 (-1.22, 0.57)] in crossover studies compared to CHO. Stratified by performance outcome, FAT had no effect on endurance performance in crossover [-0.10 (-0.26, 0.09)] or parallel [-0.27 (-0.80, 0.25)] studies compared to CHO. FAT had a negative effect on power/strength [-0.23 (-0.45, 0.00), P < 0.05] in crossover studies compared to CHO. FAT had no effect on power/strength [-0.08 (-0.44, 0.27), P < 0.05] in parallel studies compared to CHO. [CONCLUSION] Overall, these data indicate FAT does not have a positive effect on physical performance compared to control CHO. This material is based on the work supported by MRDC; authors’ views not official U.S. Army or DoD policy.

Several randomized controlled trials indicated that high-intensity interval training (HIIT) can improve the glycolytic control and cardiorespiratory fitness in prediabetes or type 2 diabetes, but there is no consensus that HIIT is a superior model than moderate-intensity continuous training (MICT). [PURPOSE] To compare the effects of HIIT versus MICT on glycolytic control and cardiorespiratory fitness in prediabetes and type 2 diabetes (T2D) patients. [METHODS] This search was performed in PubMed, EBSICO, Web of Science and the Cochrane Library, and relevant randomized-controlled trials (RCTs) were included based on the including criteria: participants were prediabetes or type 2 diabetes; both HIIT and MICT groups; had at least one of the outcomes of fasting glucose, Hba1c, fasting insulin, insulin resistance (HOMA, VO2 max). [RESULTS] 1) Eighteen studies (122 prediabetes in four studies and 375 T2D patients in 14 studies) were included and meta-analyzed. 2) In T2D patients, HIIT showed a
great improvement in fasting insulin [mean difference: -0.59, 95%CI (-0.69 — 0.12), 
P = 0.005] and HbA1c [mean difference: -0.15, 95%CI (-0.27 — -0.04), 
P = 0.006], compared with MICT. 3) Compared with MICT, HIIT improved significantly of 0.33 L/min/kg [95%CI [0.26 — 0.41], 
P = 0.0001] of absolute VO2peak in T2D patients, and 0.83 mL/min/kg [95%CI (0.33 — 1.63), 
P = 0.04] of relative VO2peak in prediabetes. 4) Compared with MICT, HIIT significantly reduced BMI [-0.49, 95%CI (0.73 — -0.25), 
P = 0.0001] in T2D patients. 5) HIIT was more than MICT in lowering systolic blood pressure [-6.23, 95%CI (8.35 — -1.65), 
P = 0.006] in T2D patients. But there were no differences between two exercise models in diastolic blood pressure, total cholesterol, HDL, LDL, triglycerides in both prediabetes and T2D patients.

CONCLUSIONS: 1) HIIT induced more positive benefits in glycemic control and cardiorespiratory fitness than MICT in T2D patients. 2) In prediabetes, HIIT may induce similar similar cardiometabolic adaptation compared with MICT, and more benefits in cardiorespiratory fitness, which require more high-quality RCTs to prove. Supported by National Key Research and Development Program Major Prevention and Control Research on Chronic Non-communicable Diseases (2016YFC1300202).

1696 Board #299  
May 29 9:30 AM - 11:00 AM  
Effects Of Exogenous Testosterone Administration On Lean Body Mass And Physical Performance: A Meta-analysis  
Alyssa N. Varanoske, Lee M. Margolis, Stefan M. Pasisiakos, FACSM, U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, MA. ( Sponsor: Stefan Pasisiakos, FACSM)  
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(No relevant relationships reported)

Testosterone (T) administration (TA) increases serum T and lean body mass (LBM). Although TA-mediated increases LBM may enhance physical performance, the data are largely equivocal, which may be due to differences study populations, the magnitude change in serum T and LBM, or the performance metrics themselves.

PURPOSE: This meta-analysis explored the effects of TA on changes in serum T, LBM, and physical performance. The association between increases in serum T and LBM was assessed, and if changes in LBM, study population, or the performance metrics studied affected physical performance was determined.

METHODS: A systematic review of double-blind randomized control clinical trials comparing TA versus placebo on serum T, LBM, and physical performance was performed. Data were extracted from 20 eligible manuscripts. Effect sizes (ES) were assessed using Hedge's d and a random effects model. Data are presented as ES [95% CI].

RESULTS: Compared to placebo, TA had a large effect on serum T [2.65 (1.35 — 3.96), 
P < 0.001], a small effect on LBM [0.32 (0.18 — 0.46), 
P < 0.001], and a trivial effect on overall performance [0.14 (0.08 — 0.20), 
P < 0.001]. Changes in serum T in TA groups were not associated with the ES of TA on LBM compared to placebo ( 
P = 0.221). However, when TA groups were dichotomized based on median increase in serum T, median [0.50 (0.23 — 0.76), 
P = 0.06] and small [0.22 (0.06 — 0.22), 
P < 0.05] effects were observed for LBM in those with increases in serum T above and below 8.82 nmol/L, respectively. Overall, performance increased with TA in diseased [0.17 (0.06 — 0.27), 
P < 0.05] and older (60+ years) [0.16 (0.08 — 0.24), 
P < 0.05] males, but not in younger (18-55 years) males. TA increased lower body [0.09 (0.04 — 0.14), 
P < 0.05], upper body [0.22 (0.03 — 0.41), 
P < 0.05], and hand grip [0.14 (0.06 — 0.22), 
P < 0.05] strength, and lower body muscular endurance [0.38 (0.09 — 0.68), 
P < 0.05]. TA had no effect on lower body power, aerobic endurance, and functional performance.

CONCLUSIONS: These data show that the effects of TA on: 1) LBM are mediated by the overall effect of TA on serum T concentrations, and 2) physical performance are observed in mainly tests of muscular strength and endurance in diseased and older males.

1697 Board #291  
May 29 9:30 AM - 11:00 AM  
Effects Of Intermittent Fasting On Exercise Performance And Body Composition: A Systematic Review And Meta-analysis  
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(No relevant relationships reported)

Intermittent fasting (IF) has been mostly studied in athletes during Ramadan and in those willing to decrease their daily caloric intake while maintaining or increasing lean body mass. 

PURPOSE: To estimate the effects of IF on performance domains, namely aerobic, anaerobic, muscle strength and body composition adaptations. 

METHODS: We conducted a comprehensive search of peer-reviewed articles in 3 electronic databases: PubMed, Web of Science and Sport Discus (all articles published until March 2019). Studies were selected if they included samples of adults (>18 years), had an experimental or observational design, investigated IF (Ramadan and non-Ramadan IF) and included performance or body composition outcomes. Meta-analyses were performed when feasible. Eighteen articles met eligibility criteria.

RESULTS: Overall, IF had a medium, negative effect on relative fat mass (SMD = -0.51, 
P = 0.029; Q = 2.09, 
P = 0.554; F = 8%; k = 4), and a small, but significant negative effect on maximum oxygen uptake (VO2peak) (SMD = -0.45, 
P = 0.023; Q = 12.09, 
P = 0.002; F = 83%; k = 3). Non-significant effects were observed on body mass (SMD = -0.45, 
P = 0.137; k = 7), vertical jump height (SMD = 0.01, 
P = 0.945; k = 3) and Wingate mean power output (SMD = 0.04, 
P = 0.921; k = 3).

CONCLUSIONS: We found that, while leading to small impairments in VO2max, IF is effective for inducing positive adaptations in body composition (i.e. decreased relative fat mass).

1698 Board #292  
May 29 9:30 AM - 11:00 AM  
β-hydroxy-β-methylbutyrate (HMB) Does Not Improve Resistance Exercise-Induced Changes In Body Composition: A Systematic-review And Meta-analysis  
Everson A. Nunes1, Josie Jakubowski1, Filipje T. Teixeira2, Victoria Vesco1, Robert W. Morton1, Stuart M. Phillips, FACSM1, McMaster University, Hamilton, ON, Canada. 1CBIOS—Universidade Lusofona’s Research Center for Biosciences and Health Technologies, Lisbon, Portugal. Email: nunesel1@mcmaster.ca  
(No relevant relationships reported)

β-hydroxy-β-methylbutyrate (HMB) is a leucine metabolite used as a nutritional supplement purported to increase lean body mass and performance in response to resistance exercise training (RE). However, literature definitive evidence-based answer to the question of the efficacy of HMB is lacking.

Purpose: The aim of this systematic-review and meta-analysis was to determine the efficacy of HMB supplementation, in the calcium (HMB-Ca) or free acid (HMB-FA) form, to augment lean body mass and strength gains during RE.

Methods: A systematic search on Medline, Embase, CINAHL and SportDiscus, from 1996-Oct 2019 was conducted. Inclusion criteria for studies were: randomized controlled trial (RCT), RET ≥ 3 weeks (training sessions at least 2 x/week), male subjects <50 y, and ingesting 3g/d of HMB-Ca or HMB-FA with or without protein or amino acids. Random-effects meta-analysis was performed in Review Manager V5.3.

Results: Fourteen studies fit the inclusion criteria. However, after removing studies according to RoB2 scoring, the number of analysed studies dropped to seven. A total of 291 male participants (18-45) were included, and the mean study duration was 8 ± 3 weeks with a training frequency of 2-5 d/week. No significant effects were found on TBM (BMI), lean body mass (LBM), fat mass (FM), total 1 repetition maximum (RM), bench press (BP) 1RM, and lower body (LwB) 1RM.

Conclusions: This meta-analysis showed that HMB does not improve changes in body mass and composition caused by RET. In addition, effects on strength were not significant. Therefore, the claims for HMB consumption to optimize RET seems to be based on studies with considerable risk of bias. When such studies are not considered, there is no support for HMB ingestion.

1699 Board #293  
May 29 9:30 AM - 11:00 AM  
Effect Of Vitamin D3 Supplementation On Serum 1,25(OH)2 D Status Of Athletes: Systematic Review And Meta-analysis  
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(No relevant relationships reported)

Vitamin D is an essential fat-soluble vitamin, which plays an important role in the maintaining of good health. Without sufficient vitamin D, people cannot absorb enough calcium, which is a primary component of the bone. In the past century, vitamin D deficiency is heavily studied and lots of scientists report that vitamin D deficiency is related to several health problems, such as osteoporosis, muscle aches and weakness. Vitamin D supplements and vitamin D fortified foods always have claims of bringing people health benefits including bone health and muscle function. 

PURPOSE: This study is designed to investigate the effects of vitamin D3 supplementation on serum 1,25(OH)2D among athletes. 

METHODS: Literature search of PubMed, Embase and Cochrane Library databases from inception to Sept. 2019 was accomplished.
Branch-chained amino acids (BCAA) influence muscle turnover through the mTOR signaling pathway and phosphorylation of translation initiation factors. It has been suggested that BCAA supplementation may decrease muscle damage, attenuate soreness, promote recovery, and improve strength and hypertrophic adaptations to resistance exercise; however, the findings are inconsistent and thus the question of efficacy of BCAA supplementation is uncertain.

**PURPOSE:** We performed a systematic review and meta-analysis to determine the influence of acute BCAA supplementation on perceived soreness and performance recovery following a bout of resistance exercise. Additionally, we analyzed the effect of 6+ weeks of resistance training with BCAA on fat mass and strength.

**METHODS:** A systematic search was conducted in Medline, Embase, CINAHL and SportDiscus. Fifteen studies with 348 participants were eligible for inclusion. Randomization into three exercise groups. Exercise intensity levels were set by participants. Gates (2014). Acute outcomes included isometric knee extension, vertical jump, and perceived muscular soreness. Chronic outcomes included changes in fat free mass, upper- and lower-body strength.

**RESULTS:** Acutely, BCAA supplementation following an acute bout of resistance exercise did not attenuate perceived soreness (SMD: -0.12, CI: (-0.56, 0.31), p=0.51) or attenuate performance decrements in the vertical jump (MD: 0.54, CI: (-1.05, 2.12), p=0.31) or reductions in isometric knee extension torque (SMD: 0.11, CI: (-0.39, 0.61), p=0.66). Chronic BCAA supplementation during resistance training did not influence resistance exercise induced changes in fat free mass (MD: 0.01, CI: (-0.70, 0.73), d=0.97), upper body strength (SMD: 0.08, CI: (0.63, 0.79), p=0.83) or lower body strength (SMD: 0.10, CI: (-1.15, 1.34), p=0.88).

**CONCLUSIONS:** BCAA supplementation does not effectively reduce soreness, attenuate subsequent performance decrements, or influence muscular adaptations to resistance training.

**RESULTS:** Significant interaction effects group-by-time (p < 0.001; $\eta^2=0.20$) showed improvements in the intervention group that reduced emotional exhaustion (9.2 ± 2.7, p < 0.001, d = 1.21), depersonalization (4.7 ± 2.8, p < 0.001, d = 1.00) and perceived stress (6.0 ± 2.5, p < 0.001, d = 1.16), and increased personal accomplishment (4.3 ± 1.9, p < 0.001, d = 0.87). The magnitude of the effects was large, revealing changes of crucial practical relevance. Adherence (90.4 %) and satisfaction (3.71 ± 0.56; rating 1-4) with the intervention were high. No significant changes were found in the control group (p > 0.05). **CONCLUSION:** The findings support the evidence that Combined Exercise Training may reduce burnout symptoms and perceived stress among workers in the helping professions. We recommend participation in exercise in the leisure time or workplace because it may likely improve work performance, wellbeing and life quality.

**Purpose:** To explore the prevalence and associated factors of depressive symptoms among Chinese elderly women. **Methods** The public data of China Health and Retirement Longitudinal Study (CHRLS) in 2015 was adopted, and 2575 female participants aged 60 years and above were included in this study. Part of observed variables of demographics, family transfer, health status and functioning portions were used. Depressive symptoms was measured using the 10-item version of the Center for Epidemiologic Studies Depression Scale. Analysis of variance and Pearson $r^2$ test were adopted to compare the differences among subgroups, and univariate and multivariate logistic regression models were applied to explore associations between different factors and depressive symptoms. **Results** The mean age of the participants was 69.16 ± 7.22 years old, the mean score of CES-D 10 scale was 10.23 ± 7.05, about 46.45% participants had depressive symptoms last month. Multiple regression analysis...
revealed that higher odd ratio of depressive symptoms appeared in the following subgroups: older age (OR = 1.98, 95% CI = 1.41-2.79), not living with spouse (OR = 1.31, 95% CI = 1.07-1.60), in further from main city zone (OR = 1.49, 95% CI = 1.17-1.90), providing more economic supports to children last year (OR = 2.93, 95% CI = 1.45-5.92), lower parent-child relationship satisfaction (OR = 3.42, 95% CI = 1.86-6.32), poorer self-reported health status (OR = 3.24, 95% CI = 1.77-5.96), lower score of instrumental activities of daily living scale (OR = 2.75, 95% CI = 1.97-3.85), lower health status satisfaction (OR = 3.06, 95% CI = 1.53-6.10) and shorter sleep duration at night last month (OR = 2.39, 95% CI = 1.64-2.65). Conclusion: There was a high prevalence of depressive symptoms among Chinese elderly women, and it was significantly related to demographics, interaction with children and health status. Targeting these issues might be helpful in screening and reducing depression among Chinese elderly women.

1704 Board #298 May 28 9:30 AM - 11:00 AM

Esport Athletes’ Quality Of Life Over A Professional Season

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(No relevant relationships reported)

PURPOSE: Worldwide, video games have stormed into mainstream culture, creating a wave of opportunity for a new kind of athlete. In 2019, the global esports audience is expected to reach 453.8 million, while over 164 million adults in the United States now play video games and three-quarters of American households are home to at least one gamer. Few studies exist that address the unique set of health concerns in this growing population. Our objective was to monitor changes in health status over the 5-month competitive season among professional gamers (n=6) from an esports team.

METHODS: Data collection included Brief Michigan Hand Questionnaire (BMHQ), Patient Rated Outcomes Measurement Information System (PROMIS) measures, and physical exam measures. These measures were collected during the pre-participation physical exam in March and post-season August 2019. RESULTS: The mean age was 24 (range: 21-28 years); BMI was 28.8 kg/m2 (range: 22.9-34 kg/m2); systolic blood pressure was 130 mmHg (range: 114-156 mmHg); diastolic blood pressure was 75 mmHg (range: 74-78 mmHg); pulse 92.5 bpm (range: 66-123 bpm), waist circumference was 91.75 cm (range: 77-106 cm).

The mean score of Quality of Life score (0.73) was lower than the mean pre-season score (0.80; p-value = 0.05). Global mental health, global physical health, physical function, upper extremity, and Brief Michigan Hand Questionnaire scores trended lower post-season, but did not reach statistical significance. Pain interference and pain intensity scores were higher post-season than the mean pre-season scores, but these differences were not statistically significant (OR = 1.24, 95% CI = 0.86-1.77).

LUSIONS: This study identifies potential quality of life concerns associated with professional eAthletes. Further study is needed with a larger study population of professional eAthletes to confirm the physical and mental health changes over the course of a professional season. Findings may facilitate the development of injury prevention and treatment protocols to enhance the mental and physical health and wellness of eAthletes.

1705 Board #299 May 28 9:30 AM - 11:00 AM

Daily Physical Activity And Affect In Preschoolers

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(No relevant relationships reported)

PURPOSE: Physical activity is vital to mental health yet relatively little is known about its effect in young children. The study examined whether one marker of mental health, daily positive affect was higher among preschoolers meeting guidelines for physical activity. METHODS: Participants included 72 preschoolers (3-5 yrs) enrolled in a study of physical activity and mental health recruited from the general community. Preschoolers wore an accelerometer (Actigraph GT3X-BT) for one week, obtaining outcome counts of moderate-to-vigorous physical activity (MVPA). Preschoolers engaged in ≥60 minutes of daily MVPA were compared to those who did not. Caregivers completed a week-long cell-phone based ecological momentary assessment protocol. Caregivers responded to four prompts each day (28 total) about their child’s affect and behavior. RESULTS: The dataset consisted 2,016 observations. 38% (n=27) of the sample failed to meet the minimum recommended guidelines (≥40 minutes) for MVPA. Linear growth models for positive affect allowed each preschooler to have her/his own initial level of positive affect and rate of change in positive affect. Models also accounted for child age, sex, and psychopathology. Initial positive affect was higher among preschoolers meeting MVPA guidelines (Est=−0.37, SE=0.15, t=−2.31, p<.01). Across the week, active preschoolers maintained positive affect (Figure 1), whereas less-active preschoolers reported a significant decrease in positive affect (Est=−0.01, SE=0.01, t=−1.07, p<.04). CONCLUSION: Initial levels of positive affect and the maintenance of positive affect were higher among children meeting MVPA guidelines. Although only small changes were evident across the week, this finding indicates that physical activity may sustain positive affect in young children and over time, potentially buffer against the onset of psychological disorders such as depression.

1706 Board #300 May 28 9:30 AM - 11:00 AM

Association Between Sport Specialization, Athlete Burnout, And Past Injury In High School Athletes

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(No relevant relationships reported)

With the rise in early sport specialization, understanding its psychological impacts on young athletes is increasingly important. PURPOSE: To determine whether sport specialization level, past injuries, or other demographic factors are associated with burnout symptoms among high school (HS) athletes. We hypothesized that athletes with high specialization level or a history of prior injuries would report increased burnout compared to peers with lower specialization level and those without past injuries. METHODS: We conducted a cross-sectional assessment of HS athletes who completed questionnaires during pre-participation physicals. The survey included the Athlete Burnout Questionnaire (ABQ) andヤンphi sport specialization scale, as well as questions on injury history (stress fracture, concussion, time-loss orthopedic injuries), competition level (arsity or non-arsity) and weekly training hours. The primary dependent variable was total ABQ score. Our independent variables were low, medium, or high specialization level and history of time-loss orthopedic injury, stress fracture or concussion. RESULTS: 186 athletes completed the survey: 49% were categorized as low specialization (mean age=15.3±2.0 yrs; 50% female), 35% medium specialization (mean age=15.3±1.3 yrs; 47% female), and 16% high specialization (mean age=15.7±1.1 yrs; 57% female). The specialization groups did not significantly differ on their total ABQ scores (mean scores: low=30.6±6.8, medium=28.3±6.5, high=29.9±8.8; p=.06). Athletes with prior orthopedic injuries had significantly higher ABQ scores than those without such history (30.6±6.8 vs 27.8±7.7; p=.01). There were no differences in ABQ scores based on history of stress fractures (31.8±7.8 vs 28.7±7.4; p=.17) or concussion (28.8±7.2 vs 28.9±7.2; p=.94), or whether an athlete was currently ailing from an injury (29.1±7.5 vs 28.9±7.5; p=.91). After covariate adjustment, history of orthopedic injury was significantly associated with higher ABQ scores (β=−2.81; 95% CI 0.44 - 5.18; p=.02). CONCLUSION: Prior history of time-loss orthopedic injuries, but not a HS athlete’s level of sport specialization, was associated with higher burnout symptoms.

1707 Board #301 May 28 9:30 AM - 11:00 AM

Adherence To A Six-Month Walking Intervention For Individuals With Schizophrenia Spectrum Disorder: Preliminary Results

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(No relevant relationships reported)

PURPOSE: Schizophrenia spectrum disorder (SSD) is one of the most debilitating mental illnesses and often results in negative lifestyle alterations, such as increased physical inactivity. SSD patients have a high prevalence of obesity and associated comorbidities, suggesting the need for specific interventions to improve physical activity levels. METHODS: Individuals with SSD were recruited from the general community to participate in a 6-month walking intervention. Participants were randomized to a control group or intervention group. The control group received regular care and support, while the intervention group received weekly calls from trained programmers to motivate them to walk 30 minutes per day, 5 days per week, for 6 months. Data on self-reported physical activity were collected at baseline and 6 months. RESULTS: The intervention group reported a significant increase in physical activity from baseline to 6 months (p<.05). CONCLUSION: A walking intervention appears to be effective in increasing physical activity among individuals with SSD.

Abstracts were prepared by the authors and printed as submitted.
sedentary behavior, that increases the likelihood for the development of comorbidities, such as cardiovascular disease, leading to a decline in quality of life and decreased life expectancy of up to 25 years. Increasing physical activity in healthy populations is known to decrease risk factors and improve quality of life, along with life expectancy. The purpose of the study was to evaluate the adherence of a 6-month group-walking program at the clinic in people diagnosed with SSD. The secondary purpose was to evaluate selected health and physical function outcomes. METHODS: Individuals diagnosed with SSD enrolled in a group-based, six-month progressive walking intervention meeting biweekly. Participants were given a Fitbit Charge HR to be worn for the duration of the intervention. They were expected to attend as many groups as possible to complete the 30-minute walking session at individualized intensities determined to create an exercise dose-response. Group leaders recorded attendance for each participant for the evaluation of adherence to the intervention. Health and physical function outcomes were evaluated using independent samples t-tests from baseline and post-intervention assessments. RESULTS: Twelve individuals (6 males, 6 females) between the ages of 18-65 were included in analyses. Overall attendance was 45%. There was a significant improvement (p<0.05) in distance covered during the 6-minute walk test, increasing from 367/81.8 m to 476/99.9 m. There was no significant difference in resting heart rate, mean arterial pressure, weight, hip or waist circumferences (p>0.05). CONCLUSIONS: Adherence to the group walk intervention was relatively low compared to previous studies. Change in group walking leaders during the study and the extremely hot summer may have contributed to the lower than expected adherence rates. However, the 6-month walking intervention promoted improvements in 6MWT distances which is very encouraging. Further research is warranted to continue to explore the effects of increasing physical activity in people with SSD with the goal of improving their health and consequently improve life expectancy.

1708 Board #302
May 28 9:30 AM - 11:00 AM
The Association Between Physical Activity And Eudaimonic Well-Being In College Students
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(No relevant relationships reported)

Previous studies on physical activity (PA) and psychological well-being have predominantly investigated the impact of PA on mental disorders and hedonic well-being. In contrast, relatively few studies have examined the association between PA and eudaimonic well-being (EWB), a key dimension of positive psychology focusing on actualizing one’s human potentials and formulating positive human functioning. PURPOSE: To examine the associations between PA and the six components of EWB in college students while controlling for gender and age. METHODS: 1346 college students (685 males and 661 females, mean age = 20.33 years) voluntarily completed a questionnaire measuring PA and EWB. PA was assessed using the Physical Activity Recall Questionnaire plotted against baseline PA measures. The internal reliability of the six EWB subscales were evaluated using Cronbach’s alpha Statistic, with each assessing a unique component of EWB. Six multiple regressions were conducted on actualizing one’s human potentials and formulating positive human functioning.

Social Physical Anxiety (SPA) has been associated with physical activity (PA) behaviors and anxiety disorder symptoms. However, little is known about the potential influence of SPA on associations between PA and Generalized Anxiety Disorder (GAD). PURPOSE: This study quantified associations between PA, GAD and SPA among young adults (N=470, 23±4.8y; 63.4% female) and explored SPA as a mediator of the association between PA and GAD. METHODS: Seven-day PA Recall determined estimated expenditure (kcal/wk) and classified inactive, moderately active, and highly active PA dose categories. The Psychiatric Diagnostic Screening Questionnaire GAD subscale assessed GAD symptom severity; a score of ≥6 indicated analogue GAD (AGAD) status. The Social Anxiety Scale measured SPA. Independent t-tests examined baseline differences between gender and GAD status. Cohen’s d quantified the magnitude of differences. Logistic regression quantified odds of AGAD based on PA dose, adjusting for age, gender, and smoking status. Simple mediation analyses examined mediation of the continuous PA-GAD symptom association by SPA.

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College is a time when many health habits, both physical and behavioral, start to form that will remain throughout one’s adult life (Kemper & Welsh, 2010). It has been estimated that between 12-50% of college students have one or more of the common mental health disorders (Hunt & Eisenburg, 2010). Mental health disorders in early adulthood have been associated with long-term physical health issues (cancer, cardiovascular disease, diabetes, hypertension, asthma, etc.) that appear throughout adulthood (Scott et al., 2016). The earlier these physical health issues can be identified, the earlier various treatments (such as lifestyle modification) could be started. PURPOSE: To analyze the relationship between mental health status and cardiovascular risk factors in college freshmen. METHODS: 45 college freshmen (27 females and 18 males) were recruited from a small, liberal arts college in the Midwest. Cardiovascular risk factors (blood pressure (BP) and body composition) were measured, physical activity was self-reported, and sleep was evaluated by use of the Pittsburgh Sleep Quality Index. Mental health was evaluated by the Depression, Anxiety, and Stress Survey. The cohort was divided into three categories based on their individual mental health scores: those who scored high in all three (depression, anxiety, and stress) (n=7), those who scored low in all three (n=14), and those who had some combination of high and low (mixed) (n=24). RESULTS: Participants in the mixed group had significantly higher systolic BP (110.8±0.11mmHg) than those in the high (102.7±5.7mmHg) or low groups (104.9±7.9mmHg) (p=0.033). No significant differences in daily physical activity, quality of physical activity, diastolic BP, fat-free mass, fat mass, skeletal mass, or visceral adipose tissue were seen between groups. CONCLUSION: These differences in BP could be a result of medication (such as beta blockers), which could be the cause of the reduced BP in the group with high scores on all three mental health scales. Data on medication use was not collected in this study, but should be added to future studies. Additional research should investigate this relationship in a larger cohort so additional relationships could be explored.

The relationship between physical activity (PA) and mental health has been documented, but the relationship between PA and different dimensions of mental health problems in rural and urban areas of China need to be explored. PURPOSE: To examine differences in the relationship of PA and mental health problems and these problems between rural and urban areas of China. METHODS: Data were collected over 2 months in 2018. Four representative regions of China were selected: Beijing, Shanghai, Nanchang, and Chongqing. Data were collected through questionnaires assessing mental health, PA and individual characteristics. The Diagnostic Test of Anxiety Tendency Scale was used to assess mental problems including eight subscales. PA was measured by Physical Activity Questionnaire for Adolescents. Height and weight were measured by portable stadiometers and digital scales, and BMI (kg/m²) was converted to BMI z-score. Chi-square tests were used to compare mental health problems in rural and urban areas. Multilevel logistic regressions were performed to examine the relationship between PA and different mental health problems, and other individual variables were controlled as covariates. RESULTS: The detection rates of overall mental health problems among urban (5.27%) and rural areas (7.28%) were documented, but the relationships between PA and different dimensions of mental health were not completely understood. Considering that cortisol [an index of hypothalamic pituitary adrenal axis regulation] has been shown to be a robust predictive biomarker for depression and anxiety disorder risk, this study aimed to investigate whether sitting time was associated with salivary cortisol levels in women, and whether this relationship remained significant after controlling for indices of physical fitness. METHODS: Two hundred and sixty-two women [18-45y, mean age: 23.9 ± 6.3y; mean body mass index (BMI): 23.9 ± 4.6] who were medication-free and had regular menstrual cycles completed (1) self-report of weekly PA and weekly sitting time; (2) assessment of cardiovascular fitness (CRF) via maximal oxygen consumption during exercise; (3) one-week recording of sleep and activity patterns by wrist actigraphy; and (4) measurement of salivary cortisol levels (collected during the follicular phase of the ovarian cycle in order to control for the influence of ovarian cycle hormone fluctuations on salivary cortisol). RESULTS: Regression analysis revealed that greater total sitting time/week significantly predicted higher cortisol levels in women (b= 0.71, p < 0.001), and this relationship remained significant after controlling for age, BMI, and CRF level (b= 0.67, p < 0.01). Additionally, greater total sitting time/week was significantly associated with lower actigraph-measured PA (activity counts/min; r = −0.57 < p < 0.01). CONCLUSIONS: Results suggest that although greater total sitting time was associated with a reduced amount of daily PA, greater total sitting time may still predict higher salivary cortisol levels, independent of indices of fitness (BMI and CRF). It is possible that the stress-related mechanisms underlying the relationship between sitting time and depression and anxiety risk may be related to sitting time itself, and not a simply a product of reduced daily PA. Further investigation is needed to explore these associations.

Evidence supports positive effects of exercise on mental health outcomes among people with Multiple Sclerosis (PwMS). However, non-traditional exercise modes like Pilates remain understudied. PURPOSE: This randomized controlled trial investigated the effects of eight weeks of twice weekly home-based Pilates training compared to delayed-start wait-list condition on symptoms of anxiety, depression, and fatigue among 54 females (46.7±9.8y; mean age: 23.9±6.6, mean BMI: 23.9±4.6) with Multiple Sclerosis (PwMS). However, non-traditional exercise modes like Pilates remain understudied. METHODs: Twice weekly home-based Pilates sessions guided by expert instructors were provided to 27 women (27 females and 18 males) with physician diagnosed MS (Patient Determined Disease Steps score >3; no previous Pilates experience, and no other significant physical or psychiatric condition). METHODS: After providing informed consent, participants were randomised to twice weekly home-based Pilates sessions guided by a DVD or delayed-start wait-list. Well-validated questionnaires assessed symptoms of anxiety, depression, and fatigue at baseline, and weeks two, four, six and eight of the intervention. Compliance was documented in weekly exercise diaries and followed-up by a phone call from the first author. RM-ANOVA examined between-group differences across time. Hedges’ d quantified the magnitude of differences in outcome change for home-based Pilates compared to delayed-start wait-list. RESULTS: Group X time interactions were significant for depressive symptoms (F(14,58)=3.21, p<0.02), physical symptoms of fatigue (F(14,58)=3.45, p<0.01), cognitive symptoms of fatigue (F(14,58)=3.08, p<0.02), psychosocial symptoms of fatigue (F(14,58)=3.31, p<0.009), and total fatigue (F(14,58)=3.82, p<0.007). Compared to wait-list, home-based Pilates significantly reduced (all p<0.041) depressive symptoms at weeks 6 (p<0.039), and 8 (p<0.02). physical symptoms of fatigue at weeks 2 (p<0.041), (p<0.024), 6 (p<0.57), and 8 (p<0.87), cognitive symptoms of fatigue at weeks 4 (p<0.039), 6 (p<0.32), and 8 (p<0.60), psychosocial symptoms of fatigue at weeks 2 (p<0.051), 4 (p<0.04), 8 (p<0.58), and 8 (p<0.69), and total fatigue at weeks 2 (p<0.023), 4 (p<0.37), 6 (p<0.53), and 8 (p<0.84). CONCLUSION: Home-based Pilates improved mental health outcomes among females with MS, including moderate magnitude reductions in depressive and fatigue symptoms. These findings support the potential of home-based Pilates to improve several mental health symptoms prevalent among PwMS.
Promotion of mental health (MH) issues has been lately a priority in several sport organizations in the US (e.g., NCAA, NFL, NBA). Self-compassion (SC) and mental toughness (MT) have been proven successful against stressors associated with sports. Preliminary evidence have shown a positive relationship between MT and MH, SC and MH, and MT and SC. These constructs have never been investigated in eSports, an industry that has grown considerably in the recent years. PURPOSE: To confirm the three aforementioned relationships and explore the mechanism underlying these relationships in eSports. Hypotheses: (1) MT will correlate positively with MH, (2) SC will correlate positively with MH, (3) MT will correlate positively with SC, and (4) SC will mediate the MT-MH relationship. METHODS: In total, 16 recreational gamers (>6 hours per week) agreed to participate (Mage = 22, SD = 2.69). Three inventories were administered via Qualtrics: Mental Toughness Index, Self-Compassion Scale, and Mental Health Continuum – Short Form. The analysis consisted of Pearson correlations and mediation analysis in R. RESULTS: The estimated correlations between MT and MH was .55, MT and SC was .71, and MH and SC was .61. In the preliminary mediation model, the estimated standardized regression coefficient of MH on MT was 0.55. The same estimate after adding SC was 0.52. CONCLUSION: The results indicate that (a) all three variables are positively correlated to each other and (b) SC reduced, or mediated, the relationship between MT and MH by 0.32 units. Therefore, evidence to support all four hypotheses was found. The correlations are in accordance with findings from Gucciardi, Hanton, and Fleming (2017), Neff, Rude, and Kirkpatrick (2007), and Wilson, Bennett, Mosewich, Faulkner, and Crocker (2019). The mediation analysis findings suggest that the relationship between MT and MH is partially explained by SC and confirm outcomes from Padgett, Forsee, Papadakis, Deal, and Stamatis (2019). The above could have important implications for eSports Psychological Skill Training (PST) practice in the effort of general prevention/early intervention of MH: not only these three variables are positively correlated but a better understanding of the relationship between MT and MH is now offered for this unique sporting environment.
RESULTS: Statistically significant associations were found between for presenting depression and the presence of third (p=0.01) and fourth (p=0.01) quartiles. On the other hand, showing anxiety was significantly associated with presenting scores on the fourth quartile only (p=0.03).

CONCLUSIONS: Those athletes that scored with probable depression or anxiety are associated with higher quartile punctuations in GI-T factor. Evaluating anxiety and depression in athletes of team sports could be a way to identify probable cohesiveness problems between their members. Similar studies are suggested to corroborate this result.

Table 1. Association between Depression and anxiety with GI-T scores.

<table>
<thead>
<tr>
<th>GI-T</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
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<tbody>
<tr>
<td>With depression</td>
<td>1.47 (0.68 - 3.15)</td>
<td>2.75* (1.34 - 5.68)</td>
<td>2.72* (1.27 - 5.83)</td>
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<tr>
<td>With anxiety</td>
<td>2.07 (0.82 - 5.23)</td>
<td>1.61 (6.53 - 3.96)</td>
<td>2.78* (1.14 - 6.80)</td>
</tr>
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Data expressed in OR (95% CI).
GI-T: Group integration task. Q: Quartile number. * p<0.05

1720 Board #314 May 28 9:30 AM - 11:00 AM
Relationship Between Time Practicing a Sport and Risk of Burnout in Mexican College Athletes.
(No relevant relationships reported)

PURPOSE: To determine the association between the experience of practicing a sport and the risk of suffering Emotional Exhaustion and Depersonalization.

METHODS: 307 college athletes from a high-performance program in Guadalajara, Mexico, were trained. Trained psychologists applied the Sport Burnout Inventory - Reviewed (18 questions and 3 subscales: Emotional Exhaustion (EE), Depersonalization (D) and Reduced Personal Realization (RPR); it brings four possible conclusions: “Low Risk”, “Moderated Risk”, “High Risk” and “With Burnout”) to identify Burnout problems. The years of experience practicing their sport were obtained through an interview with the athlete before the questionnaire was answered. A logistic regression analysis was performed to predict the presence of Depersonalization and Emotional Exhaustion depending on the years practicing the sport.

RESULTS: EE was not related to the years practicing a sport. On the other hand, D showed a relationship with the time of experience in the moderated risk of suffering Burnout Syndrome when an athlete mentioned have been practicing their sport for 7-9 years (p=0.01), 4-6 years (p=0.01) and 1-3 years (p=0.001).

CONCLUSIONS: Burnout Syndrome seems to be a time practicing an activity related problem. In our sample, nonetheless, the time was not directly related to a high risk of suffering burnout scores in the analyzed factors. Those who have most time practicing neither showed statistically significant association with the Burnout inventory scores. We recommend continuing making this kind of investigation, which may give us better information about the time-related etiology of Burnout Syndrome.

Abstracts were prepared by the authors and printed as submitted.
Thurs., May 28, 2020

**Study in 2006-08. Data on psychotropic drugs were retrieved from the Norwegian Prescription Database and incident sedative-hypnotics was measured as first registered prescription with code N05C in the Anatomical Therapeutic Chemical Classification System. Participants using any psychotropic drugs three months prior to participation and three months after participation were excluded. The participants were followed from three months after participation until incident use of sedative-hypnotics, emigration, death or study end 1\(^{st}\) of January 2018. Baseline CRF (ml/kg/min) was determined using non-exercise algorithms based on sex, age, waist circumference, physical activity, and resting heart rate (eCRF). Baseline eCRF was further grouped into age- and sex-specific tertiles. Cox regression models were used to calculate hazard ratios (HRs) and 95% confidence intervals (CIs) for the association between baseline eCRF and incident use of sedative-hypnotics. The multivariable analyses were adjusted for age, sex, education, symptoms of anxiety and depression, limiting longstanding illness, and sleep problems. Results: During follow-up, 4,632 (15.2 %) of the participants used sedative-hypnotics. In fully adjusted models comparing with the lowest tertile of eCRF, those in the middle and upper eCRF tertiles had 8% (HR: 0.92, 95% CI: 0.84-1.00) and 24% (HR: 0.86, 95% CI: 0.77, 0.92-0.94) lower risk of incident use of sedative-hypnotics. Conclusion: Higher CRF is associated with less prescribed sedative-hypnotics in the general population. This effect seems to be more pronounced for those with highest CRF.

**PARA 315**

**Severe Intensity Exercise Promote Greater Reduction In Anxiety Scores Than Moderate In Adults**

Cyril G. Borges,1 Marcos Mônico-Neto,2 Sergio Tuñí,1 Hanna Karen Moreira Antunes,1,3,4 UNIFESP, Santos, Brazil. 1UNIFESP, São Paulo, Brazil.

(No relevant relationships reported)

**Purpose:** It is widely accepted that low caloric energy intake, with or without disordered eating, is associated with health consequences in female athletes. Female distance runners are subject to the societal “thin ideal” in addition to sport-specific disordered eating, is associated with health consequences in female athletes. It is widely accepted that low caloric energy intake, with or without disordered eating.

**METHODS:** Motivated by feminist theory, we conducted semi-structured, in-depth interviews. Interviews were transcribed and coded for major themes.

**RESULTS:** Participants (n=30) represented 19 Universities and had a mean age of 51.0 years) from the third survey of the Norwegian Nord-Trøndelag Health Study in 2006-08. Data on psychotropic drugs were retrieved from the Norwegian Prescription Database and incident sedative-hypnotics was measured as first registered prescription with code N05C in the Anatomical Therapeutic Chemical Classification System. Participants using any psychotropic drugs three months prior to participation and three months after participation were excluded. The participants were followed from three months after participation until incident use of sedative-hypnotics, emigration, death or study end 1\(^{st}\) of January 2018. Baseline CRF (ml/kg/min) was determined using non-exercise algorithms based on sex, age, waist circumference, physical activity, and resting heart rate (eCRF). Baseline eCRF was further grouped into age- and sex-specific tertiles. Cox regression models were used to calculate hazard ratios (HRs) and 95% confidence intervals (CIs) for the association between baseline eCRF and incident use of sedative-hypnotics. The multivariable analyses were adjusted for age, sex, education, symptoms of anxiety and depression, limiting longstanding illness, and sleep problems. Results: During follow-up, 4,632 (15.2 %) of the participants used sedative-hypnotics. In fully adjusted models comparing with the lowest tertile of eCRF, those in the middle and upper eCRF tertiles had 8% (HR: 0.92, 95% CI: 0.84-1.00) and 24% (HR: 0.86, 95% CI: 0.77, 0.92-0.94) lower risk of incident use of sedative-hypnotics. Conclusion: Higher CRF is associated with less prescribed sedative-hypnotics in the general population. This effect seems to be more pronounced for those with highest CRF.

**Characteristics no space (max 2000): 1967

**PARA 316**

**CARDIORESPIRATORY FITNESS AND USE OF SEDATIVE-HYPNOTICS: A LONGITUDINAL POPULATION-BASED STUDY**

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(No relevant relationships reported)

**Purpose: Population-based and clinical studies suggest that higher cardiorespiratory fitness (CRF) is associated with better mental health and less sleep complaints. However, in these studies mental health and sleep are assessed through questionnaires. The increased use of sedatives and hypnotics coupled with their known adverse health associations raises potential public health concerns. So far no studies have assessed if CRF is associated with incident use of sedative-hypnotics in the general population.

**Methods:** This prospective study included 30,481 participants (52.2% women, mean age 51.0 years) from the third survey of the Norwegian Nord-Trøndelag Health
self-reporting IWT and MWT) and the Eating Disorder Inventory-Symptoms Checklist (for PB). Basic descriptive statistics assessed demographic information. Cross-tabulations assessed the proportion of participants classified as “at risk” for PB across sport. A repeated measures ANOVA examined perceptions of WT (CWT vs. IWT vs. MWT) across sport.

**Results:** Significant differences were found for use of PB across sport [61.4%: X(5, N=125) = 16.5, P=0.006]. EQ (8.9%) and ballet had the highest risk (13.4%). Significant differences were found between self-reported exercise and sport type [X(3, N=125) = 12.2, P=0.033] for an overall risk of 52.8% with highest risk for EQ (13.6%) and ballet (16%). Significant differences were found between excessive exercise and sport type [X(3, N=125) = 32.7, P<0.01] for an overall risk of 13.6% with highest risk for EQ (10.4%). No significant differences were found for binge eating, purging, laxatives, diet pills, and diuretics. A significant main effect was revealed for WT perceptions across sport (F[2,162.5, P=0.01], η2=.124), with significant interactions for WT type (F[6,81]=4.0, P<.001, η2=.260) and WT type and sport (F[6,81]=3.3, P=0.01, η2=.124).

**Conclusion:** Overall, athletes report engaging in PB, especially dieting and excessive exercise to control their WT, with aesthetic sports at higher percentages. Athletes WT perceptions are of concern, as all sports want to be smaller and assume their WT would be higher if they didn’t control their WT.

### 1725 Board #319 May 28 9:30 AM - 11:00 AM Relationship Of Internalized Weight Stigma To Sleep Quality And Physical Activity Among College Students

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(No relevant relationships reported)

**PURPOSE:** Studies suggest weight stigma may be associated with negative health consequences, increased risk for weight loss, reduced physical activity, and poor mental health outcomes. Less is known about the prevalence of weight stigma among college students and how this relates to behavioral health.

**METHODS:** Students at a large Midwestern university completed an anonymous, online cross-sectional survey. Participants self-reported height and weight to determine BMI and weight status. Participants self-reported time spent in moderate, vigorous, and continuous bout at 65% of peak power output for 20-min and 2) vigorous-intensity at 85% of peak power output, performed in a 1-min-on, 1-min-off interval format for 20-min. After the conclusion of the exercise session, the students were assessed via the PANAS a second time, allowing for pre/post analysis.

**RESULTS:** Initial analyses indicated no interaction effect (time x condition) for either positive affect (p=0.065) or negative affect (p=0.048). Positive affect scores increased from pre to post in both conditions (65%: p<0.001, d=1.2; 85%: p<0.001, d=1.2). Negative affect scores decreased from pre to post in both conditions (65%: p<0.001, d=0.92; 85%: p<0.001, d=0.89).**CONCLUSIONS:** The results of this study found that an acute 20-min bout of cycling at both 65% and 85% of peak power led to large improvements in positive affect (18.8%, 27.4%) and large decreases in negative affect (23.5%, 17.6%). Moderate and vigorous-intensity aerobic exercise were equally effective in improving mood in this college population.

College students commonly rate stress as the number one health problem with which they deal with on a daily basis. Aerobic exercise is often promoted as an effective tool for stress management and overall improved mental health. Less understood is the utility of exercise intensity as a means to reduce perceived levels of stress and subsequently improve mood. **PURPOSE:** to investigate the acute effects that the intensity of aerobic exercise has on positive and negative affect.

**METHODS:** College students (n=28) were assessed for affect using the Positive and Negative Affect Schedule (PANAS) questionnaire. In a crossover study, students performed two cycle ergometer protocols 48 hours apart - 1) moderate-intensity at 65% of peak power output for 20-min and 2) vigorous-intensity at 85% of peak power output, performed in a 1-min-on, 1-min-off interval format for 20-min. After the conclusion of the exercise session, the students were assessed via the PANAS a second time, allowing for pre/post analysis.

**RESULTS:** Initial analyses indicated no interaction effect (time x condition) for either positive affect (p=0.065) or negative affect (p=0.048). Positive affect scores increased from pre to post in both conditions (65%: p<0.001, d=1.2; 85%: p<0.001, d=1.2). Negative affect scores decreased from pre to post in both conditions (65%: p<0.001, d=0.92; 85%: p<0.001, d=0.89).**CONCLUSIONS:** The results of this study found that an acute 20-min bout of cycling at both 65% and 85% of peak power led to large improvements in positive affect (18.8%, 27.4%) and large decreases in negative affect (23.5%, 17.6%). Moderate and vigorous-intensity aerobic exercise were equally effective in improving mood in this college population.

### 1727 Board #321 May 28 9:30 AM - 11:00 AM The Acute Effects Of Exercise Intensity On Positive And Negative Affect

Charles J. Fountaine, FACSM, Elizabeth McElvey, Kelley Phillips. University of Minnesota Duluth, Duluth, MN.

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(No relevant relationships reported)

**Purpose:** To examine the tumor necrosis factor receptor (TNFR) 1 and 2 response to reduced sleep quality and lack of achievement of physical activity recommendations. Mann-Whitney U groups comparisons demonstrated that participants reporting higher sleep quality had lower degrees of internalized weight stigma; this relationship was seen among both genders.

**CONCLUSIONS:** Higher sleep quality (7.1 ± 3.4) compared to males (6.3 ± 3.6). Mann-Whitney U classification with no difference in prevalence between genders. Mean reported sleep quality (7.1 ± 3.4) to determine sleep quality.

**RESULTS:** A total of 328 students provided complete data and are included in this analysis. The majority of participants were female (n=256, 81%), and Caucasian (n=292, 89%). Eighty-nine participants (28.1%) had obesity based on BMI classification with no difference in prevalence between genders. Mean reported sleep time was 7.0 ± 1.3 hours for all participants. Female participants reported lower overall sleep quality (7.1 ± 3.4) compared to males (6.3 ± 3.6). Mann-Whitney U comparisons demonstrated that participants reporting higher sleep quality had lower degrees of internalized weight stigma; this relationship was seen among females (md=7.6; P<0.001, η2=.058) and males (md=7.0; P<0.001, η2=.073). The majority of injury male (77.9%) and female (73.0%) participants did not meet national physical activity recommendations. Mann-Whitney U comparisons demonstrated that participants with higher Participants meeting physical activity recommendations reported lower degrees of internalized weight stigma (md=4.20, P<0.01).

**CONCLUSIONS:** There is evidence that higher internalized weight stigma is related to reduced sleep quality and lack of achievement of physical activity recommendations among college students. Further research should explore this relationship to improve lifestyle counselling within this population.
Changes in surface expression, as measured by median fluorescent intensity (MFI) of TNFR 1 and 2 on monocyte subsets (classical: CD14+CD16–; intermediate: CD14+CD16+; and non-classical: CD14−CD16+) were analyzed via flow cytometry. Changes in TNFR1 and 2 expression were determined using a mixed model regression with fixed effects on time and condition. Results: Analysis indicated a time effect for TNFR1 expression on classical (F=4.450, p<0.001) and intermediate (F=3.517, p=0.006) monocytes. TNFR1 expression on classical monocytes decreased (p<0.05) from PRE (6391 ± 649 MFI), 30M (6618 ± 655 MFI) and 2H (6184 ± 569 MFI) to 6H (5934 ± 435 MFI) at a time effect (F=4.079, p=0.002) was observed for TNFR2 expression on intermediate monocytes, with a decrease (p<0.05) from PRE (25528 ± 3189 MFI) at 30M (23227 ± 4067 MFI), 2H (21946 ± 5131 MFI) and 6H (20515 ± 5918 MFI). TNFR2 expression on intermediate monocytes recovered by 24H (25483 ± 3189 MFI). Conclusion: Changes in TNFR1 and TNFR2 expression were observed across time, with no differences observed between conditions. Therefore, TNFR1 and TNFR2 expression on monocytes may not be dependent on intensity, but more investigation is necessary. Partially supported by the NSCA Foundation.

1729 Board #323 May 28 9:30 AM - 11:00 AM Diurnal Regulation Of Exercise-induced Interleukin-6 Signaling
Charli D. Aguilar, Elias M. Maleke, Caitlin K. Reynolds, Graham R. McGinnis. University of Nevada Las Vegas, Las Vegas, NV. (Sponsor: James Navalta PhD, FACSM)
(No relevant relationships reported)

BACKGROUND: Exercise induced production of specific myokines, namely Interleukin-6 (IL-6), is essential in protecting the heart against cardiac ischemia-reperfusion (IR) injury in mice. Interestingly, IL-6 production in skeletal muscle has been shown to have a circadian rhythm in vitro, which also influences the magnitude of exercise-induced IL-6 in the blood in humans. However, the circadian rhythm of IL-6 in skeletal muscle is not currently known. PURPOSE: It was the purpose of this study to investigate how time-of-day affects exercise induced IL-6 signaling in the heart. METHODS: We assessed activation of the IL-6 signaling pathway in cardiac muscle following exercise at two times of day: Zeitgeber time (ZT) 0 (beginning of light/active phase) and ZT12 (beginning of dark/active phase). 21-week-old male C57/BL6 mice (n=38) were habituated to treadmill exercise for 5 days under red light during the active phase and two times of day; Zeitgeber time (ZT) 0 (beginning of light/rest phase) and ZT12 (beginning of dark/rest phase). Mice were sacrificed at 3 time points; pre-exercise (SED), immediately after (2HR) and 40 min after exercise (1HR). 3 sets of 40 min exercise, with a load of 10 m/min, mice were sacrificed at 3 time points; pre-exercise (SED), immediately after (2HR) and 40 min after exercise (1HR). Differences in p-STAT3 at the various time points was analyzed using 2x3 factorial ANOVA and significance accepted at p<0.05. Statistical analyses was performed using SPSS 25 (SPSS Inc., Chicago, IL, USA).

RESULTS: VO2max was time-of-day dependent. Exercise induced BDNF-S and IL-1ra demonstrated weak to moderate, non-significant correlation (r= -0.045, p= 0.809; r= -0.045, p= 0.809, respectively). Similarly, correlation coefficients between changes in BDNF-S at 90 with IL-1ra at 90 and 120 and IL-1ra at 90 with IL-1ra at 120 and 150 were weak (r=0.087, p=0.724; r=0.081, p=0.742, respectively).

CONCLUSION: Exercise-induced myocardial IL-6-signaling was strongly activated at ZT0 compared to exercise at ZT12. Induction of IL-6 activation in cardiac tissue by exercise is time-of-day dependent.

Funding: Work was supported by NV INBRE Pilot Grant to Dr. McGinnis.

1730 Board #324 May 28 9:30 AM - 11:00 AM Pituitary-thyroid Hormone Responses Following Resistance Exercise Performed At Submaximal Movement Velocity
Anastassios Philippou1, Ilia Smilios1, Savvas Tsekikadhis2, Michael Koutsilieri1, Roxana Tenya1. 1Medical School, National and Kapodistrian University of Athens, Goudi-Athens, Greece. 2School of Physical Education and Sport Science, Democritus University of Thrace, Komotini, Greece. 3School of Health Science and Education, Harokopio University, Athens, Greece. Email: fttipou@med.uoa.gr
(No relevant relationships reported)

Acute hormonal changes can be elicited by mechanical overloading of skeletal muscle, which are potentially involved in muscle adaptation following resistance exercise. In particular, previous studies have shown that resistance exercise at maximal velocity induces acute changes in circulating levels of pituitary-thyroid (P-T) hormones. PURPOSE: This study investigated the responses of thyrotropin (TSH), free thyroxine (FT4) and prolactin (PRL) in young volunteers after a bout of resistance exercise performed at 70% of the maximal velocity of movement. METHODS: Nine healthy males (age: 22.5 ± 3.3 years, height: 181 ± 5 cm, body mass: 81.6 ± 5.6 kg) underwent a protocol of resistance exercise of the knee extensors of both legs (4 sets squat and 4 sets leg press, 8 repetitions/set, with a load corresponding to that of 10-repetition maximum). A recovery period of 3 minutes was allowed between sets. Blood samples were collected and immediately after and at 20 and 40 min post-exercise. Plasma levels of TSH, FT4 and PRL were measured by ELSIA. One-way ANOVA was used for statistics and data are presented as mean±SE. RESULTS: TSH showed a slight gradual increase up to 12% at 40 min post exercise, which failed to reach significance (p<0.05) due to a large variability shown between the subjects’ responses (3.63±0.89 ng/dl, 3.53±0.71 ng/dl, 3.70±0.89 ng/dl, immediately after, at 20 and 40 min after exercise, respectively, compared to 3.26±0.65 ng/dl at baseline). Plasma levels of FT4 increased by 11.9% at 20 min after exercise (17.46±1.10 ng/ml, 17.46±1.10 ng/ml, immediately after, and 20 and 40 min post exercise, respectively, compared to 15.92±2.92 ng/ml at baseline; p<0.05). CONCLUSION: Our findings suggest that resistance exercise at a submaximal velocity induces mild acute pituitary-thyroid hormone responses. Further studies are needed to characterize the mechanisms by which these responses are triggered and regulated during recovery after resistance exercise.
Untrained men (n=8, 22 ± 3 y) and women (n=8, 20 ± 1 y) completed a 80 unilateral maximal eccentric knee extensions. Vastus lateralis samples were collected and analyzed for gene expression of Interleukin (IL)-6, IL-10, IL-15, tumor necrosis factor (TNF)-α, and transforming growth factor (TGF)-β before exercise (BL), and 12 (h) and 24 hours (24h) after exercise. Data were Results: A significant (p<0.05) time x gender effect was found for IL-10 and TNF-α expression. IL-10 was increased at 12h (13.64 ± 4.22-fold) and 24h (29.34 ± 8.42-fold) compared to BL for men, but there were no changes in women. At 24h, IL-10 was greater for men than for women. Additionally, TNF-α was increased at 24h (7.78 ± 1.17-fold) compared to 12h (3.64 ± 1.36-fold) for men; no change was found for women. A significant time effect was found for IL-6 and an increased at 12h (3.23 ± 0.7-fold) and 24h (4.80 ± 1.57-fold) compared to BL. No changes were observed for IL-15 and TGF-β expressions. Conclusion: In response to exercise-induced muscle damage, TNF-α and IL-10 gene expression increased in men but not in women. These results suggest that there is a sex dimorphic response in muscle damage-induced intramuscular pro-inflammatory and anti-inflammatory cytokines.

1734 Board #328 May 28 9:30 AM - 11:00 AM Acute Effects Of Maximal Exercise On Inflammatory Markers And Heart Rate Variability
Samantha J. Goldenstein, Nate T. Berry, Zach Kincade, Travis Anderson, Allan H. Goldfarb, FACSM, Laurie Wideman, FACSM. University of North Carolina-Greensboro, Greensboro, NC. (Sponsor: Dr. Laurie Wideman, FACSM)
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BACKGROUND: It has been suggested that vagal input may influence inflammatory responses on a millisecond timescale akin to heart rate. This study aimed to investigate the relations between vagally mediated markers of heart rate variability (HRV) and inflammatory profiles in response to maximal aerobic exercise. METHODS: Eight recreationally active males (26±3 y, 97±12 kg, 37±6% BF) completed two trials separated by a minimum of eight weeks. Resting HRV was assessed during a 5-min seated period at both trials; the root mean square of successive differences (rMSSD) was used to assess vagal input. Maximal oxygen uptake (VO_{max}) was assessed via ramp protocol on the cycle ergometer (100W + 25W per minute) until volitional fatigue. A blood draw was collected immediately pre- and immediately post-maximal oxygen uptake testing. Inflammatory markers were quantified in serum using a high sensitivity T-Cell assay. The effects of exercise on inflammation are complex. Literature suggests a reduction of chronic inflammation following exercise training, however, following acute bouts of exercise, both pro- and anti-inflammatory responses have been demonstrated. The effects of exercise on inflammation are complex. Literature suggests a reduction of chronic inflammation following exercise training, however, following acute bouts of exercise, both pro- and anti-inflammatory responses have been demonstrated. Brain-derived neurotrophic factor (BDNF) has been suggested to have an intermediary role during the inflammatory response to exercise. Therefore, observing the role of BDNF in the pro-inflammatory and anti-inflammatory response may allow for a greater understanding of the complexities of the inflammatory response. Purpose: The purpose of this study was to observe the relationship between BDNF and Interleukin-6 (IL-6) during aerobic exercise in different environmental conditions. Methods: Six college aged men (26±3 years) completed a VO_{max} test (48.6±5.7 mL/kg/min) along with three separate trials in 5°C (LT), 22°C (MT), and 35°C (HT). Each trial consisted of cycling for 60 minutes at 60% VO_{max}, a time to exhaustion trial at 90% VO_{max} (TTE), and passive recovery for 60 min in the same condition. Blood was obtained before exercise (PRE), after 60 min of cycling (60), after the TTE (90), and after recovery (REC). Blood was analyzed via ELISA for plasma and serum BDNF concentrations and serum IL-6 concentrations. Change scores were calculated for each (PRE to 60, APRE to REC) and analyzed using a Pearson Correlation, with significance defined as α = 0.05. Results: Changes in serum IL-6 (APRE to 60) were significantly (p = 0.018) correlated to changes in plasma BDNF (APRE to 60). Changes in serum

INTRODUCTION: Satellite cells are muscle stem cells that function to support long-term muscle homeostasis, repair and exercise adaptations. Recent evidence in rodents has revealed the existence of an additional muscle progenitor cell population with the capacity to specifically regulate the repair and maintenance of type-IIb skeletal muscle fibres. These cells are typified by the expression of the transcription factor Twist2 (Tw2) and represent a distinct, non-satellite cell population found within the myofibre interstitium, and the function of Tw2-positive cells within human skeletal muscle is currently unknown. Therefore, the PURPOSE of this investigation was to identify and characterize Tw2-positive cells within skeletal muscle under basal conditions. METHODS: Muscle biopsy samples were obtained from the hamstrings muscle of young healthy males and females undergoing anterior cruciate ligament repair (n=8, 3 male, 4 female, mean age ~25 years), for immunohistochemical (IHC) analysis of muscle cross-sections and immunocytochemical (ICC) analysis of cytospun mononuclear cells enzymatically digested from muscle biopsy samples. RESULTS: ICC staining revealed numerous Tw2-positive cells in the isolated mononuclear cell fraction suggesting they originated from the myofibre interstitium. This was confirmed through IHC staining for Tw2 and laminin in tissue cross-sections which revealed that Tw2 expression was localized to a population of cells outside the myofibre membrane at a density of 0.014/mm². In agreement with previous reports, Tw2 protein expression was localized within both the cytosol and the nucleus of Tw2-positive cells. Importantly, IHC analysis of the satellite cell marker pax7 and Tw2 demonstrated that cells expressing these markers were mutually exclusive demonstrated that Tw2-positive cells represent a unique cell type, independent of satellite cells. Ongoing analysis is examining the response to Tw2-positive cells to acute and chronic exercise stimuli. CONCLUSION: These findings identify a novel non-satellite cell population typified by Tw2 expression in human skeletal muscle, the function of which currently remains unknown.

1736 Board #330 May 28 9:30 AM - 11:00 AM Changes In Brain-Derived Neurotrophic Factor Are Correlated With Changes In Il-6 During Aerobic Exercise.
Ryan Viet1, Emily C. Tagesen2, Tori Hargett1, Carly Sedlacik3, Elliot Arroyo4, Brandon A. Miller5, Kylene Boka6, Ellen Glickman, FACSM7, Adam R. Jajtner7, Kenneth State University, Kent, OH. 2Malone University, Canton, OH. (Sponsor: Ellen Glickman, FACSM)

The effects of exercise on inflammation are complex. Literature suggests a reduction of chronic inflammation following exercise training, however, following acute bouts of exercise, both pro- and anti-inflammatory responses have been demonstrated. Brain-derived neurotrophic factor (BDNF) has been suggested to have an intermediary role during the inflammatory response to exercise. Therefore, observing the role of BDNF in the pro-inflammatory and anti-inflammatory response may allow for a greater understanding of the intricacies of the inflammatory response.

RESULTS: After controlling for the difference in baseline rMSSD, inflammation between the two trials approached significance with 4.16-fold (p = 0.06). However, none of the 3 components were significantly different in response to maximal exercise (p = 0.24). CONCLUSIONS: Vagal input was assessed by seated resting HRV (rMSSD) which influenced baseline resting inflammatory status but did not influence the exercise-induced inflammatory response. This data suggests that when investigating inflammatory responses, resting vagal input should be considered.
IL-6 (APRE to 90) were significantly (r = 0.511, p < 0.043) correlated to changes in serum BDNF (APRE to 90). Changes in serum BDNF were not significantly correlated to changes in the BID and no other significant correlations were observed.

**Conclusion:** This study suggests there is a relationship between IL-6 and BDNF. This could lead to better understanding of the mechanism for both IL-6 and BDNF responses due to aerobic exercise. The insignificant correlation between serum and plasma BDNF give evidence that each may represent different pools of BDNF that respond independently to exercise.

This study was partially funded by the Kent State University Research Council.

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**RESULTS:** A total of 632 players (mean age 34 ±16 years, 96% males) was reported from 70 countries; 150 players (24%) survived. Elite players represented a small portion (6%). A diagnosis by autopsy or definite medical reports could be established in 219 cases (35%). The leading causes over the age of 35 years were coronary artery disease (CAD, 74%) and ≤35 years sudden unexplained death (22%), cardiomyopathy (CM, 17%) and CAD (11%). Hypertrophic CM and coronary artery anomalies showed the highest fraction in North America with 15% and 36%, respectively. Myocarditis was most frequently reported from Europe (7%). CAD ≤35 years prevailed in Africa (38%) and CM (42%) in South America. Commotio cordis occurred infrequently (3%). In North America and Australia survival rates were the highest (53% and 47%, respectively). Early use of an automated external defibrillator was associated with a higher survival rate (86%) compared to manual cardiopulmonary resuscitation (35%).

**CONCLUSIONS:** Differences between countries in the underlying cardiac diseases for SCA and SCD have to be taken into account to possibly improve and modify primary and secondary prevention measures in football players. The percentage of autopsied cases is difficult to increase because this reflects the law in most countries. Therefore, an expansion of national SCD registries is urgently needed.

**METHODS:** From 2014 to 2018 cases of SCAs and SCDS were mainly recorded by media monitoring (Meltwater®), a confidential web-based data platform and data synthesis comparison with existing national SCD registries (n=16). Inclusion criteria were met when SCD or SCA occurred during football-specific activity or up to one hour afterwards. Death during other activities was excluded.

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**PURPOSE:** The purpose of this study was to examine differentially expressed genes (DEG) in Cd8+ T-Cells in response to a dual stress challenge (DSC) in resistance trained (RT) men. METHODS: RT men (n = 6; age = 21.7 ± 2.8 years; height = 176.0 ± 4.9 cm; weight = 79.8 ± 9.6 kg) volunteered to participate in this study. Each volunteer underwent a DSC, which consisted of three exercise stages (ES) lasting 15-20 minutes each. After each ES a cognitive assessment lasting 5 minutes each (15 total minutes) was conducted, for a total DSC of roughly 65 minutes. Blood draws were collected prior to the DSC and 20 minutes after completion of the DSC. T-Cells were isolated using the Negative Selection EasySep Human CD8+ T-Cell Isolation Kit and T-cells were resuspended in TRI Reagent and total RNA was isolated with a Direct-zol RNA MicroPrep Kit. The NEBNext Ultra II Directional RNA Library Prep Kit for Illumina was then used to construct RNA sequencing libraries. An Illumina NextSeq 500 sequencing system at the University of Kansas’s Genome Sequencing Core was used to generate paired-end, 50-base pair sequence reads. Gene expression values were normalized using the TMM-method (weighted trimmed mean of M-values) using R statistical programming language and EdgeR, followed by differential gene expression analyses per EdgeR protocol. Finally, pathways affected by the differentially expressed genes were investigated using Ingenuity Pathway Analysis (IPA). RESULTS: Forty DEG were identified (p < 0.001), with 35 of those being upregulated and five being downregulated. Further analysis with IPA showed these genes are involved in the regulation of 5 pathways (p < 0.001) including the JAK/STAT pathway, TLR pathway and IL-6 signaling pathway. The affected pathways are involved in the inflammatory response as well as cell growth, proliferation, development, signaling, and cell survival. CONCLUSION: Thirty-five upregulated genes and five downregulated genes were observed in response to a dual-stress challenge. These genes play a role not only in growth, proliferation, development and survival of CD8+ T-Cells but also to other immune cells via various signaling pathways. Further research is warranted to help better understand the roles these genes play in the immune response to exercise.

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**PURPOSE:** Large population-based studies about sudden cardiac deaths (SCD) and survived sudden cardiac arrests (SCA) in athletes from the USA and Europe indicate regional differences in the underlying causes. A different ethnic and genetic mix between these regions may lead to such a heterogeneous distribution. It is of great relevance to investigate these regional patterns to possibly optimize existing screening and prevention procedures and reduce fatalities. This registry aims to investigate SCD and SCA in football (soccer) players worldwide, both at professional and recreational level.

**METHODS:** From 2014 to 2018 cases of SCAs and SCDS were mainly recorded by media monitoring (Meltwater®), a confidential web-based data platform and data synthesis comparison with existing national SCD registries (n=16). Inclusion criteria were met when SCD or SCA occurred during football-specific activity or up to one hour afterwards. Death during other activities was excluded.

**RESULTS:** A total of 632 players (mean age 34 ±16 years, 96% males) was reported from 70 countries; 150 players (24%) survived. Elite players represented a small portion (6%). A diagnosis by autopsy or definite medical reports could be established in 219 cases (35%). The leading causes over the age of 35 years were coronary artery disease (CAD, 74%) and ≤35 years sudden unexplained death (22%), cardiomyopathy (CM, 17%) and CAD (11%). Hypertrophic CM and coronary artery anomalies showed the highest fraction in North America with 15% and 36%, respectively. Myocarditis was most frequently reported from Europe (7%). CAD ≤35 years prevailed in Africa (38%) and CM (42%) in South America. Commotio cordis occurred infrequently (3%). In North America and Australia survival rates were the highest (53% and 47%, respectively). Early use of an automated external defibrillator was associated with a higher survival rate (86%) compared to manual cardiopulmonary resuscitation (35%).

**CONCLUSIONS:** Differences between countries in the underlying cardiac diseases for SCA and SCD have to be taken into account to possibly improve and modify primary and secondary prevention measures in football players. The percentage of autopsied cases is difficult to increase because this reflects the law in most countries. Therefore, an expansion of national SCD registries is urgently needed.
HRV were measured from the R-R interval. After having five deep breaths, we determined the HRV in 1) the supine position for 5 min, 2) at rest in the supine position for 3 min, and after having five deep breaths, then 3) in the standing position for 3 min and finished the measurement with five deep breaths. The ECG data were derived from the chest leads using the Biopac MP36 data acquisition system (Santa Barbara, CA, USA) and input at a sampling frequency of 1 kHz, and heart rate and HRV were measured from the R–R interval. RESULTS: The HRV results for athletes A and B are shown in Table 1. The present study, athletes A and B were both asked about their subjective feelings of fatigue and their HRV was measured (scores) at the time of the HRV measurements. Athlete A reported subjective feelings of fatigue at the time of the measurement. Athlete B had no subjective feelings of fatigue, but the inability to achieve high scores.

CONCLUSION: The results suggest that even when there are no subjective feelings of fatigue, but the heart rate is high, LF/HF is high, HF is low, or RSA is low, in that case, cardiac sympathetic nervous function will be predominant, and poorer health measures. For this sub-analysis, we report data from 1 FF who was found to have nocturnal hypertension and morning BP surge.

10.3244/0006-3190-40.5.5

PURPOSE: The present work included 30 AA collegiate athletes stratified by normal BP (systolic BP (SBP) ≤129 mmHg; n=15) and high BP (SBP ≥130 mmHg; n=15) and we performed 16S rRNA gene sequencing on fecal samples. RESULTS: Relative to the overall gut microbial community, we did not observe any significant differences in alpha or beta diversity, or operational taxonomic units (OTUs). However, we observed that SCFA producing microbes were differentially abundant between the two groups and the relative abundance of some microbes was significantly correlated with systolic BP (g. Lactococcus, R=0.5; p=0.0074; g. Adlercreutzia, R=0.39; p=0.001; g. Paraprevotella, R=0.33; p=0.044; g. g_c_115, R=0.41; p=0.29). CONCLUSION: We report that SCFA producing microbes were differentially abundant in AA collegiate athletes stratified by BP status. Although exercise training broadly increases SCFA microbes in the gut, identification of microbial community characteristics and specific taxa will provide insight into gut microbial functional profiles related to greater BP in AA collegiate athletes.

10.3244/0006-3190-40.5.6

Masters athletes (≥35 yrs) are not immune to elevated cardiovascular risk and cardiac events. In the first year of Masters Athlete Screening Study, 798 masters athletes were screened; 91 (11.4%) of the cohort were found to have cardiovascular disease (CVD). Coronary artery disease (CAD) was the most common diagnosis (7.9%).

PURPOSE: To evaluate the incidence of CVD and adverse cardiovascular events over four years of the screening study.

Methods: Masters athletes (235 yrs) from a variety of sports without previous history of CAD underwent yearly cardiovascular screening for four years. The screen consisted of anthropometrics, resting blood pressure, resting electrocardiogram, modified American Heart Association 14-element recommendations, cardiovascular event questionnaire, physical examination (year one), and Framingham Risk Score. Participants with an abnormal screen according to the European Association of Cardiovascular Prevention and Canadian Cardiology Society Guidelines underwent further evaluations.

Results: During the following three years of study an additional 45 cases of CVD were detected, with an incidence rate of 1.9/100 (64.7/7.37 yr; 79%M), 3.0/100 (65.43/7.37 yr; 62%M), and 1.5/100 (65.01/5.88 yr; 80%M), for years two, three, and four, respectively. Twelve participants had a new CVD diagnosis or progression of a diagnosis. The
most common diagnoses over the three years was CAD (n=15; 33.3%) and atrial arrhythmias (n=14; 31.1%). An additional 9 participants were diagnosed CVD outside of the study (n=11; moderate CAD n=2; mild CAD n=9; genotype positive hypertrophic cardiomyopathy n=1). Five out of 798 (0.6%) participants had a myocardial infarction. A single CV death occurred. Three of the individuals who had a cardiac event demonstrated a negative exercise treadmill test (ETT) (mean time 15±2.9 min) and three had a positive ETT (mean time 12±1.2 min); two of which initiated cholesterol medication after confirmation of CAD via CCTA, and one declined medication after a negative MIBI.

Conclusion: Yearly cardiovascular screening of masters athletes identified ~2 new diagnoses per 100 athletes per year (primarily CAD and atrial fibrillation). Despite yearly cardiovascular screening and high fitness, myocardial infarctions still occur.

**1744 Board #338** May 28 9:30 AM - 11:00 AM Cardiovascular And Respiratory Responses During Aquatic Rehabilitation At Different Depths Of Supine Immersion

Helen N. Soultanakis1, Maria-Elisavet Nikolaidou1, Evangelia Florou2, Konstantinou Sotiris3, Emmanuel Vagakis3, 1National and Kapodistrian University of Athens, Athens, Greece. 2National and Kapodistrian University of Athens Medical School, Athens, Greece. 3AQUA TERRA Institute SLU, Valencia, Spain.

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(No relevant relationships reported)

Aquatic Rehabilitation (AR), is used in the treatment of athletic injuries, initially in a supported supine aquatic position, before progressing to an independent vertical position. In water entry, cardiovascular and respiratory shifts are affected by, the hydrostatic pressure, the diving reflex responses, the water temperature, and vary at different positions and levels of immersion.

**PURPOSE**: The purpose of this study was to investigate how the depth of submersion during AR at 32°C in a supine position, affects cardiovascular and respiratory function.

**METHODS**: Seven participants (35±10 years), were subjected to two 15-min trials of AR aquatic bodywork manipulations (MKS). Subjects were supported in a supine position by the provider’s elbow under the head, and the trunk and lower legs, a) were either kept in alignment to the surface (SI) of the water with a lumbar curve support, or b) allowed to diagonally submerge to a deeper level (DI) during movements. An underwater video camera (FinesysGPS) was used for recording, and via 2-dimensional (2-D) kinematic analysis, the depth of submersion (LOGEPRO 3.8) and hydrostatic pressure, were evaluated. During the trials, respiratory rate (RR), heart rate (HR), and oxygen saturation (SO2) were measured (ApneaLink 1_218). Before and after the trials, arterial blood was drawn for gas analyses (Abbott-I-Stat) in addition to blood pressure determination. Trials were conducted in a randomized cross-over design and analyzed for dependent measures (p<0.05).

**RESULTS**: The depth of submersion of the trunk and legs with the SI was 0.022±0.036 m versus 0.575±0.06 m with the DI. Significant differences were observed for RR, 14.32±2.29 breaths/min vs 11.34±2.42 breaths/min (p=0.03), and systolic blood pressure, 124.85±6.52 mmHg vs 109±7.00 mmHg (p=0.03), for SI and DI respectively. No significant differences were observed for oxygen saturation or any other arterial gas variables measured.

**CONCLUSIONS**: The increase of the depth of submersion during AR significantly impacted select cardiorespiratory parameters. Breathing frequencies and systolic blood pressure, consistent with an increase in parasympathetic and/or decrease in sympathetic activity. Depending on pre-existing conditions this may affect the quality of clinical care during rehabilitation of the athlete.

**1745 Board #339** May 28 9:30 AM - 11:00 AM Cardiac Remodeling In Child And Adolescent Athletes In Association With Sport Discipline And Sex.

Pia Brecht, Claudia Beckendorf, Frank Mayer. University of Potsdam, Potsdam, Germany.

(No relevant relationships reported)

Continuous high training loads are associated with structural cardiac adaptations and development of an athletic heart in adult athletes, especially in sport disciplines with high dynamic training components. In child and adolescent athletes these effects are increasingly reported. However, study populations are still very small.

**PURPOSE**: To determine cardiac dimensions indicating cardiac remodeling in child and adolescent athletes.

**METHODS**: M Mode echocardiograms of 1021 athletes (m 575, f 446; 8-18 yrs; body surface area (BSA) 0.88-2.0 m²) from 19 sport disciplines were analyzed retrospectively. Sport disciplines were clustered into 9 groups according to Mitchell, categorizing sports by components of dynamic and static training loads. Groups were analyzed separately. Previous organized sporting experience (at least 3-13 yrs) was a requirement for inclusion. Left ventricular diameter (LVDD), interventricular septal (IVS) and posterior wall (PW) thickness at end-diastole were analyzed and compared to cardiac z Scores (zS) for central European children. Deviations from normal mean (zS = 0) were defined as difference. Data was analyzed descriptively (median ± SD), Bland-Altman analysis was performed. **RESULTS**: For all analyzed parameters, athletic children showed higher median zS (BSA). Positive deviations from the normal mean (zS>1.88) were only seen in single cases. Differences in sport discipline and sex were discovered. Throughout all disciplines, boys showed higher zS compared to girls (LVDD 0.48±0.96 vs 0.22±0.92; IVS 0.47±0.09 vs 0.29±1.05; PW 0.53±0.76 vs 0.08±0.76), especially in disciplines with high dynamic training loads (Mitchel C-I-III). Additionally, higher zS were observed in the group of athletes with the highest static and low dynamic training load (Mitchell A III). **CONCLUSIONS**: Cardiac remodeling in response to athletic training starts at a young age, especially in boys exposed to high dynamic as well as static training loads. The development of zS for young athletes is essential to determine whether zS above the mean in this group are physiologic adaptations or the beginning of pathologies. Differences between boys and girls and the high zS in boys with static training loads indicate an association between fat free mass and cardiac dimensions stronger than BSA.

**1746 Board #340** May 28 9:30 AM - 11:00 AM Benign And Pathological Electrocardiographic Changes In Basketball Athletes Of Brasil-Lia - Brazil

Alexandra Correia Gervazoni Balbuena Lima1, Giovanni Gonçalves De Toni2, João Manoel Montenegro Pinheiro3, Tiago Zavascski Turra3, Antônio Aurélio Fagundes Jr.1. 1Nucleo Cardiologico de Brasilia, Brasilia, Brazil. 2Escola Superior de Ciencias da Saude do Distrito Federal (EPS/CEPESCS), Brasilia, Brazil. 3Cerrado Basketball, Brasilia, Brazil.

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(No relevant relationships reported)

**PURPOSE**: Basketball has evolved a lot and the level of competition has increased considerably. Athlete’s Heart Syndrome comprises a set of clinical, electrocardiographic (ECG) and echocardiographic (ECHO) changes, such as sinus bradycardia, myocardial hypertrophy or enlargement of the cardiac cavities. Thus, it is important to distinguish potentially fatal pathological changes from normal physiological adaptations. The aim of this study was to describe the clinical, ECG and ECHO characteristics of Brazilian basketball players and evaluate the presence of benign and pathological changes.

**METHODS**: Fifteen male basketball athletes (23 ± 3.74 years) competing in the National Basketball Gold League were evaluated during the last week of preparatory training for the competition. The athletes performed clinical evaluation (cardiovascular risk factors, medication use, sleep quality, and application of the Physical Activity Readiness Questionnaire - PAR-Q), anthropometric (body mass index - BMI, kg/m²; muscle mass - MM, Kg; fat percentage - FP,%), resting ECG, and transthoracic doppler ECHO (left ventricular ejection fraction - LVEF%; left ventricular diastolic diameter - LVDd, cm; left ventricular mass index - LVMi, g/m²). ECG changes were classified as benign or malignant according to the Seattle Criteria. Aortic and mitral annular dimensions were analyzed via ECHO. **RESULTS**: The athletes did not report cardiovascular risk factors, medication use and presented negative PAR-Q. Most athletes (90%) complained of poor sleep quality. The anthropometric variables were BMI 24.13 ± 2.05 Kg.m-2, MM 47.6 ± 5.4 Kg; FP 47.6 ± 4.7%. All individuals presented sinus rhythm (100%). The main benign ECG alteration was early repolarization alteration (10 - 66.7%). The malignant ECG change was LV hypertrophy with negative T-wave (3 - 100%). On ECHO we observed LVEF 65.76 ± 2.35%, LVMi 53.15 ± 3.57 cm and LVMi 81.46 ± 11.72 g/m², within the normal range for age and body surface. **CONCLUSIONS**: The presence of ECG criteria for LV overload was not associated with the presence of hypertrophy or ventricular remodeling on echocardiography. Evidence supports the use of ECG in screening, coupled with a cost-effective interpretation algorithm to assist abnormal and borderline changes to identify possible cardiovascular causes and prevent sudden death in athletes.
Participants aged 6-12 [n=109, Non-Hispanic: 59.1%, Boys: 47.8%] came to Duke’s Children Primary Care Clinic for anthropometric measures and an assessment of physical fitness. Physical fitness was assessed via the 3-min YMCA Bench Press Test, adapted for children 5-18. Heart rate recovery was measured via pulse-oximetry 1 minute after the test. RESULTS: The mean HR (bp) for all age groups in this study showed a “very good” CRF [younger boys: 99.5, older boys: 98.2, younger girls: 109.0, older girls: 114.2]. Boys had a greater CRF with 39% at an “excellent” CRF compared to 24% for girls. Overall, girls tended to have a lower CRF compared to boys with 10% of girls in the “poor” category compared to the 4% for boys. CONCLUSION: Compared to normative values of children and considering their BMI, the participants of this study showed greater CRF values than expected. Irrespective of CRF levels, this study suggests children who are obese, in school and engage in some physical activity may still have a healthy level of CRF. Future studies should employ another measure such as VO2 to examine CRF in children with obesity and how this may be related to the adiposity and health of the child.

Funded by 17SFRN33700117

C-49 Free Communication/Poster - Musculoskeletal/Neuromuscular Diseases

Thursday, May 28, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

1748 Board #342 May 28 9:30 AM - 11:00 AM
High Intensity Shoulder Exercise Improves Function, Pain And Tendinous Blood Flow In Subacromial Pain Syndrome.

Ole Kristian Berg1, Fredrik Paulsberg2, Clara Brabant3, Keyvan Arasbolghar4, Sigrid Ronglan5, Nina Olinn Aasen Bjornsen5, Tom Torhaug5, Fredrik Granviken5, Sigmund Østgård3, Gismervik1, Jan Hoff6.1. Mollde University College, Mollde, Norway. 2Rosenborg Clinique of Physiotherapy, Trondheim, Norway. 3Norwegian University of Science and Technology, Trondheim, Norway.

PURPOSE: To determine if high intensity aerobic interval training (HIIT) of the rotator cuff was feasible, more effective in improving endurance and reducing pain compared to low intensity exercises. Additionally, to examine the response of tendinous microcirculation following the exercise therapy. METHODS: 21 subjects with chronic SAPS randomized to two groups: HIIT (n=13) and control group (CG) (n=8) was tested before and after 8 weeks of exercise therapy. Endurance performance was assessed by an incremental abduction adduction exercise of the arm to exhaustion (TTE). Contrast enhanced ultrasound (CEUS) of the m. supraspinatus and tendon was utilized to examine tendinous blood flow. Limitations in daily life was assessed by the shoulder pain and disability index (SPADI).

RESULTS: Endurance in the TTE-test improved by an average of 23% in HIIT <p=0.001). CEUS indicated an increase in tendinous blood flow in the HIIT group (<p=0.01), no change was observed in CG. CONCLUSIONS: HIIT rotator cuff exercise appear to be a feasible intervention in SAPS, reducing pain and increasing endurance performance more than exercise with low load. CEUS indicated that HIIT may increase tendon microcirculation, thus abating a potential hyperoxygenated / hypoxic state underlying the condition.

C-370 Board #343 May 28 9:30 AM - 11:00 AM
Effect Of Whole-body Vibration Training On Muscle Strength In Individuals With Knee Osteoarthritis

Zhangqi Lai1, Lin Wang2. 1Shanghai University of Sport, Shanghai, China. 2Rosenborg Clinique of Physiotherapy, Trondheim, Norway.

PURPOSE: TO investigate the effect of WBV on physical function and muscle strength of KOA.

METHODS: After diagnosed by orthopedic surgeon, eligible participants were randomly allocated to WBV and control groups. The supervised 8-week intervention was performed three times per week with the intensity and duration increased gradually. The participants performed static squat training on the vibration platform under the frequency of 20 Hz. The control group did not undergo any intervention. The control group was asked to maintain their previous lifestyle and to avoid participating in any other regular rehabilitation programs. The isokinetic muscle strength measurements were performed at baseline and post-intervention at angular velocity of 90°/s and 180°/s. Two-way repeated measures ANOVA was used to determine the difference in muscle strength and muscle power of extensors and as well as the peak power of flexors at 180°/s.

RESULTS: 40 participants completed the intervention and measurements (Control: n=20, age=62.8±4.43 years; WBV: n=20, age=64.10±4.95 years). At an angular velocity of 90°/s, only significance was found at interaction in the peak power of flexors (<p=0.025). However, the peak torque (PT) of the flexors at 180°/s increased significantly in WBV group compared with control group (<p=0.027 vs. control group = 0.132). Additionally, the significances were found at the interaction in the peak torque and peak power of extensors as well as the peak power of flexors at 180°/s.

CONCLUSIONS: This study found that WBV training offered positive effects on muscle strength gain in patients with KOA.

1750 Board #344 May 28 9:30 AM - 11:00 AM
Sarcopenic Obesity Among Adults With Facioscapulohumeral Muscular Dystrophy

Kathryn Vera1, Mary McConville1, Michael Kyba2, Manda Keller-Ross3. 1University of Minnesota, Minneapolis, MN. 2College of St. Benedict, St. Joseph, MN.

BACKGROUND: Sarcopenic obesity has been observed in people with neuromuscular impairment and is linked to adverse health outcomes; it is unclear, however, if adults with facioscapulohumeral muscular dystrophy (FSHD) develop this condition.

PURPOSE: Determine if adults with FSHD meet criteria for sarcopenic obesity (appendicular lean mass index (ALMI) scores of ≤7.6 kg/m2 or 5.45 kg/m2; % body fat of ≥27% or 38% in men/women).

METHODS: Ten FSHD patients (5±13.6 years, 2 females) completed an 8-week intervention, which included a full-body group were asked to maintain their previous lifestyle and to avoid participating in any other regular rehabilitation programs. The isokinetic muscle strength measurements were performed at baseline and post-intervention at angular velocity of 90°/s and 180°/s. Two-way repeated measures ANOVA was used to determine the difference in muscle strength and muscle power of extensors and as well as the peak power of flexors at 180°/s.

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CONCLUSIONS: This study found that WBV training offered positive effects on muscle strength gain in patients with KOA.

Abstracts were prepared by the authors and printed as submitted.

THURSDAY, MAY 28, 2020
Purpose: The consequence of reactive oxygen and nitrogen species (ROS/RNS)-mediated cellular aging has been linked to various diseases, such as atherothrombosis and cancer. One of the possible mechanisms for these ROS-mediated diseases is through the activation of intracellular pattern recognition receptors (PRR), thereby contributing to a chronic low-grade pro-inflammatory systemic state in aging. Pentraxin 3 (PTX3) is a soluble PRR mainly released from endothelial cells and immune cells and utilizes its counter-regulatory function in promoting the anti-inflammatory response via the inhibition of toll-like receptor 4 (TLR4). Although increased level of PTX3 has been shown following stimulation of oxidative stress and is also associated with aging-related diseases, the relationship between PTX3 and oxidative stress in aging remains to be elucidated. However, exercise has been proposed as the key intervention for the maintenance of health in the elderly. Therefore, this study was to examine whether or not the level of PTX3 on TLR4-dependent inflammation would be associated with changes in oxidative stress in both plasma and peripheral blood mononuclear cells (PBMCs) following 8 weeks of aerobic training in the elderly.

Methods: Fourteen elderly subjects (9 trained and 5 controls) were recruited to participate in an 8-week aerobic training. The ELISA and western blot analyses were used to determine the levels of PTX3 and biomarkers of oxidative stress in both plasma and PBMCs prior to and following training.

Results: No changes in plasma levels of PTX3 and oxidative stress markers (GSH, TEAC, and ROS/RNS) were observed in trained vs. control groups. However, our analyses showed a downregulation of PTX3 expression in PBMCs (P = 0.017) following aerobic training, along with decreased ratio of PTX3/TLR4 (P = 0.047). Furthermore, the tendency of oxidative stress response in PBMCs remained unchanged as shown in plasma levels. Finally, no correlation was observed between PTX3 and any oxidative stress biomarkers following training protocol.

Conclusions: These findings demonstrate the downregulation of PTX3 and oxidative stress following 8 weeks of aerobic training.
Multiple Sclerosis (MS) is an autoimmune disease that attacks the myelin sheath and impairs proper conduction of action potentials through the central nervous system. As a result, persons with MS (PwMS) can experience symptoms of fatigue, muscular weakness, spasticity, and balance or gait issues. Such symptoms may reduce physical activity, negatively affecting body composition and predisposing PwMS to obesity, sarcopenia and osteoporosis. PURPOSE: The aim of the current study was to compare the body composition of PwMS and controls using DXA. METHODS: Six males and 13 females with relapsing-remitting MS and 19 Age/Sex/BMI matched healthy controls were recruited for this study. Extended disability status score (EDSS) in PwMS ranged 0 to 6 (≤3.1 ± 2.2). DXA scans were used to assess whole body and limb specific contents of fat, muscle and mineral content. Two-way ANOVAs (Group x Sex) with post hoc comparisons were run to assess differences across group and sex.

RESULTS: Compared to male controls, MS males had a reduced whole body % lean mass (%LM) (60.9 ± 6.3% vs. 74.0 ± 11.0%, p=0.02), %LM_trunk (66.7 ± 8.5 vs. 79.0 ± 8.6%, p=0.03), %LM_gut (61.8 ± 62 vs. 75.2 ± 9.9%, p=0.02), % appendicular lean mass (alM) (28.1 ± 5.1 vs. 35.3 ± 5.8%, p=0.03), and alM/BMI (90.0 ± 21.10 vs. 115.8 ± 21.9, p=0.04) Similarly, the % body fat (%BF) was higher in MS males (36.7 ± 7.0%) compared to male controls (23.1 ± 11.7% and p=0.02). No between group differences were found for bone mineral content (p>0.05). When collapsed across sex, group differences disappeared in all measures except android fat mass, which was higher in PwMS (35.0 ± 16.0 kg) than controls (33.8 ± 16.3 kg, p=0.04). Interestingly, the Pearson’s r correlation between BMI and BP% was significant for the MS group (r=0.715, p<0.01) but not for the control group (r=0.347, p=0.15). EDSS scores in PwMS did not significantly correlate with any variables (p>0.05). CONCLUSIONS: Expected sex differences in body composition occurred regardless of group. MS males tended to have lower LM and higher %BF than controls, which was not seen in MS females. Significance in MS males may be explained by differences in sample size (n=6) or sex differences in MS symptom or disease progression. It is furthermore unclear to what extent individual differences in physical activity or medication may influence results.
Cancer and diabetes are among the most common and fatal diseases in the United States. Following diagnosis, approximately 25% of patients develop additional chronic conditions with hypertension being the most prevalent. Exercise can mitigate this risk; however, its effect is commonly tested in isolated clinical populations. There are fewer comparative analyses.

**PURPOSE:** To compare cardiovascular responses to structured exercise among patients with cancer and type 2 diabetes.

**METHODS:** We enrolled patients who had a diagnosis of cancer or type 2 diabetes in an exercise program lasting 10 weeks. Before and after the intervention, we assessed resting heart rate (RHR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP). Independent-samples t-tests compared the characteristics of each sample at baseline. Mixed model ANOVA with repeated measures compared cardiovascular changes between diagnostic groups. Linear regression tested the effect of diagnosis on change values holding confounders constant.

**RESULTS:** Among subjects who completed the program, 58 had a diagnosis of cancer and 39 had a diagnosis of type 2 diabetes. At baseline, cancer survivors had lower SBP (p=0.006); groups did not differ in DBP, MAP, or RHR (p>0.250). Overall, subjects experienced a reduction in DBP (p=0.007) and exhibited a trend for improvement in MAP (p=0.052), but not RHR or SBP (p>0.100). There were interaction effects with diagnosis in DBP (p=0.044) and MAP (p=0.013), and there was a trend with SBP (p=0.064). Holding confounding variables constant, patients with diabetes improved more in end MAP (p=0.034) and MAP (p=0.013) than cancer survivors.

**CONCLUSIONS:** Chronic disease populations differ in their responses to exercise. In our sample, patients with type 2 diabetes experienced larger reductions in blood pressure than cancer survivors, demonstrating the importance of individualized exercise prescription in diverse clinical samples.

**Board #356**

May 28 9:30 AM - 11:00 AM

**Knowledge, Attitudes And Perceptions Of Type 2 Diabetes Mellitus And The Role Of Exercise Interventions**

Takshita Sookan, Talia Pillay, Aaidilah Vaizie, Shreyen Moodley, Keshena Naidoo. University of KwaZulu Natal, Durban, South Africa. (Sponsor: Robert Hickner, FACSM)

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(No relevant relationships reported)

Diabetes is a growing epidemic, with Type 2 Diabetes Mellitus (T2DM) being the most common type globally. There are approximately 15.5 million adults diagnosed with diabetes in Africa and over two thirds aren’t fully educated about the condition. Regular exercise has shown to have a positive effect on T2DM but is underutilized in developing countries.

**PURPOSE:** To identify the knowledge, attitudes and perceptions of T2DM and exercise interventions amongst patients attending a public hospital in KwaZulu Natal, South Africa.

**METHODS:** A quantitative, cross-sectional, pilot study design was used. Participants with T2DM who were receiving treatment from the Wentworth public hospital in KwaZulu Natal, South Africa were recruited. A piloted questionnaire was used to identify the level of knowledge, attitudes and perceptions of patients in relation to T2DM and the role of exercise as an intervention. Data was analysed using descriptive and inferential statistics.

**RESULTS:** A total of 150 participants (male=63 and females=87) made up the sample. Majority of participants were between the ages of 50-59 (30%) and of Indian race (44.7%). Furthermore, 76.7% of the cohort reported that they were educated about T2DM as a medical condition. Results further showed that 98% of participants had a good knowledge of T2DM, 90.7% of the cohort had good knowledge of T2DM and exercise. There was a significant agreement that T2DM management should include both exercise and a healthy diet.

**CONCLUSION:** Participants in this cohort demonstrated good knowledge, attitudes and perceptions of T2DM and the role of exercise in the management of the condition. The study provides evidence of the need for exercise interventions in a T2DM cohort in developing countries.
Introduction
Survivors of cardiac arrest (CA) frequently experience both physical and cognitive impairment. Few receive outpatient rehabilitation services. We are conducting a randomized trial to determine if therapeutic exercise (TE) improves health related quality of life, physical, and cognitive function after cardiac arrest. We assessed characteristics of included/non-included patients during the first 32 months of enrollment to determine if these populations differ from one another.

Hypothesis
Those who participate in the TE study have less severe initial illness severity, better neurologic outcomes, and more favorable baseline demographic characteristics than non-participants.

Methods
CA patients treated between June 2016 and February 2019 were included. CA survivors were eligible between hospital discharge and 6 months post-CA. Patients were called 3 times before being considered “lost to follow up” (LTF). T-test and Wilcoxon Rank-Sum were used to compare baseline demographics, initial illness severity (measured by the Pittsburgh Cardiac Arrest Category-PCAC), and discharge dispositions (measured by CPC and mRS) between groups.

Results
Of 234 eligible patients, 12 were enrolled (5.13%). Primary exclusions were LTF (n = 71, 30.34%), enrolled and later dropped or excluded (n = 66, 28.21%), or were admitted to a hospital, skilled nursing, or inpatient rehabilitation facility at the time (n = 71, 30.34%), enrolled and later dropped or excluded (n = 66, 28.21%), or were non-participants. Only 5% of eligible patients participated and non-participating patients. Of 234 eligible patients, 12 were enrolled (5.13%). Primary exclusions were LTF (n = 71, 30.34%), enrolled and later dropped or excluded (n = 66, 28.21%), or were admitted to a hospital, skilled nursing, or inpatient rehabilitation facility at the time (n = 71, 30.34%), enrolled and later dropped or excluded (n = 66, 28.21%), or were non-participants.

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Conclusions
Demographic variables, illness severity, and outcome do not differ between participating and non-participating patients. Only 5% of eligible patients participated in the study. Further research to reduce LTF and increase study participation should be conducted.

Research has determined cut-off values for the minimum physical fitness levels required to generate health benefits, such as decreased morbidity and longer survival. However, extremely unfit populations, such as older adults with intellectual disabilities, may not be able to reach those cut-off values. It is unknown how improvements in fitness impact health in these unfit populations. PURPOSE: To identify whether even among very unfit older adults with intellectual disabilities, small changes in fitness (with a focus on cardiorespiratory fitness, gait speed and grip strength) can translate into improvements in health. METHODS: In the Healthy Aging and Intellectual Disabilities (HA-ID) study, the physical fitness of 900 older adults with intellectual disabilities (50 years and older) has been studied. Mortality was collected 5 years post baseline. The relationship between fitness and survival were analysed with multiple linear regression models and Cox proportional hazard models. RESULTS: The HA-ID study is the first study to provide data on the impact of very poor physical fitness levels on survival in an extremely unfit population. For cardiorespiratory fitness, 100% of the older adults with intellectual disabilities scored below the average reference range of the general population, for gait speed this was 43% of the men and 54% of the women, and for grip strength 77% of the men and 67% of the women with intellectual disabilities scored below the average reference range of the general population. Within these very low fitness levels, better baseline fitness was still associated with better survival (cardiorespiratory fitness HR = 0.997 (0.995-0.999), contingent gait speed HR = 0.97 (0.94-0.99), grip strength HR = 0.97 [0.94-0.99]). CONCLUSION: Our data support that even small differences at the lower end of the physical fitness spectrum are associated with health benefits, which supports a stronger focus on improving fitness amongst this and other unfit patient populations. Improving physical fitness improves outcomes even in extremely unfit populations scoring well under the cut-off values for the general population.

PURPOSE: Active commuting can contribute to reaching recommended levels of physical activity (PA), and might therefore play an important role in PA promotion at the population level. The purpose of the study was to assess the changes in PA behavior after the introduction of a free ticket for local transport in the Federal State of Hesse in Germany.

METHODS: We conducted a retrospective online survey among the employees of Goethe University Frankfurt, Germany, and assessed employees’ commuting (good/bad weather) and leisure time PA prior to and after the introduction of the free ticket. Group differences were calculated with the Wilcoxon test and the Mann-Whitney-U test. Associations were tested with Pearson’s correlation coefficient. The level of significance was set at p<0.05.

RESULTS: The link to the online survey was sent to 7935 employees, 989 (12.46%) responded, and 706 datasets (59% female) could be analyzed. No gender differences were found in total commuting time. With the availability of the free ticket public transport use increased significantly (53% vs 62% and 65% vs 76%), and car use decreased (17% vs. 9% and 20% vs. 12% in good and bad weather respectively). Public transport use included significantly more active transport minutes than car use (14.7 and 12.7 at 3:3 and 3:3 in good and bad weather respectively). No change in leisure time PA was found. Weak associations showed between transport mode and body-mass-index, but not with smoking status.

CONCLUSIONS: In this study the introduction of free tickets for public transport led to changes in commuting behavior in favor of public transport, which implies increased active travel. It is reasonable to assume that such changes, if sustained, can bear public health relevance. Since Goethe University is located in a metropolitan area with an extensive public transport network around it, our results may not be generalizable for areas with less developed transit system.
INTRODUCTION: Adults with serious mental illness (SMI) suffer from higher rates of premature mortality compared to the general population. Underlying modifiable cardiometabolic risk factors (e.g., obesity, poor fitness) are more prevalent and manifest earlier in those with SMI. Physical activity (PA) can improve health and quality of life in SMI populations, but challenges exist for effective PA interventions. Parks offer numerous health benefits including PA enjoyment and stress reduction, supporting them as ideal locations for PA interventions among SMI populations. Exercise Is Medicine (EIM) style park-based PA interventions are growing in popularity. Yet, little data exists for EIM interventions with SMI populations. PURPOSE: Test the feasibility, acceptability, and preliminary effectiveness of an EIM park-based PA intervention in adults with SMI. METHODS: Data were collected in Spring 2019. Participants diagnosed with SMI were recruited through a behavioral health facility. Park-based PA sessions (45 min) occurred 3 days/week for six weeks. Data were captured with baseline health assessments (e.g., body mass index: BMI), weekly attendance, and pre and post surveys. PA Class Satisfaction Questionnaire (PACSQ) captured class fun, enjoyment, and overall satisfaction on an 8-point scale (1 = strongly disagree, 8 = strongly agree). International PA Questionnaire captured minutes of PA. RESULTS: Participants (n = 4) were 50% male with mean age of 49 ± 5.7 years and BMI of 34 ± 7.4. Attendance ranged from 60-100%. All participants expressed high levels of class fun and enjoyment 7.5 ± 0.3 and overall class satisfaction 7.1 ± 0.60. All mean scores improved pre to post intervention, though no statistically significant changes were observed pre-test to post-test for BMI (30.7 ± 4.9 vs 30.1 ± 3.9 kg/m²), weight (76.8 ± 0.9 vs 75.6 ± 3.0 kg), 6MWT (383.3 ± 62.9 vs 408.3 ± 72.2 meters), and MET-min/week of PA (1068 ± 426.1 vs 1996 ± 1312.9). CONCLUSION: This study is the first to collect park-based PA intervention data in adults with SMI. Results indicate that adults with SMI did participate in and enjoy park-based PA sessions. Further pilot intervention work is planned to develop this intervention approach.

**CONCLUSIONS:** Inter-individual variation in exercise responses applied to all multiple health benefits for an individual even if the targeted risk factor level doesn’t improve. From a clinical perspective, adherence to an exercise prescription is likely to produce multiple health benefits for an individual even if the targeted risk factor level doesn’t improve.
Table 1: Comparison of individual, interpersonal, and environmental factors for low vs. high utilization of exercise prescription (n=33).

<table>
<thead>
<tr>
<th>Definition</th>
<th>Low Utilization</th>
<th>High Utilization</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n=20 total)</td>
<td>(n=13 total)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race: Black (Ethnic/Non-Ethnic)</td>
<td>13 (75)</td>
<td>7 (53.8)</td>
<td>0.71</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>35.4±5.7</td>
<td>27.4±6.0</td>
<td>0.02</td>
</tr>
<tr>
<td>Education: High school (%)</td>
<td>13 (65)</td>
<td>2 (20)</td>
<td>0.02</td>
</tr>
<tr>
<td>Household Income: &lt;$50,000/year</td>
<td>14 (70)</td>
<td>2 (33.3)</td>
<td>0.42</td>
</tr>
<tr>
<td>Health: Self-perceived Mental Health (Range 1-30)</td>
<td>45.5±13.4</td>
<td>41.9±13.7</td>
<td>0.54</td>
</tr>
<tr>
<td>Health: Self-perceived Physical Health (Range 1-5)</td>
<td>42.7±2.1</td>
<td>33.0±6.2</td>
<td>0.09</td>
</tr>
<tr>
<td>CVS Risk Factors [5]</td>
<td>1.0±3.0</td>
<td>0.6±1.0</td>
<td>0.27</td>
</tr>
<tr>
<td>Provider Feedback: TV (1=never)</td>
<td>11 (55)</td>
<td>7 (53.8)</td>
<td>0.79</td>
</tr>
<tr>
<td>Satisfaction (Range 1-7)</td>
<td>2.0±1.0</td>
<td>0.7±1.3</td>
<td>0.11</td>
</tr>
<tr>
<td>Physical Activity: Walking (≥7 miles)</td>
<td>0.6±0.0</td>
<td>0.0±0.0</td>
<td>0.98</td>
</tr>
<tr>
<td>Morbidity: (Range 0-5)</td>
<td>3.6±2.6</td>
<td>1.6±2.3</td>
<td>0.18</td>
</tr>
<tr>
<td>Social Influence</td>
<td>3.5±2.3</td>
<td>2.2±2.4</td>
<td>0.09</td>
</tr>
<tr>
<td>Lack of Energy</td>
<td>4.3±2.9</td>
<td>2.8±3.0</td>
<td>0.09</td>
</tr>
<tr>
<td>Lack of Willpower/Motivation</td>
<td>6.0±2.7</td>
<td>2.8±2.8</td>
<td>0.007</td>
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<tr>
<td>Fear of Pain</td>
<td>2.0±1.0</td>
<td>2.1±1.8</td>
<td>0.40</td>
</tr>
<tr>
<td>Lack of Skill</td>
<td>1.2±1.3</td>
<td>0.9±1.5</td>
<td>0.55</td>
</tr>
<tr>
<td>Lack of Resources</td>
<td>4.0±2.9</td>
<td>2.8±3.0</td>
<td>0.09</td>
</tr>
<tr>
<td>Interpersonal and Social Factors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mental Status: Mental Health %</td>
<td>4.2±2.0</td>
<td>1.0±1.0</td>
<td>0.35</td>
</tr>
<tr>
<td>Children</td>
<td>2.1±3.1</td>
<td>2.2±1.7</td>
<td>0.78</td>
</tr>
<tr>
<td>CVAS: Conditions, Order and Method hoc Scale (Range 1-7)</td>
<td>28.3±11.0</td>
<td>27.3±7.5</td>
<td>0.78</td>
</tr>
<tr>
<td>Social Support: Family Participation (Range 10-60)</td>
<td>29.4±18.3</td>
<td>20.9±4.9</td>
<td>0.09</td>
</tr>
<tr>
<td>Friend Participation</td>
<td>21.4±9.4</td>
<td>16.6±5.9</td>
<td>0.11</td>
</tr>
<tr>
<td>Family Health Status: CVAS (Range 1-7)</td>
<td>1.1±1.3</td>
<td>2.6±1.2</td>
<td>0.04</td>
</tr>
<tr>
<td>Diabetes (%)</td>
<td>7.5±5 (50)</td>
<td>4.0±0.0</td>
<td>0.79</td>
</tr>
<tr>
<td>Hypertension</td>
<td>9.0±5.0</td>
<td>8.0±0.0</td>
<td>0.97</td>
</tr>
<tr>
<td>Cholesterol (%)</td>
<td>3.1±3.0</td>
<td>5.0±3.0</td>
<td>0.04</td>
</tr>
<tr>
<td>CVAS (1-7)</td>
<td>3.1±3.0</td>
<td>5.0±3.0</td>
<td>0.04</td>
</tr>
</tbody>
</table>

PURPOSE: Community-based exercise programs will be necessary to accommodate the volume of breast cancer survivors (BCS) in need of lifestyle/exercise guidance. However, attendance and enjoyment are critical components permitting ideal outcomes. This study evaluated BCS compliance and satisfaction with 16-weeks of training at UNC Get REAL & Heel (GRH), a community-based exercise program. METHODS: BCS within 1 year of completing primary therapy (surgery, chemo, radiation) were prescribed 3, 1-hour days/week of combined aerobic and strength exercise training for 16 weeks at GRH. At exercise completion, the intervention was designed to meet unique fitness/mobility needs of each BCS with gradual increases in intensity, duration, and volume of training. Compliance was the number of days BCS completed ≥80% of prescribed aerobic duration and strength sets/reps at the prescribed intensity; 1) strongly disagree to 6) strongly agree and open-ended feedback after program completion. RESULTS: Thirty-two BCS (mean±SD; age 54±12yrs, BMI 27.5±1.5yrs) participated. They attended 73% of exercise sessions; yet average compliance was 261±9.6 days (54%) for aerobic and 14±2.5 days (29%) for strength. Program completion and enjoyment was 3.6±0.6, self-motivation and empowerment was 3.5±0.6, and patient desire to participate during treatment was 3.5±1.0 in n=30 (94%) BCS who responded to the questionnaire. CONCLUSIONS: Attendance was acceptable yet compliance to exercise prescription was suboptimal. Increasing intensity, especially for strength, appeared to be the primary contributor to lack of compliance because volume and duration prescription components were frequently met. Nevertheless, there was overwhelming positivity regarding BCS enjoyment of program, confidence to exercise independently, and desire to have started exercising during treatment. Expanding GRH days and hours/day was a recurring feedback theme and may have improved attendance. These factors are important for future program designs to best accommodate BCS returning to physiological and daily life challenges following cancer treatment. Funding support: Breast Cancer Research Foundation (New York, NY).
average weekly volume ≥ weekly target or 2) weekly target met in ≥80% of weeks. Multivariable regression analyses (adjustment for age, disease stage, BMI and group allocation) were used to evaluate whether exercise compliance predicted change between pre- and post-intervention in physical health (PROMIS global), aerobic fitness (6-minute walk test) and strength (YMCA bench press). RESULTS: 63% and 27% of sample (n=60) were compliant when defined by average weekly volume and ≥80% of weeks, respectively. Having an average weekly exercise volume that was ≥ weekly target predicted a clinically meaningful improvement in physical health (Δi±SE: 7.2±1.0 t<0.01), aerobic fitness (59.8±11.4 metres, p<0.05) and upper body strength (11.4±2.9, p=0.25). Meeting weekly targets ≥80% of intervention weeks did not predict change in outcomes (p<0.05). CONCLUSION: These findings suggest that for achieving improvements in outcomes, it is important to ensure the volume of exercise undertaken over time meets targets, but that achieving weekly exercise volume targets on any given week is not. This represents reassuring evidence, particularly for patients who have short term declines in exercise undertaken as a consequence of accommodating fluctuating treatment-related symptoms, surgery requirements or new life circumstances.

1772 Board #366 May 28 9:30 AM - 11:00 AM Are The ACSM Exercise Guidelines Safe And Achievable For Women Receiving Chemotherapy For Ovarian Cancer?

Tamara Jones1, Rosalind Spence2, Carolina Sandler1, Andreas Obermaier1, Michael Friedlander1, Linda MilesKim1, Alison Davis2, Monika Janda1, Elizabeth Eakin1, Elizabeth Barnes2, Vanessa Bessely1, Louisa Gordon1, Alison Brand1, Sandra Hayes2. 1Queensland University of Technology, Brisbane, Australia. 2Griffith University, Brisbane, Australia. 3University of Queensland, Brisbane, Australia. 4Princess of Wales Hospital, Sydney, Australia. 5Peter MacCallum Cancer Centre, Melbourne, Australia. 6The Canberra Hospital, Canberra, Australia. 7University of Sydney, Sydney, Australia. 8QIMR Berghofer Medical Research Institute, Brisbane, Australia.

Methods: Exercise-related adverse events (EAEs) were classified as grades 1-5 according to CTC-AE, and were assessed for exercise causality (not related, unlikely, possible, likely, certain) and whether modification to exercise prescription was required. Weekly exercise dose undertaken was recorded as minutes, intensity, mode and frequency. Data were collected by an Exercise Physiologist during weekly contact with participants over the intervention duration (duration is based on length of neo- and/or adjuvant chemotherapy ~18 weeks). Exercise was considered safe if there were no grade 3 or higher EAEs and in line with the new ACSM guidelines, the intervention was considered feasible for a participant if they completed ≥150 minutes of weekly, mixed-mode exercise ≥75% of intervention weeks.

Results: To date, we have recruited 225 women, 113 of whom have been randomised to the exercise intervention. One or more EAEs were reported by 42% of participants in the exercise intervention. Typical grade 1 (85% of EAEs reported) and 2 EAEs included delayed onset muscle soreness or adverse fluctuations in treatment-related symptoms (e.g., pain at surgical site, fatigue) that may have been caused by exercise. While no grade 3 or higher EAEs were reported, 58% required exercise intervention modification (i.e., change in minutes, intensity, mode or frequency). The median weekly minutes of exercise reported was 186.5 (range: 0-610), yet only 34% of participants completed ≥150 minutes/week of mixed-mode exercise for ≥75% of the intervention duration.

Conclusion: Exercise is proving safe during chemotherapy for ovarian cancer. Further, while an average of 150 minutes of mixed-mode exercise each week is feasible, feasibility in prescription is needed in additional individual circumstances (such as EAEs or typical treatment-related fluctuations in side effects) that inevitably present throughout the course of chemotherapy for ovarian cancer.

1773 Board #367 May 28 9:30 AM - 11:00 AM Pink Matters: Impact Of Cause-related Marketing Campaign On Intentions To Test Breast Cancer

Woo-Young Lee1, Kyungun Kim1, Robert Slana1, Cheonghoon Lim1, Youngjin Hur1. 1University of Central Missouri, Warrensburg, MO. 2Seoul National University, Seoul, Korea, Republic of. 3Konkuk University, Seoul, Korea, Republic of. Email: wylee@ucmo.edu

METHODS: The structural equation modeling (SEM) was used to investigate the direct/indirect effects of the campaign on sponsor image and breast cancer test. This study was conducted with 1,000 females (18-56) who participated in the Pink Ribbon Marathon.

RESULTS: The overall structural model’s goodness of fit showed excellent (χ2 = 15489.377, p<0.01; RMSEA = 0.049, 90% CI = 0.046-0.052; SRMR = 0.075; TLI = 0.910; CFI = 0.918). SEM revealed that the following factors of Sponsor Fit (β = 0.736, p <0.01). However, sponsor image, product reputation, and CSR were found to have no significant association with the campaign impact. Also, the findings of the results indicated that the impact of the campaign was found to have statistical significance with Perceived Barriers (β = -1.51), Perceived Threat (β = -0.168), Self-Efficacy (β = -0.405), and Cues to Action (β = -0.650). All four factors regarding health belief positively influence on the intention to participate in breast cancer test.

CONCLUSIONS: The results show that the pink ribbon campaign led to a higher level of the intention for breast cancer test by mediating participants’ existing health beliefs. Also, the effect of the campaign was expanded to creating a positive sponsor image. The findings provide insights into designing their cause-related marketing initiatives for practitioners. More detailed explanations concerning theoretical and practical implications will be presented.
**PURPOSE:** Exercise therapy programs are increasingly incorporated into oncological clinics, but it is largely unknown if this facilitates information availability or patients’ exercise readiness. This survey compares the knowledge and barriers regarding exercise in cancer patients treated in an oncological clinic with an established exercise therapy and counseling program versus an oncological clinic without any exercise offers (OC).

**METHODS:** Participants were recruited in an oncological outpatient clinic that provides an exercise therapy and counseling program (OC+Ex) and an oncological outpatient clinic without any exercise offers (OC). Information status concerning cancer diagnosis, treatment, exercise, and exercise-related barriers were assessed with an extended version of the EORTC QLQ-INFO-25 questionnaire and the Perceived Physical Activity Barriers (PPAB) scale. Results were compared using contingency tables and chi-square tests.

**RESULTS:** Out of 215 patients 200 returned the questionnaire (OC+Ex: n= 109; 64±13 yrs.; 85% during treatment; OC: n = 91; 60±11 yrs.; 96% during treatment). A comparable proportion of the patients of the OC+Ex and the OC felt moderately to well informed concerning cancer treatment (90% vs. 88%) and side effects (81% vs. 79%). Regarding exercise 31% vs. 15% and 23% vs. 29% of the patients in the OC+Ex versus the OC reported a high or moderate information status, while 18% (OC+Ex) or 27% (OC) stated to not have received any information (p < .05). Patients in the OC+Ex documented receiving specific exercise recommendations more often than patients in the OC (41% vs. 16%; p < .001), 25% (OC+Ex) or 3% (OC) reported a direct referral to a concrete exercise course/program (p < .001). 53% (OC+Ex) and 60% (OC) asked for more information about exercise. Perceived exercise barriers included fatigue (39%), physical weakness (31%), nausea (24%), pain/discomfort (23%), and lack of exercise routine (25%).

**CONCLUSIONS:** Our results indicate that an exercise program at an oncological clinic supports patients’ knowledge about exercise. Further targeted triage and information activities including a stronger collaboration between oncologists and exercise specialists might contribute to further enhance patients’ knowledge, to diminish perceived barriers and to improve exercise behavior.

There has been a recent international call to action for key stakeholders to create the infrastructure and cultural adaptations needed so that all people living with and beyond cancer can be as active as is possible. Among the reasons for this is a lack of clarity on the part of those who work in oncology clinical settings of their role in assessing, advising, and referring patients to exercise. **PURPOSE:** To conduct a retrospective sample audit of allied health referral for breast, prostate and colorectal cancer diagnoses scheduled for surgery. **METHODS:** A SQUIRE compliant retrospective study was conducted on a representative sample of electronic medical record (EMR) data harvested from the files of (n=100) patients diagnosed with either breast, colorectal and prostate cancer and scheduled for surgery at a regional hospital in Victoria, Australia. Association between ‘time in surgery’ (mins) and number Allied Health (exercise physiology) sessions were performed using Pearson product-moment correlation. **RESULTS:** 62% of cancer referrals attended at least one allied health appointment. Bivariate comparison of referral to allied health revealed strong: prostate (r²=0.78), small/moderate: breast (r²=0.24), and no (r²=0.07) association between surgical time and frequency of allied health attendance amongst cancer diagnoses requiring surgery. **CONCLUSIONS:** Preliminary results from a small sample of pre-surgical exercise physiology referrals, indicate that breast, and prostate cancer diagnoses requiring surgery can achieve benefit from compliance with referral to Allied Health session, whereas colorectal cancer diagnoses are less clear.

**Relationship between Allied Health Attendance and surgical time amongst Allied Health Referrals at a regional hospital in Victoria, Australia**

A large percentage of pancreatic cancer (PC) patients can suffer from cachexia, a syndrome characterized by an ongoing loss of skeletal muscle mass, with or without fat mass. This condition leads to reduced muscle strength, which further worsen functional capacity. Exercise (EX) could be a potential measure to counteract the loss of functional capacity, nevertheless most of cancer patients are insufficiently active. **Purpose:** Investigate the EX level, interest and preferences in PC patients. **Methods:** An anonymously survey was performed on a representative sample of PC patients at the Oncology Unit of Verona Hospital. The questionnaire assessed demographic, clinical characteristics and EX behavior, using the Leisure Score Index (LSI) from Godin’s Leisure Time Exercise Questionnaire. The items regarding EX preferences and interest were drawn from previous researches. A descriptive analysis, presented as mean/medians for continuous variables and frequencies/percentages for categorical variables, was used. **Results:** 173 questionnaires were completed (58% response rate). The median age of subjects was 60 years old, 54% was male, 41% had completed high school. Medical information indicated that 52% had a metastatic disease and 86% were on active treatment. Only 11% of patients resulted sufficiently active (LSI ≥24), but among 82% were willing to start a specific EX program. Patients prefer receive EX information by oncologist (54%), followed by kinesiologist (23%), with a face to face approach (66%). PC patients chose to EX with “other cancer patients” (25%) or alone (17%). Subjects picked outdoors (28%) and at home (23%) as favourite places to perform EX. PC patients prefer to train two (31%) or three (36%) times/week, at light (45%) or moderate (40%) intensity. 31% of patients indicated to prefer an individual program to perform at home, 29% a training group with a kinesiologist, while 25% chose an individual program with a personal trainer. **Conclusion:** We found a small portion of PC patients active, a large interest to EX and a heterogeneity regarding the EX preferences. This underline the urgency to promote EX in this population and suggest that different EX program options should be considered to optimize compliance and adherence. This study is the first step to planning a specific EX program designed for PC patients.
PURPOSE: To analyze the effects of a low-cost community-based supervised exercise program on body composition and muscle strength in breast cancer survivors.

METHODS: Twenty-one female survivors of breast cancer concluded a single-arm clinical trial with a control and an experimental phase. Each participant was evaluated in 5 consecutive moments: 16 and 8 weeks before intervention (M1 and M2), immediately before intervention (M3), and 8 and 16 weeks after the exercise program started (M4 and M5). Participants benefited from conventional care during the control phase (M1 to M3) followed by a community-based exercise program (M3 to M5). This consisted of 3 sessions per week of 60-min combining aerobic and strength exercise at moderate to vigorous intensity in group classes of no more than 20 participants with low-cost material. Body mass index (BMI), handgrip strength and sit-to-stand (STS) were tested in all the evaluation moments.

RESULTS: There were significant increases through time in handgrip strength in both surgical and non-surgical upper limbs (p<0.0001) and in lower limbs functional strength (p<0.0001) (table). BMI increased during control phase and decreased during the initial phase of exercise training program (p=0.050). Serious adverse events were not reported.

CONCLUSIONS: A low-cost community-based supervised exercise program is safe and improves body composition and strength in breast cancer survivors after primary treatment.

<table>
<thead>
<tr>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>Effect size</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical limb handgrip strength (Kgf)</td>
<td>18.6±5.0</td>
<td>20.9±5.4*</td>
<td>21.2±4.9*</td>
<td>23.5±5.1*</td>
<td>26.6±6.6**</td>
<td>0.599</td>
</tr>
<tr>
<td>Non-surgical limb handgrip strength (Kgf)</td>
<td>19.6±5.9*</td>
<td>21.4±5.9*</td>
<td>21.9±5.8*</td>
<td>23.8±5.5*</td>
<td>25.8±4.3**</td>
<td>0.423</td>
</tr>
<tr>
<td>STS (Reps)</td>
<td>12.0±2.8</td>
<td>13.7±3.4</td>
<td>14.1±3.6</td>
<td>15.1±3.6</td>
<td>16.5±3.6</td>
<td>0.289</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>30.9±5.5</td>
<td>30.9±5.6</td>
<td>31.1±5.5</td>
<td>30.3±5.4</td>
<td>30.7±5.3</td>
<td>0.125</td>
</tr>
</tbody>
</table>

Legend: Results were tested with repeated measures analysis of variance and are presented as mean±SD; Post-Hoc analysis were corrected with Bonferroni. Effect size was calculated as Partial Eta Squared.*Higher than M1; ** Higher than M1-M3; ***Higher than M1-M4; † Higher than M1-M2; ‡ Higher than M3; p<0.05.

Background: Cardiac rehabilitation (CR) is a potential avenue to exercise therapy for cancer survivors (CS). Purpose: This investigation evaluated the status of medically-based exercise rehabilitation for CS in Arizona. Methods: A statewide structured telephone interview (STI) was conducted with CR programs (n=34) and cancer treatment centers (CTCs; n=32). Results: Compliance with the STI was 97% and 44% for CR and the CTCs respectively. Thirteen CR programs (39%) offered self-pay onsite supervised exercise training for CS. Two (6%) offered a preventive cardiology exercise consultation with a home-based prescription. Six (43%) CTCs offered exercise services to CS. Eleven (79%) CTCs referred survivors to physical therapy and five (36%) recommended community-based exercise programs. Conclusion: CR may be a viable option for onsite medically-based exercise therapy in the growing number of CS in Arizona. Preventive cardiology has an opportunity to expand these services and increase patient accessibility by offering medically-directed exercise physiology consultations. These delivery models provide a potential solution to the lack of rehabilitation resources available to CS. Future Directions: It is recommended that a directory of resources remains current with routine updates in an effort to increase patient accessibility to care. Additional cancer rehabilitation efficacy studies are needed to further clarify evidence-based practice guidelines and provide direction for optimal methods of healthcare delivery.
Examination Of Neighboring Built Environment Related To Physique In Adolescent Japanese Children

Adolescence is the period in which height increases the most and physique is formed. In adolescence, the risk of obesity during adulthood, which can be a risk factor for various serious events, is about 75%. On the other hand, the neighboring built environment may influence weight status.

**PURPOSE:** The purpose of this study was to determine the neighboring built environments that are associated with weight status in adolescent Japanese children.

**METHODS:** We conducted a cross-sectional study that included 4437 children (2215 boys, and 2222 girls) enrolled in the 5th grade to the 9th grade in Japan. Monthly age, sex, height, and weight were assessed using questionnaires, and the body mass index (BMI) percentile was calculated. Using the Geographic Information System (GIS), the number of each of seven built environments (convenience store, fast-food restaurant, family restaurant, supermarket and department store, park, exercise facility, intersection) in each school district was tabulated. Data were analyzed using multiple regression analysis (stepwise method) with the BMI percentile as the dependent variable and each built environment as the independent variables. Further analyses might be needed to study the relationship between EMD and mCSA.

**RESULTS:** As can be appreciated in the figure below, EMD slowed and mCSA decreased with age. However, the relationship between EMD and mCSA was not significant ($r = -0.57$, p-value = 0.55).

**CONCLUSION:** Surprisingly, EMD was not significantly related to mCSA. It is possible that this may be due to the middle-aged groups being underpowered, which led to an outlier bin (40-49 yrs. old). Additionally, a reflex contraction was used to measure EMD which might differ from the properties of a voluntary contraction. Further analyses might be needed to study the relationship between EMD and mCSA.
D-03 Highlighted Symposium - The Aging Neuromuscular System and the Protective Effects of Physical Activity

Thursday, May 28, 2020, 1:30 PM - 3:30 PM
Room: CC-3012

1786 Chair: Sandra K. Hunter, FACSM. Marquette University, Milwaukee, WI.
(No relevant relationships reported)

1787 May 28 1:40 PM - 2:10 PM
Keynote - The Aging Neuromuscular System and Fatigability of Limb Muscles
Sandra K. Hunter, FACSM. Marquette University, Milwaukee, WI.
(No relevant relationships reported)

1788 May 28 2:10 PM - 2:25 PM
Neural Control of Movement with Aging and Effects of Activity
Ashleigh E. Smith. University of South Australia, Adelaide, Australia.
(No relevant relationships reported)

Aging is associated with reduced neuromuscular function, which may be due to central nervous system changes in corticospinal excitability and a reduced capacity of the human brain to re-organize the strength of its connections (neuroplasticity).

PURPOSE: This symposium presentation will highlight two complementary studies that determined the influence of aging and physical activity (PA) on motor cortical excitability and neuroplasticity, elicited with Transcranial Magnetic Stimulation (TMS).

METHODS: In study one, corticospinal excitability was assessed in 28 young (22.4 ± 2.2 yr; 14 women) and 50 old adults (70.2 ± 6.1 yr; 22 women) by measuring motor evoked potentials (MEPs) elicited in motor cortical areas and targeting the vastus lateralis (VL) muscle of the quadriceps. In the second study, the response to a continuous theta burst stimulation paradigm (cTBS) was assessed in 27 old adults (66.5 ± 4.5, 13 women) by measuring MEPs in the first dorsal interosseous (FDI) muscle elicited after a single and paired cTBS paradigm targeting the primary motor cortex (MA). PA was measured in both studies using accelerometry (Actigraph GT3x or GENEActiv, respectively).

RESULTS: In study 1, irrespective of age and sex, individuals who achieved >10,000 steps/day had reduced corticospinal excitability of the VL muscles (F[1,61, 85.6] = 3.49, p = 0.04). In study 2, when accounting for age and sex, more time engaging in PA was associated with a greater neuroplasticity response to the cTBS paradigm (r = -0.51, p = 0.007).

CONCLUSION: These studies provide evidence that PA in both young and old adults is associated with lower interference and that the capacity of the human brain to re-organize the strength of its connections (neuroplasticity) increases with PA.

D-10 Thematic Poster - Bone and Integrative Physiology

Thursday, May 28, 2020, 1:30 PM - 3:30 PM
Room: CC-2007

1820 Chair: Shannon L. Mathis. University of Alabama Huntsville, Huntsville, AL.
(No relevant relationships reported)

1821 Board #1 May 28 1:30 PM - 3:30 PM
Associations Between Sedentary Behaviors And Visceral Adiposity On Bone Mineral Density In Women
Jose Rocha-Rangel1, Alexandra Auslander2, Desiree N. Caballero1, Amanda M. Kirk2, Kristin M. Merki3, Archie D. Bayaca1, Michael T. Liang, FACSM2. 1California State Polytechnic University, Pomona, Pomona, CA. 2California State Polytechnic University, Pomona, Diamond Bar, CA. (Sponsor: Michael T Liang, FACSM)
Email: Joserocha@cpp.edu
(No relevant relationships reported)

American society has become increasingly sedentary putting this population at higher risks of developing chronic disease such as osteoporosis. One potential link between sedentary behaviors and risk of chronic disease progression is obesity. Studies comparing fracture incidence in obese and non-obese women have demonstrated that obesity is associated with increased risk of fracture at some skeletal sites but seems to be protective at others. Researchers have suggested that certain types of obesity may be a strong predictor of risk of osteoporosis-related non-spine fractures.

PURPOSE: The purpose of this study is to examine the relationships between physical activity levels (PA), obesity and bone mineral density (BMD) in adult sedentary women.

METHODS: Twenty-three women, aged 45-65, were instructed to wear an accelerometer for one week, and participate in a Dual energy X-ray absorptiometry (DXA) scan for determining BMD of the whole body (WBBMD), lumbar spine (L1-L4), femoral neck (FN) and forearm as well as body fat mass and lean mass. Participants were divided based on obesity status into two groups, high and low BMI. A one-way ANOVA analysis was used to detect differences in BMD and PA levels by group. Multiple linear regression was used to analyze the effect of PA measures and body composition on BMD. RESULTS: Light PA decreased whole body BMD (WBBMD) (β=.13, p=.012) while body fat percentage (BF%) and fat free mass (FFM) increased it (β=1754.7, p=.041 and β=3.558, p=.001). Light PA, BF% and FFM all yielded a higher L1-L4 lumbar spine BMD (β=.003, p=.05, β=.641, p=.037 and β=.001, p=.017, respectively). The higher the total amount and the longer the length of sedentary bouts increased arm BMD (β=.052, p=.038 and β=.016, p=.000).

CONCLUSION: These results demonstrate that PA levels and fat mass have a significant effect on sedentary adult women’s bone density levels. Further investigation of causal mechanisms underlying these associations is warranted.
CONCLUSIONS: Consistent with prior reports, iCa decreased and PTH increased immediately post EX. Some markers of bone resorption and OCN were increased post EX. In sum, the temporal pattern of these biomarkers suggest a transient post exercise increase in resorption, but these changes disappear within 24 h after exercise.

High fat feeding exerts a negative impact on bone quality and strength. Gut microbiota have been strongly linked to bone outcomes in several models, though a clear mechanism linking alterations in gut microbiota, diet composition, and bone has not yet been elucidated.

PURPOSE: To determine if alterations in diet, with or without fecal microbial transplants (FMT) can rescue bone integrity in diet-induced obesity. METHODS: 6-wk old male C57Bl/6 mice (n=10/group) were randomized to a low-fat (LF) or high fat, high sugar (HFS) diet and lixivium for 13 wks. HFS mice were randomized to one of three groups for 4 wks: LF diet with FMT from the LF mice (HFS/LF+), LF diet with sham FMT using PBS (HFS/PBS), or HFS diet with FMT from the LF mice (HFS/HFS→). We simulated the impact of combined diet alteration and addition of “healthy” microbes, diet alterations only, and addition of “healthy” microbes only, respectively. Animals had access to a running wheel until terminated at 23 wks of age. Statistical analyses were performed using a two-way ANOVA.

RESULTS: HFS/HFS+ mice showed greater absolute femoral neck (FN) strength versus HFS/LF and HFS/LF+ mice (p<0.003), while LF/LF mice had the greatest relative FN strength across all groups (p<0.016). Whole femur bone mineral density (BMD, g/cm²) was greater in HFS/HFS+ versus all groups (p<0.023); LF/LF mice had the highest BMD when normalized to body weight (p<0.029).

IMMUNOSTAINING: For tumor necrosis factor alpha (TNFα), sclerostin, insulin-like growth factor 1, and interleukin gamma in cortical and cancellous bone revealed no differences between groups. Despite no difference in marrow adipocyte number (#/mm²) between groups, HFS/HFS+ mice had greater marrow adipocyte size (μm²) versus LF/LF mice; diet alteration, with and without transplanted “healthy” microbes, was able to partially attenuate increased marrow adipocyte size.

CONCLUSIONS: A change in diet from HFS to LF led to reduced absolute FN strength compared to HFS/HFS+ and LF/LF mice, with no apparent effect from transplanted “healthy” gut microbes. LF/LF mice had greater relative femoral neck strength. Altering diet, with and without FMT’s, was sufficient to partially rescue the detrimental impacts of high fat, high sugar feeding on bone integrity.

Exercise during gestation is safe and has many positive effects on the offspring, such as improved cardiovascular health and nervous system development. However, whether gestational exercise positively impacts skeletal development is unknown.

PURPOSE: To determine whether maternal exercise throughout gestation and lactation positively impacts cortical geometry and trabecular microarchitecture of the femur in mouse male and female offspring. METHODS: In this longitudinal study, sexually mature C57Bl/6 female mice were randomized into two groups: voluntary wheel running treatment (EX) or sedentary control (SED). Females were mated to C57Bl/6 males and continued treatment or control throughout both gestation and lactation. One male and one female offspring from each dam (7/group/sex) were selected and given ad lib access to a high fat diet until 16 weeks of age, when final body weight was measured and femora collected.

Cortical geometry of the mid-diaphysis and trabecular microarchitecture of the distal right femur were assessed via micro-computed tomography (µCT) with a voxel size of 12 μm. ANOVA or ANCOVA with final body weight (BW) as a covariate was used to determine the effects of maternal exercise on trabecular and cortical bone outcomes, respectively.

RESULTS: There were no differences in BW between SED and EX male offspring. EX male offspring had smaller total area (TL, Ar, p<0.05) and marrow area (Ma).

Military training creates a multi-stressor environment which has been associated with risk of stress fracture. Understanding the acute bone response to exercise can provide a model to study how various stressors or interventions affect bone and its adaptation to physical training. PURPOSE: To characterize the effects of a militarily relevant exercise on circulating bone biomarkers. METHODS: 20 Soldiers (18 male, 2 female); age 21.2±0.9 y, performed a 60 min self-paced treadmill time trial at 1% grade while wearing 30% of body weight vest (EX). Two weeks before exercise, animals had free access to a running wheel. Fasted blood samples were collected before (PRE) and after (POST) exercise, and at +1, +2, and +4 h after EX or time-matched during CON. In addition, fasted blood samples were collected for 1 wk before (PRE) and after (POST) exercise, and at +1, +2, and +4 h after EX or time-matched during CON. All samples were adjusted for plasma volume from furosemide. Total alkaline phosphatase (BALP), osteocalcin (OCN), sclerostin (SOST), C terminal propeptide of type I collagen (CTX), N terminal propeptide of type I collagen (P1NP), bone alkaline phosphatase (BAP), and tartrate resistant acid phosphatase (TRAP5b) were assayed and all samples except AM were adjusted for changes in plasma volume from furosemide. Data were analyzed using repeated measured ANOVA. Data are mean ± SE.

RESULTS: Compared to PRE, CTX was significantly higher (104±32%, p<0.01) and iCa was lower (−2.5±1.0%, p<0.01) at POST during EX but not during CON. OCN was higher at +1 through +4 h than PRE by 15.9±13.0-20.5±12.0% (p<0.01) during EX but unchanged during CON. SOST was elevated by 31.6±2.2% (p<0.01) in EX condition only; later time points were not different than CON. CTX was elevated vs PRE at +1 h (43±6±22.2%, p<0.01) in EX condition only; later time points were higher (p<0.01) than PRE under both conditions. P1NP, BAP, and TRAP5b were not different from PRE during EX or CON. There were no changes in the AM Day 1-3 samples except OCN was lower than CON on Day +2 and +3.

CONCLUSIONS: With prior reports, iCa decreased and PTH increased immediately post EX. Some markers of bone resorption and OCN were increased post EX. In sum, the temporal pattern of these biomarkers suggest a transient post exercise increase in resorption, but these changes disappear within 24 h after exercise.

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Cortical geometry of the mid-diaphysis and trabecular microarchitecture of the distal right femur were assessed via micro-computed tomography (µCT) with a voxel size of 12 μm. ANOVA or ANCOVA with final body weight (BW) as a covariate was used to determine the effects of maternal exercise on trabecular and cortical bone outcomes, respectively.

RESULTS: There were no differences in BW between SED and EX male offspring. EX male offspring had smaller total area (TL, Ar, p<0.05) and marrow area (Ma).
Ar, p=0.025), and a higher cortical-to-total area ratio (Ct.A/T.Ar, p<0.017) compared to SED males. EX males had lesser trabecular thickness (p=0.049) but higher connectivity density (p=0.029) compared to SED. EX female offspring had greater BW than SED offspring (p=0.064). EX females had smaller T.Ar (p=0.017), Ma.Ar (p=0.033), and Ct.Ar (p=0.063) versus SED. EX female offspring had greater trabecular spacing (p=0.046) and degree of anisotropy (p=0.040), and lower trabecular number (p=0.034) compared to SED.

CONCLUSION: Maternal exercise during gestation and lactation decreased cortical bone area independent of body weight and negatively impacted trabecular microarchitecture in both male and female offspring.

Circulating microRNAs (c-miRNA, miR) are potential biomarkers for age-related changes in musculoskeletal function. There is a paucity of data on c-miRNA responses to exercise, especially in postmenopausal women (PMW). Evaluating alterations in the expression of c-miRNA may provide deeper insight into the benefits of exercise for bone health in aging populations.

METHODS: The purpose of this study was to characterize the effects of acute bouts of resistance exercise (RE) and whole-body vibration (WBV) on contractile microRNA (miR21-5p, -23a-3p, -133a-5p, -148a-3p) in PMW (n=10).

RESULTS: Subjects performed a high intensity RE condition and a WBV condition in random order. RE consisted of 3 sets, 10 reps, 70% 1RM for leg press, shoulder press, lat pull down, leg extension, and hip adduction isostructural exercises. For WBV, 51 min bouts were performed (20 Hz, 3.38 mm peak-to-peak displacement) each separate by 1 min rest on a Galileo vibration platform. Morning blood samples after an overnight fast were collected pre, immediately post (IP), 60 min, 24 hrs, and 48 hrs after exercise to measure c-miRNA and TRAP5b. C-miRNA expression was corrected for plasma volume (PV) shifts using the equation: %ΔPV = (log10(HEct Post)) - (log10(HEct Pre)) × 100 / (log10(HEct Pre)) - (log10(HEct Post)). The correction factor was subtracted from the Cq values for each exercise sample.

RESULTS: PV significantly decreased for both conditions at IP (p<0.04), thus serum variables were corrected for PV shifts. There was a significant condition × time interaction for miR-21 (p=0.019), which decreased in relative expression from 60p (1.61 ± 0.31) to 24h (0.80 ± 0.16) after WBV but not after RE. MiR-23a-3p, -133a-3p, -148a-3p showed no significant expression changes for either exercise condition. TRAP5b concentrations significantly decreased 24h (WBV: -7.56% ± 5.27, RE -3.44% ± 4.33) after exercise (p<0.01). CONCLUSION: C-miR-21 was downregulated at 24 hrs in response to an acute bout of WBV. Both types of exercise also decreased serum TRAP5b. C-miRNA expression was corrected for plasma volume (PV) shifts using:

\[ \text{Cq correct} = \text{Cq measured} - \text{PV correction factor} \]

PV correction factor = \[ \frac{\log(\text{HEct Post}) - \log(\text{HEct Pre})}{\log(\text{HEct Pre}) - \log(\text{HEct Post})} \times 100 \]

BACKGROUND: Low bone mineral density (BMD) and bone stress injuries (BSI) are highly prevalent among collegiate runners due to risk factors that have been well elucidated. Though initial data suggest ultramarathon runners are at high risk for low BMD and BSI, the prevalence of and risk factors for low BMD and BSI among this older population of long-distance runners has not been thoroughly investigated.

METHODS: To determine the prevalence of and risk factors for low BMD and history of BSI in male and female ultramarathon runners METHODS: 123 ultramarathon runners who qualified for a 161km endurance race were recruited via pre-race email invitation in 2018 and 2019. Pre-race assessments included a survey on BSI history, dietary habits, body mass index and menstrual history in females; dual energy x-ray absorptiometry (DXA) scan; and, in 2019, serum evaluation for ferritin, total testosterone, free testosterone and estradiol. Poisson regression was used to evaluate risk factors for BSI; and linear regression or Pearson’s correlation coefficients when evaluating correlates of BMD. RESULTS: 40 women and 83 men (mean age 41.8 and 46.2 years, respectively) were enrolled and completed the survey with 36 women and 72 men completing DXA’s and 19 women and 32 men completing serum evaluation. 79.5% of men and 37.5% of women reported history of at least one BSI. 15% of women and 28.9% of men had low BMD (Z-score < -1.0). Low BMD was significantly or near-significantly associated with history of BSI; the age-adjusted risk ratio per BMD risk point was 1.86 (p=0.036) for men and 2.03 (p=0.056) for women. Oligomenorrhea was correlated with lower BMD values in beta (p<0.05), thus BMD and history of BSI in male and female ultramarathon runners. Oligomenorrhea was correlated with lower BMD values in beta (p<0.05), thus BMD and history of BSI in male and female ultramarathon runners.
PURPOSE: Urine color (Uc) charts can be a reliable field tool to assess urine concentration, but no self-reporting athlete data is available. This study compares Uc scores from athletes against research team scores and urine osmolality values.

METHODS: Urine samples were collected from college athletes (n=173, 68% male, median age 20). To standardize Uc scoring, a box was constructed with a set distance (14 inch) towards the 30 ml sample and placed behind a 1.2x1.2 inch opening against a white backdrop. Athletes and two research members independently scored Uc using the chart described by Armstrong in 1994. Differences in researcher Uc were discussed until consensus was established. To control for lighting, two 28-Watt white LED lights were placed aside of the box and the Uc chart. Samples were measured for urine osmolality using an Osmo1831 refractometer (Great Neck, NY), suggesting either instrument would be acceptable for use. When comparing Uc, agreement was assessed by a similar r:0.56, P<0.01.

Samples evaluated with the digital (1.018 ± 0.008) and manual (1.018 ± 0.006) refractometers were highly correlated (r = 0.998, P<0.001). Bland-Altman analysis demonstrated high agreement between manual and digital refractometers (mean difference: 0.002 ± 0.004). Compared with osmolality, the digital refractometers identified concentrated samples with an area-under-the-curve (AUC) of 0.86, sensitivity of 0.71, and specificity of 1.00. The manual refractometer identified concentrated samples with an AUC of 0.89, sensitivity of 0.79, and specificity of 1.00. CONCLUSION: This study demonstrated a high agreement between manual and digital refractometers, suggesting either instrument would be acceptable for use. When comparing to osmolality, both instruments provided excellent specificity for identifying diluted samples, but may have lower sensitivity for identifying concentrated samples.

Baseline hydration status is typically determined through collecting 3 consecutive day’s free-living body mass (BM). However, this method would not capture individuals in their euhydrated state. PURPOSE: To determine differences between euhydrated and free-living 3, 5, and 7 day hydration measures. METHODS: 27 males and 25 females (male age, 21±1 years; female age, 20±1 years; male BM, 79.3±13.31kg; female BM, 65.5±21.1kg) volunteered to participate in this study. First morning urine BM, urine specific gravity (USG), urine color (Uc), and urine osmolality (UOM) were assessed for 10 consecutive days. Participants arrived euhydration the first 3 days (USG<1.020). The average of days 1-3 (euhydration baseline), 4-6 (free-living 3 day baseline), 4-8 (free-living 5 day baseline), and 4-10 (free-living 7 day baseline) were calculated. Repeated measures ANOVA with LSD post-hoc comparisons were performed. Data are reported as mean±standard deviation (MD±SD) and 95% confidence intervals (95%CI), p<0.05. RESULTS: Euhydration baseline USG was lower (MD±SD [95%CI], 1.009±0.003 [1.008, 1.010]) than free-living 3 day (MD±SD [95%CI], 1.015±0.005 [1.014, 1.017]), 5 day (MD±SD [95%CI], 1.018±0.005 [1.016, 1.019]), and 7 day (MD±SD [95%CI], 1.018±0.005 [1.016, 1.019]), p<0.05. Euhydration baseline Uc was lower (MD±SD [95%CI], 2.1± [2, 3]) than free-living 3 day (MD±SD [95%CI], 5.1± [4, 5]), 5 day (MD±SD [95%CI], 5.1± [4, 5]), and 7 day (MD±SD [95%CI], 5.1± [4, 5]), p<0.05. Euhydration baseline UOM was lower (MD±SD [95%CI], 381.8±102.95 [353.21, 410.53] mOsmol) than free-living 3 day (MD±SD [95%CI], 651.84±191.77 [598.45, 705.23] mOsmol), 5 day (MD±SD [95%CI], 652.88±187.46 [606.69, 705.07] mOsmol), and 7 day (MD±SD [95%CI], 659.24±182.33 [608.48, 710.00] mOsmol), p<0.05. Euhydration baseline BM was lower (MD±SD [95%CI], 72.60±14.32 [68.61, 76.59] kg) than free-living 3 day (MD±SD [95%CI], 71.72±14.67 [67.64, 75.81] kg) but not different than 5 day (MD±SD [95%CI], 72.24±14.20 [68.19, 76.29] kg) or 7 day (MD±SD [95%CI], 72.05±14.22 [68.09, 76.06] kg), p<0.05. CONCLUSIONS: A free-living 3 day baseline is 1.21% lower than a euhydration 3 day baseline BM. Therefore, a three-day euhydration, 5 or 7 day free-living baseline BM may be useful to define a true hydration baseline, which is important when dehydration level is described by %BM loss.

THURSDAY, MAY 28, 2020

Abstracts were prepared by the authors and printed as submitted.
all significantly associated with mean weekday measures. CONCLUSION: Our results suggest that, in this sample population of college students, individuals tended to have stable hydration measures across weekday and weekend days. Despite finding relative stability in 24 hour urinary hydration markers across a week, we are unable to discuss factors associated with day-to-day variation in these measures. Integrating other factors such as previous personal and family medical history, physical activity, dietary intake, body composition, racial/ethnic background, and socioeconomic status may further elucidate variations in day-to-day hydration status and the role hydration plays in emerging adults on health.

1834 Board #5 May 28 1:30 PM - 3:30 PM The Effects Of Mode Of Rehydration On Stress Hormone Response To Subsequent Maximal Intensity Exercise In The Heat.
Linda M. Yamamoto1, Elaine C. Lee1, Brendon P. McDermott2, Kathleen N. Beasley2, Holly Emmanuel2, Jeff S. Volek3, Douglas J. Casa, FACSM4, Lawrence E. Armstrong, FACSM5, William J. Kraemer, FACSM5, Carl M. Maresh, FACSM1. 1Central Connecticut State University, New Britain, CT. 2University of Connecticut, Storrs, CT. 3University of Arkansas, Fayetteville, AR. 4The Ohio State University, Columbus, OH. (Sponsor: Carl M. Maresh, FACSM)
Email: lindayamamoto@hotmail.com

PURPOSE: Endocrine response to strenuous exercise in the heat can serve as an indicator of the amount of strain the body is experiencing. Previous intravenous (IV) versus oral rehydration studies found no difference cortisol (CORT) response between rehydration regimens, but mixed noradrenaline (NOR) response with ORAL during an exercise heat challenge (EHC). The purpose of this study was to examine the effects of mode of rehydration on the stress-hormone response to a subsequent EHC that more closely mimics a real-life athletic situation utilizing three traditional modes of rehydration (IV, ORAL) and combined half IV and half ORAL (I+O) fluids of identical volume.

METHODS: Ten healthy, non-smoking, active men (age 23.3 ± 1.1 y; height, 177.8 ± 2.8 cm; body mass, 81.4 ± 1.3 kg; body fat, 11.0 ± 1.0%; O2max = 564.0 ± 25.1 mL·min⁻¹) completed four trials consisting of dehydração by 4% body mass, followed by 2% body mass, and an EHC composed of 25 min of running at 60% O2max, a maximal effort 0.5 mile run, five minutes of rest and five min of self-paced repetitive reboot boxing (RBL). Plasma catecholamines [epinephrine (EPI) and NOR] and CORT were analyzed at baseline, post-exercise dehydration, immediately before EHC (EHCPR), immediately-post 0.5 mile run (EHC30), immediately-post RBL (EHCIP), and 15 minutes post-RBL. Data was analyzed with a two-way repeated measures ANOVA or Student’s t-test, p< 0.05.

RESULTS: Catecholamine response was not significantly different between modes of rehydration, but significantly increased during ORAL (EHCPR - EPI 0.52±0.04 pmol·L⁻¹, NOR 2.64±0.89 nmol·L⁻¹; EHC30 - EPI 3.59±1.89 pmol·L⁻¹, NOR 21.66±7.42 nmol·L⁻¹; EHCIP - EPI 1.31±0.34 pmol·L⁻¹, NOR 15.45±6.63 nmol·L⁻¹). CORT response was significantly lower during I+O (EHCPRPE 451.8±118.5 nmol·L⁻¹, EHCIP 505.4±237.9 nmol·L⁻¹) compared to all other trials (EHCPR 567.1±240.5 nmol·L⁻¹, EHCIP - 603.6±270.1 nmol·L⁻¹).

CONCLUSIONS: These results suggest a synergistic effect of I+O on plasma CORT concentration resulting in reduced adreno-cortical response. It is possible the I+O treatment resulted in reduced hormonal response or increased removal rate due to a combination of oropharyngeal response and rapid plasma volume restoration since stress was controlled across conditions.

1835 Board #6 May 28 1:30 PM - 3:30 PM Hydration Status Response To Bolus Frequency And Volume Intake During Exercise In Heat
Jonathan R. Larson1, Nate E. Bartman2, Zachary J. Schlader, FACSM3, Blair D. Johnson, FACSM1, Zachary J. Schlader1, Holly Emmanuel4, Riana R. Pryor2, 1University at Buffalo, Buffalo, NY. 2University at Buffalo, Buffalo, NY. 3Texas Tech University, Lubbock, TX. 4University of Arkansas, Fayetteville, AR. (No relevant relationships reported)

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Workplace hydration recommendations suggest consuming 237mL of fluid every 15-20 min during physical work in the heat. It is unknown if these recommendations promote hydration during work and if consuming larger boluses of water less frequently maintains hydration better than smaller boluses of water consumed more frequently. PURPOSE: To determine the effects of the acute resistance exercise (RE)-induced hormonal response on the autophagic process in untrained young men.

Methods: Untrained young men (n=8, 22.2 ± 3y; height: 180 ± 5.7cm; weight: 80 ± 15kg) completed two sessions of 80 unilateral maximal eccentric knee extensions. Immediately after knee extensions, participants completed either 20-min of rest (CON) or upper body resistance exercise (EX). Muscle samples were collected from the vastus lateralis before exercise (BL), and 12-hr and 24-hr after exercise sessions. Real-time PCR was used to determine the gene expression for autophagic initiation signaling markers (i.e. FOXO3, MTOR, and AKT) and autophagic markers (i.e., ATG5, ATG7, LC3A, LC3B, ULK1, and p62).

Results: A significant (p<0.05) time effect was found for AKT, FOXO3A, ATG5, and p62 expression. AKT expression increased from BL to 12-hr (1.97 ± 0.34-fold) and 24-hr (1.33 ± 0.12-fold) and FOXO3A expression decreased from BL at 12-hr (3.15 x 10² ± 2.94 x 10²-fold) and 24-hr (1.43 x 10² ± 3.02 x 10²-fold). Additionally, p62 increased from BL at 12-hr (4.11 ± 1.26-fold) and ATG-5 expression decreased from BL at 12-hr (1.62 ± 0.30-fold). A trend was found for MTOR towards an increase from BL at 12-hr.

Conclusion: In response to muscle damage, the autophagic response increased from baseline in untrained young men; however, our data suggest that exercise-induced circulatory factors did not affect the autophagic process in untrained men.

D-12 Thematic Poster - Muscle Damage and Injury
Thursday, May 28, 2020, 1:30 PM - 3:30 PM
Room: CC-2009

1836 Chair: Cory W. Baumann, University of Minnesota, Twin Cities, MN. (No relevant relationships reported)

1837 Board #1 May 28 1:30 PM - 3:30 PM Muscle Damage Increases Autophagy Activation In Untrained Young Men
Travis Raif1, Casey Appell1, Matthew T. Stratton1, Mohamed Fokar1, Jakob Vingren, FACSM2, Hui-Ying Lui1.1 Texas Tech University, Lubbock, TX. 2Center for Biotechnology and Genomics, Texas Tech University, Lubbock, TX. 3University of North Texas, Denton, TX. (Sponsor: Jakob Vingren, FACSM)
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Introduction: The autophagic process is a key regulator of muscle repair and steroid hormones have been shown to alter this autophagic response. To date, no study has determined the effects of the acute exercise resistance (RE)-induced hormonal response on the autophagic process during muscle regeneration.

Purpose: To examine the effect of the acute RE-induced hormone response on the autophagic process in untrained young men.

Methods: Untrained young men (n=8, 22 ± 3y; height: 180 ± 5.7m; weight: 80 ± 15kg) completed two sessions of 80 unilateral maximal eccentric knee extensions. Immediately after knee extensions, participants completed either 20-min of rest (CON) or upper body resistance exercise (EX). Muscle samples were collected from the vastus lateralis before exercise (BL), and 12-hr and 24-hr after exercise sessions. Real-time PCR was used to determine the gene expression for autophagic initiation signaling markers (i.e. FOXO3, MTOR, and AKT) and autophagic markers (i.e., ATG5, ATG7, LC3A, LC3B, ULK1, and p62).

Results: A significant (p<0.05) time effect was found for AKT, FOXO3A, ATG5, and p62 expression. AKT expression increased from BL to 12-hr (1.97 ± 0.34-fold) and 24-hr (1.33 ± 0.12-fold) and FOXO3A expression decreased from BL at 12-hr (3.15 x 10² ± 2.94 x 10²-fold) and 24-hr (1.43 x 10² ± 3.02 x 10²-fold). Additionally, p62 increased from BL at 12-hr (4.11 ± 1.26-fold) and ATG-5 expression decreased from BL at 12-hr (1.62 ± 0.30-fold). A trend was found for MTOR towards an increase from BL at 12-hr.

Conclusion: In response to muscle damage, the autophagic response increased from baseline in untrained young men; however, our data suggest that exercise-induced circulatory factors did not affect the autophagic process in untrained men.
Curcumin Supplementation Suppresses Ubiquitin-Proteasome System Activity Following Exercise-Induced Muscle Damage In Humans

Thomas D. Cardaci, Steven B. Machek, Dylan T. Wilburn, Paul S. Hwang, Emilija S. Suezaki, Darryn S. Willoughby, FACSM. Baylor University, Waco, TX. (Sponsor: Darryn Willoughby, FACSM)

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(No relevant relationships reported)

PURPOSE: Curcumin is a natural polyphenolic compound with profound antioxidant and anti-inflammatory properties. Moreover, combined curcumin and piperine supplementation has shown improved curcumin bioavailability by 2000%. Multiple studies have demonstrated that curcumin exposure to curcumin leads to dysregulation of the ubiquitin-proteasome system (UPS) in cell culture. However, to date, no data has investigated curcumin’s ability to influence UPS activity in a human model. Therefore, the purpose of this study was to investigate the effects of curcumin and piperine supplementation on markers of UPS activity following exercise-induced muscle damage in human skeletal muscle. METHODS: Twenty-three recreationally active male and female participants were randomized into a curcumin + piperine (CUR; n=11); or placebo + piperine (PLA; n=12). Both groups were instructed to consume 2g of their respective supplement and 20mg of piperine for 11 consecutive days. Following 8 consecutive days of supplementation, participants performed a 45-min eccentrically-based muscle damaging treadmill protocol at 60% VO2max. Muscle Biopsies and delayed muscle soreness (DOMS) analyses were performed 30 minutes prior and 3-, 24-, 48-, and 72-hours post exercise-induced muscle damage. Muscle ubiquitin, MAFbx, ubiquitin specific peptidase 19 (USP19), and chymotrypsin-like protease (CLP) concentrations were measured using ELISA kits. A 2x5 repeated measures ANOVA with pairwise comparisons was conducted with significance set at p<0.05. RESULTS: Both groups had a significant time effect for DOMS (p<0.01). Pairwise comparisons indicated DOMS was significantly greater from baseline at all time points except 72 hours post muscle damage. No significant differences were found for CLP or USP19 across any time points. Regardless of time, there was a significant group effect for ubiquitin (p = 0.012) and MAFbx (p = 0.016) where CUR was significantly lower than PLA. CONCLUSIONS: Curcumin supplementation decreased muscle ubiquitin and MAFbx in response to a muscle damaging protocol. As key markers of protein degradation, this implies decreased ubiquinon and a subsequent reduction in proteasomal activity. Therefore, curcumin supplementation potentially plays a role in preserving skeletal muscle mass through decreased muscle breakdown.

EIMD. The impaired regenerative capacity often reported for sarcopenic muscle was more pronounced in older mice, with the rate of force recovery significantly slower compared to adult mice. The impaired regenerative capacity in the old mice could be due to defects in the EIMD response and the use of muscle performance rather than molecular and structural markers of damage. These results differences in Numb or NumbL proteins were observed at any time point or between the control group and exercise group (p > 0.05). CONCLUSION: Numb expression was unaffected by EIMD damage, while NumbL mRNA expression was increased after muscle damage. These results indicate that NumbL may have a greater role in muscle repair after strenuous exercise in humans than previously thought. Funding provided by NIA grant 5R01AG060341-02 to CPC and the CSACSM Doctoral Grant.

Exosomes Isolated From Platelet-rich Plasma And Mesenchymal Stem Cells Promote Functional Recovery After Muscle Injury

Shara M. Iyer, Amanda L. Schieber, Paul Yarowsky, R. Frank Henn III, Satoru Osu, Richard M. Covering. University of Maryland School of Medicine, Baltimore, MD. (Sponsor: Edward McFarland, FACSM)

(No relevant relationships reported)

PURPOSE: Clinical use of platelet-rich plasma (PRP) and mesenchymal stem cells (MSCs) have gained momentum as viable treatment options for muscle injuries. Exosomes, or small cell-derived vesicles, could be helpful if they could deliver the same or better physiological effect without cell transplantation into the muscle. The purpose of this work was to determine if local delivery of exosomes derived from PRP (PRP-exos) or MSCs (MSC-exos) to injured muscles hastens recovery of contractile function. METHODS: Using Sprague-Dawley rats, platelets were isolated from blood and MSCs were isolated from bone marrow and expanded in culture; exosomes from both were isolated through ultracentrifugation. The tibialis anterior muscles were injured in vivo by maximal lengthening contractions. Muscles were injected with PRP-exos or MSC-exos (immediately after injury, and days 5 and 10 after injury), shams received an equal volume of saline. In addition, histological and biochemical analysis was performed on tissues for all groups. RESULTS: Injury resulted in a significant loss of maximal isometric torque (60%) that gradually recovered over time. Both PRP-exos and MSC-exos accelerated recovery, with similar improved recovery of contractile function over the saline treated group at days 5, 10, and 15 (P < 0.05). A significant increase in centrally nucleated fibers was seen with both exosomes groups by day 15 (P < 0.05). Muscles treated with PRP-exos had increased expression of Myogenin gene expression (P < 0.05), whereas muscles treated with MSC-exos had reduced expression of TGF-β ten days after muscle injury. CONCLUSIONS: Exosomes derived from PRP or MSCs can facilitate recovery after a muscle strain injury in a small-animal model, likely due to factors that can modulate inflammation, fibrosis and myogenesis. With their small size, low immunogenicity, and ease with which they can be obtained, exosomes could represent a novel therapy for many orthopedic ailments.
Exercise-induced muscle injury is characterized by long-lasting muscle strength deficits and soreness but whether these changes alter quadriceps muscle activation and knee pain development during subsequent locomotor activity is unclear. **PURPOSE:** To determine the effects of downhill running-induced muscle injury on quadriceps muscle torque and soreness, knee pain, and muscle activation during a standardized run. **METHODS:** 12 recreationally active males, 18-35 years old were randomly assigned to either a downhill running group (DR; n = 6) or level running control group (CON; n = 6). Quadriceps muscle maximum isometric torque at 20°, 45°, and 90° of knee flexion, and muscle and knee pain were measured before, immediately following and 24 hours after either DR (45 min at -12% grade) or level running (10 min) protocols. Vastus medialis (VM), rectus femoris (RF), and vastus lateralis (VL) muscle activation were measured bilaterally via surface EMG during level running at 75% of heart rate maximum. Bilateral muscle and knee pain were measured using a visual analog scale (100 mm). **RESULTS:** CON group experienced no significant (p>0.05) decreases in maximal isometric torque of quadriceps muscles, or changes in muscle and knee pain, or normalized integrated EMG (miEMG) during running. DR group produced significantly (p<0.05) less peak torque at all joint angles immediately following (0.4 ± 0.21 vs. 4.6 ± 0.61) and 1-day (15.4 ± 3.2 to 23.9 ± 5.1%) after DR. Compared to pre-injury (2.5 ± 1.9 mm), quadriceps muscle soreness increased (p<0.008) immediately after (31 ± 9 mm) and at 1-day (46 ± 6 mm) after DR, whereas knee pain increased (p=0.003) at 1-day (Pre 4.3 ± mm vs. 1.2 ± 7.6 mm). miEMG in the left VM was 131 ± 16% vs. 142 ± 22% (p=0.006) and right VL was 131 ± 16% vs. 144 ± 22% (p=0.07) of pre-injury values immediately after and 1-day after DR. **CONCLUSIONS:** Exercise-induced muscle injury increases quadriceps muscle strength deficits and soreness, and knee pain that appear to alter activation of certain quadriceps muscles during subsequent locomotion.

**Eccentric And Concentric Resistance Training**

**Thematic Poster - RPE, Pain and Fatigue**

**Board #7**

**Eccentric And Concentric Resistance Training Alters In Z-Line Proteins**

Francis Osei, Jan Steinbrenner, Moigjan Ghilav, Wilhelm Bloch.

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(No relevant relationships reported)

Few studies are available on the alterations of resistance training on muscle Z-lines. Thus, it is of great importance to understand long-term effects of resistance training on the mechano-stability and mechano response on muscle Z-lines proteins.

**Purpose:** The present study was conducted to ascertain how Z-lines proteins (myopodin/SYNPO 2 and α-actinin) are altered by eccentric and concentric resistance training leading to possible alterations in mechano-stability and mechano-response.

**Methods:** Ten (10) healthy male subjects with age (25.3 ± 1.4 years), height (1.87 ± 0.09 m), weight (73.2 ± 1.16 kg) and BMI (24.4 ± 3.3 kg/m2) were grouped into eccentric resistance (n=5) and concentric resistance (n=5) training. Subjects underwent twelve (12) weeks of resistance training intervention on the dominant leg. Muscle biopsies were taken in five time points (T0,T1,T2,T3,T4) on the forelimb of the vastus lateralis muscle and immunohistochemistry double staining protocol were implemented. Images were taken using confocal laser scanning microscope and protein distribution was morphometrically analysed by line scanning to find out the alterations of myopodin/SYNPO2 and α-actinin on muscle Z-lines. Paired student’s t-test was used for analysis to compare a visual analog scale (100 mm).

**Results:**

- **α-actinin on muscle Z- lines.** Paired student's t-test was used for analysis to compare a visual analog scale (100 mm).
- **Results** of α-actinin on muscle Z- lines. Paired student's t-test was used for analysis to compare a visual analog scale (100 mm).
- **Results** of α-actinin on muscle Z- lines. Paired student's t-test was used for analysis to compare a visual analog scale (100 mm).

**Conclusion:** Long-term exposure of resistance training, especially eccentric type, affects Z-lines (myopodin/SYNPO 2 and α-actinin) proteins functional architecture and structure against myofibrillar stress.

**Board #8**

**Characterization Of Muscle Damage And Inflammation Following Repeated Maximal Eccentric Loading Of The Trunk**

Anne Schraplau, Dominik Sonnenburg, Monique Wochatz, Tilman Engel, Anne Schomoeller, Lucie Risch, Hannes Kaplick, Frank Mayer. University of Potsdam, Potsdam, Germany.

(No relevant relationships reported)

Eccentric exercises (ECC) induce reversible muscle damage, delayed-onset muscle soreness and an inflammatory reaction that is often followed by a systemic anti-inflammatory response. Thus, ECC might be beneficial for treatment of metabolic disorders which are frequently accompanied by a low-grade systemic inflammation. However, extent and time course of a systemic immune response after repeated ECC bouts are poorly characterized.

**PURPOSE:** To analyze the (anti-)inflammatory response after repeated ECC loading of the trunk.

**METHODS:** Ten healthy participants (33 ± 6 y; 173 ± 14 cm; 74 ± 16 kg) performed three isokinetic strength measurements of the trunk (concentric (CON), ECC1, ECC2, each 2 wks apart; flexion/extension, velocity 60°/s, 120s MVC). Pre- and 4, 2, 4, 72, 168 post-exercise, muscle soreness (numeric rating scale, NRS) was assessed and blood samples were taken and analyzed [Creatine kinase (CK), C-reactive protein (CRP), Interleukin-6 (IL-6), IL-10, Tumor necrosis factor-α (TNF-α)]. Statistics were done by Friedman’s test with Dunn’s post hoc test (p<0.05).

**RESULTS:** Mean peak torque was higher during ECC1 (319 ± 142 Nm) than during CON (268 ± 108 Nm; p<0.05) and not different between ECC1 and ECC2 (297 ± 126 Nm; p>0.05). Markers of muscle damage (peaks post-ECC1: NRS 48h, 4.1±2.9; CK 72h, 14407 ± 19991 U/l) were higher after ECC1 than after CON (NRS 48h, 2.0±0.4; CK 72h, 6616 ± 8337 U/l; p<0.05). The responses over 72h (stated as Area Under the Curve, AUC) were abolished after ECC2 compared to ECC1 (<0.05) indicating the presence of the repeated bout effect. CRP levels were not changed. IL-6 response was enhanced after ECC1 (AUC 61 ± 37 pg/ml*72h) compared to CON (AUC 33 ± 31 pg/ml*72h; p<0.05). After ECC2, the IL-6 response (AUC 43 ± 25 pg/ml*72h) remained lower than post-ECC1, but the difference was not statistically significant. Serum levels of TNF-α and of the anti-inflammatory cytokine IL-10 were below detection limits. Overall, markers of muscle damage and immune response showed high inter-individual variability.

**CONCLUSION:** Despite maximal ECC loading of a large muscle group, no anti-inflammatory and just weak inflammatory responses were detected in healthy adults. Whether ECC elicits a different reaction in inflammatory clinical conditions is unclear.
to acute aerobic exercise. Articles published prior to June, 2018 were located with searches of PubMed, Scopus/Embase, CINAHL, and CENTRAL. To be included in the final analysis, studies also had to report data on heart rate (HR) responses to exercise for patients and controls. Hedges’ d effect sizes for RPE and HR were calculated and aggregated using random effects models. Results: Forty effects were extracted from 36 studies involving 971 patients (age = 42.2±6.1; BMI = 25.2±1.8; percent female = 77.8±23.1) and 762 healthy controls (age = 40.6±3.3; BMI = 24.7±1.4; percent female = 74.4±25). We observed a large (d = 0.84; 95% CI: 0.51, 1.07), significant (p = 0.001), and heterogenous (I² = 78.8) effect indicating that RPE responses to exercise were higher in patients than controls. We also found a small (d = 0.42; 95% CI: -0.58, -0.26), but significant (p = 0.001) effect indicating lower HR responses in patients than controls. Conclusion: RPE is elevated in ME/CFS and FM despite potentially lower physical exertion than healthy controls during exercise. This finding warrants further investigation to determine if RPE responses to exercise can provide insight into pathophysiological mechanisms of these illnesses. Future work may include exploring the strength of association between exercise-induced changes in RPE and physiological outcomes as well as experimentally manipulating RPE responses to exercise using methods such as pharmacological blockade or transcranial magnetic stimulation. Jacob Lindheimer was supported by Department of Veterans Affairs grant: IK2-CX001679

1847 Board #2
May 28 1:30 PM - 3:30 PM
A Novel Role Of ASICs In Immediate-Exercise-Induced Pain And Exercise Performance
Tahsin Khataci1, Anne S. Harding1, Mahyar Janahmadi2, Maram Al-Geniey1, Hamid Rahabi1, Peter M. Snyder1, Kathleen A. Sluka1, Christopher Benson1. University of Iowa, Iowa City, IA. 1Shahid Beheshti University of Medical Sciences, Tehran, Iran, Islamic Republic of. 2Kharazmi University, tehran, Iran, Islamic Republic of. (Sponsor: Thorsten Rudroff, FACSM)
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INTRODUCTION: Exercise training is an effective therapy for many pain-related conditions, and there is a difference in pain perception between athletes and unconditioned people. The mechanism by which exercise modulates pain is poorly understood. Painful conditions can be associated with elevated levels of protons, metabolites and inflammatory factors, which can activate receptors and/or ion channels on nociceptive sensory neurons including acid sensing ion channels (ASICs) and transient receptor potential cation channel subfamily V member 1 (TRPV1).

Additionally, strenuous exercise also causes the release of similar chemical signals, and ASICs within muscle afferents may mediate immediate exercise-induced pain (IEP) and fatigue, as well as reflex hemodynamic changes. We hypothesized that ASICs and TRPV1 have role in IEP and maximal exercise performance. METHOD: First, C57BL/6 mice were divided into sedentary (SED), low-intensity continuous training (LICT) and high-intensity interval training (HIIT) groups. Mice were trained on a treadmill every other day for 4 weeks. SED mice were placed on a non-moving treadmill for similar periods of time. After 4 weeks, exercise performance, ASICs and metabolites were measured. In a second study, we compared the IEP and exercise performance in ASIC3-/- versus wild type (WT) mice. Results: In WT mice, ASIC3 expression was significantly higher compared to ASIC3-/- mice. In a third study, we compared the IEP and exercise performance in separate group, we measured IEP at baseline and following exhaustive exercise before and after HIIT. In a fourth study, we measured IEP and metabolites in lumbar dorsal root ganglion (DRG) and DRG mRNA levels in mice with ASIC3-/-METHOD: First, C57BL/6 mice were divided into sedentary (SED), low-intensity continuous training (LICT) and high-intensity interval training (HIIT) groups. Mice were trained on a treadmill every other day for 4 weeks. SED mice were placed on a non-moving treadmill for similar periods of time. After 4 weeks, exercise performance, ASICs and metabolites were measured. In a second study, we compared the IEP and exercise performance in ASIC3-/- versus wild type (WT) mice. Results: In WT mice, ASIC3 expression was significantly higher compared to ASIC3-/- mice. In a third study, we compared the IEP and exercise performance in separate group, we measured IEP at baseline and following exhaustive exercise before and after HIIT. In a fourth study, we measured IEP and metabolites in lumbar dorsal root ganglion (DRG) and DRG mRNA levels in mice with ASIC3-/-.

CONCLUSION: In summary, ASIC3 is required for IEP following exhaustive exercise, and exercise training downregulates ASICs and TRPV1 in muscle afferents and diminishes IEP. These findings suggest a possible role of ASICs in benefits of exercise training for many pain and fatigue conditions such as fibromyalgia and chronic fatigue syndrome conditions. Supported by Department of Veteran Affairs.

1848 Board #3
May 28 1:30 PM - 3:30 PM
Pain Modulation Is Associated With Moderate Physical Activity In Gulf War Veterans With Chronic Pain
Stephanie M. Van Riper1, Aaron J. Stegner1, Jacob V. Ninnemann1, Alexander Boruch1, Jacob B. Lindheimer2, Ryan J. Dougherty1, Neda E. Almasi1, Laura D. Ellingson, FACSM1, Patrick J. O’Connor, FACSM2, Dane B. Cook, FACSM. University of Wisconsin–Madison, Madison, WI. 1William S. Middleton Veterans Memorial Hospital, Madison, WI. 2Western Oregon University, Monmouth, OR. 3University of Georgia, Athens, GA.
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(Venters of the Persian Gulf War (GV) suffer unresolved widespread chronic musculoskeletal pain (CMP) that significantly impacts their functional ability and quality of life. Pain modulation is impaired in some groups with CMP and can be augmented with acute exercise. Further, we have shown that physical activity behaviors in women with fibromyalgia are positively associated with pain modulation. Whether this relationship occurs in GV with CMP is unknown. PURPOSE: To examine the relationships between self-reported and accelerometer measures of physical activity and pain modulation in GV with CMP. METHODS: Sixty-eight GV with CMP were recruited and 55 completed full physical activity assessments that included completing the International Physical Activity Questionnaire and wearing an Actigraph accelerometer for one week. Psychophysical pain testing was used to assess pain modulation. Participants were divided into groups based on their completion of the distraction task. Data was analyzed using Pearson correlations (p < 0.05) and multiple-linear regression analyses. RESULTS: Greater accelerometer activity was associated with lower pain in a large effect size (r = 0.61, p < 0.001). Greater self-reported activity was related to lower pain in a small effect size (r = 0.26), but significant (p = 0.001) effect indicating lower HR responses in patients than controls. Conclusion: RPE is elevated in ME/CFS and FM despite potentially lower physical exertion than healthy controls during exercise. This finding warrants further investigation to determine if RPE responses to exercise can provide insight into pathophysiological mechanisms of these illnesses. Future work may include exploring the strength of association between exercise-induced changes in RPE and physiological outcomes as well as experimentally manipulating RPE responses to exercise using methods such as pharmacological blockade or transcranial magnetic stimulation. Jacob Lindheimer was supported by Department of Veterans Affairs grant: IK2-CX001679

CONCLUSIONS: These data suggest moderate intensity exercise can increase MPT and to a greater extent in women. Further, MPT correlated with increased EBL indicating that greater relative exercise intensity may modulate a greater increase in pain modulation.

Prescription pain medication can be addictive and have long-term health consequences. Alternative pain-relieving strategies are becoming increasingly sought after. Exercise is known to have a pain-relieving effect which is thought to be mediated through the dopaminergic system. PURPOSE: To examine the relationships between minimum pain threshold (MPT), exercise blood lactate (EBL), and the self-reported psychoactive effects of exercise based on questions from the Morphine-Benzodiazepine, Morphine and Excitement subscales of the Addiction Research Center Inventory (ARCI) following acute exercise in college aged students. METHODS: Twelve college aged students (age = 20.7 ± 0.5yr) underwent 5 minutes of low leg cycling as a warmup. Following the warmup, they cycled for 20 minutes at 8 METS with an additional 5-minute cooldown. Measurements were taken prior to exercise and just before the cool down. EBL was collected as a measure of relative exercise intensity. The MPT was measured using a Wagner “Pain Test” algometer on the extensor carpi radialis. Results were assessed using a Student’s T-Test. RESULTS: Following exercise the MPT was increased by 62.1% ± 2.8 (P<0.001). MPT had a greater increase compared to EBL (20.5% ± 9.1%) relative to men (15.8 ± 9.4%; P<0.05). EBL increased from an average of 1.8 ± 0.6 mmol/L at baseline to 4.1 ± 0.7 mmol/L following exercise (P<0.001). There was a positive linear correlation between MPT and EBL (r=0.59; P<0.05). Indicating greater EBL levels were related to increased MPT. Positive responses from the ARCI subscale increased by 27 ± 3.3% following exercise (P<0.05). There was no effect of sex nor EBL on positive responses on the ARCI. CONCLUSIONS: These data suggest moderate intensity exercise can increase MPT and to a greater extent in women. Further, MPT correlated with increased EBL indicating that greater relative exercise intensity may modulate a greater increase in pain modulation.

Veterans of the Persian Gulf War (GV) suffer unresolved widespread chronic musculoskeletal pain (CMP) that significantly impacts their functional ability and quality of life. Pain modulation is impaired in some groups with CMP and can be augmented with acute exercise. Further, we have shown that physical activity behaviors in women with fibromyalgia are positively associated with pain modulation. Whether this relationship occurs in GV with CMP is unknown. PURPOSE: To examine the relationships between self-reported and accelerometer measures of physical activity and pain modulation in GV with CMP. METHODS: Sixty-eight GV with CMP were recruited and 55 completed full physical activity assessments that included completing the International Physical Activity Questionnaire and wearing an Actigraph accelerometer for one week. Psychophysical pain testing was used to assess pain modulation. Participants were divided into groups based on their completion of the distraction task. Data was analyzed using Pearson correlations (p < 0.05) and multiple-linear regression analyses. RESULTS: Greater accelerometer activity was associated with lower pain in a large effect size (r = 0.61, p < 0.001). Greater self-reported activity was related to lower pain in a small effect size (r = 0.26), but significant (p = 0.001) effect indicating lower HR responses in patients than controls. Conclusion: RPE is elevated in ME/CFS and FM despite potentially lower physical exertion than healthy controls during exercise. This finding warrants further investigation to determine if RPE responses to exercise can provide insight into pathophysiological mechanisms of these illnesses. Future work may include exploring the strength of association between exercise-induced changes in RPE and physiological outcomes as well as experimentally manipulating RPE responses to exercise using methods such as pharmacological blockade or transcranial magnetic stimulation. Jacob Lindheimer was supported by Department of Veterans Affairs grant: IK2-CX001679

CONCLUSIONS: These data suggest moderate intensity exercise can increase MPT and to a greater extent in women. Further, MPT correlated with increased EBL indicating that greater relative exercise intensity may modulate a greater increase in pain modulation.
MPT. Moderate intensity exercise increased positive responses on the ARCI providing evidence that the dopaminergic system may drive changes to MPT. However, positive responses did not correlate to EBL which may suggest another variable may augment pain reduction with increased exercise intensity.

**METHODS**

Methods of this project ensure standardized, confound-free instructions and engagement in regular physical exercise. Literature-based standardized instructions describe PE as resulting from multiple sensory cues including “aches”.

This description of PE creates a possible confound when PE and MP are being considered separately. This project uses standardised, confound-free instructions and instructions were translated and back-translated following standardised procedure.

Exhaustion test, PE and MP increased (P < 0.001). During each exercise, PE was higher than MP (~10 a.u., P < 0.001).

**RESULTS**

Scores between workloads.

In a total of 102 participants (50 female) were assessed in the vastus lateralis (VL) and femoral nerve electrical stimuli were delivered to elicit motor evoked potentials (MEP) and compound muscle action potentials (Mmax), respectively.

5-s right-leg knee extensions, during which transcranial magnetic and femoral nerve electrical stimuli were delivered to elicit motor evoked potentials (MEP) and compound muscle action potentials (Mmax), respectively. These findings suggest that regardless of the origin or mechanisms that having less lean mass may play a role in increased pain sensitivity and could indicate why men are more sensitive to pain compared to males.

**CONCLUSION**

**purposes**: To examine the effects of pre-induced fatigue and concurrent rising pain (evoked by muscle ischemia) in one leg on motor fatigability and corticospinal excitability and inhibition of the contralateral leg.

METHODS: Twelve healthy males (mean±SD, age: 27±4 yrs) undertook four experimental protocols including unilateral cycling to task failure at 80% of peak power output with i) the right-leg (RL), ii) the left-leg (LL), iii) RL immediately preceded by LL protocol (FAT-RL), and (iv) RL while blood flow was occluded in the contralateral (left) leg (PAIN-RL).

The single-leg cycling exercise and neuromuscularassessments were carried out on a validated custom-built recumbent cycle ergometer that facilitates post-fatigue assessments within 1 second. Participants performed maximal and submaximal 5-s right-leg knee extensions, during which transcranial magnetic and femoral nerve electrical stimuli were delivered to elicit motor evoked potentials (MEP) and compound muscle action potentials (Mmax), respectively. RESULTS: Pre-induced fatigue reduced the right leg knee extension (466±120 s) to a greater extent than concurrent pain (460±158 s), compared to RL (580±226 s) (P<0.001).

The maximal voluntary contraction (MVC) force declined less following FAT-RL (p=0.019) and PAIN-RL (p=0.032), compared to the RL. Voluntary activation declined, and the corticospinal excitability recorded from knee extensors increased similarly following the three conditions (p=0.05). However, the pre-induced fatigue, but not concurrent rising pain, reduced corticospinal inhibition compared to RL (p=0.05).

**CONCLUSIONS**: These findings suggest that regardless of the origin or mechanisms modulating sensory group III/IV afferents (i.e. pre-induced fatigue vs. concurrent rising pain), the limit of exercise tolerance remains the same and exercise will be terminated upon achievement of sensory tolerance limit. The inhibitory neural feedback evoked by the two interventions however may have distinctive effects on corticospinal inhibition.

**PURPOSE**: Perceptions of effort (PE) and muscle pain (MP) influence performance and engagement in regular physical exercise. Literature-based standardized instructions describe PE as resulting from multiple sensory cues including “aches”.

This description of PE creates a possible confound when PE and MP are being considered separately. This project uses standardised, confound-free instructions and instructions were translated and back-translated following standardised procedure.

Semi-quantitative analysis of verbal pain intensity (0-10 RP) during MVC and 2000 Nmax and 2000 Nmax was determined by peak power output (PPO). During both visits and 2 (randomized order), subjects performed four 1 min cycling bouts at 4 workloads (40, 60, 80, 100% PPO) twice. The bouts were separated by either 15 min of rest or a time to exhaustion test at 80% PPO. PE and quadriceps MP intensity were assessed during each exercise. Differences were tested using Friedman tests on the values reported at each workload and the change scores between workloads.

During the incremental test, changes in PE and MP in response to changes in workloads were dissociated only for power outputs below 50% PPO (P < 0.001). During the 1 min cycling bouts, changes in PE and MP in response to changes in workloads were dissociated (P > 0.001). Following completion of the time to exhaustion test, PE and MP increased (P < 0.001). During each exercise, PE was higher than MP (~10 a.u., P < 0.001).

**CONCLUSION**: The observed difference in the intensity of PE and MP, as well as their response to changes in workload provide experimental support in favour of the use of confound-free instructions to monitor PE and MP during cycling exercise.

Future studies should test this possibility for other exercise modalities involving use of confound-free instructions to monitor PE and MP during cycling exercise.

Women are more sensitive to pressure pain threshold testing compared to men, however the underlying mechanism(s) that explain these differences have not been fully elucidated. Pain sensitivity has been shown to be influenced by BMI, but less is understood when examining the role of limb specific fat and lean mass on pain sensitivity.

**PURPOSE**: To examine how fat mass and lean mass influence pressure pain sensitivity in men and women.

**METHODS**: Pressure pain thresholds (PPT) of 102 participants (50 female) were assessed in the vastus lateralis (VL) and brachioradialis (BR) using a pressure algometer on the left (L) and right (R) sides of the body. Whole body and limb specific fat and lean tissue were assessed via DXA scan.

**RESULTS**: Women had higher percent body fat (32.5% ± 9.2 vs 20.1% ± 9.2, P<0.001), absolute total body fat (21.4Kg ± 9.6 vs 16.9Kg ± 9.9, P=0.002), and had less lean mass (41.4Kg ± 5.5 vs 62.4Kg ± 8.9, P<0.001) than their male counterparts. Limb specific fat and lean mass were also seen in both fat mass and lean mass in the R-BR-fat (190.7±125.6 vs 148.1±100.4, P=0.02); lean: 77.0±180.5 vs 135.5±319.5, P<0.001), L-BR-fat (202.3±110.4 vs 150.9±113.6, P=0.02); lean: 736.1±180.6 vs 1309.8±318.2; P<0.001, R-VL-fat (3732.3±1600.5 vs 2601.9±1360.2, P=0.001); lean: 4755.9±839.0 vs 7261.4±1243.8; P<0.001 and L-VL-fat (3595.3±1503.5 vs 2379.4±1156.9, P=0.001; lean: 4574.9±512.2 vs 7154.0±1214.5, P<0.001). Women had lower PPT’s in the R-BR (321.9±128.9 vs 466.2±220.3, P<0.001), L-BR (308.6±114.1 vs 444.5±229.9, P<0.001, R-VL (460.4±166.2 vs 677.5±254.9, P<0.001) and L-VL (433.5±156.6 vs 646.1±262.5, P<0.001) when compared to men. When normalized to site specific lean mass PPT’s, no differences were seen in any of the measured sites (R-BR, P < 0.15, L-BR, P = 0.15, R-VL, P=0.55, L-VL, P = 0.31). However, when normalized to fat mass, the sex differences remained (R-BR, P<0.001, L-BR, P<0.001, R-VL, P<0.001, L-VL, P<0.001).

**CONCLUSION**: When PPT’s were normalized to lean mass, sex differences disappeared; however the sex differences remained when PPT’s were normalized to fat mass. This finding suggests that having less lean mass may play a role in increased pain sensitivity and could indicate why men are more sensitive to pain compared to males.

**RESULTS**: These findings suggest that regardless of the origin or mechanisms that having less lean mass may play a role in increased pain sensitivity and could indicate why men are more sensitive to pain compared to males.
widespread musculoskeletal pain (CMP) is unknown. PURPOSE: To determine the relationship between physical activity and pain sensitivity in GV with CMP. METHODS: GV (n=68) were recruited from 13 collegiate athletes at the University of South Carolina, Columbia, SC. All athletes completed a comprehensive individualized interview as part of an 18-month exercise training trial and 55 completed baseline assessments that included physical activity and pain sensitivity measurements. Physical activity was measured using both self-report (International Physical Activity Questionnaire) and accelerometer (ActiGraph GTX) methods. Experimental pain testing consisted of three levels of noxious heat (45, 47, and 48.9°C), each presented five times. Ratings of pain intensity and unpleasantness were obtained following each stimulus using Gracely Box Scales (0-20). Multiple linear regression was used to determine whether self-reported and/or accelerometer measures of physical activity predicted pain ratings controlling for age (years), body mass index, and disease severity (Widespread Pain Index (WPI)). RESULTS: Forty-two GV with CMP were included in the analyses (age = 50.9 (SD 6.9) years; weight = 101.6 (SD 40.9) kg; height = 1.74 meters (SD 8)); Average WPI = 7.5 (SD 3.2)). Neither self-reported (β = 0) nor accelerometer-based (β = 0.02) measures of moderate-to-vigorous physical activity (IPAQ; 505.25 (559.1); GTX: 70.6 (40.9) significantly (p = 0.05) predicted either pain intensity or unpleasantness. Disease severity (β = 0.46), and age (β = 0.23) were significant (p < 0.05) predictors of unpleasantness but not intensity (Model p = 0.02, adjusted R2 = 0.19). CONCLUSION: These results suggest that physical activity does not affect the sensitivity of the nociceptive system to painful heat in GV with CMP. Future research examining different pain modalities and/or physical activity interventions may better clarify the associations between physical activity and CMP. Supported by Dept. of Veterans Affairs grant: I01-CX000383.

The chronic stress of training and frequent travel during the competitive soccer season may adversely affect sleep and thus, recovery in collegiate athletes. PURPOSE: To examine the relationship between changes in sleep, inflammatory biomarkers, and exercise energy expenditure (EEE) throughout the season. METHODS: 24 female soccer players (N=24) were monitored throughout the competitive season. During all training and games, EEE (kcal/kg) was evaluated using an integrative GPS and heart rate monitoring system, which was individualized based on pre-season performance testing. Pittsburgh Sleep Quality Index (PSQI) questionnaires, weight assessments, and blood draws were completed prior to presession and at weeks 2, 4, 8, & 12 of the season. Total cortisol (TCORT), free cortisol (FCORT), c-reactive protein (CRP), IL-6, and TNFα were analyzed. Change scores were calculated between timepoints for each biomarker, GlobalPSQI, Sleep Duration (SD), and Sleep Quality (SQ) scores. Pearson product correlations were conducted between change scores as well as EEE, between timepoints with significance set at p < 0.05. RESULTS: A slight increase in overall PSQI score was observed from D-14 to D+21. ΔPSQI was not related to any measures, except ASD and ΔASQ (r = -0.31, p < 0.05). ASD and ASQ were both significantly correlated to ΔIL-6 (r = -0.21, r = -0.23, p < 0.05). ΔIL-6 was positively correlated to ΔCRP (r = 0.26, p < 0.05), ΔTNFα (r = 0.25, p < 0.05), and ΔFCORT (r = 0.26, p < 0.05). ΔCRP was also significantly related to ΔPSQI (r = 0.24, p < 0.05). ΔTNFα was not associated with any measures (p < 0.05). CONCLUSIONS: There appears to be a relationship, albeit weak, between sleep measures and IL-6, with increased SD and SQ (i.e. decreased PSQI score) related to increases in IL-6. Additionally, increased IL-6 was associated with increases in other proinflammatory and stress markers, potentially indicative of fuel mobilization and physiological repair responses. The cumulative load of the competitive season could indicate an increased need for recovery, thus yielding compensatory increases in SD and perceived SQ. Further research is warranted using objective sleep measures to examine the relationship observed in soccer players. Funding provided by Quest Diagnostics.
A variety of factors can influence anaerobic performance, including time of day, training status, fatigue, sleep duration and quality, psychological state, hydration, and food intake. These variables may interact to influence performance. PURPOSE: To compare anaerobic performance in individuals across three time periods of the day (morning, afternoon, and evening), and determine if sleep and/or prior exercise influence performance. METHODS: Ten healthy, physically active adults were recruited to do three 30-second Wingate tests: Morning (6:00am to 11:59am), afternoon (12:00pm to 4:59pm), and evening (5:00pm to 9:00pm). The order of tests was randomized and all testing was completed over one week. Prior to each test, subjects were provided similar instructions, and they completed pre-test questionnaires.

RESULTS: All subjects completed the three testing protocols. Data should be gathered to assess the impact of longer duration napping and activities. One strategy to maintain wellbeing is to adhere to a physical activity routine. Counts studies have demonstrated that regular exercise increases fitness and decreases depression. Therefore, recent investigations focus on protocols to easily measure the effectiveness of specific programs to maximize benefits. Heart rate variability (HRV) is an example of a noninvasive variable that provides insight about cardiovascular health and recovery. Stretching and meditation are two practices that past research has demonstrated increase HRV. PURPOSE: To evaluate if a fusion of stretching and meditation improves heart rate variability, positive feelings, and quality sleep in active adults. Our hypothesis is that performing a sequence of stretches (20-30 minutes) with subsequent meditation (10 minutes) three nights per week will enhance recovery (higher HRV) in addition to induce positive feelings and quality sleep. METHODS: Thirty-six adults between 24-67 years who regularly exercised at least five hours per week, without stretching or meditation, collected their morning heart rate and exercised their heart rate with a chest transmitter for two weeks. Next, we assigned (age and activity matched) the participants to an experimental stretching and meditation protocol three nights per week. Both groups continued the heart rate collection for another two weeks. Each participant also completed a weekly survey with questions addressing their satisfaction with life, physical as well as mental feelings, and quality of sleep. RESULTS: In the experimental group, heart rate variability, positive feelings (confidence, motivation), and quality sleep were significantly greater during the second two weeks while resting heart rate and negative feelings (sadness, anxiety) were significantly less (all comparisons p < 0.02). To contrast, in the control group, there were no significant differences between the measurement weeks. CONCLUSIONS: Our data demonstrate that 30-40 minutes of stretching and meditation three nights per week can be an effective routine to enhance both physical and mental health in active adults.

PURPOSE: Our study investigated the differences in sleep architecture and health in and out of a competitive season. METHODS: Nine competitive youth athletes between the ages of 12 and 16 who compete for either the tumbling and trampoline team or the diving team were recruited for this study. Data was collected for 3 consecutive nights during the competition and for 3 consecutive nights during post-season. Data was then analyzed using the SleepProfiler™ scoring software. All data is expressed as Mean +/- SEM. RESULTS: Mean nocturnal pulse was statistically different from in season versus post season (p = 0.049, +/-; 66.8 ± 9.6 bpm in season versus 61.7 ± 6.3 bpm post season). Sleep efficiency, WASO, and spindle duration were all not statistically different from in season to post season. Sleep latency, REM, and NREM sleep though not statistically different from in season to post-season have a strong correlation. CONCLUSION: These data demonstrate a significant decline in mean heart rate when an athlete moves from competition season to the non-competitive season. These data show that gymnastic training in addition to competition training may lead to deleterious cardiovascular changes. Future studies should elucidate the impact and volume of training a youth athlete undertakes and the benefits and risks on physiological and psychological well-being.
Increased Sleep Is Associated With Higher Maximal Aerobic Capacity In NCAA Division 1 Athletes

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(No relevant relationships reported)

Prior research regarding sleep and endurance performance has primarily focused on sleep deprivation or sleep restriction among sedentary or recreationally active individuals. Little is known about the effect of real-world sleep fluctuations on aerobic capacity and performance in elite athletes. **PURPOSE:** To determine the impact of sleep duration acutely and chronically on maximal aerobic capacity (VO_{2max}) and ventilatory threshold (VT) in NCAA division 1 athletes.

**METHODS:** Over 2 years, 254 collegiate Division I varsity athletes from multiple sports (17-23 years old) performed incremental maximal exercise testing to determine VO_{2max} and VT. On the day of testing, participants reported sleep duration for the prior night and the average sleep duration for the prior month. Acute:chronic sleep was calculated as the ratio of prior night to prior month sleep duration (<8 hours or ≥8 hours/night) as well as acute:chronic (<1, ≥1). VO_{2max} and VT were compared between groups using independent t-tests. Separate linear mixed effect models were used to evaluate the relationship between acute and chronic sleep on VO_{2max} and VT, while adjusting for age and individual repeated measures.

**RESULTS:** Athletes who slept >8 hours the night before the test had significantly higher VO_{2max} than those who slept <8 hours (53±5.1 v 51±1.6 ml/kg/min, p<0.02). Athletes who slept more than usual before the test (acute:chronic ≥1) had higher VO_{2max} (53±5.9 v 50±8.6 ml/kg/min, p=0.01) and VT (43±1.5 v 39±4.7 ml/kg/min, p=0.01) than those who slept less than usual. In the multivariable models, prior night sleep duration was predictive of VO_{2max} (1.0±0.31, p<0.01) and VT (0.9±0.13±p<0.01). In the 200 bootstrap resamples, the area under the ROC curve for VO_{2max} and VT, both of which are important predictors of athletic performance. In addition to the well-known and wide-ranging physical and mental benefits of sleep, interventions to increase sleep duration among elite athletes may improve endurance performance, and would support the NCAA’s mission to promote the well-being and lifelong success of college athletes.

**Conclusions:** Among collegiate NCAA Division 1 athletes, increased sleep duration was associated with significantly greater VO_{2max} and VT, both of which are important predictors of athletic performance. In addition to the well-known and wide-ranging physical and mental benefits of sleep, interventions to increase sleep duration among elite athletes may improve endurance performance, and would support the NCAA’s mission to promote the well-being and lifelong success of college athletes.

**D-15**

Free Communication/Slide - Exercise Training, Intensity and Fitness

**Chair:** Rachel A. Tinias. Western Kentucky University, Bowling Green, KY.

(No relevant relationships reported)

**May 28 1:30 PM - 3:30 PM**

**Room:** CC-3014

**May 28 1:30 PM - 1:45 PM**

**S873**

**Muscular Strength Cut-points For Detection Of Type 2 Diabetes Risk In Apparently Healthy Adults**

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(No relevant relationships reported)

In the early stages of type 2 diabetes, patients are often asymptomatic. More screening tools are needed for early detection of diabetic injuries in this increasing patient population. Low muscular strength is associated with increased diabetes risk, and use of handgrip dynamometers to determine normalized grip strength (NGS) may serve as a cost-effective diabetes screening tool for clinical and community settings. **PURPOSE:** To establish sex- and age-specific NGS cut-points for estimating diabetes risk in apparently healthy adults.

**METHODS:** Publicly available National Health and Nutrition Examination Survey 2011-2012 and 2013-2014 data were used, and informed consent was obtained from all participants. Those aged 20-80 years who were free of underlying health conditions such as stroke, cardiovascular diseases, and cancer were retained (n=4,451 participants; 67.9% aged 20-50 years; young males, n=1609, mean age=33.39 [95% CI=32.5, 34.3] years; young females, n=1412, mean age=33.27 [95% CI=32.3, 34.2] years). Grip strength was assessed using a handgrip dynamometer, and normalized by adjusting for body mass. Risk for diabetes was determined using the American Diabetes Association diagnostic criteria. A logistic regression for survey data controlling for sociodemographic, anthropometric, and lifestyle covariates was used to determine NGS cut-points.

**RESULTS:** NGS was a significant predictor for diabetes (p=0.0472), and the established cut-points for estimating diabetes risk was 0.76 (young men), 0.59 (young women), 0.62 (older men), and 0.47 (older women). When comparing estimated rates and actual diabetes risk, the risk percentages reported for all subgroups were similar. The risk percentages included 1.59 [95% CI=0.76, 2.42] (young men), 2.58 [95% CI=1.64, 3.53] (young women), 3.01 [95% CI=0.44, 5.57] (older men) and 2.03 [95% CI=0.34, 3.73] (older women).

**Conclusions:** NGS cut-points presented in this study may be a useful screening tool for estimating diabetes risk in apparently healthy adults, and these cut-points could be implemented in community and clinical settings for early diabetes detection.
maximum for squat, deadlift and overhead press were totaled (CFT) to serve as training outcomes. Daily HRV was measured upon waking via a smartphone photoplethysmography application throughout. RESULTS: VO\textsubscript{2max} increased in two HRV response profiles while CFT increased occurred regardless of profile. There was a main effect for time in CFT (p <.05) but not for VO\textsubscript{2max} (p >.05). There was a significant inverse relationship between ΔHRV and ΔVO\textsubscript{2max} (r = -.46, p <.05). No significant relationships between baseline HRV and ΔVO\textsubscript{2max} (r = -.02, p >.05) or ΔACV (r = -.03, p >.05) were identified. The relationship scatterplot between ΔACV and ΔVO\textsubscript{2max} was used to classify participants into four unique HRV profiles, ΔACV (mean difference = -8.2, ±0.05, p <.05). No significant difference was found for ACFT between HRV profiles (p >.05); all HRV profiles significantly increased CFT (mean difference = -32.8, ±6.97, p <.05).

CONCLUSION: Improving multiple training outcomes is desired in HIFT, so a HRV\textsubscript{2max} profile may indicate a decline in VO\textsubscript{2max}. Thus, training should be altered to optimize aerobic adaptations.

1867 May 28 2:15 PM - 2:30 PM
Effects Of Amount, Intensity, And Mode Of Exercise Training On HOMA - The Strride Clinical Trials
Cris A. Slentz1, Leanna M. Ross1, Joseph A. Houmard, FACSM2, William E. Kraus, FACSM3, 1Duke Univ, Durham, NC. 2East Carolina University, Greenville, NC. (Sponsor: William E. Kraus, FACSM)

Purpose: To examine the effects of amount, intensity, and mode of exercise training on HOMA (a marker of fasting insulin resistance) across 10 exercise-only interventions from the three STRRIDE (Studies of Targeted Risk Reduction Interventions through Defined Exercise) clinical trials. Methods: A total of 518 subjects completed the three trials with pre and post intervention HOMA values. Subjects with dyslipidemia [STRRIDE I (n=224) and STRRIDE AT/RT (n=144)] or prediabetes [STRRIDE-PD (n=150)] were randomized to either control group or one of 10 interventions, ranging from doses of 8-22 kcal/kg week (KKW); intensities of 50-75% VO\textsubscript{2max} and durations of 6-9 months. Two groups included resistance training and one group included diet intervention (weight loss of 7%). Fasting blood samples were obtained at baseline and 16-24 hours after the final exercise bout. Paired t-tests determined within group change score significance (p<0.05).

RESULTS: In the inactive controls, HOMA increased significantly —became more insulin resistant. After training, all intervention groups became more insulin sensitive; 6 of these 10 groups had significant improvements in HOMA. In non-statistical comparisons across the trials, the diet + exercise group had the greatest improvement (ΔHOMA = -1.90 ± 0.9); resistance training alone experienced the least improvement in HOMA. Conclusion: This study characterized the role of non-metabolic expired carbon dioxide (nm-VCO\textsubscript{2}) in the relationship between recovery and performance fatigability (PF). Methods: Twenty adults (men, n=9, age=44.7±13.9 years; women, n=11, age=50.3±11.1 years) completed peak cardiopulmonary exercise tests (CPET) and submaximal constant work rate tests (CWRT) on the cycle ergometer on separate days before and after a vigorous, 4-week aerobic exercise training (AET) regimen. Each test was followed by a 10-minute passive recovery and endurance test at 70% of peak watts attained during CPET. PF was indexed by endurance test duration following both peak CPET (End1) and CWRT (End2), peak CPET time (pk-Time) and watts (pk-Watts). Metabolic indices were total VO\textsubscript{2} (VCO\textsubscript{2}), metabolic VCO\textsubscript{2}, mm-VCO\textsubscript{2}, and recovery VO\textsubscript{2} and recovery VCO\textsubscript{2} (off-kinetcs response indices (ORI). Data were analyzed using paired t-tests and comparisons and correlated before and after AET.

RESULTS: Significant improvements in recovery and PF measures were observed after AET, along with significant increases in VCO\textsubscript{2} and mm-VCO\textsubscript{2}. No significant change in m-VCO\textsubscript{2} was observed.

1868 May 28 2:30 PM - 2:45 PM
Non-metabolic VCO\textsubscript{2} Recovery Off-kinetcs, And Performance Fatigability Following Chronic Exercise
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Purpose: This study characterized the role of non-metabolic expired carbon dioxide (nm-VCO\textsubscript{2}) in the relationship between recovery and performance fatigability (PF). Methods: Twenty adults (men, n=9, age=44.7±13.9 years; women, n=11, age=50.3±11.1 years) completed peak cardiopulmonary exercise tests (CPET) and submaximal constant work rate tests (CWRT) on the cycle ergometer on separate days before and after a vigorous, 4-week aerobic exercise training (AET) regimen. Each test was followed by a 10-minute passive recovery and endurance test at 70% of peak watts attained during CPET. PF was indexed by endurance test duration following both peak CPET (End1) and CWRT (End2), peak CPET time (pk-Time) and watts (pk-Watts). Metabolic indices were total VO\textsubscript{2} (VCO\textsubscript{2}), metabolic VCO\textsubscript{2}, mm-VCO\textsubscript{2}, and recovery VO\textsubscript{2} and recovery VCO\textsubscript{2} (off-kinetcs response indices (ORI). Data were analyzed using paired t-tests and comparisons and correlated before and after AET.

RESULTS: Significant improvements in recovery and PF measures were observed after AET, along with significant increases in VCO\textsubscript{2} and mm-VCO\textsubscript{2}. No significant change in m-VCO\textsubscript{2} was observed.

1869 May 28 2:45 PM - 3:00 PM
Non-exercise Equations For Determining Change In Cardiorespiratory Fitness
Simrat Soni, Louise de Lannoy, Robert Ross, FACSM, Queen’s University, Kingston, ON, Canada. (No relevant relationships reported)

CRF is a strong and independent predictor of morbidity and all-cause mortality beyond traditional risk factors. However, CRF is not routinely measured in clinical settings where cost, time, training, and discomfort on behalf of the patient have all been cited as barriers to routine integration. An alternative to measuring CRF is to estimate it using a non-exercise CRF equation. It is currently unknown whether eCRF can be used to estimate change in mCRF following the adoption of regular exercise. Purpose: To determine whether change in estimated cardiorespiratory fitness (eCRF) is associated with change in measured CRF (mCRF) independent of exercise amount and intensity over 24 weeks. Methods: Participants were 163 sedentary adults with abdominal obesity (waist circumference: mean 109.9 (SD; 11.5) cm) randomly assigned to: i) no-exercise control (n=42), ii) low-amount, low-intensity exercise (LALI; n=39), iii) high-amount, low-intensity exercise (HALI; n=51), iv) high-amount, high-intensity exercise (HAHI; n=31). mCRF was measured using a maximal treadmill test at baseline, 8, 16 and 24 weeks. eCRF was calculated using a published non-exercise equation with the following variables: sex, age, waist circumference, resting heart rate, self-selected physical activity. Results: Participants attended 115 of 120 exercise sessions prescribed (96.0 (4.0) % adherence). eCRF change from baseline to 8, 16 and 24 weeks was not different from mCRF change for control, LALI or HALI (P=0.03). In HAHI, eCRF change was significantly greater than mCRF change at all time points (P<0.001). Change in mCRF and eCRF at 24 weeks were separated into tertiles to determine whether there were systematic differences between the two measures. Tertile scores revealed that for LALI and HALI, eCRF change significantly overestimated the lowest mCRF tertile (P<0.001) and underestimated the highest mCRF tertile (P=0.003). For HAHI, eCRF change overestimated mCRF within both the lowest and middle tertile (P=0.005). Conclusion: eCRF change was associated with mCRF change at 24 weeks independent of exercise amount but not intensity. Systematic variation between eCRF.
Typical procedures for measuring blood lactate involve either finger stick blood samples or venous blood draws. The literature is equivocal regarding whether sweat lactate values change with exercise intensity. Recently, wearable technology devices have been developed to measure sweat lactate. PURPOSE: To examine the relationship between sweat lactate and blood lactate values during incremental exercise. METHODS: This study consisted of 12 (8 male, 4 female) healthy recreationally active individuals (VO2 peak 35.5 ± 7.6 mL/kg/min) between the ages of 18 and 25 (22 ± 2 y) who volunteered for the study. Participants performed an exercise test on a cycle ergometer to volitional fatigue to determine blood lactate, lactate threshold, VO2 peak, and peak heart rate (HR). Blood lactate was collected via finger stick at each 3-min stage of exercise. Participants performed a subsequent exercise session at 40, 60, and 80% heart rate reserve (HRR). During the 20-min stages of this test, blood and sweat lactate were collected during each intensity level. Sweat lactate was collected in a sweat “pouch” at each state of exercise. Sweat lactate samples were analyzed via the lactate oxidase method on a Chemwell 2910 chemistry analyzer. Blood lactate samples were analyzed using a Lactate Plus analyzer. Whole body sweat rate was calculated from pre- and post-exercise body weight at each intensity, factoring in water consumed and urine voided. RESULTS: Sweat rate increased with increasing intensity (40%: 9.66 ± 7.58; 60%: 16.80 ± 12.51; 80%: 24.32 ± 15.44 mL/min). Sweat lactate significantly differed between 60 and 80% intensities (15.66 ± 5.73, 12.52 ± 4.44 mmol/L, respectively), P = 0.03. Blood lactate levels at 40, 60, and 80% intensities were 2.67 ± 1.15, 3.60 ± 1.90, and 4.83 ± 1.52, respectively (P < 0.001). CONCLUSIONS: These findings agree with Buono, Lee, & Miller, 2010 who found sweat lactate decreases as sweat rate increases. It is likely that sweat lactate decreases with increasing exercise intensity due to dilution as sweat rate increases. From this data, it appears that sweat lactate does not demonstrate a relationship with blood lactate that warrants replacing blood lactate in exercise testing with sweat lactate. This may be due to the lactate in sweat originating from eccrine glands and thus is not reflective of muscle metabolism.
1874  May 28 1:45 PM - 2:00 PM
High Compared To Standard Essential Amino Acid Intakes Enhance Whole-Body Protein Balance During Energy Deficit
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BACKGROUND: The effects of energy deficit on postabsorptive, postprandial, and post-resistance exercise muscle protein synthesis are generally well described. However, few studies have assessed whole-body protein turnover responses to energy deficit and concomitant protein feeding after exercise, particularly after ingesting varying amounts of essential amino acids (EAA). Assessing the post-exercise whole-body protein kinetic response to EAA feeding during energy deficit may provide a critical indication of the potential protein requirements needed to prevent disruptions in whole-body protein balance induced by the metabolic stress of underfeeding.

PURPOSE: Determine the effects of consuming varying EAA intakes on integrated whole-body protein turnover during energy deficit.

METHODS: Nineteen males (mean ± SD; 23 ± 5 y; 25.4 ± 2.7 kg/m²) were assessed in random order, either 4.3 ± 0.0 g or 8.6 ± 0.0 g EAA, separated by 7 d. In BAL, measures were determined in 8 healthy adults (mean ± SD; 22.9 ± 5 y; 25.4 ± 2.7 kg/m²), ingesting either 7.8 ± 0.9 or 23.5 ± 2.6 g EAA, separated by a 14d washout. Whole-body protein turnover during energy deficit was determined in 8 healthy adults (mean ± SD; 21.4 ± 2 y, 24.6 ± 3.2 kg/m²), ingesting in random order, either 4.3 ± 0.0 g or 8.6 ± 0.0 g EAA, separated by 7 d. In DEF, measures followed 5 days of controlled energy deficit (30 ± 4%) separated by a 14d washout. Whole-body protein synthesis (PS), breakdown (PB), and net protein balance (NET) were determined in 8 healthy adults (mean ± SD; 23 ± 5 y; 77±4kg; 14±3% body fat; mean±SD) or post-resistance exercise (EX-FED; n=8; 22.5±2y; 78±10kg; 13±5% body fat) condition. Participants consumed a mixed carbohydrate (0.75g/kg body weight) complete amino acid (0.25g/kg) beverage, enriched to 5% with L-[1-13C]leucine, which is primarily metabolized within skeletal muscle.

RESULTS: PS was markedly elevated in BAL (12.9±0.0 vs. 8.0±0.0; P<0.05) and DEF (12.9±0.5 vs. 8.0±0.0; P<0.05), but not different in PB or NET. Significant metabolic differences were observed during the postabsorptive, resting period and the postprandial, post-resistance exercise period. RESULTS: In BAL, mean ± SD, 23.5±2.7 kg/m²) resulted in marked differences in peripheral concentrations; yet the anabolic stimulus was similar. The reduction in postprandial MPS during DEF, despite ingesting 2-3 times the amount of EAA compared to BAL, suggests that muscle is not the primary target for the greater rise in peripheral EAA. Supported by USAMRDC; authors’ views not official U.S. Army or DoD policy.

CONCLUSION: These data demonstrate that higher EAA intake enhances net protein balance in response to the combined stress of exercise and energy deficit, largely by attenuating protein breakdown, suggesting higher protein meals are necessary to support whole-body protein balance during the metabolic stress of underfeeding.

1875  May 28 2:00 PM - 2:15 PM
Energy Deficit Attenuates Muscle Protein Synthetic Responses To Essential Amino Acids
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BACKGROUND: Peripheral essential amino acid (EAA) concentrations regulate muscle protein synthesis (MPS). During energy balance, consuming ~9 g EAA doubles whole-body protein turnover during energy deficit. During energy balance, consuming ~9 g EAA doubles the stimulation of MPS during energy balance and deficit.

PURPOSE: Determine the effects of peripheral increases in EAA concentrations and MPS during energy balance and deficit.

METHODS: Sixteen healthy, recreationally active males (23±1yrs) underwent 7-days of unilateral knee immobilisation, with (LEU; n=8) or without (PLA; n=8) thrice daily leucine supplementation (15g/d). Strength and compartmental tissue composition were assessed prior to and following immobilisation.

RESULTS: Leg fat-free mass was reduced in the IMB leg following immobilisation (-3.6±0.5%; P<0.05) in both the LEU and PLA conditions (P>0.05), with no such alterations noted in the CTL leg (0.6±0.5%; P>0.05). Isometric knee extensor strength declined following immobilisation (P<0.01), with a greater (P<0.05) and equivocal decline in the IMB (27±9±3±4%) vs. CTL (14±3±4%) leg in both the LEU and PLA group (P>0.05). Following immobilisation, type II fibre cross sectional area was significantly lower in the IMB vs. CTL limb (5561±49±657 vs. 6319±9±412 μm²; P<0.05) but not type I fibre cross sectional area (4805±324±3 μm²; 5424±5±323±6 μm²; P>0.05), with no differences between treatment groups (P>0.05).

CONCLUSION: Leucine supplementation, even at a high-dose (15g/d), does not appear to attenuate declines in leg fat-free mass, strength, muscle morphology or post-resistance exercise muscle protein synthesis following 7-days of unilateral knee immobilisation.


Dietary amino acids that are not oxidized are retained in the body to support net protein anabolism, which is important for individuals aiming to maintain or enhance lean body mass. There are limited methodologies with which to measure protein anabolism noninvasively in response to physiological stimuli (e.g. single meal feeding and exercise), which represents a challenge for research in vulnerable populations.

PURPOSE: To determine the efficacy of a novel, noninvasive stable isotope ‘breath test’ to measure differences in anabolism in response to a physiological anabolic stimulus. METHODS: Fifteen healthy men were randomized to a rested (FED; n=7; 23±5y; 77±8kg; 14±3% body fat; mean±SD) or post-exercise stimulus (EX-FED; n=8; 22.5±2y; 78±10kg; 13±5% body fat) condition. Participants consumed a mixed carbohydrate (0.75g/kg body weight) complete amino acid (0.25g/kg) beverage, enriched to 5% with L-[1-13C]leucine, which is primarily metabolized within skeletal muscle.

RESULTS: Peak EAA concentrations were 36% higher in DEF compared to BAL (22.9±470 vs. 1634±320 μmol/L; P<0.05), but for the low doses. Peak EAA concentrations were higher (p<0.05) in HIGH doses for both energy states compared to LOW doses. Independent of EAA dose, postprandial MPS for BAL (0.78±0.36 %/h) and DEF (0.58±0.15 %/h) were 81% and 26% greater than postabsorptive MPS for BAL (0.43±0.18 %/h) and DEF (0.46±0.24 %/h), respectively (energy-by-fed state, p<0.05). Postprandial MPS was 25% lower in DEF than BAL (energy-by-state, P<0.05).

CONCLUSION: Ingesting roughly triple the dose of EAA in DEF than BAL (23.5 g vs. 8.6 g) resulted in marked differences in peripheral concentrations; yet the anabolic stimulus was similar. The reduction in postprandial MPS during DEF, despite ingesting 2-3 times the amount of EAA compared to BAL, suggests that muscle is not the primary target for the greater rise in peripheral EAA. Supported by USAMRDC; authors’ views not official U.S. Army or DoD policy.

Unavoidable periods of physical inactivity (i.e. illness/injury) lead to muscle atrophy and functional declines, which likely stem from alterations in both anabolic signaling processes and oxidative metabolism. Preventing such declines is important to reduce the risk of re-injury and preserve musculoskeletal health across the lifespan.

PURPOSE: To determine the effectiveness of high-dose leucine supplementation to preserve muscle mass, strength, and morphology following 7-days of unilateral knee immobilisation.

METHODS: Sixteen healthy, recreationally active males (23±1yrs) underwent 7-days of unilateral knee immobilisation, with (LEU; n=8) or without (PLA; n=8) thrice daily leucine supplementation (15g/d). Strength and compartmental tissue composition were assessed prior to and following immobilisation. Muscle biopsy samples were immediately following immobilisation were used to determine muscle fibre morphology as well as key indicators of mitochondrial function between the control (CTL) and immobilised (IMB) limbs.

RESULTS: Leg fat-free mass was reduced in the IMB limb following immobilisation (-3.6±0.5%; P<0.05) in both the LEU and PLA conditions (P>0.05), with no such alterations noted in the CTL leg (0.6±0.5%; P>0.05). Isometric knee extensor strength declined following immobilisation (P<0.01), with a greater (P<0.05) and equivocal decline in the IMB (27±9±3±4%) vs. CTL (14±3±4%) leg in both the LEU and PLA group (P>0.05). Following immobilisation, type II fibre cross sectional area was significantly lower in the IMB vs. CTL limb (5561±49±657 vs. 6319±9±412 μm²; P<0.05) but not type I fibre cross sectional area (4805±324±3 μm²; 5424±5±323±6 μm²; P>0.05), with no differences between treatment groups (P>0.05). A significant Group*Leg interaction was identified for mitochondrial complex I phosphorylating respiration (P>0.05). However, post-hoc analysis revealed no differences in Pi in the IMB vs. CTL limb in either the PLA (FC=1±0±0±0.19, P=0.06) or LEU (FC=0.83±0.27; P=0.87) group.

CONCLUSION: Leucine supplementation, even at a high-dose (15g/d), does not appear to attenuate declines in leg fat-free mass, strength, muscle morphology or post-resistance exercise muscle protein synthesis following 7-days of unilateral knee immobilisation.
Acute muscle contraction exercise (RE) is associated with acute increased protein synthesis while repeated resistance training (RT) increases muscle growth. Although the molecular events that initiate these events are well described there is a lack of knowledge concerning the involvement of skeletal muscle metabolic pathways in the adaptive response towards RT. Yet, skeletal muscle metabolic studies have not addressed differences in the metabolic signature between acute RE and repeated loading of skeletal muscle by RT. PURPOSE: To determine myofiber diameter and the skeletal muscle metabolism after acute and prolonged RE in humans.

METHODS: 7 male subjects (Age: 24±4 years; Height: 180±8 cm; Weight: 81±10 kg) conducted 13 RE sessions over 5 weeks. Muscle biopsies from vastus lateralis muscle were taken at rest (Rest), 45 min after the first and the last (13th) RE session. Muscle protein enrichment analysis is ongoing to determine the extent to which these whole-body outcomes reflect those within skeletal muscle. Further validation will enhance the applicability of this new technique to a variety of populations experiencing growth (e.g. children) and/or atrophy (e.g. clinical populations).

CONCLUSIONS: Sustained physical activity levels in older individuals and regular structured exercise may diminish age-related mTORC1 desensitisation of skeletal muscle in response to AA ingestion in cultured myotubes.
**Pulmonary Embolism - Rowing**

**Missouri Orthopedic Institute, Columbia, MO.**  
**Rugby Research and Injury Prevention Group, Hospital for Special Surgery, New York, NY.**  
**Pennsylvania State University, Schuylkill, PA.**  
**University of Connecticut, Storrs, CT.**  
**Sports Medicine Institute, Hospital for Special Surgery, New York, NY.**  
**Rugby Research and Injury Prevention Group, Inc, Hospital for Special Surgery, New York, NY.**  
**(Sponsor: Niallah Coleman, MD, FACSM)**

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**No relevant relationships reported**

**HISTORY:** A 17-year-old male club rower sustained a chest injury 2-3 weeks post-season. He presented with shortness of breath (SOB), sharp chest pain and coughing up blood. Campus urgent care sent him to a Trauma 1 ED. He was admitted, had labs drawn and a chest CT. No significant medical history. He did note over the past year, episodic lower leg/foot muscle cramping and lower back pain, exacerbated with rowing. Three-months post initial event, patient presented again coughing up blood. He self-ambulated to a local ED, was admitted and observed for 3-days.

**PHYSICAL EXAM:** Urgent care examination revealed young male with SOB and hemothypsis with need for higher care evaluation. ED exam revealed, Helt ported stabilized young slut male with SOB, hemothypsis and chest pain. He was tachypneic/bradycardic, RR=28, O2=84% room air, HR=124, BP=118/89. Chest auscultation unredeemable. No thigh or calf swelling. No tenderness on palpation of lower extremities.


**TREATMENT AND OUTCOMES:** 1. Emergency. Urgent care IV resuscitation for right lower lobe PE. No new PE.  
2. Serial blood work, noting elevated BUN, creatinine and stage 2 AKI, with decrease post IVF, urinalysis reflected of dehydration, and monitoring.

**No relevant relationships reported**

**Acute Kidney Injury From Heat Illness - Rugby Union**  
**(7-players-a-side)**

**Rugby Research and Injury Prevention Group, Inc., Hospital for Special Surgery, New York, NY.**  
**Rugby Research and Injury Prevention Group, Inc, Hospital for Special Surgery, New York, NY.**  
**Oregon Health & Science University, Portland State University School of Public Health, Portland, OR.**  
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**Pennsylvania State University, Schuylkill, PA.**  
**Sports Medicine Institute, Hospital for Special Surgery, New York, NY.**  
**(Sponsor: Niallah Coleman, MD, FACSM)**

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**No relevant relationships reported**

**HISTORY:** A 30-year-old men’s club Division I Rugby-7s winger sustained abdominal cramping and profuse sweating at tournament end. Player reported these symptoms from exertional demands of the sport. Player noted his hydration throughout the tournament (Local Temp<91°F) with water and electrolyte supplementation with “sports drinks.” Diet included fruits, candy, and meats during tournament. Player denies difficulty urinating, yet described urine to be dark in color. No significant medical history, but noted comparable cramping events that occurred approximately 2½ months prior, as well as 2-years ago with no medical intervention. Eight National Championship tournament matches (each match lasted 14 minutes) later he advised the team doctor.

**PHYSICAL EXAM:** Examination post tournament, reflected profuse diaphoresis and abdominal muscle cramping at end of tournament. Patient transferred to local ED, where exam revealed an alert player in no acute distress, mild Temp=98.3°F, BP=136/89, Pulse=66, PO2=98, cool to touch and mildly diaphoretic. Player had generalized abdominal muscle cramping. No lower or upper extremity muscle presentation. Blood was drawn and urine collected. Post-IV infusion patient noted cessation of abdominal cramping and tolerated peroral ingestion. Repeated blood labs.

**DIFFERENTIAL DIAGNOSIS:** 1. Acute kidney injury 2. Exertional rhabdomyolysis 3. Heat illness

**TEST AND RESULTS:** Urinalysis: Yellow, + protein, +bilirubin, +ketones, +RBC’s, +UA crystals. Preliminary Blood test: BUN=29, creatinine =2.3, AST=42 and CK=1581

**FINAL WORKING DIAGNOSIS:** Acute kidney injury (Stage 2) with rhabdomyolysis 2ndry to Heat Exhaustion.

**TREATMENT AND OUTCOMES:** 1. Emergency. Immediate removal from play to avoid progression and transfer to ED for rapid IV bolus.

2. Serial blood work, noting elevated BUN, creatinine and CK of stage 2 AKI, with decrease post IVF, urinalysis reflected of dehydration, and monitoring.

3. Discharged to self-care and advised to return if necessary, to ED with complaints of fever, inability to urinate, back pain, discolored/blood in urine, or other new symptoms.

4. Returned to sport 3-weeks post-injury with no sequelae and able to meet the demands of his sport.

**Acute Kidney Injury From Heat Illness - Rugby Union**  
**(7-players-a-side)**

**Rugby Research and Injury Prevention Group, Inc., Hospital for Special Surgery, New York, NY.**  
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**No relevant relationships reported**

**HISTORY:** A 14-year-old high school student presented to Orthopedics Urgent Care for right arm numbness and discoloration. Four days prior had noticed that her right arm would turn a dusky purple or blue color from the shoulder to her fingers with associated numbness and tingling in the entire arm. Episodes lasted only a few seconds to a minute. She would have multiple episodes a day. No specific pattern or time of day, however she thinks it may occur more frequently while wearing a backpack or if her arm is in an elevated position. Episodes resolve on their own. ROS otherwise negative.

**PHYSICAL EXAMINATION:** Right upper extremity without dusky appearance, appears similar to left upper extremity. Full ROM and strength at the shoulder, elbow, wrist, and fingers. Decreased sensation in the ulnar distribution of the right hand compared to the left. Strong radial pulse when right hand is lowered. Positive Adson for loss of radial pulse, positive Roos for numbness and tingling.

**DIFFERENTIAL DIAGNOSIS:** 1. Right upper extremity DVT 2. Thoracic outlet syndrome 3. Pancost tumor

**TEST AND RESULTS:** Right upper extremity venous ultrasound normal. Right upper extremity arterial ultrasound with normal triphasic arterial waveforms with arm at patient’s side and at 90 degrees abducted in the subclavian, axillary, brachial, radial, and ulnar arteries. With arm raised above patient’s head, abnormal monophasic waveform in the right subclavian artery.

**FINAL WORKING DIAGNOSIS:** Arterial thoracic outlet syndrome.

**TREATMENT AND OUTCOMES:** 1. Referred to pediatric vascular surgery.

2. Was referred to physical therapy, will follow up in 6 months.

**HISTORY:** 19-year-old female DI field hockey player with PMH of fainting episodes presented to the training room after having a syncopal episode at the end of a game over the weekend and again at practice the day prior to presentation. In both cases, she described having no warning before suddenly passing out. Both events were witnessed by her ATC who described her being unconscious for one minute, and then having horizontal nystagmus and a pulse of 100-130 bpm once conscious. She described previous syncopal episodes at the end of games, with no warning before passing out. However, the second event occurred on a cool cloudy day during practice. Denied any recent upper respiratory illnesses or alcohol intake.

**PHYSICAL EXAMINATION:** Alert, oriented to person, place and time. Blood pressure: 110/72, heart rate: 120, RR: 18, O2 saturations: 100% room air.

**DIFFERENTIAL DIAGNOSIS:** 1. Vasovagal syncpe 2. Syncope due to dehydration 3. Syncope due to anemia 4. Syncope due to hypoglycemia 5. Syncope due to cardiac arrhythmia

**PHYSICAL EXAMINATION:** Finger pulse examination revealed decreased distal pulses. Fundus examination revealed normal retinal arteries. Peripheral pulses were normal. 

**FINAL WORKING DIAGNOSIS:** Vasovagal syncope.

**TREATMENT AND OUTCOMES:** 1. Patient instructed to drink more fluids during times of increased activity. 2. Referred to family medicine for further evaluation.

**No relevant relationships reported**
Knee Arthroscopy, ACL reconstruction with bone-patellar tendon-bone autograft, loose body in the suprapatellar pouch. 19 days after the injury, patient underwent Left fracture of the posterior medial tibial plateau and lateral femoral condyle, and a small

**HISTORY**: A 20 year old male collegiate rugby athlete suffered a noncontact left lower extremity injury during practice. An MRI was obtained and showed a complete tear of the ACL, central free edge tear of the lateral meniscal body, subchondral fracture of the posterior medial tibia plateau and lateral femoral condyle, and a small loose body in the suprapatellar pouch. 19 days after the injury, patient underwent Left Knee Arthroscopy, ACL reconstruction with bone-patellar tendon-bone autograft, lateral meniscus repair, and loose body removal. Patient was discharged home on the same day after being successfully weaned off general anesthesia without difficulty. On post-op day number 1, he presented for initial physical therapy session and admitted to restrosternal chest pain with deep inspiration. He was referred to the Emergency Room.

**PHYSICAL EXAMINATION**: Pulse Ox: 98% on room air, BP 158/93, HR 80, Temp 36.7 °C, RR 20 General: No acute distress, well appearing Cardiac: Regular Rate and rhythm, no murmurs, rubs, or gallop Chest: No tenderness with Palpation of chest wall, lungs clear to auscultation bilaterally, no wheezes, cracks, or rhonchi Lower Extremity: No pitting edema, no calf tenderness, no erythema, no warmth, Negative Homan’s, incisions clean, dry, and intact, neurovascularly intact

**DIFFERENTIAL DIAGNOSIS**:
- 1. Pulmonary Embolism 2. Pneumonia with Pleurisy

**TEST AND RESULTS**: Portable CXR: Faint Parenchymal infiltrate right pulmonary. CT without contrast: Soft tissue calcified lesion medial to the patient's small Baker's cyst secondary to prior trauma. CT knee and CXR. CXR normal.

**TREATMENT AND OUTCOMES**: Symptomatic treatment, quit smoking, weight loss.


**PHYSICAL EXAMINATION**: BMI 38, vitals stable. Knee Exam: No malalignment, bruising, erythema, or obvious swelling; gait normal. Full AROM without pain; + patellar j sign; + patellar crepitus; 5/5 strength without pain; Neurovascularly intact. Negative patellar apprehension; equivocal patellar inhibition. positive patellar grind bilaterally. Full AROM. Negative bounce test, McMurray. Minimal tenderness of medial joint line. Palpable, firm 4cm mass in the right popliteal fossa that is mildly tender to palpation. No overlying skin changes. No ligamentous instability, calf pain, swelling, tenderness, warmth, erythema. Negative Homan’s sign.

**DIFFERENTIAL DIAGNOSIS**:
- Synovial/baker’s cyst, ganglionic cyst, meniscal cyst, DVT, aneurysm, muscular deformity, soft tissue mass

**TEST AND RESULTS**:
- 2-view knee x-ray: ill-defined soft tissue sclerosis in the postemiodial right knee which could be a bone forming soft-tissue tumor, Moderate bilateral tricompartmental knee OA.
- Knee MRIt: Round, lobular mass measuring 3 x 3 x 3.6 cm adjacent to the distal semimenibransous myotendinous junction. Central ossification and a thin rim of peripheral enhancement. A bone forming tumor, benign or malignant, is a possibility.
- Bone tumor surgeon notified and patient seen. Felt unrelated to symptoms and likely secondary to prior trauma. CT knee and CXR. CXR normal.
- CT without contrast: Soft tissue calcified lesion medial to the patient’s small Baker’s cyst partially surrounds the semimembranous tendon. Tissue sampling is recommended to exclude a matrix forming neoplasm. Knee OA.
- Sarcoma Tumor Board: benign; treat underlying knee pain.

**TREATMENT**: Symptomatic treatment, quit smoking, weight loss.

**OUTCOME**: Asymptomatic at 2-months

**D-18 Clinical Case Slide - Running II**

**Thursday, May 28, 2020, 1:30 PM - 3:30 PM**

**Room**: CC-2016

**1888**

**Chair**: Kevin R. Vincent, FACSM. University of Florida, Gainesville, FL.

**Discussant**: Emily Kraus. Stanford Hospital and Clinics, Woodside, CA.

**1891**

**Discussant**: Hallie Labrador. NorthShore University HealthSystem, Gurnee, IL.

**1892**

**Anterior Knee Pain In A Runner**

Keri L. Denay, FACSM, Vivek Kalia. University of Michigan Medical School, Ann Arbor, MI.

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**HISTORY**: 40 yo F runner with bilateral, right, anterior, aching, intermittent, 3-10/10 knee pain. Wakes at night. Worse with going down stairs, running, fast walking. Better with rest and ibuprofen. ROS negative. PMHx: DVT, PE, depression, endometriosis, sleep apnea. PSXh: C-section, IVC filter. Meds: ibuprofen prn, citalopram, fluticasone nasal spray, Coumadin. FHx: DVT in father. SocHx: +tobacco, no alcohol or drug use; desk job; recreational runner. No recent immobilization/long travel.

**PHYSICAL EXAMINATION**: BMI 38, vitals stable. Knee Exam: No malalignment, bruising, erythema, or obvious swelling; gait normal. Full AROM without pain; + patellar j sign; + patellar crepitus; 5/5 strength without pain; Neurovascularly intact. Negative patellar apprehension; equivocal patellar inhibition. positive patellar grind bilaterally. Full AROM. Negative bounce test, McMurray. Minimal tenderness of medial joint line. Palpable, firm 4cm mass in the right popliteal fossa that is mildly tender to palpation. No overlying skin changes. No ligamentous instability, calf pain, swelling, tenderness, warmth, erythema. Negative Homan’s sign.

**DIFFERENTIAL DIAGNOSIS**:
- Synovial/baker’s cyst, ganglionic cyst, meniscal cyst, DVT, aneurysm, muscular deformity, soft tissue mass

**TEST AND RESULTS**:
- 2-view knee x-ray: ill-defined soft tissue sclerosis in the postemiodial right knee which could be a bone forming soft-tissue tumor, Moderate bilateral tricompartmental knee OA.
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- Bone tumor surgeon notified and patient seen. Felt unrelated to symptoms and likely secondary to prior trauma. CT knee and CXR. CXR normal.
- CT without contrast: Soft tissue calcified lesion medial to the patient’s small Baker’s cyst partially surrounds the semimembranous tendon. Tissue sampling is recommended to exclude a matrix forming neoplasm. Knee OA.
- Sarcoma Tumor Board: benign; treat underlying knee pain.

**TREATMENT**: Symptomatic treatment, quit smoking, weight loss.

**OUTCOME**: Asymptomatic at 2-months
improved her symptoms. She denied weakness, paresthesias, night pain, pain with lying on her left side, or mechanical symptoms. She hoped to run in the Boston Marathon, which was 13 days after her initial visit.

PHYSICAL EXAMINATION

Patient was tender to palpation over the gluteal musculature and greater trochanteric region however this was not her typical pain. Hip range of motion and strength were full. Resisted hip abduction was painful. Stinchfield reproduced posterior buttock pain. Log roll, lateral scuf, FABER, FADIR, and ischiofemoral impingement maneuvers were negative. Reflexes and sensation were intact.

DIFFERENTIAL DIAGNOSIS

1. Greater trochanteric pain syndrome
2. Femoral acetabular impingement
3. Myofascial pain
4. Piriformis syndrome
5. Stress fracture

TESTS AND RESULTS


Femur MRI: Periostial edema along the medial proximal femoral shaft with periostial thickening and trace underlying bone marrow edema.

FINAL WORKING DIAGNOSIS

Adductor insertion avulsion syndrome (thigh splints)

TREATMENT AND OUTCOMES

1. Partial weight-bearing with crutches with progression to full weight-bearing over two weeks as pain with walking improved.
2. Physical therapy with a return to running program and running analysis.
3. Discussed the risks of stress fracture or complete fracture if continued to run.
4. Patient ran in the Boston Marathon and finished in just over four hours.

HISTORY: A 24-year-old female recreational runner with a past medical history of ADHD on Vyvanse presented to clinic for worsening left forefoot pain and great-toe numbness without antecedent trauma. She also noted blue color changes to the great toe. She presented on crutches due to an inability to bear weight on the forefoot.

PHYSICAL EXAMINATION: On inspection of the ankle and foot, there was a bluish-hue to the great toe; no swelling was evident in the foot. She was most tender over the plantar second and third metatarsal heads. Range of motion and strength were preserved. PT pulses were symmetric bilaterally, DP pulses were difficult to appreciate. The foot was cool to the touch with hyperalgesia.

DIFFERENTIAL DIAGNOSIS

1. Vasospastic disease
2. Arterial embolization
3. Myopathy
4. Plica syndrome
5. Osteosarcoma

TEST AND RESULTS

CT Guided Biopsy

• Mildly heterogeneous mass with peripherally located enhancement

Knee Radiographs

• Osteosarcoma

• Plica syndrome

• MCL strain

• Distal adductor tendinopathy

DIFFERENTIAL DIAGNOSIS

• Distal adductor tendinopathy
• Femoral epicondyle stress fracture
• MCL strain
• Plica syndrome
• Osteosarcoma

TEST AND RESULTS:

Knee Radiographs

• Small eccentric lytic lesion in the distal right femoral diaphysis medially with a thin rim of peripheral sclerosis and faint rim of T1 hyperintensity

Femur MRI

• Small eccentric lytic lesion in the distal right femoral diaphysis medially with a thin rim of peripheral sclerosis and faint rim of T1 hyperintensity

Knee MRI

• Thinning of the lateral femoral cortex without definitive cortical breakthrough

• Moderate surrounding marrow and periosteal edema

• Mildly heterogeneous mass with peripherally located enhancement

CT Guided Biopsy

• Pathology positive for Langerhans cell histiocytosis

FINAL WORKING DIAGNOSIS:

• Langerhans cell histiocytosis

TREATMENT AND OUTCOMES:

• Extended intralesional curettage for gross total resection with synthetic bone graft
• Discharged home the next day with weight bearing as tolerated, walker and Aspirin 325mg BID for 4 days for DVT prophylaxis
• Recovery complicated by soleal DVT and hematoma requiring aspiration
• 6 week post-op started full weight bearing and nonathletic activities
• 4 month follow up with stable x-rays, pain free and cleared to resume full activities
• Plan for one year follow up with repeat radiographs and baseline MRI

HISTORY: A 18-year-old high school female cross-country runner presented with one week of left anterior hip pain. Denied a specific injury. Pain started during a late season...
meet causing her to finish at a slower pace. Pain progressively worsened requiring crutches to ambulate, despite no further activity. Max mileage was 40 miles/week, had tapered to 20 miles/week prior to injury. History of stress fracture 4 years prior. Initial x-ray of left hip revealed open epiphyseal plates, no other osseous abnormalities. Inquiring about menstrual history, she had yet to reach menarche. Per the patient’s mother, she had been trialed on growth hormone and is currently on estradiol patches. She has a known eating disorder for which she is not actively receiving help, despite multiple hospitalizations. PMHx Primary amenorrhea, followed by endocrinology. Lab work revealed low estradiol, LH, FSH with high alkaline phosphatase. Normal labs were thyroid studies, BMP, LFT, vitamin D and prolactin. Genetics showed 46XX. Multiple XR for bone age showed that of an 11-year-old. Cardiac work up showed sinus bradycardia on EKG and normal echo. Brain/pituitary MRI revealed normal pituitary and mild enlargement of ventricles, sulci, cerebellar folia. PHYSICAL EXAMINATION Patient stands 55 inches tall, weighing 61 pounds with a BMI of 14. She appears much younger than stated age. Hair is full, though fine. Breast tissue is not appreciated. On left hip exam, there is TTP along flexor tendon, lateral hip, and piriformis. She has pain with external rotation, weakness and pain with hip flexion, abduction, and adduction against resistance. She is unable to do a single leg hop due to groin pain. She is neurovascularly intact. DIFFERENTIAL DIAGNOSIS 1. Femoral neck stress fracture 2. Primary amenorrhea 3. Hip flexor strain 4. Relative Energy Deficiency in Sports syndrome 5. ASIS avulsion fracture TESTS/RESULTS MRI left hip1. Partial thickness tear at attachment of left iliosposus tendon to lesser trochanter with intramuscular hematoma 2. Minimal partial thickness tear of the left common hamstrings and hamstring 2. RED-S TREATMENT/OUTCOMES 1. Shut down from all activities 2. Weightbearing as tolerated 3. Referral to gynecology for transvaginal ultrasound 4. Referral to Eating Recovery Center

HISTORY: 17yo F cross-country runner with hx of 2 bone stress injuries (BSI) of L femoral neck, presents with continued deep anterior L hip pain since 4/2019. No back or radicular pain. Initial BSI (11/2018) was inferomedial femoral neck and was treated with limiting impact activities & PT. Second BSI (4/2019) was supralateral femoral neck. Training volume was at that time was only 35-40 mi/wk. No disordered eating or restrictions. Adequate calcium intake from dietary sources. Taking calcium 8.9 mg/mL. DEXA: Total body less head Z-score = Total body less head -0.9. L hip: Normal. TSH, CMP, Mg, Phos, & Ca. Celiac screen negative. FT3 3.8 pg/mL. DEXA: Total body less head Z-score = Total body less head -0.9. L hip XR. Normal. MRI 9/2019 - grade 2 femoral neck BSI w/o significant change compared to MRI obtained 5 weeks prior. FINAL DIAGNOSIS: Inferomedial femoral neck (Grade 2 BSI) with delayed healing TREATMENT/OUTCOMES: 1. NWB x 4 wks and then partial WB 2. No impact activities 3. PT 4. Bone stimulator 5. Ortho consult re: surgical intervention 6. Repeat imaging to monitor healing 7. Sports psych consult, initiated by mom & pt 8. Nutrition counseling to assess for underfueling.

PHYSICAL EXAMINATION: On examination of his right shoulder there is slight fullness appreciated over the deltoid head and got hit in the anterior aspect of his right shoulder by an opponent’s helmet. Initially he couldn’t even raise his arm up. He states that his motion has mildly improved but continues to have pain and points anterior and lateral when describing his pain. Denies significant swelling, bruising, paralysis, or paresthesias, or previous injuries to his shoulder. Pain is 4/10. Describes it as a shooting type pain worse with movement and better with ice and holding his arm still. No feelings of instability.

DIFFERENTIAL DIAGNOSIS: - Subacromial Impingement - Rotator Cuff Tear - Scapular Fracture TEST AND RESULTS: AP external rotation and axillary views were obtained which showed lucency over the base of the coracoid process consistent with fracture.

FINAL WORKING DIAGNOSIS: Fracture of the base of the right coracoid process TREATMENT AND OUTCOMES: 1. Placed in a shoulder sling and was instructed to not do any lifting with that arm. 2. Seen 2 weeks later with significant improvement in pain and was able to move arm with still some mild discomfort over the anterior shoulder. 3. Followed up 6 weeks post injury and had no pain with range of motion and had symmetrical strength. 4. Blue TheraBand with Joe’s exercises started and was allowed back to play in a graded RTP fashion with follow up as needed.

HISTORY: A 29-year-old male CrossFit and surfing instructor with a history of left ulnar shaft fracture treated nonoperatively presented with a 9 month duration of chronic, intermittent, left, sharp and burning elbow pain since injuring himself while weight lifting. Bicep flexion and thumb rotation caused pain radiating to the elbow. He endorsed numbness of the left hand that led to an ER visit 9 months ago. His tingling

Abstracts were prepared by the authors and printed as submitted.
resolved prior to our visit and he denied shoulder or neck pain. He has been seen previously by a Hand Specialist, was offered a steroid injection, and presented to us for further evaluation.

PHYSICAL EXAMINATION: The patient exhibited no obvious atrophy of the forearm, but trace atrophy at the left medial triceps. He had full flexion and extension equal bilaterally, with slightly decreased supination on the left as compared to the right side. He was tender to palpation over the distal biceps, but nontender in the antecubital fossa. There was mild crepitus with resisted supination and pronation on the lateral epicondylar region. Radial head was minimally tender to palpation. He had elbow pain with resisted elbow flexion in neutral and supination more so than pronation. No skin changes were appreciated and no obvious elbow effusion. Distal neurovascular exam was grossly intact.

DIFFERENTIAL DIAGNOSIS:
1. Distal biceps tear
2. Bicipitoradial bursitis
3. Ulnar shaft fracture
4. Radial head fracture
5. Osteochondritis dissecans of the capitulum

TEST AND RESULTS: Elbow MR arthrogram (obtained 3 weeks ago) demonstrated a very small partial thickness tear of the ulnar collateral ligament, minimal radial cartilage loss, and a partial thickness tear of the distal biceps with prominent bicipitoradial bursitis.

FINAL/WORKING DIAGNOSIS:
Left partial thickness distal biceps tear AND associated bicipitoradial bursitis

TREATMENT AND OUTCOMES:
1. Patient elected to avoid steroid injections and pursue conservative management involving physical therapy and topical NSAIDs
2. Pain continued intermittently. Further work up 1 year later included CT elbow showing mild left ulnolhumeral joint osteoarthritis with small osseous joint loose bodies and healed proximal left ulna shaft and coronoid process fractures
3. Elbow pain may be subsequent to malalignment from an old Monteggia fracture

1903 May 28 2:10 PM - 2:30 PM Left Elbow Pain In An Elite Basketball Player
Ryan Robin1, Elena J. Jelsing2, Nancy M. Cummings1. 1 Mayo Clinic, Rochester, MN. 2 Mayo Clinic, Minneapolis, MN.

HISTORY: A 32 year old, right handed, female professional basketball player presented two weeks following injury to the left elbow. Her history is significant for various lower extremity musculoskeletal injuries but no previous elbow or shoulder complaints. She presented two weeks following an in-game injury, in which she was “tied up” with another player and felt a hyperextension and valgus movement at the elbow. She felt immediate pain at the medial elbow. Initially there were paresthesias in the ulnar distribution but these resolved shortly. She continued playing through the discomfort for two weeks.

PHYSICAL EXAMINATION: On inspection, there was a trace effusion about the left elbow. There was tenderness to palpation over the flexor pronator mass, medial epicondyle, and sublime tubercle. Extension lacked 5 degrees of range of motion. Flexion was normal at 130 degrees. Strength testing was normal, although there was pain with resisted wrist flexion and pronation. There was no pain with wrist or finger extension or elbow supination. A moving valgus stress test reproduced pain. There was no obvious laxity. Timel’s test over the ulnar nerve was negative.

DIFFERENTIAL DIAGNOSIS:
1. Medial epicondylitis
2. Ulnar collateral ligament sprain or tear
3. Ulnar neuropathy
4. Valgus extension overload syndrome

TEST AND RESULTS: Left elbow X-ray: Unremarkable; Left elbow ultrasound:

1904 May 28 2:30 PM - 2:50 PM Pediatric Elbow Pain - Baseball
Marcus I. Ng. North Shore University Hospital, Manhasset, NY.

HISTORY: A 12-year-old RHD developed sudden onset right elbow pain after pitching in a game in the Dominican Republic. He did not have any associated numbness, tingling, or weakness of the affected extremity. Patient states that he plays primarily as pitcher for his team, and had a sudden sharp pain with a “pop.” During the baseball season, patient plays 3 games a week, usually all on the same day. He estimates that he throws at least 100 pitches per game, including warm-up pitches, but is not completely sure because his coaches do not keep strict pitch counts.

PHYSICAL EXAMINATION:
Right elbows without gross deformities, no ecchymosis or crepitus. There is TTP of the medial epicondyle with none in lateral epicondyle, olecranon process, RC joint, or flexor/extensor insertions. Pain with resisted flexion and pronation. Elbow ROM 20-110 degrees, with supination and pronation of 80 degrees. Milking test was positive. Moving valgus stress test was positive, though no varus or valgus laxity appreciated. Sensation was grossly intact to touch along median, ulnar, radial, and axillary distribution. 2+ radial and brachial pulse. Strength was full.

DIFFERENTIAL DIAGNOSIS:
1. Medial epicondylitis
2. Fracture of medial epicondyle
3. UCL injury / Little League Elbow Syndrome

TREATMENT AND OUTCOMES:
3 views of the right elbow:
— Widening of the medial apophysis to 4.5mm.
— Small osseous fragment at the inferior aspect of the right medial epicondyle apophysis compatible with avulsion injury.

FINAL/WORKING DIAGNOSIS:
Avulsion fracture of the medial epicondyle with apophysitis

TREATMENT AND OUTCOMES:
1. Immobilization with forearm sugar tong splint for 1 week.
2. Patient returned to Dominican Republic and was placed in long-arm cast by his doctor for 4 weeks.
3. Cast removed 6 weeks after injury with no pain elicited on exam. Repeat XR of the elbow showed near resolution of apophyseal widening and healed avulsion fracture.
4. Started PT with emphasis on ROM and joint stabilization with graduated progression to overhead thrower’s program.
5. Re-evaluated after 6 weeks of PT with no pain even with overhead throwing. Patient cleared to return to regular baseball activity with strict adherence to pitch count restrictions per Andrews Institute.
The use of commercially accessible activity monitors has increased over the past few years. Assessing the accuracy of these devices is necessary to inform recreational consumers about the validity of these products. PURPOSE: To assess the validity of four activity monitors (Monitor 1, Monitor 2, Monitor 3, Monitor 4) for determining heart rate (HR) during incremental treadmill exercise using ECG as the criterion. METHODS: Twenty-one subjects (13 men, 9 women; 35.8 ± 6.3 yr, 146.7 ± 7.5 % body fat, VO2max: 55.5 ± 0.49 ml kg⁻¹ min⁻¹) performed a Bruce treadmill protocol graded exercise test. HR was recorded at rest and at the end of each minute with the Mi-o Alpha PDM device and ECG simultaneously. HR was compared between methods across the entire testing session (rest and exercise values) and separately for each exercise test stage using paired-samples t-tests and the Bonferroni correction. Validity coefficients were determined using the Pearson correlation. RESULTS: HR across the entire intensity range (rest to maximal exercise) showed a significant correlation between methods (r = 0.97, p < 0.001) and was similar between ECG and Mi-o after the Bonferroni correction was applied, requiring p < 0.008 (overall mean HR: ECG = 124 ± 39 b min⁻¹, Mi-o = 132 ± 37 b min⁻¹, t₁₅₋₂₀₅₉ = -2.504, p = 0.013). Significant correlations were observed at rest and each exercise test stage, with r values ranging from 0.67 to 0.96 (all p < 0.001). HR was similar between Monitor 1 and Monitor 3 was consistent; Monitor 2 was the least accurate of tested devices. However, results of this study demonstrate inaccurate assessment of EE by all wearable devices. None of the activity monitors met the correlation standard of 0.7. Future research should continue to assess the validity of these devices to provide accurate information on various modalities and exercise intensities to recreational consumers.
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No relevant relationships reported

Accelerometers are objective monitors that can be used to estimate energy expenditure (EE) during steady state exercise. However, high intensity interval training (HIIT) has received increasing attention because of its similar benefits to longer duration, steady state, less intense exercise. The accuracy of accelerometer-estimated EE during HIIT has yet to be examined. PURPOSE: The purpose of this study was to discern the differences between criterion-measured EE and accelerometer-estimated EE (kCals) during a HIIT session. METHODS: Nine participants (mean age=20.4 yrs, Body Mass Index=24.7 kg/m², males=8), completed a preliminary session, to determine treadmill speed at 95% HR max, and a HIIT session within 2 weeks of each other. For the HIIT session, each participant wore an ActiGraph GT3X+ accelerometer on their right hip while EE was measured using portable indirect calorimetry (Oxycon Mobile). The HIIT session comprised of 5 bouts: each bout included a 45-second exercise event and 90-second rest event. Data analysis was conducted using custom R scripts and paired T-tests to determine significant differences between criterion measure and accelerometer estimates of EE during the HIIT session. RESULTS: On average, the accelerometer underestimated total EE (92.76±0.33 kCals) compared with the criterion measure for the entire HIIT session by 15% (p=0.0507). During exercise events, accelerometer estimated EE (8.99±1.99 kCals) was greater than criterion measured EE (7.10±1.82 kCals; p=0.001). During rest events, accelerometer estimated EE (9.56±2.86 kCals) was less than criterion measured EE (14.64±2.81; p=0.001). CONCLUSION: Compared with the criterion measure of indirect calorimetry, the accelerometer underestimated total EE for the HIIT session due to the underestimation of EE during rest events. Future studies should further investigate the accelerometer’s underestimation in larger more diverse samples to develop an algorithm that better predicts total EE during interval training.

1912

Estimates Of Exercise Energy Expenditure From Two Optical Heart Rate Bands

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No relevant relationships reported

Introduction: There are many watches on the market today that use optical sensors to measure heart rate (HR) in order to estimate exercise energy expenditure (EE/E). It has been shown that wrist movements can interfere with the HR measurements obtained from these watch based sensors which in turn may alter EE/E estimates. The Polar OH1 (OH1) and the Wahoo TICKR FIT (TICKR) eliminate interference by using an elastic armband to hold the sensor in place on the either the forearm or just below the elbow. PURPOSE: The purpose of the study was to compare the EE/E values from the OH1 and the TICKR to actual EE/E as measured by indirect calorimetry (IDC) during specific bouts of exercise.

METHODS: Eleven females and 9 males (26.1±7.0 and 23.8±3.2 yrs old, respectively) were fitted with each armband. The sensors were placed on the forearms according to the manufacturer instructions. The exercise bouts consisted of 5 min walking stages (3.5 mph at 0% and 5% grade) and 5 min running stages (5.5 mph at 0% and 5% grade). There was a 3 min of rest between each bout. Actual EE/E was measured via IDC.

RESULTS: There were no significant differences between devices during the walking stage at 0% grade. There were significant differences between devices for the walk with 5% grade, with the OH1 overestimating compared to the TICKR and IDC (11.2±3.6 and 11.7±3.4 kcal, respectively). There were significant differences between devices for the run at 0% grade, with the OH1 overestimating compared to the TICKR and IDC (14.6±4.0 and 16.2±3.9 kcal, respectively). There were significant differences between devices for the run at 5% grade compared to the TICKR and IDC (18.3±3.8 and 15.0±3.7 kcal, respectively).

CONCLUSIONS: The Polar OH1 overestimates EE/E as exercise intensity increases when compared to IDC. The EE/E estimates from the Wahoo TICKR FIT are similar to EE/E as measured by IDC at all intensity levels. Caution should be used when tracking EE/E when using the OH1 at higher exercise intensities.

1913

Validation Of Two Wearable Chest Straps For Heart Rate Monitoring During Mountain Biking

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No relevant relationships reported

The Suunto chest strap claims to “monitor [HR] with precision” and “send accurate [HR] information to your compatible Suunto [product]”. Previous research has shown the HR feature of the Suunto to be valid during running. However, there appears to be little, if any, research determining whether the Suunto is a valid measure of HR during mountain biking. PURPOSE: This study aimed to determine the validity of the HR feature of the Suunto chest strap during mountain biking activity as compared to the criterion, the Polar H7. METHODS: Sixteen apparently healthy volunteers (males = 8, females = 8, 24.69 ± 4.44 yrs, 171.45 ± 8.9 cm, 74.23 ± 21.07 kg) rode mountain bikes on a beginner-level mountain biking trail at the McCullough Hills Trailhead in Henderson, NV. Participants concurrently wore both HR monitors on the chest while biking one mile away from the trailhead and one mile to return to the trailhead. The Polar H7 and Suunto second-by-second HR data were compared using mean absolute percent error (MAPE), a Bland-Altman analysis with limits of agreement (LoA), and an intra-class correlation (ICC). Prior to testing, the benchmark for validity was established as a MAPE = 10% and an ICC > 0.7 (p < 0.05), with the lower limit of the ICC 95% confidence interval (CI) set at < 0.7. RESULTS: The upper and lower LoA were -15.89 and 13.08, respectively. The MAPE value from the Suunto produced a forecast of 3.944. The Suunto demonstrated an ICC = 0.973 (95% CI = 0.972, 0.974, p < 0.001). CONCLUSIONS: The data indicate that there is a good level of agreement between the Polar H7 and the Suunto, suggesting that the Suunto is a valid measurement of HR during mountain biking.

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Generational Differences Of Consumer Wearable Devices For Estimating Physical Activity Outcomes

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No relevant relationships reported

Consumer activity monitors (CAMs) are commonly validated for estimating physical activity outcomes [e.g. energy expenditure (EE)] when a new model is released. It is unclear if this is a needed practice and if prediction algorithms change when a new device generation is released. PURPOSE: To compare step and EE estimates for different generations of wrist-worn CAMs from the same manufacturer [Apple Watch Series 2 (AW2) and 4 (AW4), Fitbit Charge 2 (FC2) and 3 (FC3), and Garmin Vivosport (VT) and Vivosport 4 (VF4)]. Methods: Nineteen participants (mean±SD: age, 25.1±5.0 y) completed seven structured activities (six min each) that ranged from sedentary to vigorous intensities. Each participant wore four CAMs (two different models on the same brand each on wrist) and a Cosmed K5 for measured EE. The devices were randomized by combination (e.g. Fitbit-Garmin), placement (proximal vs. distal), and side (left vs. right). Total EE was obtained for the entire activity protocol, including transitions (average total time, 48 min). The primary analysis included the comparison of the estimates of steps and EE between generations within a brand. A secondary analysis included comparing the EE estimates from each device against the K5. Paired t-tests were used to compare steps and EE between different generations within a brand. Repeated measures ANOVAs were used to compared estimated gross EE from devices and measured EE from the K5. RESULTS: There was no significant placement effect (proximal versus distal), thus, data from both placement locations was pooled together for each device for analysis. Table 1 shows the overall findings. Conclusion: It is not recommended to interchange EE estimates from different CAM brand generations. However, the step estimates had an acceptable level of (≤5%) and could be interchanged across CAM generations. Future studies should explore if the observed differences are due to changes in hardware or software between generations.
Genetic Predictors of Performance Across the Globe

Thursday, May 28, 2020, 3:45 PM - 5:45 PM
Room: CC-2000

Chair: Brian A. Irving, FACSM. Louisiana State University, Baton Rouge, LA.

(No relevant relationships reported)

Based on the single nucleotide polymorphism (SNP) of elite power performance athletes, combined with other related phenotype indicators, models for predicting and identifying the power performance of Chinese elite athletes was established, and the models were visualized by the method of nomogram.

PURPOSE: To explore the relationship between power performance and SNP of Chinese elite athletes and to create polygenic models for predicting and identifying elite power performance.

METHODS: 103 elite athletes (age=24.3±3.2 years; height=174.9±8.4 cm; body mass=66.3±14.0 kg; body mass index (BMI)=21.5±3.4) were included in the study. The best standing long jump (SLJ) and standing vertical jump (SVJ) were used to represent the power performance. It can be applied quickly and visually by using the method of nomogram. Two models can be both used in adolescent athletes to predict the development potential of power performance and the identifying one can be used in elite athletes to distinguish and evaluate power athletic status. It can be applied quickly and visually by using the method of nomogram.

RESULTS: There were no significant differences in the MCT1 genotype and allele frequency between Asian climbers and controls (genotype: p=0.192, allele frequency: p=0.073). The frequency of the T allele tended to be higher in boulderers than in Asian climbers and European climbers, respectively. The frequency of the T allele tended to be higher in lead climbers among the Asian climbers and European climbers, respectively.

CONCLUSIONS: Our results suggest that climbers have a greater frequency of the T allele in Asian and European individuals, respectively. The MCT1 genotype is associated with climbing status in European individuals, and the same trend is observed in Asian climbers. We need a greater sample size to confirm the association between gene polymorphisms and athletic status in climbers.
significantly associated with lower VO2max and insulin sensitivity even while intervention, resp. (p=.011, p=.016; pre- and post-intervention). African-American fat percentage (p=.047, p=.047; pre- and post-intervention resp.). African-American (33% vs. 68%, p<0.001). In Caucasians, CMV serostatus was not associated with impaired aerobic capacity pre (2.39 ± 0.67 L/min; CMV seropositive vs CMV seronegative) and CMV seropositive status was associated with impaired aerobic capacity pre (2.39 ± 0.67 L/min vs 1.84 ± 0.77 L/min; p=.020; CMV seropositive vs CMV seronegative) and post-intervention (2.44 ± 0.75 L/min vs 3.03 ± 0.91 L/min; p=.028). Significant effects of CMV serostatus persisted after controlling for age, sex, body weight, and body fat percentage (p=.047, p=.047; pre- and post-intervention resp.). African-American CMV seropositive participants also had higher insulin responses to an IVGTT both pre (1971.64 ± 1177.31 min. U/mL vs 849.16 ± 456.67 min. U/mL; p=.014) and post-intervention (1873.88 ± 1212.65 min. U/mL vs 909.18 ± 432.38 min. U/mL; p=.038). CMV serostatus still had significant effects on insulin sensitivity after controlling for age, sex, and aerobic capacity (p=.011, p=.016; pre- and post-intervention, resp.).

CONCLUSIONS: In sedentary African American adults, CMV serostatus is significantly associated with lower VO2max and insulin sensitivity even while controlling for variables known to mediate fitness and glucose sensitivity, and the associations persisted after exposure to 20 weeks of a standardized exercise program. We conclude that CMV status is another personal characteristic that needs to be taken into account in the assessment of cardiorespiratory fitness and insulin sensitivity in this population.

Naturally found in some meats, carnosine is a physico-chemical buffering agent that has been shown to have positive effects on high intensity exercises. Because carnosine is readily degraded by highly active carnosinase enzymes, it has been postulated that only individuals with a low carnosinase activity and protein content could show the presence of carnosine in plasma (carnosinemia), which may be beneficial for athletes engaged in high intensity activities. Of note, two carnosinases have been identified: the naturally found in some meats, carnosine is a physico-chemical buffering agent that has been shown to have positive effects on high intensity exercises. Because carnosine is readily degraded by highly active carnosinase enzymes, it has been postulated that only individuals with a low carnosinase activity and protein content could show the presence of carnosine in plasma (carnosinemia), which may be beneficial for athletes engaged in high intensity activities. Of note, two carnosinases have been identified: the serum carnosinase (CNDP1) and the tissue carnosinase (CNDP2).

PURPOSE: Explore whether the presence of polymorphisms in the CNDP1 and CNDP2 genes is associated with the personal best time of Brazilian sprinters.

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(A no relevant relationships reported)

A total 12 survey respondents (14.6%) were completed online and 7 of 12 (58.3%) of the individuals completed the semi structured interviews. Data analysis using content analysis

**PURPOSE:** Exercise based prehabilitation (EBPP) for people with non-small cell lung cancer (NSCLC) can reduce postoperative complications, however the four-week intervention period may negatively affect tumour growth, condition deterioration and programme adherence. It is unclear whether shorter 7-day EBPP can improve fitness to reduce postoperative complications. Therefore, the aim was to determine whether 7-day EBPP can increase six-minute walk distance (6MWD), improve peak expiratory flow (PEF) and improve postoperative outcomes. **METHOD:** Electronic databases (PubMed, Scopus, Medline, Web of Science and Cochrane Library) were systematically searched. Reference lists of relevant papers were also searched. Study selection was performed independently in a non-blinded manner. Only randomised controlled trials (RCTs) were included, with people with NSCLC undergoing 7-day EBPP, including at least one of pre- to post-EBPP change in 6MWD or PEF and at least one of: pulmonary complications (PC), length of stay (LoS) or length of antibiotic use. Review Manager was used to analyse risk of bias (RoB), risk ratio (RR) and mean difference (MD). **RESULTS:** 6 studies, with 346 participants, were included and presented a high RoB. Reporting of exercise performed, progression and adherence were limited. All studies used combined leg and arm ergometry aerobic training for 15-30 minutes, at a perceived exertion of "somewhat hard", 1-2 times daily. One study implemented resistance training. All studies included respiratory muscle training (20 min or 12-30 breaths). Pooled data suggested that compared to standard care, 7-day EBPP significantly increased 6MWD (20.6 m; 95% CI: 13.6 to 27.6; p<0.00001) and PEF (20.8 L·min⁻¹; 95% CI: 15.5 to 26.0; p<0.0001) in three studies and significantly reduced LoS (2.7 days; 95% CI: -3.6 to -1.1; p<0.0001) in four studies, significantly reduced the risk of developing PC (RR 0.39; 95% CI: 0.25 to 0.62; p<0.0001) in all studies and significantly reduced antibiotic use (1.2 days; 95% CI: -2.1 to 0.3; p<0.01) in two studies. **CONCLUSION:** Low quality evidence suggests that 7-day EBPP may significantly increase 6MWD & PEF and significantly reduce PPC, LoS & antibiotic use. Future RCTs should apply greater methodological quality and record and report details of their intervention.

**PURPOSE:** The Alberta Cancer Exercise (ACE) study is a 5-year study evaluating the benefit from, and implementation of, an Alberta wide clinic-to-community-based cancer and exercise model of care. The ACE program uses an integrated knowledge translation approach engaging survivors and clinicians as active participants in the research project. Shared decision-making is used to adapt the ACE program to the local context and tailor programming to meet the needs of survivors within specific tumor groups. **METHOD:** To demonstrate how an integrated knowledge translation approach can identify the need for tailored exercise programming to optimize adherence and outcomes. **RESULTS:** The results of 52 patients with brain tumours enrolled in ACE from January 2017 to March 2019 were explored. Survivor and clinician feedback was obtained to inform strategies to optimize adherence and completion outcomes. **CONCLUSIONS:** An integrated knowledge translation approach was used to identify strategies to improve study completion, exercise adherence and survivor outcomes. A sub-study is currently underway to evaluate the benefit of early intervention, tailored exercise programming and flexible scheduling for survivors with brain tumors. Supported by: Alberta Innovates and Alberta Cancer Foundation

**PURPOSE:** Exercise is an effective strategy to enhance survivorship, quality of life and physical function in individuals with prostate cancer. However, the majority of men with prostate cancer are not sufficiently active. To assist in the adoption and maintenance of recommended exercise behaviours, the Prostate Cancer Supportive Care (PCSC) program implemented an exercise clinic using a standardized delivery protocol that included group education and individualized exercise counselling delivered by an exercise physiologist. **METHODS:** A retrospective chart review was performed on data collected from attendees of the Vancouver PCSC Program Exercise Clinic (version 2.0 protocol) from June 11 2018 to April 10 2019 at four appointments, namely education session, exercise clinic

**Board #3 May 28 3:45 PM - 5:45 PM Integrated Knowledge Translation To Inform Implementation Of Exercise Counselling And Referral Of Cancer Survivors**

Kirsten Suderman¹, Nicole Culos-Reed², Edith Pittuskín¹, Margaret McNeely¹. ¹University of Alberta, Edmonton, AB, Canada. ²University of Calgary, Calgary, AB, Canada. Email: kirsten.suderman@ualberta.ca (No relevant relationships reported)

There is limited evidence supporting successful implementation of exercise-programming for cancer survivors into cancer clinical care pathways. We designed and launched a five-year hybrid effectiveness and implementation study to evaluate the relative benefit from an Alberta wide clinic-to-community based cancer and exercise model of care - the Alberta Cancer Exercise (ACE) program, and to evaluate the implementation of ACE into clinical cancer care. **PURPOSE:** To determine Health Care Providers’ (HCPs) perceptions of key barriers, enablers, and programming for tailoring exercise counselling and referral of survivors to ACE at the Cross Cancer Institute (CCI), Edmonton, Alberta, and to test the feasibility of an in-clinic, HCP-informed implementation工具. **METHODS:** Stage I: A theory-informed electronic questionaire was distributed to HCPs at the CCI, of which N=47 responded (Aug-Oct 2017). A subsequent focus group (N=7 May 2018) of CCI HCPs was held to probe into questionaire findings and to determine actionable strategies. Stage II: Responses were mapped to the Capability Opportunity Motivation Behavior model. Tools were developed to specifically target the needs of HCPs in the head and neck cancer (HNC) tumor group. Tool packages were distributed to HCPs (N=9) for in-clinic use for 4 weeks, corresponding to ACE recruitment for Spring programming (March-April 2019). **RESULTS:** Across all disciplines, only 17% of HCPs reported performing exercise counselling with survivors. The most common HCP identified barrier to exercise counselling was time, followed by a lack of knowledge regarding appropriate exercise. The most common facilitator was the ‘interdisciplinary team’, including access to physical therapy services. **CONCLUSIONS:** The implementation strategies were developed and involved an educational package and exercise screening algorithm that was distributed to HCPs. A total of N=14 HNC survivors were referred, representing more than double the average number of previous HNC referrals (N=6) per session. HCPs reported the implementation tools to be ‘somewhat’ to ‘very helpful’. **CONCLUSIONS:** HCP-identified implementation tools can enhance exercise-counselling and referral practices, and improve referral to community-based exercise programming.

**Board #4 May 28 3:45 PM - 5:45 PM Tailoring Exercise Programming To Optimize Recruitment, Adherence And Completion Among Survivors With Brain Tumours**

Ryan Alexander Spychka, Paula A. Opsina, Graeme M. Purdy, Jacob Easaw, Margaret L. McNeely. University of Alberta, Edmonton, AB, Canada. Email: spychka@ualberta.ca (No relevant relationships reported)

The Alberta Cancer Exercise (ACE) study is a 5-year study evaluating the benefit from, and implementation of, an Alberta wide clinic-to-community-based cancer and exercise model of care. The ACE program uses an integrated knowledge translation approach engaging survivors and clinicians as active participants in the research project. Shared decision-making is used to adapt the ACE program to the local context and tailor programming to meet the needs of survivors within specific tumor groups. **PURPOSE:** To demonstrate how an integrated knowledge translation approach can identify the need for tailored exercise programming to optimize adherence and outcomes. **RESULTS:** The results of 52 patients with brain tumours enrolled in ACE from January 2017 to March 2019 were explored. Survivor and clinician feedback was obtained to inform strategies to optimize adherence and completion outcomes. **CONCLUSIONS:** An integrated knowledge translation approach was used to identify strategies to improve study completion, exercise adherence and survivor outcomes. A sub-study is currently underway to evaluate the benefit of early intervention, tailored exercise programming and flexible scheduling for survivors with brain tumors. Supported by: Alberta Innovates and Alberta Cancer Foundation

**Board #5 May 28 3:45 PM - 5:45 PM Exercise Counselling To Promote Exercise Behaviour Change In Individuals With Prostate Cancer**

Sarah Weller¹, Celestia S. Higano¹, Guy E. Faulkner², Kristin L. Campbell, FACSM². ¹University of British Columbia, Vancouver, BC, Canada. ²University of Washington, Seattle, WA. (Sponsor: Kristin Campbell, FACSM) Email: sarah.weller@ubc.ca (No relevant relationships reported)
session 1 (in-person), exercise clinic session 2 (telephone follow-up) and exercise clinic session 3 (3-month in-person follow-up session). Feasibility was defined a priori as >60% attendance, >90% attrition, and >75% session timing, intervention delivery fidelity and intervention component fidelity. Self-reported aerobic and resistance exercise levels were evaluated at each session. RESULTS: A total of 34 individuals were evaluated. Feasibility targets were met for attendance (81%), attrition (19%), intervention fidelity (90%) and in-person session timing (90%). There was intervention component fidelity in 38 of 39 components. Weekly moderate-to-vigorous aerobic exercise levels increased at 3-months by 83±198 mins to a mean of 202.6±147.3 mins with a moderate effect (ES 0.54, 95% CI 0.30-0.78). Resistance exercise increased by 2.0±3.1 sessions to a mean of 3.2±2.9 sessions with a large effect (ES 0.77, 95% CI 0.3-1.3). CONCLUSION: This intervention was feasible to deliver to individuals with prostate cancer in a real-world clinical setting by exercise physiologists. The exercise counseling intervention elicited a moderate effect, showing improvements in aerobic and resistance exercise levels at 3-months. Future work should explore if this behaviour change can be sustained longer-term.

**1981 Board #6**  
**May 28 3:45 PM - 5:45 PM**  
**Community-based Exercise For Health Promotion And Secondary Cancer Prevention: A Hybrid Effectiveness-Implementation Study**  
Margaret L. McNeely1, Christopher Sellari2, Tanya Williamson2, Elaine Gobeil1, Anil Abraham Joy1, S Nicole Culos-Reed1, 1University of Alberta, Edmonton, AB, Canada. 2University of Calgary, Calgary, AB, Canada.  
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(No relevant relationships reported)

**PURPOSE:** Cancer care has expanded from a disease-focused, survival-oriented model to an approach that now considers how survivors can live well in the aftermath of intensive therapy. Research evidence supports the benefit of exercise during and following cancer treatments for cancer-related symptoms, physical fitness, and health-related quality of life. To move efficacy evidence into practice, we designed and launched the Alberta Cancer Exercise (ACE) program, a 5-year study to evaluate the relative benefit from implementing a clinic-to-community-based exercise and cancer care model of care.  

**METHODS:** A hybrid effectiveness and implementation trial design is evaluating the effectiveness of community-based exercise, and collecting data on implementation of the program. ACE opened in January 2017 and is now offered across seven cities (18 sites) in Alberta, Canada. Participants are adult survivors from all tumour groups and stages, at any time point since diagnosis, up to 3 years post treatment completion. Survivors take part in a minimum of 60 minutes of mild-to-vigorous intensity full body exercise twice weekly for a 12-week period. The primary effectiveness outcome is the proportion of participants meeting physical activity guidelines at 1-year follow-up. The Reach, Effectiveness, Adoption, Implementation and Maintenance (RE-AIM) framework is being used to capture individual-level and organizational-level impact of ACE.  

**RESULTS:** 1506 Albertan survivors have entered ACE and 1109 have completed the 12-week intervention. Completion rates for 12, 24 and 1-year follow-ups are 91%, 84% and 79% respectively. Post-intervention, statistically significant benefits were observed in SBP, DBP and self-reported fatigue. Weekly moderate-to-vigorous aerobic exercise levels increased at 3-months by 83±198 mins to a mean of 202.6±147.3 mins with a moderate effect (ES 0.54, 95% CI 0.30-0.78). Resistance exercise increased by 2.0±3.1 sessions to a mean of 3.2±2.9 sessions with a large effect (ES 0.77, 95% CI 0.3-1.3). CONCLUSION: This intervention was feasible to deliver to individuals with prostate cancer in a real-world clinical setting by exercise physiologists. The exercise counseling intervention elicited a moderate effect, showing improvements in aerobic and resistance exercise levels at 3-months. Future work should explore if this behaviour change can be sustained longer-term.

**1982 Board #7**  
**May 28 3:45 PM - 5:45 PM**  
**Community-based Exercise Programs For Cancer Survivors: Using The Consolidated Framework For Implementation Research To Identify Barriers And Facilitators To Program Implementation**  
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(No relevant relationships reported)

**PURPOSE:** Exercise is recommended as an intervention to reduce the side effects of cancer treatment both during treatment and beyond. New ACSM guidelines for cancer survivors have been recently published, alongside a recommendation for all oncology clinicians to “Ask, Advise and Refer” to appropriate exercise programs. Based on this, there is a need to understand how to best translate exercise oncology programs from research into community-based settings. The purpose of this scoping review is to describe the characteristics of existing exercise programs for cancer survivors conducted outside of a research laboratory (i.e., home- or community-based settings) mapped to a common implementation science framework in order to identify potential strategies for future implementation interventions.  

**METHODS:** A systematic search of published literature was conducted for exercise programs or interventions including individuals diagnosed with cancer either undergoing treatment or who have completed treatment in which participants exercise at home, or in a community-based setting. Data were extracted using the Oxford Implementation Index and coded under the five domains of the Consolidated Framework for Implementation Research.  

**RESULTS:** A total of 46 publications describing 30 individual programs from around the world were identified. Only 11 publications had the specific goal of reporting on program implementation and development. Most programs included both aerobic and resistance exercise, targeting either breast cancer survivors, or any cancer. A variety of intervention and individual characteristics were described. Reporting of implementation factors related to the inner and outer setting and implementation process were minimal. Partnerships with oncology clinicians appears to be a key facilitator to implementation success.  

**CONCLUSIONS:** This scoping review summarizes the implementation characteristics of existing programs that have been reported in the literature and can serve as a resource for those developing future community-based exercise oncology programs. Findings support the need for implementation science to inform best practices for program implementation.
T2D. However, in those with hypertension at baseline, both PRT and SHAM exercise were associated with clinically meaningful and significant reductions in ABP domains over 12 months. The mean difference of -8 mmHg in Awake SBP after 12 months of exercise in hypertensive individuals with T2D is particularly noteworthy. Extrapolating from meta-analyses of anti-hypertensive medication effects, a difference of this magnitude may be associated with major cardiovascular disease risk reduction.

**RESULTS**

Statistical analysis showed that the intervention groups had a lower percentage of individuals meeting the threshold for sarcopenia compared to the control group. The differences were statistically significant (P < 0.05) for both the PRT and SHAM exercise interventions.

**CONCLUSIONS**

The results suggest that regular exercise, specifically PRT and SHAM interventions, can effectively prevent sarcopenia in older adults. Further research with larger sample sizes and longer follow-up periods is recommended to validate these findings and explore the underlying mechanisms.
随机化，伴随血糖控制显著改善。

在临床队列中，6年后43%的成年人获得了持续的PRT，这一结果是值得注意的。

尽管两组均完成了最初6个月的完全监督下的力量训练，但没有显著的差异。

在自我报告数据的准确性（高估）为176%（95%置信区间120-232%）。

结果：

原始组和对照组被交叉到训练，但两组都没有在完全监督下进行锻炼。

结果：

在最初5年的随访期，HOMA2-IR，调整为总PA水平6年后，和糖尿病药物使用（p=0.23）。

虽然43%的原始对照组也报告了力量训练，但没有显著的变化。

尽管有显著的改变，对PA数据与LLPAQ数据的线性关联（r=0.323）。

在7个连续的日子里，24小时的PA数据可能有助于在60分钟或更长时间的久坐行为中观察到的个体。

积极相关性被观察到兴趣和活动的持续时间。

显著的负相关性被注意到在60分钟或更长时间的久坐行为中。

干预旨在打断久坐行为的持续时间。

尽管没有显著的改善，但在60分钟或更长时间的久坐行为中。

Positive correlations were observed between fatigue and number of hours spent in sitting bouts of >60 minutes (r=.349, p=0.034). There were no other significant correlations.

Positive correlations were observed between fatigue and number of hours spent in sitting bouts of >60 minutes (r=.356, p=0.015) and between BMI and number of hours spent in sitting bouts of >30 minutes (r=.349, p=0.034).

Positive correlations were noted between number of sitting bouts >60 minutes and sitting duration >5 minutes <10 minutes (r=0.375, p=0.010). Age negatively correlated with time spent sitting per day (r=-0.41, p<0.005).

Positive correlations were observed between fatigue and number of hours sitting bouts of 60 minutes or less (p=0.356, p=0.015) and between BMI and number of hours spent in sitting bouts of >60 minutes or less (r=0.249, p=0.034).

There were no other significant correlations.

CONCLUSION: Assisted living residents spend most of their time in prolonged bouts of sedentary behavior. Interventions aimed at breaking up bouts of sedentary behavior with light intensity stepping bouts may be useful in improving the overall sedentary profile and impact health benefits.

Supported by Research Creative Activity Award University of Michigan-Flint

Older adults in assisted living who engage in prolonged bouts of sedentary behavior and spend little time in physical activity are at risk for frailty, physical disablement and other health problems.

METHODS: To describe sedentary behavior and physical activity behaviors in assisted living residents and examine factors related to those behaviors.

METHODS: Sedentary behavior and physical activity were objectively measured for seven consecutive days, 24-hours a day, with a continuous-wear accelerometer taped to the participant’s thigh. Survey questionnaires were administered via one-on-one interviews and included measures of depression, social isolation, sleep disturbance, pain interference and fatigue. Data were analyzed with descriptive statistics and bivariate correlations.

RESULTS: Forty-six older adults (M/F=20/26) from 7 assisted living facilities participated (M=82.0 years, SD=10.95, BMI, M=29.4, SD=5.6). Approximately 20 hours/day (awake and sleeping) were spent in accumulated sedentary behavior (M=19.8 hours, SD=2.1, range 13.8-22.9). Mean sitting bouts/day of >30 minutes were 10.3 (SD=2.1). Mean sitting bouts/day of >60 minutes were 4.8 (SD=2.7). Less than one hour/day was spent in sitting activity (M=50.6 minutes, SD=29.0, range 13.1-179.7). Most sitting activity occurred during sitting bouts of one minute or less (M=38.2 minutes, SD=22.6). Three participants (6%) engaged in sitting bouts >10 minutes duration. Significant negative correlations were noted between number of sitting bouts >60 minutes and sitting duration >5 minutes <10 minutes (r=0.375, p=0.01) and between BMI and number of hours spent in sitting bouts of 60 minutes or less (r=0.349, p=0.034).

There were no other significant correlations.

CONCLUSION: Assisted living residents spend most of their time in prolonged bouts of sedentary behavior. Interventions aimed at breaking up bouts of sedentary behavior with light intensity stepping bouts may be useful in improving the overall sedentary profile and impact health benefits.

Supported by Research Creative Activity Award University of Michigan-Flint

2019年5月28日 3:45 PM - 5:45 PM

长期适应老化成人生活方式的物理活动数据

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(No relevant relationships reported)
Adaptations from heat acclimation (HA) have been suggested to alter physiological responses during a maximal exercise test in trained individuals. These responses include a decreased oxygen cost for a given workload (improved exercise economy), or an increase in the power output at which the ventilatory threshold (VT) occurs; both factors that predict endurance performance. However, these findings are inconsistent in the literature, particularly in untrained individuals, therefore the effects of HA on maximal exercise responses remain unclear. PURPOSE: To examine any differences in V\textsubscript{O\textsubscript{peak}}, peak power output (PPO), and VT pre- and post-HA in untrained individuals. METHODS: Thirty healthy men (mean ± SD: age = 21 ± 3 yr; ht: 172 ± 8 cm; wt: 76 ± 13 kg) participated in the study. Subjects completed two peak oxygen consumption tests (V\textsubscript{O\textsubscript{peak}}; on a cycle ergometer) that were separated by an 8-day exercise-HA protocol (treadmill walking: 5 km·hr\textsuperscript{-1}, 2% grade, in 40°C, 40% RH). The V\textsubscript{O\textsubscript{peak}} test workload started at 50-75 watts (W), and increased by 25 W every min until volitional exhaustion. Metabolic data were collected continuously over the course of the test. VT was determined using the ventilatory equivalence method (an increase in VE/VO\textsubscript{2} with no change in VE/CO\textsubscript{2}). The percent change in plasma volume (%ΔPV) was calculated from blood draws pre- and post-HA. A paired t-test was used to assess differences in physiological responses during the V\textsubscript{O\textsubscript{peak}} test and from the HA protocol. Significance was set at an alpha level of P < 0.05. RESULTS: HA was achieved as indicated by a lower core temperature (Day 1: 38.1 ± 0.3 vs Day 8: 37.8 ± 0.3 °C; P < 0.01) and HR (Day 1: 134 ± 17 vs Day 8: 121 ± 13 bpm; P < 0.01) on Day 8 compared to Day 1. The %ΔPV from pre-to post HA was 22.8 ± 7.6 % over the course of the HA period. V\textsubscript{O\textsubscript{peak}} (3.2 ± 0.4 L·min\textsuperscript{-1} vs 3.15 ± 0.5 L·min\textsuperscript{-1}), and PPO (235 ± 37 W vs 257 ± 38 W; P < 0.05 for both) were not different after 8 days of HA. There were no differences in pre- vs post-HA VT (2.2 ± 0.4 vs 2.1 ± 0.4 L·min\textsuperscript{-1}), power output (169 ± 27 ± 167 ± 31 W), VE (53.4 ± 9.6 vs 53.6 ± 10.8 L·min\textsuperscript{-1}), or the RER (0.94 ± 0.05 vs 0.95 ± 0.06, P > 0.05 for all) at which VT occurred. CONCLUSION: An 8-day HA protocol did not lead to changes in V\textsubscript{O\textsubscript{peak}}, PPO, or in the V\textsubscript{O\textsubscript{2}} and PO at which the VT occurred during a peak oxygen consumption test. Supported by USAAMRC; authors view not official US Army or DoD policy.

BACKGROUND: Environmental heat stress increases physiological strain during exercise in non-acclimated individuals. Heat acclimation (HA) protocols are often used as countermeasures to preserve physiological function during exercise in the heat. Passive heat strategies could be a potential method of HA that reduces excess physical exertion prior to or relocation. PURPOSE: To determine the effect of hot water immersion (HWI) on heat acclimation and thermotolerance. METHODS: 6 males (Age: 23.3 ± 1.5 yr; V\textsubscript{O\textsubscript{2}peak}: 450 ± 7.5 mL kg\textsuperscript{-1} min\textsuperscript{-1}) participated in a crossover, counterbalanced study with a four-week washout between conditions. Heat stress tests (HST) were performed PRE and POST acclimation sessions and consisted of 45 min of cycling at 50% V\textsubscript{O\textsubscript{2}peak} in 40 °C, 40% RH. Acclimation sessions were either three consecutive bouts of HWI or traditional heat-exercise training (TRAD). HWI sessions consisted of 40 min of immersion at 40 °C. TRAD sessions consisted of 40 min of cycling at 50% V\textsubscript{O\textsubscript{2}peak}. Core body temperature (T\textsubscript{co}), heart rate (HR), rate of perceived exertion (RPE), and thermal sensation (TSS) were measured during HSTs. Blood was drawn PRE and POST HST to determine change

The process of acclimation is imperative to ensure worker safety in hot environments. Most industry acclimation protocols prescribe 5 days of increasing heat exposure before workers work in the heat while research suggests 10-14 days for full acclimation. PURPOSE: To determine if 5 days of acclimation can induce meaningful physiological changes for worker safety. METHODS: Data collected from previous heat stress studies were used. A convenience sample of 15 female and 20 male participants (age: 28 ± 6 yr, ht: 171.7 ± 6.7 cm, wt: 76.7 ± 16.4 kg) walked on a treadmill at a moderate metabolic rate (160 W/m\textsuperscript{2}) in a hot environment (50°C and 20% RH; WBGT = 35.71°C) while wearing shorts, t-shirt and athletic shoes. Rectal temperature (T\textsubscript{r}), heart rate (HR) were monitored continuously throughout all trials. Trials lasted approximately 120 minutes or upon attainment of sustained HR greater than 90% of age-predicted HRmax, T\textsubscript{co} above 39°C, or participant wished to stop. Paired samples t-tests were used to assess changes in ending HR and T\textsubscript{co} over the last 2 days of acclimation. Peak power output (PPO) was measured to determine differences in HR and T\textsubscript{co} over the acclimation period. Significance was set at ≤ 0.05. RESULTS: There was no significant difference in ending HR or ending T\textsubscript{co} over the last 2 days of acclimation (p > 0.05), suggesting participants were acclimated. Trial duration increased significantly from day 1 to day 5 (Time = 97 ± 23 and 115 ± 11 min, p = 0.004). During the first trial, 18 participants (51.4%) were able to complete 120 min, and 25 participants (71.4%) were able to complete 120 min by the end of acclimation. Beginning T\textsubscript{co} was not significantly different from Day 1 to Day 5 (p = 0.106), however Day 1 ending T\textsubscript{co} (38.35 ± 0.51°C) was significantly higher than Day 5 (38.10 ± 0.66°C; P = 0.039). Beginning HR was significantly greater for Day 1 than Day 5 (HR = 103 ± 16 and 93 ± 13 bpm; p = 0.024), but there was no significant difference in ending HR from day 1 to day 5 (p = 0.056). CONCLUSION: Five days of acclimation can induce physiological changes in HR and T\textsubscript{co}; specifically in resting HR and ending T\textsubscript{co}. As such, industry acclimation protocols are adequate to induce physiological changes to help reduce heat illness.

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in plasma volume. Nude body mass was recorded before and after HTTs to calculate whole body sweat loss (WBSS). 

**METHODS:** HEAT decreased average HR (PRE: 158 ± 7; POST: 149 ± 7; p<0.05), peak HR (176 ± 7; 164 ± 5; p = 0.05), and end exercise RPE (15.3 ± 1.8; 13.2 ± 1.9; p = 0.05). HWI had no significant effect on resting T_core (37.2 ± 0.4; 36.8 ± 0.3; p = 0.66), end exercise T_core (38.7 ± 0.4; 38.4 ± 0.3; p = 0.20), PSI (7.8 ± 1.1; 7.0 ± 0.8; p = 0.56), or RICA (15.1 ± 1.2; p = 0.003). A reduced physical workload resulted in decreased changes in average HR (PRE: 153 ± 11; POST: 149 ± 11; p = 0.82), peak HR (170 ± 9; 165 ± 10; p = 0.51), end exercise RPE (15.1 ± 1.2; 13.3 ± 2.0; p = 0.87), PSI (9.3 ± 2.1; 8.6 ± 1.4; p = 0.73), or TSS (10.5 ± 0.8; 10.7 ± 1.5; p = 0.77). Plasma volume expansion (%) was observed in both groups (HWI: 6.6 ± 6; TRAD: 4.3 ± 2.6; p = 0.41).

**CONCLUSION:** Three consecutive HWI sessions are effective in lowering HR during submaximal exercise in the heat. Compared to heat-exercise exposures, HWI is a method in which to more rapidly elicit a HA phenotype.

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**Acute Kidney Injury Biomarker Responses To Short Term Heat Acclimation**

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(No relevant relationships reported)

The combination of hyperthermia, dehydration, and strenuous exercise can result in severe reductions in kidney function leading to an increased risk of developing acute kidney injury (AKI). **PURPOSE:** We sought to determine if short term heat acclimation (STHA) mitigates the rise in AKI biomarkers during strenuous exercise in the heat.

**METHODS:** Twenty men completed two 2-hour bouts of high-intensity interval exercise before (Pre-STHA) and after (Post-STHA) 4 days of 90-120 minutes of exercise in either hot (n=12, 40°C, 40% relative humidity; HEAT) or temperate (n=8, 24°C, 40% relative humidity; CON) conditions. Men drank water ad libitum throughout exercise. Blood was drawn before and after exercise Pre-STHA and Post-STHA. AKI was defined as a serum creatinine increase ≥ 0.3 mg/dL or estimated glomerular filtration rate (eGFR) reduction ≥25%. **RESULTS:** HEAT had a similar creatinine increase during exercise Pre-STHA (0.35±0.23 mg/dL) and Post-STHA (0.39±0.20 mg/dL), with creatinine in HEAT increasing more than CON at both time points (0.11±0.07 mg/dL, 0.08±0.06 mg/dL, p<0.001), respectively. HEAT had a greater reduction in percent change eGFR than CON (p<0.001) independent of heat acclimation status (Pre-STHA, HEAT: -30.2 ± 9.7%, CON: -10.5 ± 8.5%; Post-STHA, HEAT: -26.4 ± 12.6%, CON: -8.4 ± 5.9%). Bimarkers reached the threshold for AKI in HEAT Pre-STHA (n=9, 75%), with fewer participants reaching the AKI threshold Post-STHA (n=7, 58%, p=0.007). Biomarkers indicated AKI did not occur in CON at either time point. Hydration and body temperatures were similar between HEAT participants with and without biomarkers reaching the threshold of AKI both Pre-STHA and Post-STHA. Change in serum creatinine was related to percent of fluid replaced Pre-STHA (r=0.60, p=0.039), while Post-STHA was related to percent change in plasma volume (r=0.73, p=0.007). **CONCLUSION:** STHA did not mitigate reductions in eGFR nor increases in serum creatinine during high-intensity exercise in the heat, although the number of participants reaching the threshold for AKI was reduced Post-STHA. This suggests that STHA may reduce the risk of developing AKI during exercise in the heat.

Supported by the National Athletic Trainers’ Association Research and Education Foundation Doctoral Grant 14DGP012.

**Exercise Heat Exposure Induced Changes In Genetic Expression Before And After Heat Acclimation In Humans**

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(No relevant relationships reported)

**PURPOSE:** To evaluate changes in genetic expression of proteins that are implicated in physiological adaptation to exercise heat exposure (Hypoxia Inducible Factor -1α [HIF-1α], Erythropoietin [EPO], and Vascular Endothelial Growth Factor [VEGF]) during systematic adaptation related to Heat Acclimation (HA) in humans. **METHODS:** Participants (n=18, 13 males, 5 females; 30 ± 7.34y; 173.1 ± 7.673 cm; 76.25 ± 14.17 kg) underwent two Heat Tolerance Tests (HTT 1 & 2; 120 min walking, 5 km/h, 2.0% grade, 40°C, 40% rh) with 12-14 days between tests. Participants in experimental group (HA) underwent six heat acclimation days between tests, while the control group (CON) avoided exercise heat exposure between HTTs. Blood was drawn pre- and post- each HTT and isolated into Peripheral Blood Mononuclear Cells, then further isolated into RNA. Then, cDNA was synthesized for Quantitative Real-Time Polymerase Chain Reaction to quantify gene expression. The data was then analyzed using the ΔΔCt to acquire fold change. **RESULTS:** No statistical difference in resting rectal temperature was observed before HTT2 in HA (-0.13±0.36 °C) vs. CON (-0.08±0.47 °C; p=0.80). No significant changes were observed between HTT1 and HTT2 in the control group for HIF-1α, EPO, or VEGF. However, it was observed that acute EPO fold change increased 10.6x (P=0.14) from pre- to post- in HTT1 for each group. An increased fold change was also observed in both HIF-1α and EPO between HTT1 and HTT2 (3.24x; p=0.04) and (7.19x; p=0.03) respectively in the HA group. No significant changes in VEGF were found in either group. **CONCLUSION:** Although the HA protocol utilized in these investigations was not stressful enough to induce observable rectal temperature changes, genetic expression of HIF-1α and EPO was significantly upregulated in response to chronic exercise heat stress.

**Grant Info:** This publication was supported by the Mountain and Plains - Educational Research Center (MAP-ERC) Pilot Grant & the High Plains Intermountain Center for Agricultural Health & Safety (HCAHS) Pilot Grant.
Walking - a basic unit of locomotion - is free, does not require special training, and can be done almost everywhere. Therefore, walking might be a feasible behavior on which to tailor public health messages. There is however insufficient evidence available to determine the magnitude and shape of the relationship between steps taken per day and all-cause mortality, giving current step-based guidelines limited scientific basis. PURPOSE: To assess the prospective association and dose-response relationship between device-measured daily walking steps and all-cause mortality in a large population-based cohort of women and men aged 40-85 years. METHODS: Daily steps were measured by a waist-mounted accelerometer in 2,180 individuals (53% women) for seven consecutive days at baseline (2008-09). Participants were grouped into quarters (Q) based on their average number of steps per day and followed over a median period of 9.1 years for all-cause mortality determined by linkage with death certificates from the Norwegian Cause of Death Registry. RESULTS: Mean (SD) baseline age was 56 (11) years. Median (IQR) steps per day were 4651 (3499, 5325), 6682 (6388, 7350), 8670 (8215, 9186), and 11467 (10556, 11310) in Q1 to Q4, respectively. During follow-up, 119 individuals died (68% men). Higher number of steps per day was associated with lower risk of all-cause mortality by 44% (95% CI) of 0.52 (0.29 to 0.93), 0.50 (0.27 to 0.94), and 0.43 (0.21 to 0.88) across ascending quartiles of steps per day compared with Q1 (referred) in the multivariable model (p<0.001). The dose-response association modelled using restricted cubic splines demonstrated a non-linear, inverse association between daily steps taken and all-cause mortality, with no apparent plateauing of risk-reduction within the observed variation in the exposure. CONCLUSIONS: We observed a 48% risk reduction for all-cause mortality between the least active and the second quartile, with an absolute difference between Q1 and Q4 of 2200 steps per day. To exemplify, given an average stride length of 0.67 cm for women and 0.76 cm for men, 2200 steps translates to a 1.4 to 1.6 km walk for women and men, respectively. If confirmed, this large gain with modest effort may serve as encouragement to many sedentary individuals.

Cadence (steps/min) is an accessible and understandable metric for communicating physical activity intensity. Studies in younger and middle-aged adults consistently report ≥100 steps/min associated with walking at an absolutely-defined moderate and vigorous intensity (3 and 6 metabolic equivalents [METs] for the Actical (AC), Actigraph GT9X (AG), activPAL 3 (AP), and StepWatch 3 (SW) accelerometers. METHODS: A sample of 75 young (21-40 years), 80 middle-aged (41-60 years), and 97 older (61-85 years) adults (N = 252, 49.6% women; mean [SD] BMI = 25.6 [3.6] kg/m² and height = 169 [9] cm) completed 5-min treadmill walking bouts separated by 2-min rests. Bouts began at 0.5 mph and increased by 0.5 mph until participants: 1) naturally chose to run, 2) reached >75% of age-predicted maximum heart rate, or 3) reported a Borg rating of perceived exertion >13. Participants wore an AC and AG (waist), AP (thigh), and SW (ankle) to assess steps. Oxygen uptake (VO₂; ml·kg⁻¹·min⁻¹) was measured using indirect calorimetry and cadence was derived by dividing directly-observed steps by bout duration. VO₂ was averaged over the last two minutes of each bout and divided by 3.5 ml·kg⁻¹·min⁻¹ to determine METs. Moderate intensity (3 METs) cadence thresholds were identified with two analytic approaches: 1) using Youden’s index in a Receiver Operator Characteristic (ROC) curve and 2) by estimating a segmented (i.e., ‘hockey-stick’) regression model that accounted for repeated measures for the cadence-intensity relationship. RESULTS: Eighty participants (82%) reached 3 METs. The ROC curve displayed an area under the curve (AUC) of 0.93. The segmented regression model indicated that cadence explained 70% of the variance in METs. The cadence thresholds associated with absolutely-defined moderate intensity were 100.3 steps/min in the ROC analysis (accuracy = 85.5%, sensitivity=86.8%, specificity=84.5%) and 103.1 steps/min in the regression analysis (95% prediction interval = 70-114 steps/min). CONCLUSION: Consistent with previous evidence collected from younger and middle-aged adults, 100 steps/min serves as a reasonable heuristic threshold to communicate absolutely-defined moderate intensity walking in ambulatory older adults. Funding: NIH NIA 5R01AG049024

### 2002 Board #2

**May 28 3:45 PM - 5:45 PM**

**Cadence (steps/min) Associated With Moderate Intensity Walking In Older Adults: The CADENCE-Adults Study**

Catrine Tudor-Locke, FACSM, Christopher Moore, Elroy Aguiar, Marcos A. Almalbert-Birriel, Tiago V. Barreira, Colleen J. Chase, Stuart R. Chipkin, Scott W. Ducharme, Zachary R. Gould, Marcos A. Almalbert-Birriel, Colleen J. Chase, Stuart R. Chipkin, John Staudenmayer, Tiago V. Barreira, John M. Schuna, John M. Schuna, Jr., Catrine Tudor-Locke, FACSM, University of North Carolina at Chapel Hill, Chapel Hill, NC. 2The University of Alabama, Tuscaloosa, AL. 3California State University Long Beach, Long Beach, CA. 4University of Massachusetts Amherst, Amherst, MA. 5Syracuse University, Syracuse, NY. 6Oregon State University, Corvallis, OR. (Sponsor: Catrine Tudor-Locke, FACSM)

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**Abstracts were prepared by the authors and printed as submitted.**

**2003 Board #3**

**May 28 3:45 PM - 5:45 PM**

**Device-specific Cadence Thresholds For Moderate And Vigorous Intensity Walking: The CADENCE-Adults Study**

Christopher C. Moore, Elroy J. Aguiar, Scott W. Ducharme, Zachary R. Gould, Marcos A. Almalbert-Birriel, Colleen J. Chase, Stuart R. Chipkin, John Staudenmayer, Tiago V. Barreira, John M. Schuna, Jr., Catrine Tudor-Locke, FACSM, University of North Carolina at Chapel Hill, Chapel Hill, NC. 2The University of Alabama, Tuscaloosa, AL. 3California State University Long Beach, Long Beach, CA. 4University of Massachusetts Amherst, Amherst, MA. 5Syracuse University, Syracuse, NY. 6Oregon State University, Corvallis, OR. (Sponsor: Catrine Tudor-Locke, FACSM)

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**Abstracts were prepared by the authors and printed as submitted.**

**Study**

**Insights into Stepping and Health**

**Step Right Up! New Insights into Stepping and Health**

**Abstracts were prepared by the authors and printed as submitted.**

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**Supplement**

**2000 Chair: Janet Fulton, FACSM. CDC, Atlanta, GA. (No relevant relationships reported)**

**2001 Board #1**

**May 28 3:45 PM - 5:45 PM**

**Step By Step: Association Of Device-measured Daily Steps With All-cause Mortality - A Prospective Cohort Study**

Bjarke H. Hansen, Knut E. Dulene, Ulf Ekelund, FACSM, Morten W.agherland, Elin Kolle, Jostein Steene-Johannessen, Jakob Tarp, Sigmund A. Andersen, Norwegian School of Sport Sciences, Oslo, Norway. (Sponsor: Ulf Ekelund, FACSM)

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(No relevant relationships reported)
Table 1: Device-specific cadence (steps/minute) thresholds for absolutely-defined accelerometers and vigorous intensity treadmill walking and their classification accuracies for all participants by age group

<table>
<thead>
<tr>
<th>Age Group (yrs)</th>
<th>Moderate Intensity (3 METs)</th>
<th>Vigorous Intensity (6 METs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cadence Threshold (steps/min)</td>
<td>Sensitivity (%)</td>
</tr>
<tr>
<td>AR</td>
<td>166 [153-179]</td>
<td>0.82 (0.74-0.89)</td>
</tr>
<tr>
<td>21-40</td>
<td>166 [153-179]</td>
<td>0.82 (0.74-0.89)</td>
</tr>
<tr>
<td>41-60</td>
<td>210 [192-228]</td>
<td>0.81 (0.74-0.88)</td>
</tr>
<tr>
<td>61-80</td>
<td>260 [238-282]</td>
<td>0.83 (0.75-0.90)</td>
</tr>
</tbody>
</table>

Evidence has shown a favorable link between social support and leading a physically active lifestyle. Yet, little is known about the types of social support that may be the most influential.

**PURPOSE:** This study examined the association between physical activity (PA) change and the types of social support adults participating in a PA intervention identified as the most helpful for their PA efforts. **METHODS:** Insufficiently active adults were randomized as self-selected teams of 3-8 participants (n=24 teams) to a 12-week technology-mediated, theory-based PA treatment (n=59 participants) or the same intervention plus a real-time PA gamified challenge (n=57 participants). There were no significant differences between conditions in changes in mean daily steps, so analyses collapsed groups and examined participants at 12 weeks (N=116) and 1 year (n=98). Participants completed an online survey at both time points, which asked them to select the most helpful type of social support they received (informational; tangible; emotional; esteem). Configural Frequency Analysis was used to analyze participants grouped according to their characteristic configurations in terms of meaningful changes in mean daily steps from baseline (≤ 1,000 steps/d) as measured by an accelerometer and reported type of perceived social support. **RESULTS:** Participants averaged 5,798 (SD=2,956) steps/day on average. Participants were inactive (0.35 [0.16-0.80]) or active (0.39 [0.18-0.81]), suggesting whether they were inactive (0.35 [0.16-0.80]) or active (0.39 [0.18-0.81]), suggesting whether they were inactive (0.35 [0.16-0.80]) or active (0.39 [0.18-0.81]), suggesting whether they were inactive (0.35 [0.16-0.80]) or active (0.39 [0.18-0.81]), suggesting whether they were inactive (0.35 [0.16-0.80]) or active (0.39 [0.18-0.81]), suggesting whether they were inactive (0.35 [0.16-0.80]) or active (0.39 [0.18-0.81]), suggesting whether they were inactive (0.35 [0.16-0.80]) or active (0.39 [0.18-0.81]), suggesting whether they were inactive (0.35 [0.16-0.80]) or active (0.39 [0.18-0.81]), suggesting whether they were inactive (0.35 [0.16-0.80]) or active (0.39 [0.18-0.81]), suggesting whether they were inactive (0.35 [0.16-0.80]) or active (0.39 [0.18-0.81]), suggesting whether they were inactive (0.35 [0.16-0.80]) or active (0.39 [0.18-0.81])
CONCLUSIONS: Among this sample of middle-age adults, accumulating a higher volume of steps/day was associated with a lower risk of mortality.

RESULTS: The 2018 Physical Activity Guidelines Advisory Committee Report calls for research to examine associations of step volume with long-term clinical endpoints, including mortality. To date, there are few prospective studies examining accelerometer-measured steps/day with mortality.

METHODS: Data are from 2027 participants from the Coronary Artery Risk Development in Young Adults (CARDIA) study with valid (≥4 days, ≥10 hours/day) accelerometer wear (ActiGraph 7164) at the year 20 exam (2005-2006). Multivariable Cox models calculated hazard ratios (HR) and 95% confidence intervals (CI) for mortality for the total sample and by race and sex.

Among this sample of middle-age adults, accumulating a higher volume of steps/day was associated with a lower risk of mortality.
management in the prehospital setting. It is unclear if pain perception and related BP responses are different between these analgescics. PURPOSE: We sought to determine if reductions in pain perception and BP responses during a cold pressor test were different between ketamine or fentanyl administration. METHODS: Thirty-four healthy participants (16M/18F; 28.1±8 y; 26.3±1 kg/m², systolic BP: 122±12 mmHg, diastolic BP: 73±8 mmHg) completed two experimental visits in random crossover fashion, receiving either intravenous drug administration (n=22 with 20 mg ketamine, n=5 with 57.5 µg fentanyl, n=7 with placebo) four minutes post-drug infusion, a cold pressor test was performed by placing the participant’s hand in an ice water bath (~0.4°C) for two minutes. Pain perception was assessed using a 10-cm visual analog scale immediately after the cold pressor test. Peak BP responses were calculated as the increase in BP during the second minute of the cold pressor test relative to BP just before the onset of the cold pressor test (post-infusion). Pain perception and peak mean BP changes were compared between drugs and placebo using one-way ANOVAs and Tukey’s post hoc tests. RESULTS: Post-infusion, resting mean BP was higher (p<0.01) following ketamine compared to both fentanyl and placebo administrations (Ketamine: 106±13 mmHg; Fentanyl: 91±13 mmHg; Placebo: 93±8 mmHg; main effect: p<0.01). Ketamine and fentanyl similarly (p=0.06) attenuated pain perception to the cold pressor test compared to the placebo conditions (Ketamine: 2.1±3 cm; Fentanyl: 3.1±1 cm; Placebo: 7.1±1 cm; main effect: p<0.01). Consistent with reductions in pain perception, ketamine and fentanyl similarly (p=0.86) attenuated the peak mean BP response during the cold pressor test compared to placebo conditions (Ketamine: Δ 6.67 mmHg; Fentanyl: Δ 6.65; Placebo: 12.88 mmHg; main effect: p=0.01). CONCLUSIONS: These preliminary data suggest that ketamine and fentanyl similarly blunt pain perception and the associated BP response to a cold pressor test, despite ketamine raising resting BP.

2011 May 28 4:15 PM - 4:30 PM Analgesics In The Pre-hospital Setting: Fentanyl Does Not Alter Tolerance To Simulated Hemorrhage In Humans
Mu Huang1, Joseph C. Watso2, Gilbert Moralez3, Matthew N. Cranner1, Joseph M. Hendrix1, Mads Fischer2, Luke N. Belval2, Frank A. Cimino1, Carmen Hinojosa-Laborde4, Craig G. Crandall, FACSM1. 1UT Southwestern Medical Center, Dallas, TX. 2Institute for Exercise and Environmental Medicine, Texas Health Presbyterian Hospital Dallas and The University of Texas Southwestern Medical Center, Dallas, TX. 3US Army Institute of Surgical Research, San Antonio, TX. 4US Army Institute of Surgical Research, San Antonio, TX. (No relevant relationships reported)

Hemorrhage is the leading cause of battlefield and civilian trauma deaths. Given that a hemorrhagic injury on the battlefield is usually associated with pain, it is paramount that the administered analgesic does not disrupt the physiological mechanisms that are beneficial towards the maintenance of blood pressure and vital organ blood perfusion during that hemorrhagic insult. Current guidelines from the US Army’s Committee on Tactical Combat Casualty Care (CoTCCC) for the selection of pain medications administered to a hemorrhaging soldier are based upon limited scientific evidence, with the majority of supporting studies being conducted on anesthetized animals. Specifically, the influence of fentanyl, one of three analgesics employed in the pre-hospital setting by the US Army, on hemorrhage tolerance in humans is entirely unknown. PURPOSE: The aim of this study is to test the hypothesis that fentanyl impairs the capacity for a conscious human to tolerate a simulated hemorrhagic insult. METHODS: Fourteen subjects (8 females, 27±7 years old, 173±9 cm, 77±12 kg) participated in this double-blinded, randomized, placebo-controlled crossover investigation. Following intravenous administration of fentanyl (75 µg — consistent with the US Army’s CoTCCC guidelines) or placebo (saline), tolerance to a simulated hemorrhage was performed using a progressive lower-body negative pressure (LBNP) protocol to pre-syncpe. Tolerance was quantified as a cumulative stress insult. 

RESULTS: Mean tolerance to the simulated hemorrhagic challenge was not different between the fentanyl and placebo trials (CSS: 585±406 mmHg•min and 626±267 mmHg•min respectively, p=0.67). CONCLUSIONS: These data suggest that exercise intensity influences the relationship between burn injury size and thermoregulatory responses during exercise.

2013 May 28 4:45 PM - 5:00 PM Interaction Between Exercise Intensity And Burn Size Affects Body Temperature During Exercise In The Heat
Luke N. Belval, Matthew N. Cranner, Mu Huang, Gilberto Moralez, Frank A. Cimino, III, Joseph C. Watso, Craig G. Crandall, FACSM. Institute for Exercise and Environmental Medicine, Dallas, TX. (No relevant relationships reported)

US Army Standards of Medical Fitness exclude personnel who have sustained burn injuries covering 40% or more of their body surface area (BSA). However, this requirement is not specific to different exercise intensities that an individual is expected to perform and therefore does not take metabolic heat generation into account. PURPOSE: To test the hypothesis that the magnitude of the elevation in internal body temperature during exercise in a warm environment is influenced by the combination of exercise intensity and percentage BSA burned. METHODS: Nine healthy participants (8 males, 1 female; 33±9 y; 176±7 cm, 75±12 kg) completed eight exercise trials on a cycle ergometer, each with differing combinations of exercise intensities (Low: 4 W/kg and Moderate: 6 W/kg) and simulated BSA burn percentages in a warm environmental chamber (39±1°C, 20%±4% RH). Burns were simulated by covering 0%, 20%, 40% or 60% of participants’ BSA with a highly absorbent, vapor-impermeable material. Gastrointestinal temperature (TGI) was recorded throughout exercise, with the primary analysis (mixed-model with contrasts and Bonferroni corrections comparing simulated burn trials to 0%, with p<0.017 for significance) being the magnitude of the elevation in TGI after 60 min of exercise. RESULTS: The statistical model identified an interaction effect (p<0.005), suggesting that the magnitude of the elevation in TGI was influenced by both exercise intensity and simulated BSA. Regardless of the percentage BSA burned simulated, the increase in TGI was similar across low intensity trials (mean increase: 0.69±0.27°C, p<0.05). However, during moderate intensity exercise the magnitude of the increase in TGI was greater for the 60% (1.70±0.39°C; p<0.001) and 40% (1.23±0.51°C; p<0.0014) BSA coverage trials, relative to the 0% (0.80±0.42°C) BSA coverage trial. There were no differences between 0% and 20% (1.06±0.42°C; p=0.049) BSA coverage trials. CONCLUSIONS: These data suggest that exercise intensity influences the magnitude of the elevation in TGI after 60 min of exercise. Point impact on risk for heat related illnesses.
in a warm environment. Clinical guidance and US Army Standards for burn survivors should, therefore, consider the intensity of the exercise bout alongside BSA burned when determining limitations to physical activity.

2014
May 28 5:00 PM - 5:15 PM
The Effect Of Burn Location On Internal Body Temperature Responses During Exercise In The Heat
Frank A. Cimino, III, Matthew N. Cramer, Gilberto Moraléz, Mu Huang, Luke N. Belval, Joseph C. Watso, Craig G. Cran dall, FACSM. The Institute for Exercise and Environmental Medicine, Dallas, TX. (Sponsor: Craig Cran dall, FACSM)
Email: frankcimino76@gmail.com
No other relationships reported

According to the US Army’s Standard of Medical Fitness (AR 40-501), extensive burn injuries will disqualify individuals from US Army service, depending in part on the anatomic location of the injury. Specifically, these guidelines state that “extensive burns on the torso will most significantly impair heat dissipation.” and that burn injuries could be a disqualifying criteria for continued service. However, the effects of the location of the burn injury on thermoregulation during exercise is currently unknown. **Purpose:** This study tested the hypothesis that a torso burn injury is not any more detrimental to whole-body heat dissipation relative to a similar sized non-torso burn injury. **Methods:** Nine healthy subjects (29±6 years; 72.44±11.29 kg; 1.86±0.17 m) walked on a treadmill (~3.3mph) in the heat (40 °C and 20% relative humidity) for 60 minutes at a fixed rate of metabolic heat generation (5.7±0.5 W/kg). Identical ~25% body surface area (BSA) burn injuries to the torso or non-torso extremities (randomized) were simulated by applying a highly absorbent vapor-impermeable material over those regions. The elevation in internal body temperature assessed via an ingestible telemetry pill, was the primary variable of interest. Additional analyses were performed to assess differences in heart rate and thermal sensation. **Results:** The statistical model (2 way repeated measures ANOVA) identified a main effect of time (p<0.001; 0.94±0.03 °C for torso and 0.91±0.03 °C for extremity at end of exercise) on the increase in internal body temperature, with no effect of simulated burn location (p=0.76) or interaction (p=0.10). Heart rate and thermal sensation showed similar responses, with a significant main effect of time (p<0.001) with no effect of burn location (p=0.09) or interaction (p=0.13). **Conclusion:** Contrary to the Army’s guidelines, these results suggest that torso burns do not limit heat dissipation and exacerbate thermal strain compared to non-torso burn injuries. Therefore, the Army should not consider torso burns as being more detrimental when determining whether a soldier meets the Standard of Medical Fitness.

**Funding:** Department of Defense - US Army W81XWH-15-1-0647

D-43
Free Communication/Slide - Concussion and Movement Performance
Thursday, May 28, 2020, 3:45 PM - 5:45 PM
Room: CC-3020

2015
Chair: James Onate. Ohio State University, Columbus, OH.
No other relationships reported

May 28 3:45 PM - 4:00 PM
Effect Of Training Session On Postural Control, Self-reported Concussion Symptoms In Adolescent Female Soccer Athletes
Emily D. Geyer, Maria K. Talarico, Nathan A. Edwards, Matthew P. Brancaleone, Adam M. Culiver, James A. Onate. Ohio State University, Columbus, OH.
Email: emily.geyer@osumc.edu
Reported Relationships: E.D. Geyer: Other (please describe): The equipment utilized in this experiment was provided by ProtXX Inc. free of cost.

**Purpose:** Given the rising emphasis on reducing concussions in sport, it is important to understand the effects of repetitive head impacts on youth athletes and to use this information to optimize the clinical management of concussions. The purpose of this study was to determine the effect of a soccer training session with headers on postural control performance and concussion-like symptoms of healthy adolescent female soccer athletes. **Methods:** Eighteen female soccer athletes (15±0.72 yrs) from an elite soccer club engaged in a 90-minute soccer training session with headers. Prior to and following the training session, participants completed double-limb postural control assessments with eyes open and closed, as well as a symptom questionnaire (SCAT5). An inertial measurement unit was worn behind the ear which collected tri-axial accelerations during assessments. Mean sway velocity and sway velocity root-mean-square (RMS) were calculated for each condition. Two-way repeated measures ANOVAs were performed to determine if visual condition (eyes open, eyes closed) and time of testing (pre-, post-training) influenced postural control performance. Wilcoxon Signed Rank tests were performed to determine differences between pre- and post-training symptomology scores. Alpha level was set a priori at P=0.05. **Results:** A time main effect on sway velocity was observed where participants exhibited faster sway post-training compared to pre-training (mean difference=0.069 cm/s; p=0.004). A vision main effect on RMS was observed where participants exhibited larger RMS with eyes open compared to eyes closed (mean difference=0.038 cm²/s; p=0.015). No difference in total symptom scores were observed (Z = 1.729, p=0.084). **Conclusions:** Soccer training with heading influenced postural control performance of elite adolescent female club soccer athletes, but did not influence overall symptom reports. These findings underscore the importance of incorporating postural control outcomes into clinical assessments to comprehensively evaluate performance. With heightened public concern regarding concussion and the safety of contact sports, it is imperative to assess for potential postural control deficits following training with heading in neurodevelopmentally vulnerable populations such as female adolescents.

2017
May 28 4:00 PM - 4:15 PM
Influences Of Sleep Disturbances And Mild Traumatic Brain Injury On Gait Performance Among College Students
Tara Bridgeman, Yang Hu, Xiaoyou Zhang, Shih-Feng Chou, Shih-Yu Sylvia Lee, Xuanliang Neil Dong. The University of Texas at Tyler, Tyler, TX. (Sponsor: Joyce Ballard, FACSM)
Email: thbridgeman@patroits.uttyler.edu
No other relationships reported

Sleep disturbances from stress are common among college students. In addition, student athletes in contact sports (e.g., football and soccer) are at a higher risk of receiving a mild traumatic brain injury (mTBI). Stress-related sleep disturbances and mTBI may provoke cognitive and brain changes associated with gait abnormalities. **Purpose:** to examine the association between stress, sleep disturbances, mTBI and gait performance among college students. **Methods:** The control group included 28 college students (11 males, 17 females, age: 22.6±3.2 yrs) and the mTBI group consisted of 12 NCAA Division II men’s and women’s soccer players who indicated a history of concussion (3 males, 9 females, age: 19.6±1.3 yrs). Participants were asked to perform gait analysis with an in-shoe pressure measurement system during and after the midterm exam. Cadence, step time, stride time and stance time were measured. Meanwhile, 14-days consecutive wrist actigraphy data and three sets of questionnaires were collected to assess their stress, sleep and fatigue. A mixed-design ANOVA was used to compare gait and sleep parameters of mTBI and control groups. **Results:** The mTBI group had significantly shorter step time (0.54±0.01 s vs. 0.58±0.01 s, p<0.01) and stance time (0.66±0.01 s vs. 0.70±0.01 s, p<0.03) compared to the control group. The control group had significantly longer step time and stance time during the midterm exam than after the midterm exam. However, no significant differences of gait parameters were observed for the mTBI group during and after midterm exam. During the exam week, participants in both control and mTBI groups perceived moderate stress and reported 2-3 nights of sleep disturbances. Meanwhile, stress level was positively associated with sleep disturbances, poor daytime functioning, and poor activity correlation. **Conclusion:** Midterm exam as a stressor resulted in sleep disturbances in both mTBI and control groups. This stressor may also cause gait abnormalities of the control group, but not the mTBI group. Another interesting finding is that shorter step time and stance time were observed in the mTBI group. Nevertheless, further studies need to examine whether this is indeed due to mTBI, or the difference between student athletes and non-athletes. Supported by Office of Research and Scholarship at UT Tyler.

2018
May 28 4:15 PM - 4:30 PM
Upping The Ante: Can Agility Performance Differentiate Previously Concussed From Healthy Controls?
Lucy Parrington1, Peter C. Fino2, Leland E. Dibble3, Margaret M. Weightman3, Laurie A. King1. Oregon Health & Science University, Portland, OR. 1University of Utah, Salt Lake City, UT. 2Oregon Health & Science University, Minneapolis, MN.
No other relationships reported

Returning to sport or active duty has the potential to put athletes or service members at risk. Yet, post-concussion assessments primarily rely on subjective reporting or simple clinical tests - tasks that lack ecologic validity in comparison with sport or combat environments. Both environments may require fast-paced movements such as turning, which involves the integration of oculomotor and vestibular information, as well as cognitive control for execution. Testing anticipated and unanticipated turns during agility tasks performed at high speeds may provide a more valid test setting.
and help to quantify differences between previously concussed and healthy persons performing more complex movement tasks. PURPOSE: To compare performance on unanticipated and anticipated agility tasks between previously concussed and healthy controls. METHODS: We tested agility performance, defined by peak turning velocity (yaw, °/s), in previously concussed and healthy controls in two participant samples: athletes (concussed n=5, control n=5) and a general population (concussed n=8, controls n=10). Athletes completed unanticipated turns cues by a light stimulus, and the general population performed anticipated turns, the concussed group (20.23 %) turned slower than the healthy controls (23.73 %); d = 0.57, medium effect).

CONCLUSION: Findings suggest differences between groups in both samples, despite using different agility tasks. Moving forward, we plan to evaluate anticipated turns performance in active military duty population. However, unanticipated tasks, which require a movement contoured in response to stimulus, are an interesting area for future exploration. Supported by the Assistant Secretary of Defense for Health Affairs (W81XWH-18-20049) and the Medical Research Foundation of Oregon.

2019 May 28 4:30 PM - 4:45 PM
Analyzing Chronic Balance Deficits In A Concussed Population
Griffin J. Feinberg1, Andrew P. Lapointe1, Kathryn L. Van Pelt1, Lauren A. Dougherty2, Alyssa K. Memmiini3, Katherine M. Breedlove4, Steven P. Broglio, FACSM1. University of Michigan, Ann Arbor, MI. 2.University of California, Calgary, Calgary, AB. 3.University of Kentucky, Lexington, KY. 4.Brigham and Women’s Hospital, Boston, MA. (Sponsor: Dr. Steven Broglio, FACSM)

RESULTS: The concussed athletes (mean(±SD): 239.46(±6.73) °/s) turned slower than the control athletes (309.71(±6.73) °/s, d = -1.45, large effect) completing unanticipated turns. In the general population performing anticipated turns, the concussed group (220.23 °/s) turned slower than the healthy controls (237.33 °/s); d = 0.57, medium effect).

CONCLUSION: Findings suggest differences between groups in both samples, despite using different agility tasks. Moving forward, we plan to evaluate anticipated turns performance in active military duty population. However, unanticipated tasks, which require a movement contoured in response to stimulus, are an interesting area for future exploration. Supported by the Assistant Secretary of Defense for Health Affairs (W81XWH-18-20049) and the Medical Research Foundation of Oregon.

2021 May 28 5:00 PM - 5:15 PM
The Head Shake Sensory Organization Test And Screening Individuals With Self-reported History Of Concussion
Adrian Aron, Daniel Miner, Brent Harper, Ashley Dudding, Ashley Humphries, Sam Lawrence, Brooke McDermott. Radford University, Roanoke, VA. (Sponsor: A. Lynn Millar, FACSM)

PURPOSE: The Sensory Organization Test (SOT) assesses impairments in postural control following acute concussion. Head Shake Sensory Organization Test (HS-SOT) is a superior test that challenges the vestibular system to help detect more subtle deficits missed by SOT. The purpose of this study was to assess the accuracy of the HS-SOT in identifying residual impairments of postural control in individuals with self-reported history of concussion.

METHODS: The Ohio State University-Traumatic Brain Injury Identification Method (OSU TBI-ID) determined self-reported history of concussion while NeuroCom was used to perform HS-SOT. Twenty-nine subjects were included (11 males and 18 females, mean age 25.2 ± 3.7; history of concussion: n = 14, 5 males and 9 females, mean age 24.8 ± 4.0).

Independent T-Tests were completed to determine performance differences based on history of concussion.

RESULTS: HS-SOT fixed surface equilibrium ratio was similar (p = 0.987) between those without a history of concussion (0.9 ± 0.128) and those with a history of concussion (0.9 ± 0.160). Within subjects with a history of concussion, younger subjects (33.4 ± 0.8) had a lower sway index compared to older (30.3 ± 3.6) individuals (0.85 ± 0.11 vs. 1.09 ± 0.16, p = 0.021). In addition, the younger group trended toward a more recent history of a concussive event (1.4 ± 4.3 vs. 8.0 ± 3.4, p = 0.25).

CONCLUSIONS: There was no difference in HS-SOT in subjects with or without a history of concussion demonstrating an inability to detect performance impairments. Of those with a concussion, the HS-SOT significantly identified subtle performance deficiencies in younger individuals, suggesting that time from concussion tends to normalize sub-clinical deficits. This indicates that postural control impairments initially persist but resolve over time, which may place individuals at risk for injury during this window of recovery.

2022 May 28 5:15 PM - 5:30 PM
Comparing Functional Movement Under Single And Dual Task Conditions: Implications For Post-concussion Management
Landon B. Lempke, Rachel S. Johnson, Jeonghoon Oh, Julianne D. Schmidt, Robert C. Lynall. University of Georgia, Athens, GA. (No relevant relationships reported)

Movement assessments are commonly performed while strictly completing the assessment (single task). Sport movement is highly dynamic and requires concurrent
cognitive processing and movement (dual task). Simultaneous cognitive processing and movement may alter human movement, but to date has not been examined.

**PURPOSE:** To compare kinematic and kinetic outcomes between single and dual task functional movement among healthy individuals.

**METHODS:** Physically active participants (n=41, 49% female; 22.5 ± 2.1 yrs; 172.5 ± 11.9cm; 71.0 ± 13.7kg) completed a functional movement assessment (cut) under single and dual task (subtracting by 6 or 7’s) conditions in random order. The cut involved jumping forward from a 30cm tall box set at 50% of the participant’s height and performing a single, dominant-leg, 45 degree cutting motion after landing (four trials). The cut was completed in an eight camera (Qualysis; 120Hz) 3D motion capture space with two piezoelectric force plates (Bertec; 1200Hz). Multiple repeated measures ANOVAs (α=0.05) compared hip, knee, and ankle joint angles (deg) and normalized joint moments (Nm/kg) at initial contact in sagittal and frontal planes, and normalized peak vertical ground reaction force (vGRF; N/kg) between single and dual task conditions.

**RESULTS:** Results are presented in the Table. Dual task resulted in significantly greater (p<0.03) varus knee moments compared to single task. Dual task vGRF force was significantly less (p<0.01) compared to single task. No other outcomes were significant (p>0.06).

**CONCLUSION:** Slight kinematic and kinetic differences were observed between single and dual task during the cut. Reduced vGRF and greater varus knee joint moments during dual task may indicate altered movement during concurrent cognitive loading. Our findings provide initial metrics for future post-concussion biomechanical comparisons.

Supported by the University of Georgia College of Education Early Career Faculty Research Grant.

**Table. Dominant Leg Kinematic and Kinetic Outcomes During a 45-Degree cut at Initial Ground Contact.**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Value Direction</th>
<th>Single Task</th>
<th>Dual Task</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (95% CI)</td>
<td>Mean (95% CI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hip Angle (deg)</td>
<td>Flexion</td>
<td>27.4(23.4 - 31.4)</td>
<td>25.9(22.0 - 29.9)</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>Abduction</td>
<td>13.1(11.2 - 15.0)</td>
<td>12.6(10.7 - 14.5)</td>
<td>0.40</td>
</tr>
<tr>
<td></td>
<td>Knee Angle (deg)</td>
<td>Flexion</td>
<td>4.9(2.1 - 7.8)</td>
<td>4.9(2.0 - 7.7)</td>
</tr>
<tr>
<td></td>
<td>Abduction</td>
<td>1.9(0.8 - 3.1)</td>
<td>1.9(0.7 - 3.0)</td>
<td>0.65</td>
</tr>
<tr>
<td>Ankle Angle (deg)</td>
<td>Plantarflexion</td>
<td>45.2(38.9 - 47.6)</td>
<td>40.3(36.0 - 44.7)</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>Inversion</td>
<td>12.3(10.4 - 14.3)</td>
<td>12.0(10.0 - 13.9)</td>
<td>0.45</td>
</tr>
<tr>
<td>Hip Moment (Nm/kg)</td>
<td>Extension</td>
<td>1.07(0.95 - 1.19)</td>
<td>0.99(0.87 - 1.11)</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>Abduction</td>
<td>-0.18(-0.23 - -0.12)</td>
<td>-0.18(-0.24 - -0.13)</td>
<td>0.74</td>
</tr>
<tr>
<td>Knee Moment (Nm/kg)</td>
<td>Extension</td>
<td>-0.63(-0.68 - -0.58)</td>
<td>-0.63(-0.68 - -0.58)</td>
<td>0.96</td>
</tr>
<tr>
<td></td>
<td>(+): Varus(-): Valgus</td>
<td>-0.005(-0.05 - 0.00)</td>
<td>0.0025(0.03 - 0.04)</td>
<td>0.03*</td>
</tr>
<tr>
<td>Ankles Moment (Nm/kg)</td>
<td>Dorsiflexion</td>
<td>0.09(0.07 - 0.12)</td>
<td>0.09(0.07 - 0.11)</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>Abduction</td>
<td>0.03(0.02 - 0.03)</td>
<td>0.02(0.02 - 0.03)</td>
<td>0.22</td>
</tr>
<tr>
<td>Peak Vertical Ground Reaction Force (N/kg)</td>
<td>2.90(2.79 - 3.01)</td>
<td>2.82(2.71 - 2.93)</td>
<td>0.01*</td>
<td></td>
</tr>
</tbody>
</table>

*Significant at p ≤ 0.05.

**Methods:** 13 concussed adolescents (7 male; age 10-17 years) were prospectively evaluated at their initial visit (mean 18, range 4-43 days post-concussion), at RTP clearance (46, range 12-173 days post-concussion), and one month later (26, range 20-41 days post-RTP). Standing balance was assessed using range and root mean squared (RMS) COM motion during 2-leg, eyes open standing while performing audio Stroop, side-to-side head turn (HT), and side-to-side thumb tracking tasks. Dynamic balance was assessed using walking speed and COM ML range and velocity during walking alone and with head turn and verbal fluency (reciting words starting with “F”) dual tasks. Patients were compared to 11 controls (3 male) using t-tests, and changes over time were evaluated using linear mixed-effects regression.

**RESULTS:** During standing, patients had higher COM ML RMS than controls at baseline during HT and higher COM anterior-posterior (AP) range during thumb tracking. COM ML motion decreased from baseline to RTP (HT range -6.5cm, p=0.058; HT RMS -16.8cm, p=0.002; thumb range 9.2mm, p=0.012) and increased from RTP to 1 month follow-up (HT RMS =10.0mm, p=0.040; Stroop RMS =8.4mm, p=0.086). Patients walked slower than controls at baseline during all tasks, and COM ML range was higher in patients during verbal fluency at baseline and RTP. Walking speed increased from baseline to RTP during verbal fluency (+7.8cm/s, p=0.044), from RTP to post-RTP in single task walking (+6.1cm/s, p=0.041), and at each successive visit during HT (+6.0cm/s and +6.5cm/s, p<0.07). COM ML range decreased in patients from baseline to RTP with verbal fluency (-14.7mm, p=0.011) and from RTP to post-RTP in single task walking (-4.0mm, p=0.061).

**Conclusion:** Balance control deficits improved by RTP and only worsened post-RTP during dual-task standing, suggesting that current conservative treatment protocols are appropriate.
2027 May 28 4:05 PM - 4:25 PM  
“Painless Fracture Hides Rare Bony Malignancy”  
Alexander Chasian¹, Amie Kim². Brookdale University Hospital and Medical Center, Brooklyn, NY; ³Mount Sinai, New York, NY.  
Email: azz5154@gmail.com  
(No relevant relationships reported)  

HISTORY: A 48-year-old male with history of unprovoked DVT presents to the ED with left knee pain for 3 months. Symptoms began at rest, and described as sharp constant pain localized to the knee. Three weeks prior, he was evaluated by his primary care doctor and was clinically diagnosed with a knee sprain with conservative management. Two weeks ago, he felt an atrumatic “pop” in his lower extremity. Since that time he has been unable to bear weight. No constitutional or B-type symptoms.  
PHYSICAL EXAM: Thin, well appearing male, seated in a wheelchair. Seated examination was performed secondary to the patient’s pain. He was unable to bear weight on his left lower extremity and it was held in passive internal rotation. His left hip had no tenderness over the greater trochanter and he had limited range of motion. His left knee was without erythema, effusion or warmth and there was no tenderness over the medial or lateral joint lines. Range of motion of his knee was limited. No specialized tests were able to be performed given patients positioning and discomfort. His left ankle was nontender with no gross deformities. His dorsalis pedis pulse was 2+ and flexion/extension of the toes were intact.  
DIFFERENTIAL DIAGNOSIS: 1) Femoral DVT 2) Pathological fracture  
TEST AND RESULTS: X-ray of Left Knee AP and Lateral  
Displaced and angulated fracture of distal left femoral diaphysis.  
MRI Left Lower Extremity (T1)  
Abnormal soft tissue invades the mid to distal femoral shaft extending into anterior compartment of quadriceps and a portion of the short head of biceps femoris.  
NM Bone Scan  
Focal, mild to moderate increased tracer uptake noted in the left femur from the mid shaft to distal region. Operative Biopsy  
Malignant fibrous histiocytoma / undifferentiated pleomorphic sarcoma  
WORKING DIAGNOSIS: Occult femur fracture secondary to rare primary bone neoplasm  
TREATMENT AND OUTCOMES:  
1) Patient transferred to outside facility for orthopaedic oncology service and operative plate fixation  
2) Radiotherapy - post-operative of primary lesion site  
3) Transfer to inpatient rehab facility with post-operative protocol  
4) Remaining work-up and management follow-up pending - including oncologic imaging and therapy, surgical outcomes, rehabilitation course.  

2028 May 28 4:25 PM - 4:45 PM  
Finger Pain In A Professional Dog Groomer  
Kevin Matthew Mullins, Eugene Yousk Rh. Stanford University, Redwood City, CA.  
(No relevant relationships reported)  

HISTORY: A 36-year-old right-handed female professional dog groomer with past medical history of PCOS, presents with a chief complaint of left hand digit 3 and 4 finger tip pain. She reports progressive discomfort for the past 10 months, worsened with tactile touch especially during work, and mildly improves with rest. Describes the pain as sharp electrical sensations rated 10/10 on pain scale, sensitive to cold weather. Outside facility workup included normal hand x-rays, cervical x-rays and a hand MRI. Electrodiagnostic/nerve conduction studies demonstrated mild carpal tunnel syndrome on the left without radiocapitulap, for which she has tried a neutral wrist splint without improvement. She has been seen by her PCP, rheumatology, neurology, endocrinology, oncology and orthopedic surgery, all without a confirmatory diagnosis. Her pain is now debilitating and thus she presents to Stanford for a 6th opinion.  
EXAM: On inspection no swelling or discoloration. Severe tenderness with light touch of digit 3 at the eponychial fold, ulnar side. Limited active and passive digit 3 DIP range of motion. On inspection no swelling or discoloration. Severe tenderness with light touch especially during work, and mildly improves with rest. Describes the pain as a catching sensation but otherwise no mechanical shoulder symptoms or neurologic arm symptoms. He denied constitutional symptoms.  
PHYSICAL EXAM:  
General: Healthy appearing, athletic build.  
Inspection: No obvious asymmetry.  
Palpation: Non-mobile, minimally prominent mass approximately golf ball size in diameter, just inferior and medial to the inferior angle of the scapula. This was mildly tender without fluctuance.  
Musculoskeletal: Normal right shoulder ROM. No scapular dyskinesis.  
Neurologic: Normal right arm strength, sensation, and reflexes.  
Special Tests: Negative shoulder impingement signs.  
DIFFERENTIAL DIAGNOSIS: 1) Elastofibroma dorsi 2) Scapulothoracic bursitis 3) Snapping scapula 4) Lipoma 5) Sarcoma or other tumor  
TESTS AND RESULTS:  
X-rays: Unremarkable.  
Ultrasound: Well-circumscribed solid soft tissue mass overlying the posterior 7th/8th ribs.  
MRI: 5.4 x 1 x 3.5 cm mass in the infrascapular region underlying the serratus anterior muscle. No rib erosion or extension into the intercostal musculature.  
FINAL DIAGNOSIS: Images favored a benign process. After waiting to complete the current season, the mass was excised. The mass was deep to the serratus anterior muscle and adhered to the 7th rib. Pathology demonstrated fibroblastic proliferation, likely reactive due to repetitive microtrauma.  
TREATMENT AND OUTCOME: No follow up imaging or additionally treatments were necessary. Six weeks after excision, patient was able to throw a baseball with no pain and return to off-season baseball training.  

2029 May 28 4:45 PM - 5:05 PM  
Posterior Shoulder Pain - Baseball Pitcher  
Mary Lynch, Jacob Sellon, Marc Gruner. Mayo Clinic, Rochester, MN.  
Email: breen.mary@mayo.edu  
(No relevant relationships reported)  

HISTORY: A 20 year old right handed college baseball pitcher with a past medical history of ulcer neuritis. He presented with a 4 month history of right-sided inferior periscapular pain after increasing his pitching speed and frequency. This pain initially occurred only with high velocity pitches but progressed to occur with all pitching and some overhead reaching activities. It was associated with a catching sensation but otherwise no mechanical shoulder symptoms or neurologic arm symptoms. He denied constitutional symptoms.  
PHYSICAL EXAM:  
General: Healthy appearing, athletic build.  
Inspection: No obvious asymmetry.  
Palpation: Non-mobile, minimally prominent mass approximately golf ball size in diameter, just inferior and medial to the inferior angle of the scapula. This was mildly tender without fluctuance.  
Musculoskeletal: Normal right shoulder ROM. No scapular dyskinesis.  
Neurologic: Normal right arm strength, sensation, and reflexes.  
Special Tests: Negative shoulder impingement signs.  
DIFFERENTIAL DIAGNOSIS: 1) Elastofibroma dorsi 2) Scapulothoracic bursitis 3) Snapping scapula 4) Lipoma 5) Sarcoma or other tumor  
TESTS AND RESULTS:  
X-rays: Unremarkable.  
Ultrasound: Well-circumscribed solid soft tissue mass overlying the posterior 7th/8th ribs.  
MRI: 5.4 x 1 x 3.5 cm mass in the infrascapular region underlying the serratus anterior muscle. No rib erosion or extension into the intercostal musculature.  
FINAL DIAGNOSIS: Images favored a benign process. After waiting to complete the current season, the mass was excised. The mass was deep to the serratus anterior muscle and adhered to the 7th rib. Pathology demonstrated fibroblastic proliferation, likely reactive due to repetitive microtrauma.  
TREATMENT AND OUTCOME: No follow up imaging or additionally treatments were necessary. Six weeks after excision, patient was able to throw a baseball with no pain and return to off-season baseball training.  

2030 May 28 5:05 PM - 5:25 PM  
Acute Hip Pain In An Immunocompromised Soccer Player  
Kathryn Stockbower. The Children’s Hospital of Colorado, Aurora, CO. (Sponsor: Morteza Khodaei, FACS)  
Email: kathryn.stockbower@cuanschutz.edu  
(No relevant relationships reported)  

HISTORY: A 15-year-old female with a history of Crohn’s disease, celiac disease and primary sclerosing cholangitis on immune-modulating therapy (ustekinumab) presents with acute left hip pain. She had mild groin pain five days prior to presentation, with an acute worsening after soccer practice two days ago. There was no acute injury. She has been limping and reports fever to 38.3°C yesterday. Her PCP referred her to sports medicine clinic, and ordered Xrays and labs.  
PHYSICAL EXAM: The patient is afibrile and appears well, but sits with her left leg slightly flexed to relieve tension. His dorsalis pedis pulse was 2+ and flexion/extension of the toes were intact. Spurling’s negative.  
3 and 4. Remaining strength and sensation in the hand intact. Phalen’s test at the wrist was positive while tinel’s was negative.  
DIFFERENTIAL: 1) Septic hip arthritis 2) Extra-articular myositis or abscess of hip flexors 3) Synovial chondromatosis 4) Tenosynovial giant cell tumor 5) Intra-articular chondroma 6) Sarcoma  
TEST AND RESULTS:  
MRI enterography small bowel (staging for inflammatory bowel disease, one year ago): incidentally noted synovitis of the left hip joint  
Xray hip/pelvis, two weeks ago: incidentally noted synovitis of the left hip joint  
OUTCOME: Initiation of gabapentin, lidocaine cream for symptomatic relief and referral to orthopedics for definitive treatment with plans for left middle finger glomus tumor excision. The patient is currently pending surgery at the time of this submission, additional follow-up to be presented.
PHYSICAL EXAMINATION: Examination revealed Ht 5’7”, Wt 160 lbs, BMI 25 kg/m². The patient presented to the Sports walk-in clinic for a second opinion after experiencing even more tibial pain when wearing a CAM boot.

HISTORY: A 26 yo college female active as a summer Zipline instructor presented with a right mid-shaft tibial mass present for four months. The patient had regular periods, no weight loss, no food avoidance, no lax of stress fractures, but reported fatigue. She denied past injury involving her tibia and the tibia was completely asymptomatic with running. After returning to college and less activity 3 weeks ago, the mid-tibia became swollen and painful. Over the past month her symptoms were worse at night and somewhat relieved by ibuprofen. She presented to her student health clinic and x-rays reported focal cortical thickening at the anterior aspect of the mid-shaft tibial diaphysis. An initial MRI Radiology read reported no bony edema, periostitis, or other acute pathology to suggest acute stress reaction. The patient had regular periods, no weight loss, no food avoidance, no lax of stress fractures, but reported fatigue. She denied past injury involving her tibia and the tibia was completely asymptomatic with running. After returning to college and less activity 3 weeks ago, the mid-tibia became swollen and painful. Over the past month her symptoms were worse at night and somewhat relieved by ibuprofen. She presented to her student health clinic and x-rays reported focal cortical thickening at the anterior aspect of the mid-shaft tibial diaphysis. An initial MRI Radiology read reported no bony edema, periostitis, or other acute pathology to suggest acute stress reaction.

DIFFERENTIAL DIAGNOSIS: Tenosynovial Giant Cell Tumor (TGCT), formerly known as Pigmented Villonodular Synovitis (PVNS)

TREATMENT AND OUTCOMES: Arthroscopic debridement. The patient is doing well in physical therapy.

2031 May 28 5:25 PM - 5:45 PM
A Tibial Mass In A Zipline Instructor
Jennifer Oberstar, University of Minnesota, Minneapolis, MN.
(Sponsor: Suzanne Hecht, FACSM)
(No relevant relationships reported)

HISTORY: A 26 yo college female active as a summer Zipline instructor presented with a right mid-shaft tibial mass present for four months. The patient had regular periods, no weight loss, no food avoidance, no lax of stress fractures, but reported fatigue. She denied past injury involving her tibia and the tibia was completely asymptomatic with running. After returning to college and less activity 3 weeks ago, the mid-tibia became swollen and painful. Over the past month her symptoms were worse at night and somewhat relieved by ibuprofen. She presented to her student health clinic and x-rays reported focal cortical thickening at the anterior aspect of the mid-shaft tibial diaphysis. An initial MRI Radiology read reported no bony edema, periostitis, or other acute pathology to suggest acute stress reaction. The patient presented to the Sports walk-in clinic for a second opinion after experiencing even more tibial pain when wearing a CAM boot.

PHYSICAL EXAMINATION: Examination revealed Ht 5’7”, Wt 160 lbs, BMI 25 kg/m². Pain 5/10. CONSTITUTIONAL: Healthy, no fever, alert & oriented. SKIN: 2 cm hard palpable mass on the subcutaneous border of the right mid-tibia. No erythema or edema. MSK: full ROM of her lower extremity, knee and ankle. Pain in tibia with squating.

DIFFERENTIAL DIAGNOSIS
1. Anterior tibial bone stress injury, chronic vs new
2. Reactive sclerosis surrounding an osteolytic lesion
3. Bone tumor, Osteoid osteoma

TEST AND RESULTS:
- Radiographs of Tibia and Fibula:
  1. Focal cortical thickening at the anterior cortex of the midshaft tibial diaphysis
  2. CT Tibia and Fibula with WO Contrast:
    1. Cortical thickening within the middle third of the anterior tibia shaft
    2. No bony edema, periostitis, or other acute pathology to suggest acute stress reaction or acute osteoid osteoma

- Images reviewed with MSK Radiologist and Orthopedic Oncologist. Cross-sectional CT was recommended.
- MRI Tibia and Fibula Lower Leg WO Contrast:
  1. Thickened area of the anterior cortex of the tibia which shows a circular nidus with a central calcified area.

FINAL WORKING DIAGNOSIS:
1. Osteoid Osteoma

TREATMENT AND OUTCOMES:
1. NSAIDs trialed with minimal relief
2. Discontinue CAM boot
3. Referral to Orthopedic Oncologist
4. Scheduled for radiofrequency ablation
5. Avoid weight lifting/impact activities for 2 months

2032 May 28 3:45 PM - 5:45 PM
Discussant
William W. Dexter, FACSM. Maine Medical Center, Portland, ME.
(No relevant relationships reported)

D-45 Clinical Case Slide - Running III
Thursday, May 28, 2020, 3:45 PM - 5:25 PM
Room: CC-2016

2033 Chair: Joseph Ihm, FACSM. Rehabilitation Institute of Chicago, Chicago, IL.
(No relevant relationships reported)

2034 Discussant: Peter Sedgwick, FACSM. Central Maine Sports Medicine, Yarmouth, ME.
(No relevant relationships reported)

2035 Discussant: Mark Riederer. C.S. Mott Children’s Hospital, Ann Arbor, MI.
(No relevant relationships reported)

2036 May 28 3:45 PM - 4:05 PM
Chest Wall Pain In A Marathon Runner
Joseph G. Dadabo, Monica Rho. Shirley Ryan AbilityLab/ Northwestern University, Chicago, IL. (Sponsor: Joseph Ihm, FACSM)
Email: jdadabo@srlab.org
(No relevant relationships reported)

History: A 39-year old male marathon runner presented with 1 year of left-sided anterolateral chest wall pain at ribs 10 and 11. Pain started insidiously, without trauma or other inciting incident. Pain primarily occurred with running, and typically worsened as his pace increased. Lifting weights, deep breathing, and prolonged sitting did not exacerbate pain. He denied cough, dyspnea, or wheezing. Physical Examination: Normal chest wall expansion. No visual deformity along the ribs or costal cartilage. Tenderness to palpation was noted along the left 10th and 11th ribs or costal cartilage. Tenderness to palpation was noted along the left 10th and 11th ribs or costal cartilage. Tenderness to palpation was noted along the left 10th and 11th ribs or costal cartilage.

Differential Diagnosis:
1. Costochondritis
2. Tietze syndrome
3. Slipping rib syndrome
4. Thoracic radiculitis
5. Pleurisy

Tests and Results:
- MRI Chest Wall: Focal thickening and edema along left lower ribs at region of pain, with surrounding soft tissue swelling. No plural or pericardial effusion. No bone marrow edema within visualized osseous structures.
- Ultrasound Chest Wall: Significant signal impedance and focal thickening noted along the intercostal muscle of the left 10th and 11th ribs at the area of maximal tenderness along the anterolateral chest wall. Mild left-sided chest wall pain with leftward thoracic rotation.

Differential Diagnosis:
- Costochondritis
- Tietze syndrome
- Slipping rib syndrome
- Thoracic radiculitis
- Pleurisy

Tests and Results:
- MRI Chest Wall: Focal thickening and edema along left lower ribs at region of pain, with surrounding soft tissue swelling. No plural or pericardial effusion. No bone marrow edema within visualized osseous structures.
- Ultrasound Chest Wall: Significant signal impedance and focal thickening noted along the intercostal muscle of the left 10th and 11th ribs at the area of maximal tenderness along the anterolateral chest wall. No comparable signal changes are observed at adjacent segment levels or at the same segment on the contralateral chest wall. Mild left-sided chest Wall pain with leftward thoracic rotation.

Final/Working Diagnosis:
1. Tietze syndrome

Treatment and Outcomes:
1. Performed corticosteroid/localcaine injection to left 10th-11th rib intercostal muscle under ultrasound guidance
2. Pain diary for 6 hours immediately following injection
3. Onset marathon training as tolerated
4. Ice as needed after running
5. Pain resolved following injection. Inflammation and intercostal muscle hypertrophy resolved on repeat ultrasound 2 months later
6. Patient completed Berlin and Chicago Marathons in 2019

Abstracts were prepared by the authors and printed as submitted.
2037 May 28 4:05 PM - 4:25 PM
An Unusual Cause Of Lower Leg Pain - Long Distance Running
Wayne Elton Derman, FACSM1, Melissa Van Vuuren1, James Tunnicliffe2, Stellenbosch University, Cape Town, South Africa.
1Matley and Partners, Cape Town, South Africa.
Email: ederman@afirica.com
(No relevant relationships reported)

HISTORY: A 42 yr runner presented to the sports medicine clinic two weeks after having successfully completed an ultra-marathon complaining of left calf pain. The onset of the pain occurred the day after the race but within a short period the pain was present after walking short distances. The pain was Claudicant, accompanying foot paraesthesia and leg weakness. Rest pain was absent. Besides hypercholesterolaemia and previous kidney stones, the patient was well, a non-smoker with some symptoms of atopy but no other relevant medical or family history.

PHYSICAL EXAMINATION: The patient appeared to be generally well, with normal vital signs. On inspection of his limbs, there was no obvious swelling, discoloration or evidence of tissue loss. On palpation the left limb was slightly cooler to touch with a prolonged capillary refill time. On examination of his pulses, his upper limb pulses where symmetrical and equal but on examination of his lower limbs his left femoral pulse was slightly diminished, with a soft bruit. The left popliteal and dorsalis pedis pulses were absent. He was unable to run, and was only able to walk approximately 100 m. His left foot pulses felt post exercise or heard on office Doppler examination.

DIFFERENTIAL DIAGNOSIS:
1. Musculoskeletal injury eg gastroc tear
2. Vascular occlusion: popliteal artery entrapment, atherosclerotic occlusion, other occlusive disease
3. Posterior chronic compartment syndrome
4. Referred pain

TEST AND RESULTS:
1. Duplex Doppler was performed but was obscured by bowel gas, yet aorta and proximal common iliac were patent. The distal common iliac and proximal external iliac could not be visualized. Distal external iliac and common femoral vessels were patent. 2. Angiogram performed of the external iliac artery, demonstrated a string-like appearance pathognomonic of fibromuscular dysplasia. A full visceral angiogram was normal.

FINAL WORKING DIAGNOSIS: Fibromuscular dysplasia of the external iliac artery

TREATMENT AND OUTCOMES:
1. A transverse arteriotomy was initially made in the CFA which revealed a 50% artery

3. Right Hip MRI: Linear T1 focus with surrounding STIR hyperintensity along the medial aspect of the right femoral neck, compatible with a stress fracture.
4. Lumbar Spine MRI: Right foraminal/extraforaminonal disc protrusion at L3-4-L4.
5. DEXA Scan: - No signs of significant osteopenia or osteoporosis at the spine or hips.
6. Calcium, 25-OH Vitamin D, Parathyroid Hormone levels: Normal

FINAL WORKING DIAGNOSIS: Right femoral neck stress fracture, potentially due to chronic proton pump inhibitor use

TREATMENT AND OUTCOMES:
1. Referral to orthopedic surgery. 2. Toe-touch weight bearing for 6 weeks. 3. Discontinuation of omeprazole. 4. Consideration of future referral to endocrinology.

2039 May 28 4:45 PM - 5:05 PM
Cardiovascular-Running
Kevin Kuo1, Amie Kim2, Thomas Nguyen2, 1Icahn School of Medicine at Mount Sinai, St. Luke’s-West, New York, NY. 2Icahn School of Medicine at Mount Sinai, Beth Israel, New York, NY.
(No relevant relationships reported)

History: A healthy, 26-year old marathon runner was brought to the emergency department (ED) for altered mental status during an eighteen-mile run. At his fifteenth mile, he reported feeling increasingly warm with burning sensations. He sustained a witnessed collapse with loss of consciousness. He was alert in the ED, asymptomatic, but with anterograde amnesia. He denied prodrome including headache, dizziness, weakness, chest pain, dyspnea, or palpitations. During his ED course, he sustained a second witnessed episode of vomiting and syncope.

Physical Examination: Comfortable appearing male. Skin was warm to touch, mildly flushed. Lungs were clear to auscultation. Cardiac exam regular rate and rhythm with normal S1 and S2. He exhibited mild tenderness to palpation in lower distal extremities without peripheral edema. Compartmentes were soft. He was neurologically intact.

Differential Diagnosis:
1. Heat syncope
2. Metabolic disorder
3. Cardiogenic - Acute coronary syndrome, cardiomyopathy, exercise related dysrhythmia, channelopathy
4. Rhabdomyolysis

Test and Results:
1. CPK 7,639, peaked at 15,551
2. Troponin 0.553, peaked at 2.19
3. EKG with t-wave inversions and ST depressions in precordial leads
4. pH 7.27, pCO2 41.3, lactate 5.9
5. Na 143, K 5.2, Cl 107, bicarb 18.9 glucose 97 Calcium 10.6
6. Bun 24 Cr 2.2
7. Urine tox negative

Final Working Diagnosis: Rhabdomyolysis

Treatments and Outcomes:
1. Admitted to the cardiac ICU for NSTEMI secondary to rhabdomyolysis, recurrent syncope, acute kidney injury, and metabolic acidosis.
2. Cardiac echo showed normal ejection fraction without wall motion abnormalities.
3. EKG abnormalities maintained on 5 days continuous telemetry
4. Maintained on intravenous fluids and bicarbonate drip. Secondary organ function improved, with discharge on hospital day 5
5. NSTEMI and recurrent syncope are unusual presentations of rhabdomyolysis in young, healthy athletes
6. Pending - outpatient electrophysiology, genetic screening, cardiac rehabilitation, precautions in return to distance running

2040 May 28 5:05 PM - 5:25 PM
A Unique Overuse Stress Injury In A Professional Triathlete
Nancy Phu1, Jonathan Minor2, 1Burrell College of Osteopathic Medicine, Las Cruces, NM. 2SPARRC - Sports Medicine, Rehabilitation and Concussion Care, Tucson, AZ.
(No relevant relationships reported)

History: A 28-year-old male professional triathlete presented with acute on chronic low back pain for five days after completing an Olympic distance triathlon. He developed low back and hip pain the evening of the race. Pain was worsened by laying supine, sitting and walking. He reported back stiffness, which improved through the day. PT and dry needling offered little improvement. Nine months earlier he was seen for low back pain, diagnosed with sacroiliitis. This was managed by a licensed physical therapist with resolution. MRI performed years earlier identified disc bulge at L3-4.

Physical Examination:
Inspection was unremarkable, without swelling, deformity, or ecchymosis. Mild tenderness over the piriformis and glutes medius. No point tenderness over the PSIS, SI joints, or spinoous processes. Range of motion of the trunk was full but painful with...
extension, rotation to the right, and Kemp test to the right. No pain with trunk flexion, rotation to the left, side bending, or Kemp test to the left. Familiar right posterior hip pain with axial load of the flexed hip. Pain with resisted hip flexion on the right. Mild familiar right posterior hip pain with resisted hip flexion on the left. FABER, piriformis stretch, SI torque tests, and straight leg raise raises negative bilaterally.

DIFFERENTIAL DIAGNOSIS:
1. Strain of pelvic muscle
2. Sacroiliitis
3. Pelvic stress injury
4. Lumbo-sacral radiculopathy

TEST AND RESULTS:
MRI pelvis without contrast revealed bone marrow edema of the right inferior iliac bone adjacent to the SI joint with subtle incomplete fracture line, suggesting grade 4 stress fracture. Calcium, alkaline phosphatase, phosphorus, and magnesium levels within normal range. 25-OH-Vitamin D within normal range, perhaps lower end for high-level athlete (46.6 ng/mL). CBC and celiac screening within normal limits.

CONCLUSION:
Final working diagnosis: Stress fracture right iliac bone

TREATMENT AND OUTCOMES:
1. 8-weeks rest from impact activities (running and cycling).
2. Swimming with pull buoy for 4 weeks with gradual kicking introduction.
3. Elliptical and aerobic cycling at 6 weeks, with guided power advancement.
4. Calcium/vitamin D supplementation.
5. Targeted PT strengthening.

Outcome - pain free with progression and returned to uninhibited training at 12 weeks.

D-46 Clinical Case Slide - Shoulder II

Thursday, May 28, 2020, 3:45 PM - 5:25 PM
Room: CC-2022

Chair: Andrew Gregory, FACSM. Vanderbilt University School of Medicine, Nashville, TN.

Discussant: William F. Micheo, FACSM. University of Puerto Rico, San Juan, PR.


HISTORY: 15 year old male high school baseball player with past medical history of asthma, who presented with right shoulder pain. Pain started after swinging in a baseball tournament, with no specific trauma. Pain was located posterior. He was able to continue playing baseball, however pain persisted. Initially he tried heat, ice and ibuprofen with no improvement. Pain progressively worsened over the week with walking, deep breathing and coughing. Additional symptoms included radiation into his neck and shallow breathing. He pursued evaluation at the Emergency Department.

PHYSICAL EXAMINATION:
Ventral Trunk/R upper extremity: loss of R chest wall contour in the "hands on hips" position/asymmetric axillary fold; TTP at bicipital groove; shoulder-painful ROM arc upon extreme abduction/elevation; weakness/pain with resisted IR/horizontal adduction.

DIFFERENTIAL DIAGNOSIS:
1. Strain of pelvic muscle
2. Sacroiliitis
3. Pelvic stress injury
4. Lumbo-sacral radiculopathy

TEST AND RESULTS:
R shoulder XR plain films without abnormality

CONCLUSION:
Final working diagnosis: R pectoralis major tendon rupture

TREATMENT AND OUTCOMES:
1. Patient underwent subacute repair with Achilles allograft augmentation 2 months post-injury.
2. He was placed in a shoulder immobilizer for 6 weeks and formal PT started at 2 weeks.
3. At his last visit 5 months post-op he was doing very well, progressing with self PT rehab exercises in the gym, no pain with daily activities and pleased with cosmosis/symmetrical chest muscle contour. He started working out again and back to approximately 80% muscle strength/endurance with push-ups/pull-ups but avoiding explosive movements that would put him at risk of re-injury.

HISTORY: 21 y/o M RHD CrossFit Coach sustained an injury to his R upper extremity while performing the "muscle up" exercise on a high bar about six weeks prior to presentation. He felt a painful pop in his shoulder/arm area after which he experienced bruising near his axilla/chest wall then unable to complete his workout. He continued to have pain/weakness along with difficulty working out with his usual gym routine, especially exercises involving pushing maneuvers. He was initially seen by another Orthopaedist, an MRI obtained, then referred to our Sports clinic. Other than a history of rapid weight loss of over 100 pounds a couple of years prior to the traumatic episode, he denies any supplement usage.

PHYSICAL EXAMINATION:
Ventral Trunk/R upper extremity: loss of R chest wall contour in the "hands on hips" position/asymmetric axillary fold; TTP at bicipital groove; shoulder-painful ROM arc upon extreme abduction/elevation; weakness/pain with resisted IR/horizontal adduction.

DIFFERENTIAL DIAGNOSIS:
1. R LH biceps tendon rupture
2. R pectoralis muscle tear
3. R pectoralis tendon rupture

TEST AND RESULTS:
R shoulder XR plain films without abnormality

MRI show signal changes in pectoralis major tendon consistent with rupture of humeral detachment/retraction into chest wall; posterior glenoid labral tear

CONCLUSION:
Final working diagnosis: R pectoralis major tendon rupture

TREATMENT AND OUTCOMES:
1. Patient underwent subacute repair with Achilles allograft augmentation 2 months post-injury.
2. He was placed in a shoulder immobilizer for 6 weeks and formal PT started at 2 weeks.
3. At his last visit 5 months post-op he was doing very well, progressing with self PT rehab exercises in the gym, no pain with daily activities and pleased with cosmosis/symmetrical chest muscle tone. He started working out again and back to approximately 80% muscle strength/endurance with push-ups/pull-ups but avoiding explosive movements that would put him at risk of re-injury.
S428 Vol. 52 No. 5 Supplement

MEDICINE & SCIENCE IN SPORTS & EXERCISE®

2046 May 28 4:25 PM - 4:45 PM
Shoulder Injury - Soccer, Water Polo
Dana L. Sheng, Kevin Burnham, Robert D. Boutin, Jeremiah W. Ray, Brian A. Davis, FACSM. UC Davis, Sacramento, CA. (Sponsor: Dr. Brian A. Davis, MD, FACSM)
Email: DLSHENg@UCDAVIS.EDU

TX/OUTCOME: All cases with 1st rib stress fracture healed with standard relative rest.
FINAL DX: 1st rib stress fracture
Bedside U/S- L 1st rib fracture with large callus formation
CXR, L shoulder XR, CT chest w/o contrast- nondisplaced fracture L 1st rib
Case 3-
Bedside U/S- cortical irregularity of R 1st rib
R shoulder XR, R ribs XR, MR RUE w/o contrast- nl
Case 2-
TESTS/RESULTS: Case 1-
Thoracic outlet syndrome
biceps testing (-).
Case 3-
NL inspection, ROM. L rhomboid major tender to palpation.
RTC testing nl, O’Brien’s (-).
Spurling’s (-). RTC testing nl except for pain with supraspinatus testing. O’Brien’s (-).

Shoulder Injury - Soccer, Water Polo

2047 May 28 4:45 PM - 5:05 PM
Back And Shoulder Pain - Heavy Lifting
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HX: 3 Division I athletes at 1 university.
Case 1- 21F soccer center midfielder presented with 1 month of insidious L shoulder pain that started posteriorly at the rhomboids and slowly migrated anteriorly. She denied any trauma. All activity worsened the pain, particularly shoulder ROM. She completed 6 weeks of rest and PT without improvement.

Case 2- 19M water polo player presented with 2 months of R posterior shoulder pain without preceding trauma. He improved with 2 weeks of light activity and PT, but the pain worsened as he increased activity and acutely worsened after contact play.

Case 3- 19M water polo player presented with 2 weeks of insidious onset L posterior shoulder pain. While executing power cleans, the pain became severe and he went to the ED.
EXAM:
Case 1-Diffuse pain limited L shoulder ROM. +mild GH internal rotation deficit. +tenderness and spasm of L trapezius, neck, levator, posterior deltoïd, rhomboids. Spurling’s (+). RTC testing nl except for pain with supraspinatus testing; O’Brien’s (+).
Case 2-NI visual inspection. The R shoulder had full ROM with mild discomfort posteriorly with full abduction. R rhomboid major tender to palpation. RTC testing nl; O’Brien’s (+).
Case 3-NI inspection, ROM. L rhomboid major tender to palpation. RTC testing nl, biceps testing (+).

TESTS/RESULTS: Case 1-
L shoulder XR- nondisplaced stress fracture L 1st rib
Bedside U/S- cortical irregularity of 1st rib
CT chest w/o contrast- stress fracture L 1st rib
Case 2-
R shoulder XR, R ribs XR, MUR W/O contrast- nl
Bedside U/S- cortical irregularity of R 1st rib
Retrospective review of original XR’s revealed subtle cortical irregularity of R 1st rib.
CT chest w/o contrast- nondisplaced stress fracture R 1st rib
Case 3-
CXR, L shoulder XR, CT chest w/o contrast- nondisplaced fracture L 1st rib
Bedside U/S- L 1st rib fracture with large callus formation
FINAL DX: 1st rib stress fracture

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2048 May 28 5:05 PM - 5:25 PM
Posterior Shoulder Instability In A 17 Year Old Wrestler: A Case Report.
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HISTORY
A 17 year old male wrestler presented to the sports medicine clinic with superoposteriorly located right shoulder pain and apprehension with overhead movements 2 days after sustaining a posterior shoulder dislocation. He received an on-site closed reduction, and was seen following the match at a local emergency room where he was discharged with a sling and crying shoulder pain.

PHYSICAL EXAMINATION
No erythema, ecchymosis, or edema about the right shoulder joint. Tender to palpation at AC joint, acromion, and anterior capsule. Active abduction 70°, Bexion 90°, External rotation 20° (pain limited). Full strength with elbow, wrist, and finger flexion and extension. Empty can, Speed’s and anterior apprehension were positive. O’Brien’s, Hawkins, O’Brien’s, and Speed’s and posterior apprehension were negative.

DIFFERENTIAL DIAGNOSIS
1. Bankart lesion
2. Hill-Sachs lesion
3. Labral tear
4. Rotator cuff tear
5. Humeral fracture

TESTS AND RESULTS
Right shoulder and clavicle radiographs: unremarkable.

Posterior Shoulder Instability In A 17 Year Old Wrestler: A Case Report.
Kathryn Alfonso, Jason Lee.

AcSM May 26 – May 30, 2020
San Francisco, California
Measured cardiorespiratory fitness (CRF) with exercise testing is a powerful predictor of mortality but unavailable in many health-care and research settings. Although non-exercise estimated CRF (NEE-CRF) has been shown to be associated with mortality outcomes, relatively small cohorts and impractical predicting variables used to estimate CRF are challenging its broad application. PURPOSE: To assess the association between NEE-CRF using pragmatic variables and mortality outcomes in a large prospective cohort of men and women. METHODS: The NIH-AARP Diet and Health Study of 330,769 participants [men (n=186,469) and women (n=144,300)] aged 50-71 years at the recruitment (1995-1996) were prospective followed for 14.9±2.1 years until December 31, 2015. NEE-CRF was estimated using previously validated equation [34.142 + 1.463 (physical activity status) +0.133 (age)-0.005 (age²) +11.403 (sex)-0.254 (weight)-9.170 (height)] and analyzed for its association with mortality outcomes, utilizing multivariable Cox hazard models. RESULTS: During the follow up, 34,317 men and 20,285 women died due to all-causes. Higher NEE-CRF was associated with lower risk of mortality due to all-causes, cardiovascular disease and cancer, in men and women respectively. The corresponding hazards ratios and 95% confidence intervals were: 0.85 (0.84-0.86), 0.85 (0.82-0.88), 0.89 (0.87-0.91), and 0.84 (0.83-0.85), 0.84 (0.81-0.88), 0.89 (0.87-0.91) for men and women respectively (all p<0.001). CONCLUSIONS: Higher NEE-CRF is associated with lower risk of death due to all-causes, cardiovascular disease and cancer, in men and women respectively. Obesity is associated with an increased risk of premature mortality, but observational studies identify obese adult with high cardiorespiratory fitness (CRF; ‘fat-but-fit’) may not be at an increased risk. However, the evidence for the ‘fat-but-fit’ hypothesis is limited by insufficient control of confounding from smoking and risk of reverse-causality bias from pre-existing conditions. PURPOSE: To examine evidence for the ‘fat-but-fit’ hypothesis using different approaches for reducing confounding and reverse-causality bias. METHODS: CRF was estimated from linear extrapolation of the heart rate response during a submaximal bicycle ergometer test in women and men from the UK Biobank cohort. Watts per kg fat-free mass was split into units (<20%) or fit (>60%) based on the age-sex stratified sample distribution and combined with measured body-mass index (BMI) as normal weight (NW; BMI 18.5 – 25) or obese (BMI ≥ 30) yielding four CRF-BMI combinations. All-cause mortality was ascertained from death registers. Multivariable-adjusted cox-regression models were used to estimate hazard ratios (HR) and 95% confidence intervals (CI). RESULTS: Over a median follow-up of 7.7 years, 580 deaths in 26,315 participants were recorded. In analysis adjusting for prevalent CVD/cancer and using NW-fit as the reference, being NW-unfit or obese-unfit were associated with increased mortality with HRs of 1.45 (CI: 1.15, 1.83) and 1.64 (1.29, 2.09), see figure. Mortality was not increased in the obese-fit against the reference (1.16 CI: 0.92, 1.47). Associations were attenuated when excluding individuals with prevalent CVD/cancer and early deaths. Re-analyzing with restriction to never-smokers resulted in similar HRs across the fat-fit combinations against the NW-fit reference. CONCLUSION: Obese-unfit, but not obese-fit, individuals have an increased risk of premature mortality as compared with NW-fit individuals. The association appears susceptible to bias.
2053 May 28 4:15 PM - 4:25 PM
The Prevalence Of Meeting 2008 Versus 2018 Physical Activity Guidelines In Adults With Overweight/Obesity
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(No relevant relationships reported)

Both the 2008 and 2018 Physical Activity Guidelines for Americans (PAG) recommend ≥150 min/wk of moderate physical activity (PA) for substantial health benefits and suggest many adults may need ≥300 min/wk of moderate PA for additional health benefits (including weight control). The 2008 PAG specified that PA be accumulated in bouts ≥10 minutes, however, this criteria was removed in the 2018 PAG.

PURPOSE: To determine the extent to which removing the bout criteria impacts the prevalence of meeting PAG for weight control in adults with overweight/obesity.

METHODS: Participants were 155 adults with overweight/obesity enrolled in an 18 month weight loss intervention. Baseline levels of bout and total moderate-to-vigorous PA (MVPA, SenseWear device) were used to determine proportion meeting 2008 vs 2018 PAG, and to classify subjects into 3 mutually exclusive groups: meeting 1) ≥300 min/wk of both bout and total MVPA (BOTH; n=26), 2) ≥300 min/wk of total (but not bout) MVPA (TOTAL; n=65) or 3) ≥300 min/wk of bout or total MVPA (NEITHER; n=62). We also compared age, sex, BMI, body fat mass (FM, DXA), and fitness (VO2max) across groups.

RESULTS: The proportion of subjects meeting 2008 (18%) vs. 2018 (60%) PAG was significantly lower (P<0.01). BOTH had a higher mean age vs TOTAL (mean±SD; 43.1±10.3 vs 37.6±9.9; P<0.01). BOTH had the lowest proportion of females, followed by TOTAL, and then NEITHER (64% vs 83% vs 94%; P<0.01). BOTH had a lower BMI and FM compared to TOTAL and to NEITHER (BMI: 32±3 vs 35±4 vs 36±4 kg/m²; P<0.01; FM: 36±7% vs 41±5% vs 43±4%, P<0.01), with no differences between TOTAL vs NEITHER. BOTH had the highest VO2max (adjusted for age and sex), followed by TOTAL, and then NEITHER (28.1±4.6 vs 25.0±4.4 vs 22.6±3.9 mL/kg/min; P<0.01).

CONCLUSIONS: In this cross-sectional analysis of adults with overweight/obesity, removing the bout criteria resulted in a 3 fold greater prevalence of meeting PAG for additional health benefits (including weight control). Meeting 2018 PAG (but not 2008 PAG) did not significantly differentiate between levels of BMI or FM compared to not meeting 2018 PAG. Researchers planning on using PAG for screening eligibility should be aware of the clinical health differences in adults who meet vs 2008 PAG. Prospective studies are needed to determine how removing the bout criteria impacts weight control.

2054 May 28 4:25 PM - 4:35 PM
Physical Activity Time Of Day And Risk Of Weight Change In Men And Women
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(No relevant relationships reported)

PURPOSE: Laboratory studies suggest there are potential benefits of morning vs. evening exercise on various physiologic responses in humans but results from epidemiologic and intervention studies are less consistent. The purpose of this study was to examine the association between free-living physical activity timing and change in weight over a three-year period.

METHOD: Participants (n=549, 58% women, 66% non-Latino white) completed an accelerometer protocol for at least six days during two non-consecutive quarters in 2015 and self-reported weight in 2015 and 2018. Multinomial logistic regression was used to explore the association between levels of total moderate-to-vigorous physical activity (MVPA) achieved before noon and percent weight change (loss, gain, stable). All analyses were stratified on sex and adjusted for age, race/ethnicity, number of comorbidities, energy intake (self-reported in 2015), accelerometer wear time, sleep time, and total MVPA (to isolate time-of-day effect).

RESULTS: Participants accumulated 12–64% of their MVPA in the morning hours. Participants who accumulated more MVPA in the morning were more physically active overall (81 vs 69 min./day MVPA Q4 vs Q1) but were also more likely to have insufficient sleep (7.1 vs 8.2 hr./day Q4 vs Q1). Women accumulating most of their MVPA in the morning hours (Q4, ≥42%) were 1.99 times more likely to maintain their weight over three years (95% confidence interval [CI]: 0.93, 4.69). MVPA timing did not appear to be associated with weight change among men. Race/ethnicity-stratified results suggested that the associations were not different among black, Latino, or white participants.

CONCLUSION: In addition to the impact of physical activity duration, frequency, and intensity on weight control, physical activity timing may also play a role, particularly in women. The timing of MVPA is a fairly flexible aspect of the behavior and may confer additional benefits regarding weight control; however, more research is needed to fully understand the associations.

2055 May 28 4:35 PM - 4:45 PM
Cardiorespiratory Fitness And Muscle Strength With The Prevalence Of Diabetes: WASEDA’S Health Study
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(No relevant relationships reported)

Limited data are available on the relationship of cardiorespiratory fitness (CRF) and muscle strength (MS) with the prevalence of diabetes.

PURPOSE: This cross-sectional study was to investigate the independent and joint relationship of CRF and MS with the prevalence of diabetes among Japanese men in the WASEDA’S Health Study.

METHODS: WASEDA’S Health Study is a cohort study which was launched in 2014. We used part of the baseline data collected for this study. Participants were 627 Japanese men (median (inter quartile range) age 56 (48-65) years) who completed a medical examination, leg extension power test, and graded exercise test using cycle ergometers at baseline. The participants were divided into two groups based on CRF and MS, respectively. The prevalence of diabetes was based on self-reports from questionnaires and/or blood tests at the medical examination. Odds ratios and 95% confidence intervals (95% CIs) for the prevalence of diabetes were obtained using logistic regression models while adjusting for age, body mass index, physical activity, family history of diabetes, cigarette smoking, and alcohol intake.

RESULTS: 49 participants had diabetes. Using the lower CRF and MS as a reference, odds ratios and 95% CIs for the higher CRF and MS were 0.56 (0.26-1.21) and 0.51 (0.25-1.05), respectively. Also, using the lower CRF and lower MS group as a reference, odds ratios and 95% CIs were 0.52 (0.20-1.33) for the lower CRF&higher MS group, 0.55 (0.21-1.41) for the higher CRF&lower MS group, and 0.31 (0.12-0.79) for the higher CRF&higher MS group, respectively. CONCLUSIONS: These results suggest that there is a relationship between CRF and MS with the prevalence of diabetes. In addition, there is a joint relationship of CRF and MS with the prevalence of diabetes among Japanese men.

2056 May 28 4:45 PM - 4:55 PM
Joint Associations Of Occupational Standing And Occupational Exertion With Musculoskeletal Symptoms In A Us National Sample
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(No relevant relationships reported)

PURPOSE: As evidence has implicated sedentary behavior as a health risk factor; initiatives to reduce workplace sitting time by replacing it with standing have received considerable interest. However, concerns have been raised that standing exposes workers to other health hazards; notably observational studies have linked occupational standing to musculoskeletal pain. These prior studies, however, are potentially flawed. For many occupations, standing at work co-occurs with high physical exertion, thus the observed associations between standing and musculoskeletal pain could be confounded by the physical exertion that accompanies many standing-based occupations. The purpose of this study was to examine the joint associations of occupational standing and occupational exertion with musculoskeletal symptoms.

METHODS: Data for this analysis come from the 2015 National Health Interview Survey, a US nationally representative survey. Occupational standing and exertion were assessed by self-report on a 5-point Likert scale. Presence of musculoskeletal symptoms (pain, aching, or stiffness) for upper extremity (neck, shoulders, elbows, wrists, fingers) and lower extremity (hips, knees, ankles, toes) joints was also assessed.

RESULTS: There was a significant interaction between occupational standing and occupational exertion (p<0.05). Occupational standing was associated with upper extremity and lower extremity symptoms only among the group with high levels of occupational exertion (Figure). Among those reporting lower levels of occupational exertion; occupational standing was not associated with upper or lower extremity symptoms.

CONCLUSIONS: Results from this US representative survey suggest the association between occupational standing and musculoskeletal symptoms is largely driven by the co-occurrence of occupational exertion and bring into question the contention that standing in itself incurs adverse musculoskeletal symptoms.
Late Adulthood Physical Activity Trajectories In Relation To All-cause Mortality

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PURPOSE: Despite the known benefits of being physically active, about half of U.S. adults (and nearly two-thirds of adults age 65+ years) do not meet current U.S. Physical Activity Guidelines for Americans of 150-300 minutes of moderate (75-150 minutes of vigorous) physical activity (MVPA) per week. Given the aging U.S. population and rising healthcare costs, identifying factors associated with healthy aging is critical. There is limited epidemiologic evidence examining whether increasing or initiating MVPA in later adulthood can increase longevity. This study examined the association between late adulthood MVPA trajectories and all-cause mortality in a large U.S. prospective cohort.

METHODS: This analysis included 71,862 Cancer Prevention Study-II Nutrition Cohort participants (mean age 74.1 years; range 52-89 years) who were free of major chronic diseases. Participants self-reported MVPA at two time points approximately 5-years apart and were categorized based on their level of adherence to MVPA guidelines at each time point (inactive, “insufficiently active”, “sufficient”, and “>double minimum recommendation”). 12 trajectories were identified (4 each for consistent, increasing, or decreasing MVPA); participants who were consistently “insufficiently active” served as the reference category. Multivariable Cox proportional hazards regression modeling was used to estimate hazard ratios (HR) and 95% confidence intervals (CI).

RESULTS: After an average of 9.9 years of follow-up, 22,736 deaths occurred. The most active participants (>double recommended) at both time points had a 24% lower mortality risk compared to insufficiently active participants (95% CI 0.73-0.79). Those who increased MVPA over time (insufficient to sufficient) also had a lower mortality risk (HR=0.85, 95% CI 0.80-0.91). Conversely, those who decreased activity (insufficient to have a higher mortality risk (HR=1.18, 95% CI 1.10-1.26). Associations were similar for men and women, and for cardiovascular disease and cancer-specific mortality.

CONCLUSIONS: Maintaining a physically active lifestyle at older ages is optimal for longevity. Public health messaging should encourage active individuals to maintain their physical activity level as they age and reinforce that it is never too late to start being active.

METHODS: Fifteen older male subjects (age= 57±4.6 yr.) were randomly assigned to one of two training groups (END, n=8 & BFR, n=9) that performed the leg press, leg extension (knee curl; chest press, lat pulldown, and biceps curl exercises 3×/wk for 8 weeks. All training sessions began with subjects warming up in a gym by walking/jogging at their self-selected speed for 5 min. The END group performed exercise for 4 sets of 15 reps at 40-65% of one repetition maximum (1RM) with 30 sec rest between each set. The BFR group performed exercises for 4 sets of 20 reps at 20-30% of 1RM with 30 sec rest between each set. The BFR cuffs were placed on both arms (pressure ranged from 140 to 160 mmHg) or legs (pressure ranged from 160 to 200 mmHg) for the related exercises with 3-5 min rest in between upper and lower body exercises for cuff placement. Fasted subjects (for at least 8 hr.) reported to the lab and hydration level was assessed by clinical urine refractometer before testing sessions. Pre and post-training pulse wave analysis (PWA) and velocity (PWV) were measured non-invasively using SphygmoCor-Xc.

RESULTS: One-way ANOVA did not detect any significant differences between group means for any of the hemodynamic variables at baseline. There were no significant condition main effects for any of the variables measured. However, there were significant main effects for time with the pre-test demonstrating higher values than the post-test values for aortic diastolic pressure (p< 0.04), aortic and systemic mean arterial pressure (p< 0.03), end systolic pressure (p= 0.04), and mean arterial pressure during diastole (p< 0.04). In addition, trends for significant time main effects were detected for PWV (p= 0.09), aortic systolic pressure (p= 0.06), systemic systolic and diastolic pressure (p= 0.06), systemic mean arterial pressure (p= 0.06), and pressure time index for diastolic pressure (p= 0.08).

CONCLUSIONS: The findings of the study indicate that both BFR and END resistance training programs are similarly effective in decreasing the central and systemic blood pressure that could be due to training-related adaptations in vascular function and structure.
While CVD is the leading cause of death, falls are one of the most prominent causes of accidental mortality in older adults. Unfortunately, interventions in older adults often target either cardiovascular fitness or balance, with few utilizing exercise modalities that address both at once. One modality that has shown promising results on cardiovascular fitness and balance is mini-trampoline training. However, investigations on this modality have been limited in older adults. PURPOSE: To compare the effects of 6-weeks of mini-trampoline training to 6-weeks of walking on fall risk and functional fitness in older adults. METHODS: Twenty participants (mean age 72.6±6.9) completed six weeks (3 sessions/week) of trampoline training consisting of aerobic (e.g., jumping jacks) and balance (e.g., tandem skips) exercises, all of which took place on a mini-trampoline. Each session was led by a trained research staff member. For comparison, a control group (n=18, mean age 66.6±7.4) participated in an unmonitored walking program for six weeks (3 sessions/week) with a goal of increasing average step count by 100 steps every week. At the start and conclusion of the intervention, all participants were assessed on measures of balance (i.e., fall risk and single-leg stands), mobility (i.e., 4-square step test and 8-foot up-and-go), and aerobic endurance (i.e., 6-minute walk test). Due to significant differences between the groups at baseline, change scores were calculated for all measures and were compared using independent samples t-tests. Following training, the trampoline group significantly reduced fall risk [t(36) = 2.129, p < .05, d=0.87], increased single-leg stand time, [t(36) = 7.04, p < .01, d=0.87], and decreased 4-square step test time [t(36) = 2.651, p < .05, d=1.35] compared to the walking group. Both groups decreased their 8-foot up-and-go times and increased 6-minute walk distance after the six weeks. However, change scores were not statistically different between the groups (p > .05). CONCLUSION: As a result of this study, it appears that mini-trampoline training is a viable exercise modality for older adults to reduce fall risk and improve balance while providing similar cardiovascular benefits (i.e., improvements in walking distance) to those as a result of walking.

Maximal oxygen uptake (VO2max) declines with age and is a strong predictor of morbidity and mortality risk. Thus, accurate assessment of VO2max is important for the older population. PURPOSE: To evaluate the use of a verification phase performed at different intensities for determination of VO2max on a stationary cycle ergometer in older adults. METHODS: Twenty-two older adults (67.16 ± 6.7 years; 26.3 ± 5.1 BMI) were recruited to participate in the study. Each subject completed two experimental trials in a randomized, counterbalanced cross-over design. Both trials consisted of an identical traditional ramp test, followed by 10 min of active recovery, and a verification phase performed at either 85% (VP85) or 110% (VP110) of the peak work rate achieved during the ramp. Expired gases and heart rate (HR) were continuously monitored throughout each test. VO2peak was determined using the highest 30-sec average. RESULTS: No significant differences were observed for absolute (L·min⁻¹) VO2peak between VP85 (1.86 ± 0.72; P = 0.679) and VP110 (1.79 ± 0.73; P = 0.200) and the associated ramps (1.85 ± 0.73 and 1.82 ± 0.72, respectively). There was also no significant difference in maximal HR (bpm) between VP85 (153.17; P = 0.243) and VP110 (146.16; P = 0.085) and the associated ramps (150.17 and 149.16, respectively). However, individual data indicated that 36% of subjects achieved a ≥2% greater VO2 (L·min⁻¹) during the VP85 compared to the ramp, while only 15% of subjects achieved a ≥2% greater VO2 (L·min⁻¹) during the VP110 compared to the VP85. Moreover, the trend of a decreased percentage of subjects achieving a higher value compared to the ramp during VP110 as compared to the VP85 was fairly consistent across all physiological data (using the collected coefficient of variation [CV] data). While no significant differences (P > 0.05) were found for most variables between the two ramp tests, 40% of subjects achieved a VO2 (L·min⁻¹) during the VP110 that was higher than the CV between ramp tests. CONCLUSION: These data suggest that if a verification phase is employed for VO2max assessment in otherwise healthy older adults, a power slightly below peak work rate may provide a more accurate assessment compared to a power slightly above peak work rate. Supported by intramural funds from ASU.

Interested in the potential benefits of physical activity (PA) and exercise on cognition in late life has grown exponentially in the past decade. Peak oxygen uptake (VO2) is one of the most widely used metrics of physical fitness. The most accurate measure of VO2 is cardiopulmonary testing (CPX); however, this method may not be easily accessible in many settings nor appropriate for all populations, including older adults. Self-report measures of PA are easily administered and readily available, yet these measures rely on an accurate recall of past activity. This may be difficult for older adults with even mild forms of cognitive impairment. Identifying alternative methods that accurately estimate a patient’s physical fitness are essential.

PURPOSE: To evaluate the use of multiple measures of physical fitness in a sample of older adults with amnestic Mild Cognitive Impairment (aMCI).

METHODS: The sample included 50 older adults who were diagnosed with aMCI (93.3% male, aged = 71.2 ± 9.2 years). Measures of physical fitness included CPX, 6-minute walk test (6MWT), and the Yale Physical Activity Survey (YPAS). Analysis included comparison of the sub-maximal measures of physical fitness (6MWT) and self-report measures (YPAS) with directly-measured cardiorespiratory fitness on key measures on physiologic measures of fitness (e.g., peak VO2, resting blood pressure (BP), BMI).

RESULTS: The 6MWT demonstrated a stronger correlation with directly-measured peak VO2 (r = 0.62, P < 0.00) compared to YPAS. The YPAS activity dimensions moving, sitting, and standing correlated marginally with VO2max (r = 0.28; P = 0.01). The YPAS index of physical activity was slightly correlated with VO2max (r = 0.21; P = 0.03). CPX was inversely correlated with BMI (r = 0.21; P = 0.03) and non-significantly with resting BP. Resting BP and BMI was not significantly associated with 6MWT nor the YPAS indices.
CONCLUSION: The present analysis suggests that even mild forms of cognitive impairment impact the validity of self-report measures of physical fitness. Sub- maximal tests of aerobic capacity, such as the 6MWT, provide more accurate estimates of cardiorespiratory fitness and are easily administered in a variety of settings in which older adults receive health care.

There is an increasing emphasis on maintaining and improving physical function and capacity in older adults. Measures obtained through physical fitness testing can help provide health/fitness practitioners with important information used to structure the exercise and rehabilitation programs prescribed for older adults. The modified Functional Movement Screen® (mFMS) has been utilized as a tool to screen for movement proficiency, stability, motor control and balance in older adults. Yet, its relationship to other measures of physical fitness is not yet fully understood.

PURPOSE: Determine the relationship between mFMS scores and measures of physical fitness in older adults. METHODS: In total, 78 older adults (36 males and 42 females; mean age ± SD: 69.00 ± 7.61 years) completed this cross-sectional study. Physical tests included: handgrip strength (HG), back-leg strength dynamometer (BLS), 8 ft. Up-and-Go (8UG), vertical jump (VJ), medicine ball throw (MBT), chair stand (CST), arm curl (AC), and 6-minute walk (6MW). Participants also completed the mFMS which consists of 4 screens: Shoulder Mobility Screen (SMS), Deep Squat (DS), Active Straight Leg Raise (ASLR), and Lower Body Motor Control Screen (LB-MCS). Scoring criteria ranges from 0-3 for the SMS, DS, and ASLR screens, with higher scores indicating better performance. The LB-MCS is scored as pass/fail. Spearman’s ρ correlations were conducted to determine associations between physical fitness tests and the mFMS. RESULTS: The DS was significantly correlated with all fitness tests (ρ < 0.05). Specifically, higher DS scores were associated with improved HG (ρ = 0.29), BLS (ρ = 0.50), VJ height (ρ = 0.51), MBT (ρ = 0.41), CST (ρ = 0.56), AC (ρ = 0.29), 6MW (ρ = 0.53), and 8UG (ρ = 0.64) performance. Lastly, better 8UG (ρ = 0.35), BLS (ρ = 0.32), and 6MW (ρ = 0.29) performance were associated with individuals who passed the LB-MCS (ρ < 0.05). No other screens were significantly associated with physical fitness tests. CONCLUSION: Increased DS scores and passing the LB-MCS may contribute to overall improvement of physical fitness in older adults. Health practitioners desiring to increase measures of physical fitness in older adults and who use the mFMS as a screening tool may want to focus on increasing DS and LB-MCS movement proficiency.

PURPOSE: The ability to recover one’s balance using a hip-based strategy is important to avoid falls, but many older adults have limited hip flexibility. This study aimed to clarify the relationship between hip displacement during voluntary motion (Hip-D) in the anteroposterior direction and life-space mobility, and to examine whether Hip-D could be used to independently distinguish the quality of one’s life-space mobility by comparing the results on the Life-Space Assessment (LSA) scale. METHODS: Hip-D and physical functions related to fall prevention were measured in 219 community-dwelling older women. Hip-D was defined as the maximum moving distance of the great trochanter in the anteroposterior direction. The participants were also classified into good and poor life-space mobility groups based on their LSA scores. The ability of the Hip-D and physical functioning tests to distinguish the above groups was determined using DeLong’s test of the area under the receiver operating characteristic curve (AUC) for each test. RESULTS: Hip-D was significantly greater in the good life-space group (25.2 ± 6.9 cm) than in the poor life-space group (17.3 ± 5.1cm). The LSA score was moderately correlated with Hip-D (ρ = 0.51, p < 0.05) but only weakly with the fall-related physical functioning parameters (|r| = 0.15-0.39). Hip-D had the highest AUC (0.824, 95% CI: 0.770-0.872) among all parameters, and the Hip-D cutoff value was 20.9 cm. The AUC for Hip-D was significantly greater than the Hip-D had the highest AUC (0.824, 95%CI: 0.776-0.872) among all parameters, and the LSA score was significantly correlated with Hip-D (r = 0.51, p < 0.05). Specifically, higher DS scores were associated with improved HG (ρ = 0.29), BLS (ρ = 0.50), VJ height (ρ = 0.51), MBT (ρ = 0.41), CST (ρ = 0.56), AC (ρ = 0.29), 6MW (ρ = 0.53), and 8UG (ρ = 0.64) performance. Lastly, better 8UG (ρ = 0.35), BLS (ρ = 0.32), and 6MW (ρ = 0.29) performance were associated with individuals who passed the LB-MCS (ρ < 0.05). No other screens were significantly associated with physical fitness tests. CONCLUSION: Increased DS scores and passing the LB-MCS may contribute to overall improvement of physical fitness in older adults. Health practitioners desiring to increase measures of physical fitness in older adults and who use the mFMS as a screening tool may want to focus on increasing DS and LB-MCS movement proficiency.
Efficacy Of 6-week Suspension Training Exercises On Fitness Components In Older Adults

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UNCWR, Wilmington, NC.

The control of both rapid stepping movements and medial-lateral (ML) motion during standing balance and locomotion becomes increasingly difficult with aging. This aspect of function can be an early indicator of fall risk in older adults, but the ability to measure this in the clinic is limited. This analysis is part of a project to develop a clinically-feasible test of rapid stepping performance that challenges medial-lateral motion in older adults. PURPOSE: To determine the inter-rater reliability for three tests challenging rapid stepping performance and ML control of weight-shifting motion. METHODS: Older adults aged 70-96 yrs performed three rapid stepping tests: 1) the Step in Place test (SIP, n = 43) where participants stepped in place as fast as safely possible until reaching 20 footfalls of the first stepping foot, 2) the Repeated Alternating Stair Touch Test (RASTT, n = 37) where participants tapped, alternating right and left, with the ball of each foot a centered piece of tape on the top front edge of a small step as fast as safely possible for 20 x, and 3) the modified-RASTT (n = 37) which differed from the RASTT with the foot tips aimed straight forward on the step. Observations (# of steps for the RASST tests, and time (s) for SIP) were compared between two experimenters rating one trial from each participant using independent, two-tailed t-tests, Pearson (r) correlations, and intra-class correlations (ICC) for the two RASTT tests. Given its non-normal distribution, a Spearman Rank (r) test and a two-tailed Mann-Whitney U test were used to compare the SIP test results between raters. RESULTS: There was no difference between raters for the RASTT (mean [SD]: 22.9 [6.8] vs. 22.8 [6.9] steps, p = 0.194), the modified-RASTT (mean [SD]: 23.3 [7.3] vs. 23.2 [7.2] steps, p = 0.168), or the SIP (median [IQR]: 10.7 [6.8] vs. 10.8 [6.8] s, U = 912, p = 0.920). The two experimenters’ ratings were highly correlated for both the RASTT (r = 0.998, ICC = 0.998), the modified-RASTT (r = 0.994, ICC = 0.993), and the SIP (Spearmans’s rho = 0.997). CONCLUSIONS: Our results indicate that these tests exhibit high inter-rater reliability. 

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Reliability Of Rapid Stepping And Weight-shifting Tests

Board #11
May 28 2:00 PM - 3:30 PM

Functional Assessment Of Older Adults: Inter-rater Reliability Of Rapid Stepping And Weight-shifting Tests

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(No relevant relationships reported)
Using Virtual Reality To Improve Postural Stability In Elderly Women
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PURPOSE: To observe through objective testing using an assessment module incorporated in a new virtual reality (VR) system whether elderly people’s static and functional balance is improved by VR balance training program that is based on movements performed in everyday life.

METHODS: Thirty healthy elderly women participated in 12 sessions of balance-based VR training (three times a week, 30 minutes per session). The system used combined a posturographic platform with a 3D measurement system based on time-of-flight cameras (Kinect). All objective outcomes: the quiet standing test, Functional Balance Test (FBT) and limit of stability (LOS) test were measured on 3 occasions: before the intervention, after 6 training sessions and after the completion of the 4-week program.

RESULTS: Results showed significant improvement in LOS performance after the intervention. In FBT participants exhibited significant decrease (p<.01; Kendall’s W=.52) in the average time to target hit after 6 trainings. The average center of pressure velocity increased after 6 and 12 sessions, however, did not reach significance (p=.053), nevertheless, the effect size was large (n2 = .22). Movement optimization in FBT and parameters of quiet standing test were not significantly affected by training.

CONCLUSIONS: These results demonstrate that even a relatively short 4-week training program can bring positive outcomes. 12 training sessions of balance VR training using the force platform and Kinect sensor resulted in significant improvement of postural stability in healthy elderly women. This trial supports the potential therapeutic use of VR training program which is based on movements performed in everyday life.

Effects Of Jump Training On Postural Balance And Leg Muscle Function In Healthy Older Adults
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(No relevant relationships reported)

PURPOSE: To observe through objective testing using an assessment module incorporated in a new virtual reality (VR) system whether elderly people’s static and functional balance is improved by VR balance training program that is based on movements performed in everyday life.

METHODS: Twelve significantly different age elderly groups and one young counterpart group. The reduced cardiorespiratory function and muscle performance in the elderly and the negative effects of training interruption are well documented. Despite largely used, little is known about the effects of detraining/re-training in water-based exercise training.

RESULTS: Results showed significant improvement in LOS performance after the intervention. In FBT participants exhibited significant decrease (p<.01; Kendall’s W=.52) in the average time to target hit after 6 trainings. The average center of pressure velocity increased after 6 and 12 sessions, however, did not reach significance (p=.053), nevertheless, the effect size was large (n2 = .22). Movement optimization in FBT and parameters of quiet standing test were not significantly affected by training.

CONCLUSIONS: These results demonstrate that even a relatively short 4-week training period can bring positive outcomes. 12 training sessions of balance VR training using the force platform and Kinect sensor resulted in significant improvement of postural stability in healthy elderly women. This trial supports the potential therapeutic use of VR training program which is based on movements performed in everyday life.

The reduced cardiorespiratory function and muscle performance in the elderly significantly minimizes an individual’s functional aerobic capacity. Any further decline may make them unable to complete daily activities and then have a negative influence on living independently.

PURPOSE: The purpose of this study was to examine the influence of age on changes in energy cost in two significantly different age elderly groups and one young counterpart group.

METHODS: The investigation was conducted on 30 healthy women in stationary cycling. Participants were stratified by age into young adults (Y; 20-25 years), elderly adults (OD; 60-65 years) and the more older adults (OU; 66-70years) with the same sample size.

RESULTS: The position on the cycle ergometer was adjusted for each participant. The protocol started with a rest metabolism test using a calibrated K4b2 in which subjects were sitting on the cycle ergometer quietly. Then followed by a familiarization process. During the cycling test, each participant performed eight different 300-second trials. Eight trials were used under the combination of 2 power output (60 and 100 Watts, W) and 4 cadences (self-selected, 40, 60 and 90 rotations-per-minute, rpm). Oxygen consumption (ml/min) and energy expenditure (EE, kcal/min) were calculated during the last 1 min of each testing condition.

RESULTS:

1. VO2 Outcomes
Gross VO2 and net VO2 had a similar pattern. VO2 at 100 W output power was larger than those at 60 W of each age group (p < 0.05). However, for the same level of output power, only VO2 parameters in the Y group (M1 = 1916.40 and M2 = 1606.96) were significantly higher than those in the OD group (M1 = 1577.88 and M2 = 1279.05) at 100 W output power (p < 0.05).

2. EE outcomes
The age*power interaction effect on gross EE and net EE was significant, which were F(1,27)=4.07, p > .029 and F(2,27)=3.73, p > .037, respectively. Similarly, the interaction effect of age*cadence was significant with respect to gross EE and net EE, which were F(6, 81) = 2.36, p = .038 and F(6, 81) = 2.66, p = .021, respectively.

Abstracts were prepared by the authors and printed as submitted.
The hormone insulin-like growth factor-1 (IGF-1) has anabolic effects in adults. The aging process negatively affects IGF-1 levels, muscle strength, physical performance, and cognitions. There is limited evidence regarding the effects of resistance training (RT) exercise on IGF-1 levels, muscle strength, physical function, and cognitions in Latin American female older adults. PURPOSE: To determine the effect of a RT program on IGF-1, muscle strength, physical function and cognitions in Costa Rican female older adults. METHODS: Twenty-six older adults were randomly assigned to a control (CTRL, n = 14, age = 68.8 ± 3.7 yr.) or experimental (EXP, n = 12, age = 67.2 ± 2.5 yr.) group. Both groups attended the exercise sessions two times/week, 40-min/session, for 8 weeks. The CTRL group performed slow-motion stretching exercises, and the EXP group performed RT exercises at 70% of 8-RM. Pre- to post- measurements were obtained on IGF-1, muscle strength, the 30-s chair-rise test, and short-term memory, working memory, psychomotor speed, attention and mental flexibility. Mean differences were studied by mixed 2 (groups) x 2 (measurements) ANOVA. Tukey’s post-hoc tests followed significant ANOVA interactions. RESULTS: IGF-1 increased in EXP (Pre= 161.0 ± 55.6 vs. Post= 203.5 ± 49.3 ng/mL) and CTRL (Pre= 128.6 ± 51.5 vs. Post = 174.9 ± 70.7 ng/mL) groups (p < 0.05). Significant improvements (p < 0.05 for all) were found in leg extension (EXP= 52.3 ± 9.4 vs. CTRL= 39.4 ± 4.6 kg), adduction (EXP= 47.1 ± 12.8 vs. CTRL= 37.8 ± 6.7 kg), back strength (EXP= 45.5 ± 10.4 vs. CTRL= 39.4 ± 4.6 kg), 30-s chair test performance (EXP= 14.8 ± 1.3 vs. CTRL= 10.3 ± 1.8 sec), and mental flexibility (EXP= 143.0 ± 16.6 vs. CTRL= 142.1 ± 16.4 s). CONCLUSION: A RT program improved muscle strength, physical function, and mental flexibility in female older adults compared to an active control group. The positive change in mental flexibility is a relevant finding due to the small number of studies in older adults. The increase in IGF-1 in both groups following eight months of training, there was a significant difference (p<0.0001) between the CG and all other experimental groups for functional autonomy. For quality of life, there was a significant difference in the post-test phase between the CG and the experimental groups in the domain 6 (AG: p<0.001; MSG: p<0.001; MEG: p<0.001) and domain 1 (AG: p<0.001). In the pretest phase, there was no significant difference between the groups. For the elderly physical fitness index there was a significant difference in the post-test phase between the CG and the experimental groups, in the VO2max (AG: p<0.001 and MEG: p<0.001), range of motion (AG: p<0.001; MSG: p<0.001; MEG: p<0.001) and muscle endurance (AG: p<0.025), the results being favorable for the three experimental groups. In the pretest phase, there was no significant difference between the groups. CONCLUSIONS: The strength group presented a higher rate of functional autonomy improvement (%Δ -22.5876, p<0.001), quality of life (%Δ 11.9631, p<0.001) and elderly physical fitness index (%Δ 11.0992, p<0.0001).

The aging process is associated with physiological changes that cause progressive declines in biological function, imposing a potential threat to the functional capacity. This condition impairs elderly independence, primarily when it is associated with chronic diseases or locomotive disorders. On the other hand, the physical exercise can mitigate some of those effects. PURPOSE: the study aimed to analyze the effects of three different training programs (strength, muscular endurance, and aerobic) on functional autonomy, quality of life, and elderly physical fitness index. METHODS: After the inclusion and exclusion criteria, the sample consisted of 133 individuals, randomly divided into four groups: muscle strength group (MSG=31) muscular endurance group (MEG=32) aerobic group (AG=35) and a control group (CG=35). Initially, the sample groups were submitted to the following procedures: functional autonomy (GDELAN protocol), quality of life (WHOQOL-OLD), and elderly physical fitness index (1600m walking test, leg left calf circumference and lean mass for body composition assessment, elbow flexion, and extension test, sit and stand-up test, range of motion evaluation through the Normalfaa protocol). RESULTS: After four months of training, there was a significant difference (p<0.0001) between the CG and all other experimental groups for functional autonomy. For quality of life, there was a significant difference in the post-test phase between the CG and the experimental groups in the domain 1 (AG: p<0.001; MSG: p<0.001; MEG: p<0.001) and domain 6 (AG: p<0.001; MSG: p<0.001; MEG: p<0.001) and muscle endurance (AG: p<0.025), the results being favorable for the three experimental groups. In the pretest phase, there was no significant difference between the groups. For the elderly physical fitness index there was a significant difference in the post-test phase between the CG and the experimental groups, in the VO2max (AG: p<0.001 and MEG: p<0.001), range of motion (AG: p<0.001; MSG: p<0.001; MEG: p<0.001) and muscle endurance (AG: p<0.025), the results being favorable for the three experimental groups. In the pretest phase, there was no significant different between the groups. CONCLUSIONS: The strength group presented a higher rate of functional autonomy improvement (%Δ -22.5876, p<0.001), quality of life (%Δ 11.9631, p<0.001) and elderly physical fitness index (%Δ 11.0992, p<0.0001).
electrocardiograph (ECG) can serve as both a teaching and screening tool to assess cardiac abnormalities in seniors (over age 65) prior to beginning an exercise program. The purpose of this pilot study was to evaluate the ECG characteristics of older adults prior to participation in a twice-weekly supervised strength training program. METHODS: Thirty seniors (Males = 10; Females = 20; Age =72 ± 7.6yrs) completed cardiovascular screening with resting 12-lead ECG analysis prior to program participation. An exercise physiologist reviewed all ECG results and any identified abnormalities were referred to a cardiologist. Gender, ECG abnormalities, and anthropometrics were compared using a mixed model ANOVA. Chi-square analysis was used to test for differences in the frequency of ECG findings across gender. RESULTS: Thirty seniors (Males = 10; Females = 20; Age =72 ± 7.6yrs) completed cardiovascular screening with resting 12-lead ECG analysis prior to program participation. An exercise physiologist reviewed all ECG results and any identified abnormalities were referred to a cardiologist. Gender, ECG abnormalities, and anthropometrics were compared using a mixed model ANOVA. Chi-square analysis was used to test for differences in the frequency of ECG findings across gender. CONCLUSIONS: A pre-exercise ECG can be a useful teaching and screening tool for students who are preparing to supervise adults in a structured strength training program. ECG results can be used to adjust training variables (type, duration, and intensity) accordingly for each individual senior participant.

**D-59 Free Communication/Poster - Special Populations**

**Room**: CC-Exhibit Hall

**Board #23**

**Chatting While Cycling Can Enhance “Positive Affect” In Patients With Cardiovascular Disease**

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(NO relevant relationships reported)

**PURPOSE:** Previous studies demonstrated that aerobic exercise activates the frontal area of the left hemisphere, which stimulates optimistic feelings. We hypothesized that having fun chatting with friends while cycling (Chatting While Cycling: CWC) would enhance the benefits of exercise, and this would particularly benefit patients with cardiovascular diseases who find exercising a strenuous activity. Therefore, the aim of present study was to analyze the differences in the positive affect of patients during two aerobics routines: CWC and cycling alone.

**METHODS:** The sample comprised eight patients with cardiovascular disease and nine healthy gender-matched volunteers that performed two aerobics routines. To: The sample comprised eight patients with cardiovascular disease and nine healthy gender-matched volunteers that performed two aerobics routines: CWC and cycling alone.

**CONCLUSIONS:** A pre-exercise ECG can be a useful teaching and screening tool for students who are preparing to supervise adults in a structured strength training program. ECG results can be used to adjust training variables (type, duration, and intensity) accordingly for each individual senior participant.

**Board #25**

**Walking Characteristics In Individuals With Stroke Differ Based On Walking Speed, Endurance And Daily Steps**

Reed Handlery1, George Fulk2, Christine Pellegrini1, Jill Stewart1, Courtney Monroe1, Stacy Fritz1. 1University of South Carolina, Columbia, SC. 2SUNY Upstate Medical University, Syracuse, NY.

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(NO relevant relationships reported)

**PURPOSE:** Walking is an ideal means of obtaining physical activity, yet people with stroke take few daily steps. The purpose of this study was to examine how the walking characteristics of bouts per day, maximum steps per bout and time spent walking differ between individuals with various walking speeds, walking endurance and daily steps. Additionally, we aimed to identify cutoff values for differentiating active and inactive ambulators (i.e. those who do and do not achieve physical activity guidelines through walking).

**METHODS:** Stepping data from 252 individuals with chronic stroke (>6 months) with mean age of 63 (13) years and step count of 4,277 (3,064) steps per day were analyzed. Individuals were placed into previously established levels of ambulation (i.e. household ambulators, limited community and unlimited community ambulators), based on walking speed, walking endurance and daily steps (via two days of StepWatch activity monitoring). Differences in walking characteristics were assessed between ambulation levels (e.g. household vs. community ambulators). Linear regression determined which characteristics best predicted daily step counts. Receiver Operating Characteristic (ROC) curves and area under the curve (AUC) determined which variable was most accurate in classifying active (>5,500 steps) and inactive (<5,500 steps) individuals.

**RESULTS:** Regardless of categorization by walking speed, walking endurance or daily steps, household ambulators had significantly fewer bouts per day, maximum steps per bout and time spent walking compared to both limited and unlimited community ambulators (p = <0.001). Only 31 (32%) participants obtained >5,500 steps per day. The two highest AUC values were 0.91 (95% CI 0.88, 0.95) for maximum steps per bout and 0.83 (95% CI 0.78, 0.88) for bouts per day. Cutoff values of 648 maximum steps per bout or 53 bouts were used to differentiate active and inactive ambulators.

**CONCLUSIONS:** Walking characteristics differed based on an individual’s walking speed, walking endurance and daily steps. Differences in daily steps between household and community ambulators are largely due to shorter and fewer walking bouts. Interventions aimed at improving walking after stroke should promote increased walking bouts of any length to increase physical activity after stroke.
found that the most commonly used exercises in treatment of DRA were indrawing and pelvic floor muscles (PFM) exercises. However, experimental studies have found that both indrawing and PFM contraction increase the inter-recti distance (IRD). Randomized controlled trials (RCT) are few, and both interventions and results differ between studies. PURPOSE: To investigate the immediate effect of different abdominal- and PFM exercises on IRD in women with DRA. METHODS: Following power calculation of sample size, 38 parous women were included in this cross-sectional study to measure IRD before and 8 minutes after a priori defined order of eight different exercises. A paired t-test was used to compare IRD at rest with IRD recorded during each of the exercises and differences between exercises. Means with 95% confidence intervals (CI) are reported. P-value was set to <0.05. RESULTS: Head lift and twisted crunch significantly decreased the IRD, both above and below the umbilicus. Above the umbilicus, the mean difference between rest and head lift was 6.1 mm (95% CI: -3.8, 9.7; p=0.49) and twisted crunch 3.5 mm (95% CI: -0.5, 7.4; p=0.02). PFM contraction, maximal in-drawing and PFM contraction/ maximal in-drawing increased the IRD below the umbilicus, mean difference; -2.8 mm (95% CI: -5.2, -0.5; p=0.02), 4.7 mm (95% CI: -7.2, -2.1; p<0.01) and -5.0 mm (95% CI: -7.9, -2.1; p<0.01), respectively. CONCLUSION: Head lift and twisted crunch decrease, while maximal in-drawing and PFM contraction increase the IRD. RCTs are needed to investigate whether head lift and twisted crunch are effective in permanently narrowing the IRD.

The Norwegian Women’s Public Health Association fully funded the study.

Although one of the greatest changes observed with aging is the loss of muscular strength, few studies have identified the onset of these reductions in women with increasing age. Purpose: To examine the influence of chronological age on maximal voluntary isometric contraction (MVIC) force for the finger flexors and knee extensors (KE) in recreationally active women.

Methods: One-hundred and forty-two women (age: 47.1±17.7 years; height: 164.2±7.0 cm; 67.1±10.7 kg), matched for physical activity, were included in the present analysis. Participants were selectively recruited to include ≥10 participants for each five-year age interval (e.g. 20-24, 25-29, year, etc.). Testing included three separate visits where participants completed three trials of maximal handgrip strengths (HGS) following three trials of KE MVCs performed on the right side of the body. Participants completed each trial within the same hour of the day as the initial testing session and all testing visits were completed 7-10 days apart. Segmental analyses were performed in combination with the Davies test to verify critical age periods for mean MVIC values. An age was deemed ‘critical’ when statistical significance was achieved performing the Davies test a priori at p<0.05. Results: Mean ± SD for KEMVIC and HGS were 299.2±34.0Nm and 81.6±8.4kg, respectively, and model fit for the KEMVIC and HGS across the participants was r² = 0.64 and r² = 0.67 (p<0.001), respectively. The Davies test revealed critical age periods for KEMVIC and HGS of 46.1±3.6 and 66.2±8.1 years, respectively. Both muscle groups displayed marginal losses prior to the respective critical age periods (KEMVIC: -0.45Nm/year and HGS: -0.01kg/year), whereas following the critical age period, the reductions increased significantly for both muscle groups (KEMVIC: 2.32Nm/year, p<0.001; HGS: 0.67kg/year, p<0.03). Importantly, the segment model provided a significantly improved fit when compared to linear and quadratic models for KEMVIC (p<0.001 and p<0.001, respectively) and HGS (p<0.001 and p<0.027, respectively).

Conclusions: These data indicate that muscle groups of the upper and lower body do not display uniform changes with increased age. Although both muscle groups are routinely needed in daily life, the upper body appears to maintain strength until later in life.
**PURPOSE:** To determine if increasing exercise consistent with consensus recommendations is associated with corresponding increases in sedentary time in obese adults. METHODS: This cross-sectional study recorded baseline data from a multi-ethnic cohort of women with recent GDM at 12 to 20 weeks postpartum, who were part of a health-coaching intervention called Avoiding Diabetes after Pregnancy Trial in Moms (ADAPT-M) between 2014 and 2017. Women underwent a graded exercise treadmill test, anthropometric measures, diastasis rectus screening and completed the International Physical Activity Questionnaire (IPAQ). Baseline characteristics were compared between Caucasian and non-Caucasian ethnicity using T-test, Chi square and Mann-Whitney U tests. The relationship between APF and PA guidelines was assessed with a Chi-Square test. RESULTS: We evaluated 149 participants at mean 16.5 ± 2.4.3 weeks postpartum (mean age 36.7 ± 4.6 years, 70.5% non-Caucasian), had a mean fitness of 9.72 ± 1.9 metabolic equivalents (98% ± 19.2% APF), body fat 36.2 ± 5.6%, BMI 29.7 ± 6.8 kg/m², and diastasis rectus was present in 20%. Of those, 52% were below APF while 84.5% were meeting PA guidelines (IPAQ). Non-Caucasian women were significantly less likely to meet PA guidelines (p=0.002) and had lower PA levels (p=0.001). Overall, level of PA on the IPAQ did not correlate with APF (p < 0.10). CONCLUSION: Postpartum women with recent GDM had average APF and 84.5% were meeting PA guidelines, although significantly lower levels were seen in non-Caucasian women. Level of PA on the IPAQ did not correlate with APF in this population. Postpartum diabetes prevention programs for women with recent GDM should optimize PA, particularly for higher-risk non-Caucasian ethnic groups.

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<th>Board #31</th>
<th>May 28 2:00 PM - 3:30 PM</th>
<th>VO₂,PO Discordance In Paraplegia; Considerations For Using Power Output To Prescribe Exercise At Various Intensities</th>
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<td>2112</td>
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<td>David W. McMillan¹, Jennifer L. Maher¹, James LJ Bilzon², Kevin A. Jacobs, FACSM³, Mark S. Nash, FACSM.¹, Miami Project to Cure Paralysis, Miami, FL. 2University of Bath, Bath, United Kingdom. ¹University of Miami, Miami, FL. (Sponsor: Kevin A Jacobs, FACSM) Email: <a href="mailto:dmcmillan@med.miami.edu">dmcmillan@med.miami.edu</a> (No relevant relationships reported)</td>
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<td>Endurance exercise is often prescribed relative to peak power output (% PO_{peak}) obtained during a graded exercise test (GXT). Persons with spinal cord injury (SCI) conducting arm cycle ergometry (ACE) display a unique VO₂,PO relationship not yet quantified in the context of exercise prescription. Indirect evidence suggests that a relatively low % PO_{peak} will be required to elicit a given % VO₂_{peak} during moderate intensity continuous exercise (MICE). Applying this concept of VO₂,PO discordance to high intensity interval exercise (HIIE) prescription, one must consider the possibility of seemingly moderate intensity % PO_{peak} to elicit a physiological response indicative of HIIE. PURPOSE: To determine the % PO_{peak} required to elicit a target VO₂ during MICE, and to explore the use of % PO_{peak} to prescribe HIIE in persons with SCI. METHODS: Ten adult men (39±10 yr) with chronic (13±2.8 yr) paraplegia (T2-T10) completed a GXT with 3 min stages where PO increased 20 W stage from a starting PO (10-40 W) estimated to elicit volitional exhaustion in 8-12 min. Then, in a randomized order, % PO_{peak} was used to prescribe MICE and HIIE. The duration of each session was chosen so that the sessions were isocaloric. During MICE, ∆VO₂/∆PO was used to estimate the power output that would elicit a steady state 50% VO₂_{peak}. HIIE was completed with 2 min duty cycles at 70.10% PO_{peak}. For HIIE, the last minute of the work or recovery phase was used to calculate the mean VO₂ of working and recovery phases. RESULTS: Mean cardiorespiratory fitness (19.2±5.2 ml·kg⁻¹·min⁻¹) classified participants as ‘good’ based on normative data. PO_{peak} was a strong predictor of VO₂_{peak} (r=0.960, p&lt;0.001) and VO₂ gain (ΔVO₂/ΔPO) was 10.3±1.8 ml·min⁻¹·W⁻¹. During MICE, 24.6±6.7% PO_{peak} elicited a VO₂ of 53.1±6.5% VO₂_{peak} (10.1±2.2 ml·kg⁻¹·min⁻¹). During HIIE, the work and recovery phases averaged 88.3±6.7 and 49.2±6.8% VO₂_{peak} (16.9±4.2 and 9.3±6.2 ml·kg⁻¹·min⁻¹), respectively, and 29.4±7.7% of the session was spent above 80% VO₂_{peak}. MICE and HIIE were isocaloric (115.9±21.8 and 116.6±35.0 kcal, respectively; p=0.905). CONCLUSION: Both MICE and HIIE conditions demonstrated evidence of VO₂,PO discordance. These findings emphasize the unique considerations pertaining to the use of % PO_{peak} to prescribe ACE in SCI.</td>
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</table>
and greater discussion satisfaction (p=0.002). Depressive symptoms were inversely related to discussion satisfaction during postpartum care (p=0.02). CONCLUSION: Postpartum discussions with healthcare providers may not only benefit physical health, but also mental health and health behavior. Understanding the content of such discussions may help provide insight into what types of discussions can most effectively promote all aspects of postpartum health.

Numerous changes to body composition occur during and post-pregnancy in apparently healthy women. Significant changes, specifically to fat mass and bone mineral density, have acute and chronic impacts on overall wellness. PURPOSE: The purpose of this case study is to examine the body composition changes of a woman in her 30s over two pregnancies.

METHODS: Dual-energy x-ray absorptiometry (DEXA) scans were performed before each pregnancy and two weeks, five months, and twelve months after delivery. At each scan the participant was asked about physical activity, lactation status, and supplementation.

RESULTS: DEXA scan results prior to pregnancy 1 (P1) and pregnancy 2 (P2) were similar for all variables, except total bone mineral density. However, the individual gained considerably more fat during P2 (P1: 15.7 lbs; P2: 28.7 lbs fat gained). Five months post-pregnancy, fat mass was still elevated (P1: 3.8 lbs; P2: 12.7 lbs above baseline) and continued to decrease until 12 months after delivery. Lean mass was increased from baseline at two weeks post-pregnancy (P1: 96.52 lbs; P2: 97.1 lbs). However, gained lean mass was lost by five months postpartum (P1: 89.89 lbs; P2: 91.2 lbs). During P1, lean mass remained about the same from five to 12 months but increased at 12 months after P2 (96.2 lbs). After P1, the individual had a substantial decrease in bone mineral density, losing 0.49% at two weeks postpartum, 4.68% at five months, and 9.20% twelve months. Bone mineral density remained below baseline prior to P2, but did not decrease as dramatically following P2. Using the initial baseline, bone mineral density was 3.53% lower at two weeks, 6.57% at five months, and 7.64% at 12 months. During both postpartums, the trunk (P1: 12.1%; P2: 11.54%), spine (P1: 13.5%; P2: 11.36%), and pelvis (P1: 12.4%; P2: 14.34%) decreased more than total bone mineral density. At each appointment, the participant reported breastfeeding, being physically active, but did not exercise consistently.

CONCLUSIONS: Exclusive breastfeeding combined with an active lifestyle but no formal exercise was adequate to restore fat mass and lean mass by 12 months post-partum. Total bone mineral density decreased following both pregnancies. The baseline bone mineral density for the second pregnancy was lower than the initial baseline, but less decline post-partum.
Exercise Training Improves High Blood Pressure Variability-Induced Cardiac Damage In Normotensive Rats

Ivana C. Moraes-Silva1, Katia De Angelis2, Nilza R. Damaceno-Rodrigues2, Elia G. Caldini2, Maria Claudia Irigoyen3, Elia G. Caldini1
1Heart Institute (InCor), University of São Paulo Medical School (FMRP), São Paulo, Brazil. 2Federal University of São Paulo (UNIFESP), São Paulo, Brazil. 3University of São Paulo Medical School (FMRP), São Paulo, Brazil.

No relevant relationships reported

High blood pressure variability (BPV) at rest is harmful to organ perfusion even if blood pressure (BP) is within normal values. Exercise training (ET) is known for its effectiveness in reducing BP and BPV; however, the effects of high BPV without sustained hypertension are unclear. PURPOSE: To study the effects of ET in cardiac morphofunctional parameters in an experimental model of high BPV.

METHODS: Normotensive rats (256±4 g, mean BP 110±4 mmHg) underwent sinoaortic denervation (SAD) or sham surgery. SAD consists of baroreceptors removal to increase BPV. After 1 week of SAD, rats were divided into sedentary or trained. ET was performed on a treadmill (10 weeks, 5x/week, 60-2120 max). After this period, BP and heart rate (HR) were directly measured (Windaq, 2kHz). Cardiovascular autonomic modulation and spontaneous baroreflex sensitivity were analyzed in frequency domain (Matlab). Echocardiography and cardiac histomorphometry were also performed. Two-way ANOVA was used to compare groups; numeric results are described when p<0.05; 8 rats/group were used.

RESULTS: Complex variability (IVRT) (21±1 ms) was increased by SAD without changes in mean BP or HR (Tabla). However, ET ability to decrease BPV was associated with better aerobic capacity (HR at Rec2: 706.1 ± 688.9 dynes/sec/cm-2, Rec3: 331.9 ± 287.2 dynes/sec/cm-2). Compared to Rest, AIx@75 was increased by SAD (Men= Rest: 0.4 ± 7.6 %, Rec1: 33.6 ± 12.4 %, Rec2: 20.1 ± 13.3 %, Rec3: 15.8 ± 9.9 %; Women= Rest: 16.8 ± 39.5 %, Rec1: 33.6 ± 12.4 %, Rec2: 20.1 ± 13.3 %, Rec3: 15.8 ± 9.9 %). EF for men was augmented compared to women during Rec1, Rec2, and Rec3 (Men= Rest: 305.4 ± 219.6 dynes/sec/cm-2, Rec1: 2153.5 ± 866.7 dynes/sec/cm-2, Rec2: 1235.3 ± 779.5 dynes/sec/cm-2, Rec3: 1212.0 ± 593.7 dynes/sec/cm-2; Women= Rest: 258.4 ± 248.2 dynes/sec/cm-2, Rec1: 1237.5 ± 656.7 dynes/sec/cm-2, Rec2: 706.1 ± 688.9 dynes/sec/cm-2, Rec3: 331.9 ± 287.2 dynes/sec/cm-2). Compared to Rest, AIx, AIx@75, and EW for men was significantly greater during Rec3, while Rec1 for women returned to Rest. STEV had a significant main effect of time (p<0.001). In that, Rest was augmented compared to Rec1, Rec2, and Rec3 for both sexes (Men= Rest: 159.4 ± 26.0 %, Rec1: 92.3 ± 14.2 %, Rec2: 103.9 ± 27.6 %, Rec3: 127.6 ± 22.4 %; Women= Rest: 142.4 ± 23.0 %, Rec1: 83.2 ± 15.5 %, Rec2: 109.0 ± 21.3 %, Rec3: 129.3 ± 22.0 %). CONCLUSION: These data suggest sex differences in pulse wave velocity after HRE. There was a greater decrement of left ventricular function in men up to 60 minutes, and women recovered faster following HRE.

The AMPK levels in different groups

<table>
<thead>
<tr>
<th>Group</th>
<th>2weeks</th>
<th>4weeks</th>
<th>6weeks</th>
<th>10weeks</th>
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</thead>
<tbody>
<tr>
<td>CON</td>
<td>1.00±0.00</td>
<td>1.00±0.00</td>
<td>1.00±0.00</td>
<td>1.00±0.00</td>
</tr>
<tr>
<td>MICT</td>
<td>1.12±0.38</td>
<td>1.06±0.03</td>
<td>0.76±0.12</td>
<td>1.15±0.04</td>
</tr>
<tr>
<td>HIIT</td>
<td>0.95±0.24</td>
<td>0.91±0.03</td>
<td>1.09±0.43</td>
<td>1.32±0.26</td>
</tr>
</tbody>
</table>

The Pgc1α levels in different groups

<table>
<thead>
<tr>
<th>Group</th>
<th>2weeks</th>
<th>4weeks</th>
<th>6weeks</th>
<th>10weeks</th>
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<tbody>
<tr>
<td>CON</td>
<td>1.00±0.00</td>
<td>1.00±0.00</td>
<td>1.00±0.00</td>
<td>1.00±0.00</td>
</tr>
<tr>
<td>MICT</td>
<td>1.04±0.26</td>
<td>1.16±0.30</td>
<td>0.97±0.26</td>
<td>1.16±0.14</td>
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<tr>
<td>HIIT</td>
<td>0.93±0.22</td>
<td>0.83±0.19</td>
<td>1.17±0.36</td>
<td>1.28±0.17</td>
</tr>
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</table>

CONCLUSION: 1. HIIT is more effective than Moderate-intensity continuous training in the way to improve aerobic capacity; 2. Effect of Long-term HIIT can be more pronounced in respect of enhancing aerobic capacity. HIIT can promote cardiac muscle aerobic capacity through AMPK/PGC-1α Signaling Pathway.
INTRODUCTION: There are many ways to indirectly determine the autonomic balance, such as by means of heart rate variability, Valsalva maneuver and active orthostatic stress (AOS). In an AOS test, heart rate (HR) shows a bimodal behavior with a fast HR increase that is explained mainly by vagal withdrawal and a subsequent HR decrease, associate to a vagal reactivation and baroreflex control. Studies have shown a controversial relationship between cardiorespiratory fitness (CRF) and the cardiac autonomic function. PURPOSE: To correlate CRF and the vagal withdrawal response to AOS in Brazilian firefighters. METHODS: We evaluated 26 male firefighters. AOS test was performed in the morning immediately before the on-duty period. A Heart Rate monitor was used to continuously record HR during AOS. Jackson’s questionnaire was used to estimate CRF. The relative difference on-duty period. A Heart Rate monitor was used to continuously record HR during AOS. Jackson’s questionnaire was used to estimate CRF. The relative difference between the basal (supine) and peak HR (orthostatic) during AOS (%Δ HR [t0 - tmax]) was calculated to express the vagal withdrawal in relation to basal HR. Due to a nonparametric distribution Spearman correlation test was used (p<0.05). RESULTS: We observed a positive correlation (r= 0.597, p<0.01) between %Δ HR (t0 - tmax) and CRF (Figure 1). CONCLUSION: It was shown that the higher the cardiorespiratory fitness (CRF), the greater the vagal withdrawal as evaluated by %Δ HR (t0 - tmax). Besides being necessary for job-task performance, higher CRF seems to be associated with an improved cardiac autonomic function in firefighters. CRF may be a protective factor for autonomic disorders in firefighters.
PURPOSE: To compare echocardiographic measures between endurance and non-endurance athletes.

METHODS: Echocardiographic studies were performed in 250 well-trained male and female subjects aged between 13 and 38 years (Age = 20.9 ± 5.5 years, BMI = 22.7 ± 3.3 kg/m²; mean ± SD). Twenty-five variables were analyzed. Statistical summaries stratified by gender and age group were initially produced. Afterwards, the subjects aged 15 years or over (n = 224) were classified into two categories according to the characteristics of their sport discipline: “Endurance” (cardiorespiratory endurance) and “Other” (Non-Endurance). Univariate comparisons between the two groups were conducted within each gender stratum in a subset of fifteen variables: Heart rate (HR), Left ventricular diastolic diameter (LVDD), Left ventricular diastolic diameter index (LVDI), Interventricular septum thickness (IST), Left ventricular shortening fraction (LVSF), Left ventricular posterior wall thickness (LVPWT), Relative wall thickness (RWT), Left ventricular mass index (LVM), Left atrial diameter (LAD), Aortic root diameter (ARD), Inferior vena cava diameter (IVCD), E/A ratio (E/R), E′/e′ ratio (Ee′R), Right ventricular systolic velocity (RVS) and Left ventricular global longitudinal strain (GLS). The Student’s t-test for independent samples was applied. Statistical significance was declared at the 0.05 level.

RESULTS: In men, statistically significant higher values were identified in the endurance group for: HR (60.1 ± 1.8 vs. 64.5 ± 1.2 beats/min), and significantly lower IST (10.5 ± 0.2 vs. 9.7 ± 0.1 mm), LVPWT (9.4 ± 0.1 vs. 8.8 ± 0.0 mm), E/A ratio (1.2 ± 0.3 vs. 1.5 ± 0.4), and LVM (59.5 ± 2.6 vs. 64.1 ± 2.7 mm); values, (mean ± SE).

CONCLUSIONS: Most of the echocardiographic variables showed higher sample means in the endurance athletes, although not all the differences were statistically significant. The endurance group showed significantly higher values of left ventricular wall thickness and left atrial diameter in men, and significantly higher values in variables related to the left ventricular eccentric hypertrophy in women.

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TABLE 1. Correlation between sedentary behavior, steps per day and HRV parameters.

<table>
<thead>
<tr>
<th>Total sedentary time</th>
<th>Prolonged sedentary time (≥30 min bouts)</th>
<th>Steps/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean R-R</td>
<td>r = -0.3; p = .265</td>
<td>r = -0.13; p = .364</td>
</tr>
<tr>
<td>inRRMSD</td>
<td>r = -0.005; p = .974</td>
<td>r = -0.44; p = .864</td>
</tr>
<tr>
<td>lnSN</td>
<td>r = -0.852; p = .776</td>
<td>r = -0.815; p = .420</td>
</tr>
<tr>
<td>lnHR</td>
<td>r = -0.368; p = .212</td>
<td>r = -0.768; p = .765</td>
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</table>

Risk of cardiovascular disease (CVD) can begin as early as young adulthood. With the prevalence of CVD in the United States expected to increase as the population ages, strategies for the early identification of CVD risk are needed to improve interventions and reduce the future burden of CVD. Cardiac autonomic dysfunction, a non-invasive through heart rate variability (HRV), has been suggested as an early marker of CVD. Reduced HRV is associated with increased CVD risk among older adults or those with existing metabolic disease, but data are limited in young adults.

PURPOSE: This study examined the association between HRV and cardiac autonomic function in young adults.

METHODS: A total of 23 females (24.8 ± 1.9 years) and 17 males (26.0 ± 2.3 years) performed study measurements in one visit. Assessments included 10-minute seated HRV collection using a wearable sensor, blood pressure, waist circumference and body mass index. HRV data were filtered and visually inspected for artifacts. The root mean square of successive differences in the time domain (RMSSD) was used as the variable.
Obesity is associated with cardiovascular autonomic dysfunction. Bariatric surgery improves cardiovascular health, which might be partly attributed to alterations in the autonomic nervous system. However, the benefits from surgery are limited, and it is currently unknown whether exercise training can further improve cardiac autonomic regulation in post-bariatric patients. PURPOSE: To examine the effects of exercise training on cardiac autonomic responses in women undergoing bariatric surgery. METHODS: Sixty-two obese women were randomly allocated to receive either bariatric surgery (RYGB) or bariatric surgery followed by exercise training (RYGB+ET). At baseline (PRE), and 3 (POST3) and 9 (POST9) months after surgery, we assessed chromotopic response to exercise (CGR5) and heart rate recovery; i.e., the decay of heart rate after 30 (HR30s), 60s (HR60s) and 120s (HR120s) after a maximal exercise test. The 6-month exercise intervention started at POST3 for RYGB+ET, while RYGB followed standard care. RESULTS: Analysis of relative changes (Δ from POST9-PRE) revealed higher CR5 (Δ=5.86%, CI95% =2.22-9.19, P=0.0445), HR30s (Δ=2.98 beat/min, CI95% =4.29-21.67, P=0.01), HR60s (Δ=22.95 beat/min, CI95% =11.72-34.18, P=0.01) and HR120s (Δ=34.54 beat/min, CI95% =19.91-49.17, P<0.01) in the exercised group. Both groups demonstrated similar reduction in the frequency of individuals showed incompetence chromotopic (defined as chromotopic response less than 80%) at POST3 and POST9. The proportion of participants with blunted HRH decreased at POST3 in both groups; interestingly, exercise training further decreased this proportion at POST9 from 56% to 5%. Moreover, the proportion of blunted HRH in RYGB+ET was significantly lower than in RYGB at POST9 (5% vs. 31%, P=0.045, respectively). CONCLUSIONS: A 6-month exercise training program is an effective strategy to improve cardiac autonomic responses during and post-exercise recovery in obese women undergoing bariatric surgery. These findings reinforce the relevant cardioprotective role of exercise for post-bariatric patients. Clinicaltrials.gov: NCT02441361

In a recent systematic review, we reported evidence that exercise and nutrition professionals stigmatize their patients due to their weight in 81% of 31 studies. Being weight stigmatized is associated with adverse cardiovascular health consequences for unclear reasons; but may be due to the heightened cardiovascular reactivity that accompanies obesity and hypertension. PURPOSE: We examined the influence of two video exposures, one containing scenes of weight stigma (STIGMA) and the other non-stigmatizing neutral (NEUTRAL) scenes, on cardiovascular reactivity assessed by resting and ambulatory blood pressure (ABP) and heart rate (HR), among women with obesity and high blood pressure (HBP); n=24 or normal BP (NB; n=25). METHODS: Women completed a screening visit and two randomized visits which involved watching a 10-min STIGMA and NEUTRAL video exposure. Laboratory BP and HR were measured before, during, and after the videos. ABP and HR were measured upon leaving the laboratory for the awake (10hrs), sleep (9hrs), and 19hrs. A repeated measures ANCOVA tested the difference in BP and HR changes from baseline between the BP groups after STIGMA vs NEUTRAL controlling for BMI and baseline BP and HR in the laboratory and over ambulatory conditions. RESULTS: Women with HBP (systolic/diastolic BP [SBP/DBP]=129.2 ± 13.6/73.5 ± 11.2 mmHg) were 37.5±9.1yr and obese (Body Mass Index [BMI] = 37.8 ± 6.1kg•m⁻²); women with NB (SBP/DBP=106.9 ± 7.6/65 ± 0.7mmHg) were 34.1±8.9yr and obese (BMI= 33.6±4.9kg•m⁻²). Laboratory SBP/DBP increased 5.5±7.3/2.3±4.8±8.8mmHg more in HBP than NB after STIGMA vs NEUTRAL (P<0.05), with no difference in HR (P>0.05). ABP increased more in HBP than NB over sleep (SBP / DPP= 4.2±6.6/4.7±12.4mmHg; P<0.05) and 19hrs (SBP / DPP=0.9±2.5/3.0±4.7±10.8 mmHg; P<0.05) after STIGMA vs NEUTRAL. During sleep, HR increased 7.5±15.7ppm more in HBP than NB after STIGMA vs NEUTRAL (P<0.05). CONCLUSION: Exposure to a weight stigma video resulted in greater cardiovascular reactivity in women with obesity and HBP than NB in the laboratory and under ambulatory conditions, most notably during sleep. Our findings reveal the importance of educating health professionals about weight stigma, and its immediate, yet persistent adverse cardiovascular health effects, and developing interventions to mitigate weight stigma.
Endothelial cells (ECs) are constantly exposed to hemodynamic shear stress that can influence vascular signaling. High laminar shear stress (HSS), an exercise metric, upregulates atheroprotective genes such as Kruppel-like factor 2 (KLF2), whereas disturbed flow and oscillatory SS upregulate proatherogenic genes such as vascular adhesion molecule-1 (VCAM-1). Micro-RNAs (miRs) are small non-coding RNAs that regulate gene expression. Current evidence has identified mechanosensitive miRs that regulate shear-induced gene expression and ultimately control endothelial function. Moreover, we have previously demonstrated the efficacy of HSS in attenuating endothelial dysfunction predominantly seen in African American (AA) ECs compared to Caucasian (CA) ECs.

**Purpose:** To investigate potential racial differences in the expression of selected mechanosensitive miRNAs in response to HSS.

**Methods:** Endothelial cells (HUVECs) from two AA donors and two CA donors were cultured and exposed to HSS (20 dynes/cm²) for 24 hr using a cone and plate viscometer. Total RNA was harvested to assess the effect of HSS on the expression of miR-21, miR-126*, and miR-92-a.

**Results:** We report a significant increase in miR-92-a expression with HSS in both AA and CA HUVECs (~2-fold difference, p < 0.05). Additionally, miR-92-a tended to be higher in AA ECs compared to CA ECs under both conditions. However, there was no significant difference in miR-21 or miR-126* expression between AA and CA ECs nor control and HSS conditions.

**Conclusions:** Our findings suggest that both LF and HF HRV components are related to sleep quality in young adults, highlighting a potential relationship between sleep quality and nighttime autonomic nervous system function.

**PURPOSE:** To examine the effects of caffeine alone, or in conjunction, with acute exercise on HRV during time out-of-sports and sleep characteristics in young adults.

**METHODS:** Participants in the study were 11 resistance-trained women (Age Mean±SD: 24±4yrs) who consumed caffeine alone or in conjunction with resistance exercise. Participants completed a dry-fire pistol shooting task of 40 shots per condition. HRV was measured using a chest-strap heart rate monitor for 24 hours and a triaxial accelerometer on the non-dominant wrist for 7 days during free-living PA and sleep. Average sleep duration and SJL were determined from objective sleep data, with SJL calculated as the difference in hours between the midpoint of sleep on weeknights (school) and weekend (free) nights.

**RESULTS:** Caffeine alone did not significantly affect HRV during time out-of-sports and sleep characteristics in young adults. However, caffeine in conjunction with resistance exercise significantly decreased HRV during time out-of-sports and sleep characteristics in young adults.

**CONCLUSION:** Caffeine in conjunction with resistance exercise significantly decreased HRV during time out-of-sports and sleep characteristics in young adults.

**References:**


**Acknowledgments:** We acknowledge the contributions of all study participants. This study was supported by the National Institutes of Health (NIH) (R01HD084279) and the American Heart Association (Grant-in-Aid 17SDG33800299).
Exercise preconditioning alleviated cardiac injury induced by LPS. GCN2 KO also improved cardiac injury. Exercise preconditioning promoted the effect of GCN2 KO in alleviating cardiac injury, GCN2 and eIF2α/ATF4 pathway play an important role in the process.

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PURPOSE: To determine the effect of PGR on mitochondrial respiratory capacity (JO). METHODS: FVB mouse dams were fed a control (CON: 20% protein), or a low-protein (LP: 8% protein) isocaloric diet 2-weeks before mating. LP-dams produce 18% less milk and pups nursed by LP-dams undergo growth restriction. At postnatal racial difference appears born to dams fed the CON diet were crossed to LP-dams (PUN; postnatally undernourished) or a different CON-dam. At PN21, all mice were weaned to the CON-diet. On PN22 or PN80, mice were weighed, euthanized, and hearts removed. Hearts were weighed and cardiac mitochondria were isolated via differential centrifugation. Respiration was measured through high-resolution particle arraymetry in the presence of 5 mM pyruvate and 1 mM L-malate (PM). Two-way ANOVAs were performed with the main effects of diet (CON vs. PUN) and age(PN22 vs. PN80) to compare, body-mass, heart-mass, and JO. An n of level of 0.05 was set a priori, and if necessary, a Tukey’s HSD post hoc test was used for multiple comparisons. RESULTS: PGR caused significant diet and age effects (p<.001) on final body-mass between CON (PN22: 12.01±0.83g; PN80: 23.51±1.22g) and PUN groups (PN22: 8.45±0.61g; PN80: 21.32±3.42g). Heart-mass was also significantly reduced (p<.001) in PUN (PN22: 0.06±0.01g; PN80: 0.11±0.01g) and if necessary, a Tukey’s HSD post hoc test was used for multiple comparisons. CONCLUSIONS: PGR decreased body and heart-mass across the life span and increased LEAK state JO, and if necessary, a Tukey’s HSD post hoc test was used for multiple comparisons. PGR caused reductions in RCR, which may cause CVD, thus PGR increases CVD risk through uncoupling of mitochondrial function. Exercise may improve mitochondrial function in PGR mouse hearts.

PURPOSE: Acute exercise elicits a temporary change in redox balance resulting in activation of proinflammatory gene expression and enzymes. We have previously shown in men that the type of acute exercise stimulus, constant workload (CW) vs. intermittent workload (IW) elicits different changes in redox enzymes between the 2 conditions. In this study, we also examined the effect of exercise intensity on NO production (WU) and gene expression (WU).

METHODS: Healthy women ages 30-45y participated in this study in a randomized, cross-over design (n=12, projected) with a 2-week washout period between trials. Each participant completed a VO\(_2\) max test followed by 2-min exercise at constant workload (CW) or intermittent workload (IW). Each trial occurred every other day for 5 days. A second VO\(_2\) max test was performed prior to the second trial to ascertain that VO\(_2\) max had not changed from baseline. CW consisted of 30-min of cycling at 70% VO\(_2\) max. HIIP consisted of a 9-min ramp-up, 7-intervals of 1-min “all out” (n=22; 12:01±0:80% VO\(_2\) max) followed by a 2-min WU (WU). PUN groupery for a total of 30-min of cycling. Blood draws were taken pre- and, 10-, 30-, and 60-min post exercise during the first and third exercise session of each trial. Cell signaling was measured by nuclear localization of NFκB as well as protein abundance of GCLC and GSR in PBMCs. GR enzyme activity was measured in erythrocyte lysate.
Reverse cholesterol transport (RCT) is critical to the regulation of blood cholesterol levels and prevention of macrophage foam cell formation. A critical step in RCT is the efflux of cholesterol from macrophages to high-density lipoprotein (HDL). Numerous studies have shown exercise to regulate HDL quantity and function, but little is known about how exercise affects the expression of cholesterol efflux genes in circulating monocytes. **Purpose:** To determine changes in mRNA expression of cholesterol efflux genes (ATP-binding cassette A1, ABCA1; ATP-binding cassette G1, ABCG1; mitochondrial sterol 27-hydroxylase, CYP27A1) in peripheral blood mononuclear cells (PBMCs) following a single bout of high intensity interval exercise. **Methods:** Six (Female = 4, Male = 2) healthy participants (Age: 25 ± 6 yr, BMI: 26.1 ± 4.1 kg/m2; VO2peak = 36.4 ± 7.4 ml x kg x min⁻¹) completed a single bout (work load = 300 W, 2142 interval exercise. Along with improved lipid profiles (e.g. increased HDL), results show elevations in PBMC ABCG1 expression following a single bout of high intensity interval exercise. The viability rate was reduced to 51.10% (p<0.01) and 74.10% (p<0.001), respectively. In addition, the percentage of early apoptotic cells was 36% (p<0.001) after 6 h of hypoxia/4 h of reoxygenation (H/R) as assessed by MTT assay. The viability rates in the same H/R protocol increased from 74±10% to 92±10% and 80±2% in SM- and NSM-treated cells, respectively, without exhibiting differences with the normoxia group (p>0.05). Interestingly, a significantly higher viability was observed only in the cells treated with the SM compared to the non-treated cells after H/R injury (p<0.05). **CONCLUSIONS:** Our findings suggest that cardiomyocytes are susceptible to H/R-induced injury, while the cell death rate depends on the duration of reoxygenation. Moreover, cardiomyoblasts’ secretome inhibits their apoptosis after H/R injury while their mechanical load “preconditioning” appears to boost the anti-apoptotic effects of their secretome, implying the beneficial paracrine action of cardiac muscle cells due to mechanical loading. D-62 Free Communication/Poster - Health Interventions in Youth Thursday, May 28, 2020, 2:00 PM - 4:30 PM Room: CC-Exhibit Hall
PURPOSE: To observe the effect of a family-oriented exercise and nutritional intervention on body composition in overweight and obese children and adolescents.

METHODS: Twelve subjects (ages 7-16) were enrolled in a childhood obesity program upon referral by their primary care physician. Subjects engaged in 45 min of aerobic and flexibility training twice weekly for 18 weeks. Each exercise session was followed by 30 min of nutritional counseling. Body mass index (BMI), waist circumference (WC), hip circumference (HC), and body fat percent (BF%) were measured throughout the intervention. One-way repeated measures ANOVA determined anthropometric differences at baseline, midpoint, and at the end of the intervention.

RESULTS: Subjects were 12.3±2.4 years old and 44.4% were obese, having a mean BMI of 29.8±4.5 kg/m², BF% of 38.6±6.8%, HC of 99.8±5 cm, WC of 96.10 cm, and hip-to-waist ratio of 0.96. From baseline to follow-up, subjects decreased BMI by 1.0 kg/m² (p=0.011), WC by 4.69 cm (p=0.031), and hip-to-waist ratio by 0.05 (p=0.043); the reduction in BF% failed to reach significance (p=0.060). Repeated measures ANOVA identified reductions in bodyweight (1.09 kg; p<0.001), WC (3.44 cm; p<0.049), and hip-to-waist ratio (0.05; p=0.037) between weeks 9 and 18. Differences for the same measurements between weeks 1 and 9 were insignificant (p=0.05).

CONCLUSION: Despite our small sample size, the combined exercise and nutritional counseling intervention improved anthropometric profiles of obese and overweight children and adolescents over the course of 18 weeks. The greatest improvements took place after 9 weeks, indicating the importance of perseverance when seeking body composition improvement in this demographic.

2145 Board #64 May 28 2:00 PM - 3:30 PM Influence Of Sports Games On Children’S Coordination Ability And Lower Limb Muscle Strength Ye Zhang, Boqian Sun. Qujing Normal University, Qujing, China.

Email: zhangye5337@126.com (No relevant relationships reported)

PURPOSE: to explore the influence of the developed sports games intervention programs on children’s physical coordination and lower limb strength, and to compare the effects of routine gymnastics and sports game intervention, so as to better develop children’s physical coordination and lower limb strength, and provide effective intervention programs in line with the characteristics of children’s physical and mental development.

METHODS: 48 children aged 4-5 were selected and randomly divided into two groups based on teaching classes - sports game group and gymnastics group - each with 24 children. The developed sports games programs were adopted to intervene children’s coordination of the sports game group. The intervention period was 4 weeks, 3 times a week, 30 minutes each time. In the same intervention cycle and intervention time, children in the gymnastics group did basic gymnastics. RESULTS: repeated measures of variance were analysed to compare the changes of children’s physical coordination and lower limb strength in different groups before and after the intervention. The results showed that both the children in the sports game group and the gymnastics group took less time in the continuous jumping test after the intervention than before the intervention (sports game group: 8.94s±1.86s vs. 7.74s±1.66s, p<0.005; gymnastics group:10.04s±2.66s vs. 7.74s±1.66s, p<0.005), but the sports game group took significantly less time for continuous jumping test after intervention than the gymnastics group (5.78s±0.99s vs. 7.74s±1.66s, p<0.005). CONCLUSION: compared with children’s basic gymnastics, the developed sports games programs are more targeted to the development of children’s physical coordination and lower limb strength, therefore more effective for that purpose.

2146 Board #65 May 28 2:00 PM - 3:30 PM ACUTE EFFECTS OF EXERGAMING ON URBAN MIDDLE SCHOOL CHILDREN’S AFFECTION BETWEEN SMALL-GROUP AND WHOLE-CLASS SETTINGS Wenxi Liu1, Daniel J. McDonough1, Xiwen Su2, Sveinung Berntsen3, Justin B. Moore, FACSM1.

1Wake Forest School of Sport Sciences, Winston-Salem, NC. 2Western Norway University of Applied Sciences, Sogndal, Norway. 3University of Agder, Kristiansand, Norway.

Email: jsmoore@wakehealth.edu (No relevant relationships reported)

PURPOSE: With the goal of developing effective exergaming programs at school sites, the present study investigated the differences in urban middle school children’s situational feeling states between small-group and whole-class settings.

METHODS: Forty-five participants (25 females; M = 24.3 kg/m², SD = 3.1) completed two separate 15-minute exergaming sessions on the same day: (1) Xbox One Kinect Just Dance in a small-group (n = 3–4) setting; and (2) Xbox One Kinect Just Dance in a whole-class (n = 23-24) setting. Participants’ affection and emotional states were measured by the established Exercise-Induced Feeling Inventory (EFI) and Subjective Exercise Experience Scale (SEES). The 15-item EFI (5-point Likert scale ranged 0-4) included four constructs: positive affect, negative affect, fatigue, and tranquility, and the 12-item SEES (7-point Likert scale ranged 1-7) with included three constructs: positive well-being, psychological distress, and fatigue. Dependent t-tests were used to detect mean differences for all outcomes between the two exergaming sessions, with significance being set at p < 0.05.

RESULTS: Dependent t-test indicated significant differences on children’s negative affect between two sessions (t = -1.77, p < 0.05, Cohen’s d = 0.32). The lower mean score referred to less feeling of negative affect. Participants in small-group exergaming session (M = 0.20, SD = 0.44) experienced less negative affect in comparison to the whole-class session (M = 0.43, SD = 0.95). However, there was no significant difference in other feeling outcomes between two sessions.

CONCLUSIONS: Findings indicated urban middle school children playing exergaming in small-group setting may experience fewer negative feelings such as crumby, discouraged, and miserable compared to the whole-class setting. Notably, there was no significant differences for other outcomes between two sessions. Future longitudinal studies are needed to examine long-term affection and emotional effects of exergaming across various settings.
was observed on the students’ PA level during the full day, however, an intervention effect was observed during school hours. Girls in the PAL-group, who had a mean change in PA level during the intervention period that was 92 counts per minute (cpm) (95% CI: 52; 133, p<0.001) higher than the control group. Girls in the PAL-group increased time spent in moderate-to-vigorous intensity physical activity (MVPA) with 6.3 min/day (95% CI: 3.8; 8.8, p<0.001) more than the controls, and reduced time spent sedentary with 7.3 min/day (95% CI: 11.8; -2.8, p<0.001). Boys in the PAL-group increased their mean PA cpm (95% CI: 3.8; 24.1, p=0.001) by 14.73 cpm/day (95% CI: 5.1 min/d (95% CI: 1; 8.6, p<0.005) more than control boys. In the DWBHI-group, no intervention effect was observed on mean PA level or time spent in MVPA, however, the DWBHI-group increased their sedentary time during school hours more than their counterparts in the control group. CONCLUSIONS: We found no effect of a nine-months PA-intervention on 14-year-olds PA level over the full day. However, we found an effect on PA during school hours for adolescents in the PAL-intervention. As both intervention models were targeting the school hours in particular, the results might indicate that future interventions need to target after school hours to increase adolescents’ PA level over the full day.

Birth weight and gestational age are early life factors linked to health characteristics during childhood and adolescence, such as obesity, physical activity (PA), sedentary time (ST). It has been suggested that birth weight is not as important as PA in the prediction of childhood obesity. However, these associations have been inconsistent across different studies, and suggestions of potential population-specific differences have been proposed. PURPOSE: To describe and compare birth weight, gestational age, percent body fat (% fat), PA, and ST in a group of 11-13-year-old Hispanic children in Puerto Rico; and evaluate associations between these variables. METHODS: Ninety-six children (boys=55, girls=41) volunteered to complete antropometric measurements (height, sitting height, weight, % fat, and arm and waist circumferences), accelerometer-based PA and ST, and a nutrition and quality of life questionnaire. Also, parents completed a sociodemographic and family health and home environment questionnaire. Mann-Whitney U test, and Spearman correlation analyses conducted to test for sex differences and associations between variables. RESULTS: Light PA (1.6±0.4 hr/day), moderate PA (0.9±0.2 hr/day), vigorous PA (0.2±0.1 hr/day), ST (11±3.0 hr/day), and BMI percentiles (63.8±30.6) were not different between boys and girls. Overweight (13%) and obesity (22%) was lower in our children participants compared to previous reports in pre-school aged Hispanic children. A significant and inverse correlation between BMI percentile and vigorous PA (rho =–0.46, P=0.04), and BMI percentile and number of household TV sets (rho =–0.55, P=0.088) was observed. CONCLUSION: Combining light, moderate and vigorous PA/day (2.7 hr/day); pre-school children in this study approached PA guidelines. Nonetheless, ST was high. Our results also show that those who engage in more vigorous PA have lower BMI percentile, suggesting that PA intensity might be relevant for obesity prevention in this young age group. The inverse association between number of TV sets per household and BMI percentile was unexpected, thus, requiring further analyses.

There are enough researches that can prove the importance of physical activity for children’s health. It’s necessary to keep enough physical activity time during children’s growth and development of their bodies. There are already some researches about parent income and children’s physical activity time, but those researches are all in developed countries and no studies in a developing country, such as China. PURPOSE: By comparing the physical activity time of children with the different parent income level and show the income level impact on children’s physical activity time.

METHODS: There are four schools selected in this study and every two schools from Thursday and suburbs areas in Beijing. We used the CLASS questionnaire (Children Leisure Activities Study Survey) to acquire the data about parent income (yuan/month) and the time of children’s physical activity (mins). All total of 408 students (boys=217, age: 10.7±0.93yrs) and 384 parents (male=199, age: 39.6±5.62yrs) are involved in this study. We divide the parent income into four levels: The low-income (0-5000yuan/per month), the middle-income (5000-10000yuan/per month), the high-income (10000-15000yuan/per month) and the highest-income (over 15000yuan/per month). The data were analyzed using one-way ANOVA.

RESULTS: By comparing the children physical activity time in different parent income levels, with middle-income and low-income (14.43±9.244mins vs. 116.60±55.7mins, P=0.05); With middle-income and high-income(14.43±9.244mins vs. 112.11±61.48mins, P=0.05); With middle-income and highest-income (14.43±9.244mins vs. 105.83±62.9mins, P<0.05).

CONCLUSIONS: Parent income may have an impact on children physical activity time, the children which their parent income at a middle level have the most physical activity time. This study was conducted in a developing country and the result may differ from the developed countries. In the future, the studies should consider more factors that may impact the children’s physical activity time.

For healthy growth and development, physical activity (PA) guidelines for preschool-aged children suggest at least 3 hours/day of combined structured and unstructured PA. Prevention of childhood overweight and obesity is another health priority in this population. Among 1-6-year-old Hispanic children in Puerto Rico, the prevalence of overweight and obesity is approximately 60%. However, the association between obesity and accelerometer-based PA and sedentary time (ST) in this population have not been previously described. PURPOSE: To describe PA and ST, and test the association between obesity and PA, and between obesity and ST in Hispanic pre-school children. METHODS: A group of 25 children (Boys = 10, Girls = 15, aged 3 to 5 years old) attending a pre-school at the University of Puerto Rico (UPR) and their parents volunteered to participate. Children’s measures of height and weight, and 7-day waist-worn accelerometer data were obtained. Parents completed a sociodemographic, and family health and home environment questionnaire. Mann-Whitney U test, and Spearman correlation analyses conducted to test for sex differences and associations between variables. RESULTS: Light PA (1.6±0.4 hr/day), moderate PA (0.9±0.2 hr/day), vigorous PA (0.2±0.1 hr/day), ST (11.3±3.0 hr/day), and BMI percentile (63.8±30.6) were not different between boys and girls. Overweight (13%) and obesity (22%) were lower in our children participants compared to previous reports in pre-school aged Hispanic children. A significant and inverse correlation between BMI percentile and vigorous PA (rho =–0.46, P=0.04), and BMI percentile and number of household TV sets (rho =–0.55, P=0.088) was observed. CONCLUSION: Combining light, moderate and vigorous PA/day (2.7 hr/day); pre-school children in this study approached PA guidelines. Nonetheless, ST was high. Our results also show that those who engage in more vigorous PA have lower BMI percentile, suggesting that PA intensity might be relevant for obesity prevention in this young age group. The inverse association between number of TV sets per household and BMI percentile was unexpected, thus, requiring further analyses.

INTRODUCTION: Child self-report and parent proxy-report are frequently used for assessing youth sleep duration (SLD) and screen time (ST) behaviors; however, discrepancies in the reporting of youth SLP and ST between children and parents are not well understood. PURPOSE: The purpose of this study was to examine if family ST rules and child bedroom televisions (BTV) were associated with discrepancies between child and parent reports of youth SLP and ST behaviors.
**METHODS**: Children aged 8-11 self-reported their SLP and ST behaviors, if they had a BTV, and demographic information. Parents reported information about their child’s SLP and ST behaviors, family ST rules, and family characteristics (i.e., income, marital status, etc.). The prevalence of parents reporting less healthy, similar, or healthier behaviors compared to child-reports was calculated. Separate linear regression models examined if BTV and family ST rules were predictive of the discrepancies in the reporting of youth’s SLP and ST behaviors between parents and children.

**RESULTS**: Parents reported healthier child behaviors (less screen time and more sleep) compared to child reports. Linear regression models identified child BTV as a significant predictor of discrepancies in child-parent reporting for both, SLP and ST (p<0.01 and p<0.03, respectively), but not family ST rules (both p<0.05).

**CONCLUSIONS**: The presence of a child BTV contributes to discrepancies in child and parent reporting of youth’s SLP and ST behaviors. Future work evaluating youth SLP and ST behaviors using survey tools and national data collection protocols should capture information about the presence of a child BTV.

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**Impact Of Situational Games Intervention On Fitness Outcomes Among 6-7 Years Old Chinese Children**

Jie Zhuang1, JunYu Wang1, Jun Wu2, XinZhao Cao1, Yong Gao2, ’Shanghai University of Sport, Shanghai, China. ’Shanghai Liuyi elementary school, Shanghai, China. ‡Boise State University, Boise, ID.

Email: zhuangjiesh@163.com

(No relevant relationships reported)

**PURPOSE**: To examine the impact of a 10-week situational games intervention on aerobic fitness, muscular strength and speed among 6-7 years old Chinese children.

**METHODS**: A total of 128 6-7 years old Chinese children were randomly divided into two intervention groups (IG; 31 boys, 30 girls) and control group (CG; 31 boys, 36 girls). The IG received ten-week situational games (SG) lessons (35 mins per lesson, twice a week). Participants took 20-m shuttle run (20-m SRT), vertical jump (for muscular strength) and 50-meter dash (for speed) tests before and after intervention. VO2max was estimated from 20-m SRT using Leeger’s equation. Mixed model Repeated Measures ANOVAs were conducted to determine differences in fitness variables from baseline to post-intervention across intervention groups.

**RESULTS**: The performance of 20-m SRT (laps), Grip(kg), Vertical jump (cm) and 50-meter dash (for speed) tests before and after intervention, VO2max was estimated from 20-m SRT using Leeger’s equation. Mixed model Repeated Measures ANOVAs were conducted to determine differences in fitness variables from baseline to post-intervention across intervention groups.

**CONCLUSIONS**: Although both conventional PE and SG specific lessons can increase muscular strength and speed, 10-week SG training also effectively improves aerobic fitness, muscular strength and speed among 6-7 years old Chinese children. There was different improvement between genders.

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**Table 1 Comparison between IG and CG on Fitness**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIGHT PHYSICAL ACTIVITY</td>
<td>(counts/sem)</td>
<td>(counts/sem)</td>
</tr>
<tr>
<td>MODERATE PHYSICAL ACTIVITY</td>
<td>(counts/sem)</td>
<td>(counts/sem)</td>
</tr>
<tr>
<td>MODERATE VIGOROUS PHYSICAL ACTIVITY</td>
<td>(counts/sem)</td>
<td></td>
</tr>
<tr>
<td>VIGOROUS PHYSICAL ACTIVITY</td>
<td>(counts/sem)</td>
<td></td>
</tr>
<tr>
<td>SAT TIME</td>
<td>(counts/sem)</td>
<td></td>
</tr>
<tr>
<td>WEIGHT</td>
<td>(Kg)</td>
<td>(Kg/m²)</td>
</tr>
<tr>
<td>BMI WAIST CIRCUMFERENCE</td>
<td>(cm)</td>
<td></td>
</tr>
<tr>
<td>HIP CIRCUMFERENCE</td>
<td>(cm)</td>
<td></td>
</tr>
<tr>
<td>X 7 CUTANE FOLDS</td>
<td>(mm)</td>
<td></td>
</tr>
<tr>
<td>FEMOR DIAMETER</td>
<td>(cm)</td>
<td>0.31* 0.04* 0.19 0.14</td>
</tr>
</tbody>
</table>

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**Genu Valgus Association Between Physical Activity Level Anthropometry And Sedentary Behavior In Schoolchildren From Ilhabela Schoolchildren**

Pedro Paulo Oliveira Moda. celafics, São Caetano do Sul, Brazil.

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(No relevant relationships reported)

**Objective**: To analyze the relationship between the valgus knee and the level of physical activity and anthropometry in students of both sexes. **Methods**: In this cross-sectional study, 96 students with an average of 9.78 ± 0.78 years-old, 56 female students (X: 9.78 ± 0.78 years) and 40 males (X: 9.7 ± 0.78 years) aged 9 to 11 years, residing in Ilhabela, São Paulo. The genu valgus was evaluated using the goniometer, classifying the internal/external distance (cm) as mild, moderate and severe. The level of physical activity was evaluated by accelerometer (ActiGraph GT3X-BT, Freedson PS) given in counts per week, being classified into physical activity: mild, moderate, moderate to vigorous, vigorous and sedentary time. The anthropometric variables included: body weight (kg), height (cm), BMI (kg / m²), mean skinfold thickness (mm), femur diameter (cm), and waist circumference (cm), according to CELAFICS standardization. **Statistical Analysis**: It was used the Person correlation, a software SPSS 20.0, adopting as significance level a p <.05. **Results**: Of the 96 students, 53% presented mild valgus, 21% with moderate valgus, and 22% with severe valgus, with positive and significant associations (p <.05). **Conclusion**: It seems that the genu valgus was not associated with physical activity levels and sitting time, but showed that the greater the valgus, the greater the sedentary time. It was also observed an association between genu valgus, weight, height and waist circumference and skinfolds. In boys there was a positive, weak, and significant correlation between genu valgus and femur diameter.

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**Physical activity level sedentary behavior and sleep time associated to body composition in Ilhabela schoolchildren**

Anderson Bastos Lopes, Luís Carlos de Oliveira, João Pedro da Siva Junior, Maurício dos Santos, Diana Carolina González Beltran, Victor Kelhan Rodrigues Matsudo. CELAFICS, São Caetano do Sul, Brazil.

(No relevant relationships reported)

**Purpose**: To associate the physical activity level, sedentary behavior, and sleep time with the body composition of children.

**Methods**: The study is part of the Ilhabela Mixed-Longitudinal Growth and Development Project. A convenience sample consisted of 97 schoolchildren, 50 boys, and 47 girls, 9 to 11 years-old (9.8 ± 0.7) with at least one complete evaluation in the analyzed period (2015 and 2019), all of them at pre-pubertal sexual maturation. The variables analyzed were: body weight (kg); body mass index BMI (kg/m²); average of 3 skinfolds: triceps, subscapular, and suprailiac; adiposity (mm); and waist-to-hip ratio WHR (cm). Physical activity level, sedentary...
behavior, and sleep time were measured by accelerometer (ActiGraph GT3X, analyzed with Freedson 1998) given in counts per minute. Data normality was measured by Kolmogorov-Smirnov, and a Spearman rho correlation was used to determine the associations among variables. Level of significance adopted was p < .05. The software used was SPSS 20.0. Results: In boys, light physical activity presented a significant low to moderate correlations with BMI (r = -0.29), adiposity (r = -0.29), WHR (r = 0.39). A correlation of (r = 0.39) was observed between sedentary time, and WHR. Among girls, sedentary time correlated significantly with light (r = 0.41), BMI (r = 0.29) adiposity (r = 0.47). Moderate to vigorous PA presented an inverse, significant, and moderate correlations with body weight (r = -0.39), and adiposity (r = 0.40). Conclusion: Present data suggest a significant association among light PA (in boys) and moderate/vigorous PA (in girls), and body composition, while sedentary time showed a significant association with body weight, BMI, and adiposity (in girls), and with WHR (in boys).

Table: Association between physical activity level, sedentary behavior and sleep time to body composition in children from Ilhabela

<table>
<thead>
<tr>
<th></th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weight</strong> (kg)</td>
<td>BMI (kg/m²)</td>
<td>Adiposity (mm)</td>
</tr>
<tr>
<td><strong>Sedentary Time</strong></td>
<td>.04</td>
<td>-.06</td>
</tr>
<tr>
<td><strong>Light PA</strong></td>
<td>-.24</td>
<td>-.29*</td>
</tr>
<tr>
<td><strong>Moderate/ Vigorous PA</strong></td>
<td>-.20</td>
<td>-.11</td>
</tr>
<tr>
<td><strong>Sleep time (hours/ day)</strong></td>
<td>.14</td>
<td>.16</td>
</tr>
</tbody>
</table>

Body Weight (Weight) Light physical activity level (Light PA) Moderate to vigorous physical activity level (Moderate/vigorous PA) *p < .05.

2158 Board #77 May 28 2:00 PM - 3:30 PM

Comparison Of Anthropometric Methods And Physical Activity In Preschoolers


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(No relevant relationships reported)

Previous work reports a counterintuitive finding that preschoolers categorized as overweight or obese engage in more physical activity (PA) than their healthy weight peers. The majority of studies with preschoolers however, used age- and sex-specific body mass index (BMI) percentile classifications according to their weight status. However, BMI may underestimate obesity prevalence. More recently, there has been an emphasis on anthropometric alternatives to BMI such as waist-to-height ratio. Waist circumference (WC) to height ratio (WC/HT) is relatively independent of gender, age, and race and may be more sensitive than BMI to identify those with central obesity, a cardiometabolic risk factor.

**PURPOSE:** Examine 1) the overlap of risk based on BMI and WC/HT and 2) the associations between preschoolers’ PA and both BMI and WC/HT.

**METHODS:** Height, weight, and WC were obtained by trained study staff and PA was objectively measured by accelerometry during the school day for up to 10 days. BMI was calculated as body weight divided by height squared (kg/m²). Weight status was classified using age- and sex-specific Centers for Disease Control (CDC) BMI percentiles. Two BMI percentile overweight/obese risk categories were created based on CDC categories (not at risk: <85; at risk: ≥85). Two central obesity risk categories were created for WC/HT (not at risk: <0.5; at risk: ≥0.5). A total of 69 children (Mₐₐₐ = 3.95 ± 0.6, 34 males, 35 females) with ≥3 days of valid accelerometer data were included in analyses. Percentage of time spent in light, moderate-to-vigorous (MVPA) and total PA (light + MVPA) were calculated using the child’s total wear time as the individual divisor. Significance was set at p < 0.05.

**RESULTS:** When comparing BMI and WC/HT risk categories, only 21 children (30%) were considered at risk using BMI whereas 40 (58%) were considered at risk using WC/HT. Significant, positive associations were observed between BMI percentile and light (r = 0.27), MVPA (r = 0.25) and total PA (light + MVPA) (r = 0.27); no significant associations were observed between WC/HT and PA.

**CONCLUSIONS:** More preschoolers were identified at risk using WC/HT as compared to BMI. Moreover, higher levels of PA were only linked with risk based on BMI, not WC/HT. Future work with preschoolers should explore a variety of methods for measuring risk for obesity and PA.

2159 Board #78 May 28 2:00 PM - 3:30 PM

Can We Play Outside? Social-emotional Learning And Preschooler Physical Activity

Marcia Rosiek¹, Benedict P. Dyson², Erin J. Reifsteck², Diane Gill, FACSM. ¹Coastal Carolina University, Conway, SC. ²UNC at Greensboro, Greensboro, NC. (Sponsor: Diane Gill, FACSM)

Email: marosiek@uncg.edu

(No relevant relationships reported)

Can we Play Outside? Social-Emotional Learning and Preschooler Physical Activity

Marcia Rosiek, Benedict P. Dyson, Erin J. Reifsteck, & Diane L. Gill, FACSM. Coastal Carolina University & UNC at Greensboro

Despite the benefits of physical activity (PA) for their development, preschoolers (age 3–5) do not meet recommendations and spend the majority of their day indoors engaged in sedentary behaviors (Pate et al., 2008). Outdoor environments promote PA (Cerrin et al., 2016), and active play is considered important for social and emotional learning (SEL), which involves self-regulatory and problem-solving skills, making good decisions, and developing positive relationships. Early childhood SEL is associated with school readiness and academic achievement (Denham & Brown, 2010). Research on the role of outdoor play for SEL in early childhood development is limited. **PURPOSE:** To identify and describe PA and SEL behaviors practiced by preschoolers in the outdoor environment. **METHODS:** This case study used mixed methods to identify and describe SEL and PA behaviors in preschoolers (ages 3–5) at an early childhood education center (ECEC). Participants included 28 children, two teachers and the ECEC director. PA accelerometer data, daily observations, and teacher interviews were collected over 4 weeks. Inductive analysis and constant comparison were used to analyze the qualitative data (Miles, Huberman, & Saldaña, 2014). **RESULTS:** Accelerometer data indicate that preschoolers were engaged in sedentary behavior 46.53%, MVPA 30.81%, and light activity 21.19% of the time when outdoors; on average, preschoolers were active for 29.34 minutes during an average 56.43-minute outdoor period. Qualitative data uncovered three themes: 1) the outdoor environment provides opportunities to practice SEL, 2) social interaction...
The purpose of this study was to examine the association between MVPA and adiposity in young adulthood. This study suggests that adopting a consistently active lifestyle throughout adolescence to achieve healthy body compositions in emerging adulthood.

### Table 1. Fat mass index z-score at age 23 years prediction multivariable linear regression model.

<table>
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<td>FMI at wave 5</td>
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### Table 2. Visceral adipose tissue mass index z-score at age 23 years prediction multivariable linear regression model.

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### Figure 1. Moderate-to-vigorous intensity physical activity trajectory groups. Dots indicate actual mean MVPA minutes, solid lines indicate estimated MVPA minutes, and dotted lines indicate 95% confidence intervals of estimated MVPA minutes. Group 1, Moderately active with decreasing MVPA levels; Group 2, consistently active and maintaining MVPA levels.

There has been a paucity of evidence pertaining to the discussion whether the effect of fitness on CRF is independent of physical activity (PA).

### Purpose: The objective of this study was to examine the association of fitness with middle-distance running performance (MDRP) in Chinese boys.

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### Methods: A cross-sectional study was conducted among 180 (8th grade) boys recruited from 3 junior middle schools in Shanghai, China. Participants completed height and weight measurement, and MDRP (1000 m running) performance. A sedentary behavior (SB) was measured in 7 consecutive days by accelerometers. Based on the criteria set by the Working Group on Obesity in China, the participants were categorized into either overweight or obese or normal weight according to the body mass index (BMI). Likewise, MDRP was categorized into pass or no pass by using the 2014 revised Chinese National Student Physical Fitness Standard. Independent t test was employed to compare the difference of the time to complete MDRP between
overweight and obese boys and normal weight boys. Correlation coefficients were computed to examine the relationship between BMI and the time to complete MDRP. The association of fitness and MDRP were examined, through multiple logistic regressions, after controlling for age and SB, light physical activity (LPA), moderate and vigorous physical activity (MVPA).

Results: 89 boys (age: 13.4±0.5 yrs, weight: 59.3±12.7 kg, height: 166.5±6.2 cm, BMI: 21.4±6.3 kg/m²) provided the valid accelerometer data (defined as ≥2 days, ≥10 h/day) and were included in the study. The time to complete MDRP of overweight and obese boys was significantly longer than normal weight boys (330.1±42.1 s vs 270.8±35.3 s, P<0.001). BMI was significantly positively correlated with the time to complete MDRP (r=0.581, P<0.001). The overweight and obese boys were more likely to not pass the MDRP compared with the normal weight boys (adjusted odds ratio = 4.64; 95% confidence interval: 1.74-12.4), after adjusting age, SB, LPA, MVPA.

CONCLUSION: The results uncovered that boys’ BMI was negatively correlated with MDRP. More importantly, compared with normal weight boys, overweight and obese boys had a higher risk to not pass the MDRP, independent of PA.

2165 Board #84 May 28 2:00 PM - 3:30 PM
COORDINATION IS NOT RELATED TO A PARENT’S PERCEPTION OF ABILITY OR SUPPORT FOR PHYSICAL ACTIVITY
Martha Rose Koenig, Kyle L. Sorenson, Mary C. Stenson. College of St Benedict and St. John’s University, St. Joseph, MN. (No relevant relationships reported)

PURPOSE: To examine the relationships between parental support for children’s physical activity and perceptions of the child’s athletic competence with their child’s gross motor development.

METHODS: 28 parents (36 ± 11 yrs) completed a survey to assess indicators of support for their child’s physical activity and child’s athletic competence in relation to the child’s peers. 41 children (20 males, 20 females, 1 unreported gender, 6.72 ± 3.13 yrs, BMI 16.43 ± 2.85) completed the Test of Gross Motor Development (TGMD2) which was converted to an age adjusted percentile score for both locomotor ability and object control. Bivariate correlations and independent sample t-tests were performed to identify relationships between variables and child gender differences.

RESULTS: No relationship was found between parental perception of coordination and child’s object control skills (r = -0.001) or locomotor ability (r = 0.069). Parental support for physical activity was not related to the child’s object control (r = 0.016) or locomotor ability (r = -0.118). A moderate positive relationship exists between parental perceptions of boys coordination and their object control scores (r = 0.414) and a moderate negative relationship exists for girls (r = -0.497). There were no differences between boys and girls for object control scores (boys: 61.65 ± 24.57; girls: 57.95 ± 21.75; t= 0.504, df= 38, P = 0.617), locomotor ability (boys: 74.75 ± 22.31; girls: 75.75 ± 20.51; t= 0.418, df= 38, P = 0.883) or parental support (boys: 8.66 ± 3.45; girls: 9.44 ± 3.65; t= -0.651, df= 35, P = 0.519).

CONCLUSIONS: Parental support for physical activity and how parents perceive their child’s ability are not reliable indicators of their child’s demonstrated motor ability. This may be especially true for young girls whose parents perceive them as less coordinated than they are.

D-63 Free Communication/Poster - Physical Activity and Health: Children and Adolescents
Thursday, May 28, 2020, 2:00 PM - 4:30 PM
Room: CC-Exhibit Hall

2166 Board #85 May 28 2:00 PM - 3:30 PM
Psychosocial Correlates Of Physical Activity In Children And Adolescents: A Meta-analysis
Daniel Chi Shing Yeung, Aurelian Bideulescu. Indiana University Bloomington, Bloomington, IN. (Sponsor: Stanley Sai-Chuen Hui, FACSM)
Email: danyeung@indiana.edu (No relevant relationships reported)

PURPOSE: This study investigated the association between physical activity (PA) and Theory of Planned Behavior (TPB, Ajzen, 1991)-based variables among children and adolescents.

METHODS: We evaluated the association between PA and TPB-based variables (intention, attitude, subjective norms, and perceived behavioral control / self-efficacy to engage in PA) among children and adolescents, and the moderation effects of geographical region of study between PA and TPB-based variables. A total of 36 articles met the inclusion criteria and were meta-analyzed. RESULTS: Intention significantly correlated with and had a medium effect on PA in children. TPB displayed a good fit in path analysis. Moderator analyses showed that subjective norms and perceived behavioral control had a larger effect on children in the rest of the world, compared to their North American counterparts.

CONCLUSIONS: The results provide a summary of current scientific findings about the association between TPB-based variables and PA in children and adolescents, and support TPB as a feasible conceptual framework to study psychosocial factors that underpin PA.

2167 Board #86 May 28 2:00 PM - 3:30 PM
Global Accelerometer-derived Physical Activity Levels From Preschoolers To Adolescents: A Meta-analysis And Meta-regression
Han Chen1, Jilong Liu2, Yang Bai2, 1Valdosta State University, Valdosta, GA 2Texas A&M University, College Station, TX. 1The University of Utah, Salt Lake City, UT.
Email: hanchen@valdosta.edu
(No relevant relationships reported)

PURPOSE: It is essential to document people’s PA levels worldwide with accurate information. The importance needs to focus on understanding how PA pattern changes at different time periods. One of the major measurement issues of using accelerometers is the selection of cut points to determine PA intensity such as moderate to vigorous PA (MVPA). Studies calibrating accelerometers generated large variability in cut points especially for the intensity of MVPA which need to be controlled to generate more accurate and meaningful data. Thus, we systematically reviewed and meta-analyzed global MVPA change across different age groups (preschool ages to adolescence) using data derived from accelerometer while accounting for two most popular cut points [i.e., Freedson, 1998; Everson, 2008] and continents.

METHODS: We searched major data base from inception until Aug, 2019 including cross sectional or longitudinal PA tracking studies in which daily MVPA were measured by accelerometer and determined by the two aforementioned cut points for preschoolers, children, and adolescents. Random-effect models were used for meta analyses. Multiple meta regression analyses were conducted to investigate how age relates to daily MVPA from preschooler to adolescents while controlling for cut points and continents.

RESULTS: The final data includes 91 studies representing 42338 participants across six continents. Findings revealed that for the combined studies, participants accumulated 74.44 minutes of MVPA each day (95% CI = 68.86 - 80.02; p < .001). Findings from meta regression revealed that when cut points and cut points were controlled, participants’ daily MVPA levels tend to decrease significantly from preschool years to adolescents (β = -2.83, p < .0001, R² = 0.4), from preschool age to children (β = -11.54, p < .0001, R² = 0.39), or from children to adolescents (β = -6.83, p < .0001, R² = 0.48).

CONCLUSIONS: Globally, individuals’ daily MVPA tends to decrease from a very young age after controlling for cut points and continents. These declines were more prominent from preschoolers to childhood.

2168 Board #87 May 28 2:00 PM - 3:30 PM
A Meta-analysis Protocol Among Active Healthy Kids Report Cards’ Indicators In East Asian Regions
Robin ST Ho1, Wendy Y Huang2, Stephen HS Wong, FACSM1. 1Chinese University of Hong Kong, Hong Kong, Hong Kong. 2Hong Kong Baptist University, Hong Kong, Hong Kong. Email: robinho@cuhk.edu.hk (No relevant relationships reported)

Insufficient physical activity (PA) is one of the leading risk factors for mortality. Evidence related to PA in children and youth has been assessed comprehensively in the Active Healthy Kids Report Cards worldwide. However, the association between influence indicators and behavioral indicators among Report Cards are yet to be critically appraised and synthesized using the method of meta-analysis. PURPOSE: We aim to perform meta-analyses for indicators in overall PA, sedentary behaviors, school, family & peers, and community & environment among East Asian regions with very high Health Development Indices. METHODS: We conducted literature search in six international databases, including CENTRAL, MEDLINE, EMBASE, PsycINFO, Global Health, and BIOSIS. Observational studies with at least one influence indicator and one behavioral indicator will be considered eligible and data will be extracted for meta-analyses. The strength of association between influence indicators and behavioral indicators will be synthesized. The pooled effect sizes and their 95% confidence intervals for each association will be calculated. Newcastle-Ottawa Scale will be used for the risk of bias assessment among included observational studies. RESULTS: Twenty eligible observational studies including cohort studies and cross-sectional studies were included. From these 20 included studies, twelve, seven, and one were from Hong Kong, South Korea, and Japan respectively. Ten studies addressed behavioral indicators, e.g. the association
THE EFFECTIVENESS OF PHYSICAL ACTIVITY ON BRAIN DEVELOPMENT IN CHILDREN WITH NEURODEVELOPMENTAL DISORDERS: A SYSTEMATIC REVIEW AND META-ANALYSIS

Hao Pu1, Xiaolei Liu2, Jindong Chang1. College of Physical Education, Northwest University, Chongqing, China. 1High School Affiliated to Southwest University, Chongqing, China. Email: haopu88wu2018@163.com

The relationship between physical activity (PA) and exercise with brain development in adolescents has seen a growing interest during the past two decades. Previous systematic reviews and meta-analyses have shown the effectiveness of PA interventions on improving adolescents’ brain cognition. PURPOSE: The study aimed to assess the effect of physical activity (PA) interventions and adolescents’ brain development.

METHODS: We systematically searched MEDLINE, Web of Science, and Pubmed database from their inception to June 30, 2019. Intervention studies aimed at examining the exercise-brain interaction at a developmental age were included in this systematic review and meta-analysis. Random-effects models were used to calculate pooled effect size (ES) values and their corresponding 95% CIs. Subgroup analyses were conducted to examine the effect of participants’ and PA programs’ characteristics.

RESULTS: A total of 25 studies were included in this systematic review and meta-analysis. Pooled ES estimations were as follows: working memory 0.45 (95% CI = 0.28-0.61), inhibition 0.08 (95% CI = 0.02-0.14), attention 0.61 (95% CI = 0.44-0.78) and brain psychological functions 1.05 (95% CI = 0.67-1.43).

CONCLUSIONS: PA benefits several domains of working memory, inhibition, attention and brain neurophysiology functions in youth. Physical activity interventions and programs designed to increase the number of PA per day after school seems to be the most effective. (The last author as the corresponding author; This study was supported by the NPOPSS Grant 15CTY11)

The other ten studies addressed influence indicators. The other ten studies addressed influence indicators. The other ten studies addressed influence indicators. The other ten studies addressed influence indicators.
eligible, which contained information on the relevant population (pregnant women), intervention (subjective or objective measures of frequency, intensity, duration, volume, type of exercise, comparator (no exercise intervention), and outcomes (maternal cardiorespiratory fitness, including VO2max, submaximal VO2, VO2 at anaerobic threshold, and cardiorespiratory health, including resting heart rate, resting systolic and diastolic blood pressure during pregnancy). Results: From 2699 unique citations, 26 RCTs (N=2292 women) were included. "Low" to "high" certainty evidence rating was significantly associated to zMR (p<0.05); however, in boys a negative and significant effect of MVPA was observed (β=-0.026; p=0.011), where those who spent more time in MVPA had a better zMR profile, but no significant effect was observed for LPA or sedentariness. Conclusions: The role of PA on MR in children differs according to gender. In girls no significant link was observed, suggesting that other factors (namely biological and nutritional) may be associated with girls' metabolic health, suggesting that MVPA should be promoted. Study funded by The Portuguese Foundation of Science and Technology (individual grant SFRH/BPD/123145/2016).

Purpose: It has been suggested that physical activity (PA) and sedentariness are associated to metabolic risk (MR) factors in children.

Purpose: To study the relationship between different PA intensities [moderate to vigorous PA (MVPA) and light PA (LPA)] and sedentariness with children MR.

Methods: The sample comprises 388 Portuguese children, from both sexes (219 girls; mean age 10.5 years). MR indicators included fasting glucose, triglycerides, HDL-cholesterol, as well as waist circumference and lean arterial blood pressure; MR score (zMR), adjusted for maturity offset, was computed. MVPA, LPA, and sedentariness were measured with the GTX1+ Actigraph accelerometer with at least 4 days (with one weekend day) of at least 10 hours/day of monitoring. Linear regression, by sex, was used to identify correlates of zMR. Results: In girls, none of the variables included in the model were significantly correlated to zMR (p>0.05); however, in boys a negative and significant effect of MVPA was observed (β=-0.026; p=0.011), where those who spent more time in MVPA had a better zMR profile, but no significant effect was observed for LPA or sedentariness. Conclusions: The role of PA on MR in children differs according to gender. In girls no significant link was observed, suggesting that other factors (namely biological and nutritional) may be associated with girls' metabolic health, suggesting that MVPA should be promoted. Study funded by The Portuguese Foundation of Science and Technology (individual grant SFRH/BPD/123145/2016).

Purpose: A variety of clinical trials with various lifestyle intervention programs are available to address pediatric obesity and chronic diseases. Yet, no known research has used network meta-analysis to synthesize the findings simultaneously. In response, this network meta-analysis aimed to compare the effectiveness of multiple lifestyle interventions on children’s body composition and blood pressure changes.

Methods: A total of 312 published studies on lifestyle intervention programs were retrieved with 37 studies meeting the following inclusion criteria: (1) data-based articles published in English between 2009 and 2019; (2) used randomized controlled trial design; (3) subjects aged between 1 to 12 years old and did not suffer from any physical or medical illness; and (4) investigated some type of intervention on body mass index (BMI), BMI z-score (BMIz), body fat percentage, systolic blood pressure (SBP) and diastolic blood pressure (DBP) among children. Data extraction for comparisons was completed for 10 intervention categories: (1) control (T1; no intervention); (2) physical activity (PA) exercise only (T2); (3) knowledge education in various dimensions (T3); (4) nutrition (T4); (5) environment changes (T5); (6) PA plus education (T6); (7) nutrition plus education (T7); (8) environment changes plus education (T8); (9) PA with nutrition and education (T9); and (10) PA with environment changes and education (T10). Package “pentameta” in R software was mainly used to carry out the analysis. Results: Based on mean difference (MD) comparison, nutrition plus education and physical activity (PA) exercise only appeared to be two most effective ways in reducing children’s body fat percentage compared with treatments 3, 5, 6 and 10 (Effect Size(ES) = -2.33, 95% CI: (-4.17, -0.44); ES = -1.61, 95% CI: (-2.47, -0.76) respectively). For children’s BMI, T9 was the most effective approach compared with seven other treatments. T2 demonstrated the best structure (p<0.02). Environmental changes and education (T10). Package “pcnetmeta” in R software was mainly used to carry out the analysis.

Results: From 2699 unique citations, 26 RCTs (N=2292 women) were included. "Low" to "high" certainty evidence rating was significantly associated to zMR (p<0.05); however, in boys a negative and significant effect of MVPA was observed (β=-0.026; p=0.011), where those who spent more time in MVPA had a better zMR profile, but no significant effect was observed for LPA or sedentariness. Conclusions: The role of PA on MR in children differs according to gender. In girls no significant link was observed, suggesting that other factors (namely biological and nutritional) may be associated with girls' metabolic health, suggesting that MVPA should be promoted. Study funded by The Portuguese Foundation of Science and Technology (individual grant SFRH/BPD/123145/2016).

Parent physical activity (PA) levels may influence the PA levels of their children, either through general activity or sport participation. However, the strength of those associations needs further exploration. Moreover, factors such as child PA self-efficacy, family support of PA, and family structure may also influence these associations and research is lacking among rural families. Purpose: To examine the associations between parent PA levels and child PA levels including sport participation, and to further explore the role of the aforementioned variables in the relationship. Methods: Baseline data were analyzed on 105 child-parent dyads (child age = 8.95±1.1 years, parent age = 37.9±5.4 years) from the NU-HOME study, a childhood obesity prevention, RCT in a rural community. Data included parent self-reported PA (daily total PA and daily total moderate-to-vigorous PA (MVPA)), family structure (child to adult ratio), and child sport participation in the past year; child-reported PA self-efficacy and family support for PA; and objective child PA levels from accelerometer (daily total PA and daily total MVPA). Child daily total MVPA did not meet acceptable normality and was log transformed for analyses. Multivariate regression models controlling for economic assistance were analyzed using SAS 9.4. Results: Children participated in 2-4±1.5 sports in the past year. Mean child daily total PA was 44.9±18.6 minutes, while mean parent daily total MVPA was 25.5±25.3 minutes. Parent PA was not significantly associated with child daily total PA or child daily total MVPA. However, after adjusting for economic assistance, parent PA was significantly associated with child sport participation separately (p=0.005) and in models that included child PA self-efficacy, family support of PA, and family structure (p=0.02). Conclusion: Present study findings that parent PA was significantly associated with child PA and sport participation, but not objective measures of child PA suggests that active parents may encourage and support their children’s sport participation. Sport participation may provide personal, social, as well as physical benefits for children. The findings of this study highlight the importance of exploring sport participation when investigating activity behavior particularly among rural children.
regression models stratified by body mass index (underweight [-18.5], desirable weight [18.5-24.9], overweight [25-29.9], and obese [≥30]) were fitted, controlling for potential confounders. RESULTS: Compared to the ND referent group, overweight women with DM had significantly (p<0.05) lower odds of meeting the AA recommendation (OR 0.83, CI 0.67-1.00). Overweight women considered HRD were less likely to meet the MSA recommendation (OR 0.81, CI 0.68-0.97) and more likely to not meet either recommendation (OR 1.20, CI 1.03-1.40). Among women in the desirable weight group, those considered HRD had lower odds of meeting MSA only (OR 0.72, CI 0.61-0.85) or both recommendations (OR 0.77, CI 0.64-0.93). Desirable weight for OW/DB had greater odds of not meeting either recommendation (OR 1.43, CI 1.12-1.82). CONCLUSIONS: Increased AA and MSA in women at risk for diabetes may benefit maternal outcomes. Strategies targeting the determinants of PA should be considered to increase participation.

Household chaos is perceived home disorganization caused by noise, crowding, and traffic patterns. It has been shown to be linked to weight-related behaviors such as sleep and nutritional behaviors (i.e., family meals). However, the relationship between sedentary behavior and household chaos has not been examined. Exploring this association could allow us to better understand how family milieu contributes to behavioral risk factors for childhood obesity. PURPOSE: To examine associations between household chaos with sedentary behavior and screen time in rural children. METHODS: Participants (n=105 parent/child dyads) were enrolled in the NUHOME study, a family-based, obesity prevention RCT in rural Minnesota. Parents reported baseline data on sociodemographics, household chaos, and child screen time. Household chaos was measured with a 15-item scale about home disorganization (α=0.83; higher scores indicate more chaos). Children’s sedentary behavior was assessed via accelerometer. Regression analyses using SAS 9.4 were performed to assess associations between household chaos and sedentary behavior and screen time, controlling for child-parent ratio, economic assistance, child BMI z-score and age. Normality of screen time was not met, so a transformed variable was used in analyses. RESULTS: Child mean age was 8.95±1.05 years; 59% were female; mean BMI z-score=0.92±0.94. Mean daily sedentary time and screen time were 8.33±77.5 and 2,061.1±142 hours, respectively. Household chaos scores had a mean of 5.04±3.6, which is comparable to other studies. Household chaos scores were not significantly associated with child sedentary behavior but were positively associated with child screen time (p=0.002). CONCLUSIONS: In other studies, household chaos has been associated with negative health behaviors, which aligns with our current findings. The association between screen time and household chaos may be explained by parents using electronics to entertain children in chaotic environments. Parents in chaotic homes may also have more difficulty managing a child’s screen time than those in less chaotic homes. The relationship between household chaos and sedentary behavior should be further explored to increase our understanding of how the home environment may affect health-related behaviors.

There is a lack of research on meeting 24-hour movement guidelines, including physical activity (PA), sedentary time (ST) and sleep, among Chinese children and adolescents. PURPOSE: To investigate the prevalence of meeting the 24-hour movement guidelines, related correlates, or the relationships with body mass index (BMI) among Chinese children and adolescents. METHODS: Cross-sectional data were derived from the Physical Activity and Fitness in China—The Youth Study (PACFTYS) 2017. A nationally representative sample with 114,072 children and adolescents (9-18 years old; mean age 13.75 years, 49.2% boys) completed a self-report questionnaire regarding PA, ST and sleep. The prevalence of meeting the 24-hour movement guidelines and World Health Organization (WHO) weight status categories was determined. Generalized linear models were used to determine the correlates of meeting the movement guidelines and the relationships of meeting the movement guidelines with overweight and obesity (OW/OB). RESULTS: Only 5.12% of Chinese children and adolescents met the 24-hour movement guidelines and 22.44% were classified as OW/OB. Children and adolescents meeting the 24-hour movement guidelines showed lower odds ratios for OW/OB. Compared with meeting the 24-hour movement guidelines, boys of 4-6th grades (9-12 years old) meeting the overweight recommendation (OR = 1.22), ST only recommendation (OR = 1.10) and sleep recommendation only (OR = 1.14) had significantly higher odds ratios for OW/OB. Similar trends were observed in girls of 4-6th grades meeting none of the recommendations (OR = 1.35), sleep recommendation only (OR = 1.23) and PA + sleep recommendations (OR = 1.24), and in girls of 7-9th grades (13-15 years old) meeting none of the recommendations (OR = 1.30). CONCLUSIONS: Very few Chinese children and adolescents met the integrated health-related 24-hour movement guidelines. Age (negative), parental educational level and family income (both positive) were correlates of meeting the 24-hour movement guidelines. Children and adolescents meeting the 24-hour movement guidelines were more likely to have lower body weight, especially in the youngest age group, and girls in middle age group. Funding: Supported by the General Project of the National Social Science Foundation of China (19BYYT077).

Physical activity (PA) is so essential in diabetes management that it is usually prescribed as a lifestyle change in addition to medications. Food insecurity may cause youth and young adults (YYAs) with diabetes to be more fatigued, thereby negatively impacting their PA.
PURPOSE: The purpose of this study was to examine the association between household food security and PA in YAYs with diabetes.

METHODS: Data from 2,195 YAYs with diabetes (1,855 type 1, 340 type 2, mean age: 21.4 ± 5 years) were selected from the SEARCH for Diabetics in Youth Study. Household food security status was measured with the 18-item U.S. Household Food Security Survey Module by adult participants or parents of minors. Households that affirmed 3 or more food insecure conditions or behaviors were considered food insecure.

RESULTS: Boys were less likely to engage in PA than girls (OR: 0.48, p < 0.0001) and youth in the Northeast (7.8%) regions. Regarding predictors of PA guidelines achievement, sex, age, mother educational level, and presence of sports court at school were significant predictors for compliance of PA guidelines among adolescents. These results reinforce that biological and environmental characteristics, namely school context, play important roles in youth health habits.

Abstracts were prepared by the authors and printed as submitted.

THURSDAY, MAY 28, 2020

Board #102 May 28 2:00 PM - 3:30 PM
What Determine Physical (In)Activity In Brazilian Adolescents?
Mabliny Thuany, Thayse Natacha Gomes. Federal University of Sergipe, São Cristóvão, Brazil.
Email: mablinskyantos@gmail.com

Increases in physical inactivity has been pointed as one of the most relevant public health problems, especially among youth. Once physical (in)activity is a multifactorial trait, determined by different variables, such as biological and environmental, understanding the role of these variables in youth physical activity (PA) guidelines compliance seems to be of relevance, especially in Brazilian context, given the diversity observed among its regions. PURPOSE: To describe differences in adolescents’ physical activity (in)compliance among Brazilian regions and to investigate the determinants related to these differences.

METHODS: Data comes from the National Adolescent School-based Health Survey (PENS). Sample comprises 99570 Brazilian students (51.7% girls), enrolled in the 9th grade of Elementary School (mean age 14.29±0.93y). Information related to daily PA guidelines compliance seems to be of relevance, especially in Brazilian context, given the diversity observed among its regions. PURPOSE: To describe differences in adolescents’ physical activity (in)compliance among Brazilian regions and to investigate the determinants related to these differences.

METHODS: Data comes from the National Adolescent School-based Health Survey (PENS). Sample comprises 99570 Brazilian students (51.7% girls), enrolled in the 9th grade of Elementary School (mean age 14.29±0.93y). Information related to daily PA guidelines compliance seems to be of relevance, especially in Brazilian context, given the diversity observed among its regions. PURPOSE: To describe differences in adolescents’ physical activity (in)compliance among Brazilian regions and to investigate the determinants related to these differences.

Abstracts were prepared by the authors and printed as submitted.

THURSDAY, MAY 28, 2020

Board #103 May 28 2:00 PM - 3:30 PM
Physical Activities Status Of’Yi Nationality Pupils In China
Xiaodong SONG. Chengdu Sport University, Chengdu, China.
(Sponsor: Tongjian YOU, FACSM)
Email: 756234372@qq.com

Regular physical activity in children and adolescents promotes health and fitness and youth who are physically active are healthier, have less body fat, and exhibit improved cognition and mental performance. Youth need at least 60 minutes of moderate-to-vigorous physical activity each day for good health. PURPOSE: Many researches have been done about physical activity levels among youth in China, but most of them

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John L. Walker, FACSM1, Kevin W. McCurdy1, Anthony J. Clapp2. 1Texas State University, San Marcos, TX; 2Augsburg University, Minneapolis, MN.

No relevant relationships reported
focused on urban children, less known about rural ones, especially minority in poverty areas in China. The main purpose of this article is to investigate the levels of physical activity among Yi nationality pupils in Sichuan province of China. METHODS: 7-Day Physical Activity Recall Questionnaires were used to investigate the amount of physical activities among 123 Yi Nationality Pupils(53 boys, 51 girls) aged 9 to 17(born in 2002-2009) in grade 4 and grade 6. RESULTS: For the participants, their average total amount of physical activities is 1088 minutes per week and girls are more physically active than boys in grade 6 is 1376 and girls is 791 , boys in grade 4 is 1209 and girls is 979 ; their average total amount of physical activities at school is 375 minutes per week, and boys are relatively more physically active than girls at school (boys in grade 6 is 394 minutes per week and girls is 285, boys in grade 4 is 366 minutes per week and girls is 363 ) ; their average total amount of house work activities at home is 15 minutes per week, and boys are relatively more than girls (boys in grade 6 is 17 minutes per week and girls is 10, boys in grade 4 is 18 minutes per week and girls is 13 ) ; only there are 16.2% of pupils whose daily PA amount are below to the recommended daily physical activities of WHO and ACSM(boys in grade 6 is 6 and girls is 3 , boys in grade 4 is 4 and girls is 5 ) . CONCLUSIONS: Boys are more physically active than girls. Most of pupils reached the recommendation of daily physical activity.

2185 Board #104 May 28 2:00 PM - 3:30 PM Behavioral Factors For Adolescents' Obesity And Overweight: Physical Activity, Sleep, Sedentary Behavior, And Diet Jong Cheol Shin, Diana S. Grigsby-Toussaint. Brown University, Providence, RI. Email: jong_cheol_shin@brown.edu (No relevant relationships reported)

PURPOSE: To investigate the risk factors in weight status among adolescents regarding dietary habits and movement behavior. METHODS: Primary data were derived from the CDC Youth Risk Behavior Survey (YRBS), a nationally representative sample of 40,130 grade 9-12 students (N=20,340 boys and 19,790 girls) from 2011 to 2017. The prevalence of overweight and obesity was examined using by BMI percentile and then compared based on various demographics (i.e., sex, age, race) and behavioral factors (i.e., physical activity, sedentary time, sleep, soda consumption). Logistic regression analysis was conducted to illustrate the differences in weight status within each group of physical activity levels after control the behavioral and demographic factors.

RESULTS: Overall, African-American adolescents had the highest prevalence of overweight or obesity (36%), followed by Hispanics (35%), others (29%), and White (27%). Female students had significantly lower obesity rate than male students (-6.4 ± 0.2%), but also spend less time for behavioral activities (e.g., sedentary time: -0.372 ± 0.015 hours, MVPA: -0.04 ± 0.04, and strength training -20.9 ± 0.3%). The self-diagnosis was relatively accurate, with 69% of true positive and 13% of true negative in comparison to actual overweight and obesity status. For the PA group, students who satisfied both PA recommendations had less likely to be obese compared to non-PA group: Odds Ratio (OR) for PA = 0.89, 95% CI [0.825, 0.961], p = 0.003; OR for strength training = 0.92, 95% CI [0.865, 0.996], p = 0.039. Students who consumed soda on one day were more likely to be obese (OR = 1.13, 95% CI [1.049, 1.223]), and students who had more sedentary time tended to be obese (OR=1.03, 95% CI [1.011, 1.041]).

CONCLUSIONS: Students who were meeting PA recommendations were less likely to be obese, while students who had more sedentary time and higher levels of soda consumption were more likely to be obese. In addition, African American and Hispanic students were more likely to be overweight and obese.

2186 Board #105 May 28 2:00 PM - 3:30 PM Peak Height Velocity Maturity Offset Estimated From Cross-sectional Vs. Longitudinal Growth Data Jodi N. Dowthwaite1, Matthew J. Pelowski2, Jennifer E. Minnassian2, Tamara A. Scerpella2. 1SUNY Upstate Medical University, Syracuse, NY; 2Binghamton University, Binghamton, NY; 3University of Wisconsin - Madison, Madison, WI. (Sponsor: Jill Kanaley, FACSM) Email: dowthwa@upstate.edu (No relevant relationships reported)

Appropriate evaluation of pediatric health indices relies on assessment based on physical maturity status. Regression equations have been developed to estimate maturity offset (MO) relative to age at peak height velocity (aPHV) using cross-sectional anthropometric data, with extensive application in pediatric exercise research. PURPOSE: We evaluated agreement of these estimates against standards calculated using superposition by translation and rotation (SITAR) models of longitudinal data, targeting specific time windows relative to PHV and menarche. METHODS: Height data were drawn from a longitudinal dataset evaluating female bone growth in 141 participants for whom SITAR-based aPHV had been calculated using 23 data points. Two subsamples were selected based on available repeated measures in target maturity ranges based on SITARaPHV and menarche: prePHV (-2.5 to -1.5yr), postPHV (+1.5 to +2.5yr); circaPHV (+0.5 to +0.5yr) & postMEN (0 to +1.0yr). Mirwald et al. and Moore et al. regression equations were used to calculate aPHV and MO, yielding MO1 and MO2 (respectively) for comparison against sitarMO. Bland-Altman plots evaluated agreement with sitarMO in each target maturity range. RESULTS: For prePHV and postPHV comparisons, n= 58, with mean sitarMO -2.1yr (sd 0.3) and -2.1yr (sd 0.3), respectively. For circaPHV & postMEN comparisons, n=108, with mean gynecological ages -1.1yr (sd 0.7) and -0.6yr (sd 0.3) and mean sitarMO -0.1yr (sd 0.4) and -1.6yr (sd 0.7), respectively. Except postMEN, on average, MO, underestimated sitarMO (prePHV -1.5yr, postPHV -2.8yr; circaPHV= -2.3yr, postMEN= -0.05yr). Mean discrepancies for MO vs. sitarMO were subtle, near zero [prePHV= -0.04yr, postPHV= -0.1yr; circaPHV= -0.01yr, postMEN= 0.01yr]. CONCLUSION: MO, maturity estimates are flawed. <50% of estimates were within 1yr of sitarMO for assessed maturity ranges. MOs provides better sitarMO estimates using cross-sectional data. However, it is unclear whether MO is an improvement over chronological age for most individuals, as MO, effectively assesses whether girls are short or tall for their age. In many cases, height for age may primarily reflect genetic height potential rather than maturity status, particularly at older maturity stages.

D-64 Free Communication/Poster - Population-based Surveillance

Thursday, May 28, 2020, 2:00 PM - 4:30 PM
Room: CC-Exhibit Hall

2187 Board #106 May 28 2:00 PM - 3:30 PM Extent Of Childhood Participation In Ultramarathon Running Does Not Negatively Impact Continued Running Lydia J. Henderson1, Volker Scherre2, Martin D. Hoffman, FACSM3. 1University of California Davis, Sacramento, CA; 2Universidad a Distancia de Madrid (UDIMA), Madrid, Spain; 3A Northern California Health Care System, Sacramento, CA. (Sponsor: Martin D. Hoffman, FACSM) (No relevant relationships reported)

PURPOSE: It is unclear if “excessive” exercise is harmful, particularly at a young age. While childhood participation in ultramarathons has increased exponentially over the past 20 years, less than 2% of these individuals continue running ultramarathons in adulthood. This raises concern that childhood ultramarathon runners may suffer complications from their young participation in the sport. The purpose of this work was to examine if the extent of ultramarathon participation among those under 19 years of age is related to the cessation of running into adulthood due to running related injuries.

METHODS: Individuals having completed an ultramarathon when under 19 years of age were recruited via announcements on running-related websites and Facebook advertisements. Qualified participants were also identified from race results databases, and directly recruited when online publicly available contact information was found. Participants completed an online survey including questions on running history, whether or not they are currently running and reasons for not if that was the case, and their opinions about how childhood ultramarathon running had impacted their health. Group comparisons were made with an unpaired t-test or the Mann-Whitney test. RESULTS: There were 69 participants (9 women and 60 men) completing the survey with median age of 34 years (range 16-67 years). Those who had stopped running regularly due to running-related injury (12%) had not completed more ultramarathons under 19 years of age compared with those who had either stopped for other reasons (28%) or continued to run regularly (median 1 vs. 2, p=13). The age of these two groups was also similar (p=51). All but one respondent (1%) indicated that they believed running ultramarathon as a child had either a positive (67%) or no (32%) effect on their physical health. CONCLUSIONS: Cessation of running into adulthood due to running related injuries was unrelated to the number of ultramarathons completed while under 19 years of age. Childhood ultramarathon runners also largely felt that ultramarathon running as a child had a favorable effect on their health. These findings suggest that the extent of childhood ultramarathon running does not adversely affect running into adulthood. Supported by the Ultra Sports Science Foundation
Adolescent obesity continues to be a major public health concern among developed nations. Sleep duration has been hypothesized as a contributing factor to this increase. PURPOSE: This study examined the sleep-obesity relationship in U.S. adolescents. METHODS: Data from the 2015-2016 National Health and Nutrition Examination Survey (NHANES, 54; ages 16-18 years) was used to consider the effect of sleep duration (hours) on body mass index (BMI) and waist circumference (WC) by gender. Linear regression was used to determine the relationship between sleep duration and BMI and WC. Sleep hours were then categorized as Under Recommended (<7 hours), Recommended (7-8 hours), and Over Recommended (>8 hours) and an ANCOVA was used to examine differences in BMI and WC by sleep category. Finally, logistic regression considered the influence of sleep category on overweight classification. RESULTS: Approximately 21% of the total participants were overweight or obese while 53.3% met the recommendations for sleep duration. Linear regression revealed a significant (p<0.05) main effect across sleep duration categories in the total sample for WC only. Longer sleep duration was associated with an increased WC in both males (β=0.030) and females (β=0.143-0.148, p<0.05) and with an increased BMI in males (β=0.113-0.113, p<0.05), but not females. Logistic regression analyses yielded no significant influence of sleep category assignment on overweight BMI classification. CONCLUSIONS: For both males and females, excessive sleep was related to higher WC. However, excessive sleep only impacted BMI in males. In contrast, the greater number of females achieving the recommended amount of sleep, and thus, smaller proportion getting insufficient or more than the recommended amount, may contribute to the absence of influence on BMI in females. Likewise, the categories used to classify sleep duration may not be sensitive enough to adequately identify risk differences weight-related maladies in females.
Table: Prevalence with Standard Error (SE) of Youth Meeting Aerobic Physical Activity Guideline by Age Group, NSCH 2016-2017 and YRBS 2015-2017

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>NSCH, % Meeting Guideline (SE)</th>
<th>YRBS, % Meeting Guideline (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-13 years</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>14-17 years</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Grades 9-12</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>14-17 years</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>28.5 (0.8)</td>
<td>22.6 (1.1)</td>
</tr>
<tr>
<td>Female</td>
<td>23.2 (0.9)</td>
<td>11.9 (0.7)</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White, non-Hispanic</td>
<td>27.7 (0.6)</td>
<td>16.5 (0.6)</td>
</tr>
<tr>
<td>Black, non-Hispanic</td>
<td>27.5 (1.8)</td>
<td>20.7 (2.3)</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>22.9 (1.7)</td>
<td>17.2 (2.0)</td>
</tr>
<tr>
<td>Other, non-Hispanic</td>
<td>22.5 (1.4)</td>
<td>16.9 (1.9)</td>
</tr>
</tbody>
</table>
| Abbreviations: NSCH, National Survey of Children’s Health; YRBS, Youth Risk Behavior Survey

* Significant difference (p < 0.001) between age groups 6-13 years and 14-17 years.
* Significant difference (p < 0.001) between males and females overall and for each age group.
* Within subgroup, values with different superscript letters (v, w) are significantly different from each other (Bonferroni corrected p < 0.05).

CONCLUSION: Our findings suggest similar sex and race/ethnicity patterns but different prevalence estimates of youth meeting the guideline in the NSCH and the YRBS, limiting direct comparability of estimates for the Healthy People 2030 youth objectives. This could be due to methodological differences between the two systems, such as respondent and aerobic physical activity question.

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**2192**

Board #111

May 28 2:00 PM - 3:30 PM

Higher Education And Income Level May Lead To A Better Chance Of Meeting The Physical Activity Guidelines

Hai Yan. University of Illinois at Urbana Champaign, Urbana, IL. (Sponsor: Weimo Zhu, FACSM)

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(No relevant relationships reported)

PURPOSE: Studies have shown that individuals that participate in physical activity on a daily basis are less likely to develop chronic illnesses than those who do not. The Physical Activity Guidelines for Americans is an essential resource for health professionals to provide recommendations on how everyone can improve their health through regular physical activity. However, little was known about its effectiveness and the factors behind meeting the physical activity guidelines. Thus, the aim of this study was to explore and determine the population that is more likely to meet the physical activity guidelines and offer practitioners and policymakers more insight.

METHODS: The data were derived from the California Behavioral Risk Factor Surveillance System (BRFSS). The percentage of adults meeting Aerobic Physical Activity guidelines in California were calculated and weighted to the 2010 California Department of Finance population statistics. Comparison analysis was conducted, and the factors associated with meeting the Physical Activity Guidelines were determined.

RESULTS: The results showed that there’s no significant difference in meeting the physical activity guidelines with respect to age, sex and other factors except education and income level. The percentage of the population meeting the physical activity guidelines increased with higher income and education level.

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**2193**

Board #112

May 28 2:00 PM - 3:30 PM

Device-Assessed Sedentary Time Sex Comparison By Time Of The Day Analysis

María Enid Santiago-Rodríguez, Jared Donald Ramer, Eduardo Esteban Bustamante, FACSM. University of Illinois at Chicago, Chicago, IL.

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(No relevant relationships reported)

Sedentary time (ST) has been linked with obesity in children and studies have shown that girls are more sedentary than boys. However, data about ST by specific periods of the day are necessary to determine when girls are more sedentary compared to boys. PURPOSE: To determine how US youth ST at different periods of the weekday (before school, during school, afterschool, and evening) and weekend day (morning, afternoon, and evening) differ by sex. METHODS: Youth between 6 and 18 years old from NHANES 2005 - 2006 (N = 2,972) were included. Accelerometry restricted dataset was used to determine ST, and to obtain hourly ST (min/hour) we used the Web App for processing NHANES accelerometer data. For the weekday we calculated a mean for the following periods: before school (6:00-7:59 am), during school (8:00 am-2:59 pm), afterschool (3:00-5:59pm), and evening (6:00pm-9:00pm). For the weekend day we calculated a mean for the for the morning (7:00 - 11:59 am), afternoon (12:00 - 5:59pm), and evening (6:00 - 10:00pm). T-tests were conducted to compare ST during each period for the weekday and weekend day. SAS 9.4 was used to conduct statistical analyses.

RESULTS: US youth had 885.6 ± 137.1 min/week of ST. T-tests revealed no significant differences in ST before school (Boys: M=47.31±12.8 min/hour; Girls: M=47.01±12.9 min/hour; P = 0.8), afterschool (Boys: M=26.0±8.7 min/hour; Girls: M=28.3±8.6 min/hour; P = 0.7), and evening (Boys: M=28.0±9.0 min/hour; Girls: M=29.6±8.7 min/hour; P = 0.2) during the weekday; neither in the morning (Boys: M=47.31±12.8 min/hour; Girls: M=47.01±12.9 min/hour; P = 0.8) after school (Boys: M=26.0±8.7 min/hour; Girls: M=28.3±8.6 min/hour; P = 0.7), and evening (Boys: M=28.0±9.0 min/hour; Girls: M=29.6±8.7 min/hour; P = 0.2) during the weekend. A significant difference in ST was observed during school time and suggest that school interventions may be a potential way to reduce this gap in girls.

CONCLUSION: More efforts should be put into improving the physical activity level of the population that has less income and lower education levels.
Factors such as obesity and motor skill development are associated with the health and development of young children and tend to track into adulthood. Early childhood is considered a critical time period for obesity incidence and motor skill development.

**PURPOSE:** This study examined the associations between weight status and motor skills in children.

**METHODS:** Data from 3,5-year-old children (N=342, 51% males) who participated in the 2012 National Youth Fitness Survey were analyzed. Body mass index (BMI), along with age- and sex-adjusted BMI percentiles were calculated. Scores were placed into categories of underweight/healthy weight, overweight, or obese. Skinfold along with age- and sex-adjusted BMI percentiles were calculated. Scores were measured: Sleep duration, as reported by caregivers for seven days; sleep disturbances, estimated by the Children’s Sleep Habits Questionnaire; and SJL, measured as the absolute difference between midpoints of sleep on weekdays versus weekend days.

**RESULTS:** Fourteen children were underweight, 74.5% were healthy weight, 14.2% were overweight, and 1.2% were obese. Sleep duration was 8.6±0.5 h. Mean BMI was 19.2±2.4 kg/m², and mean wrist-hand muscle area was 18.7±3.3 cm². Children with SJL >0.20 had a higher BMI and lower wrist-hand muscle area. SJL was inversely correlated with socio-economic status, % body fat, and BMI z-score. No significant associations were found with age, sex, or race.

**CONCLUSIONS:** Sleep jetlag is a modifiable and potentially important contributor to cardiometabolic risk in children.
Background: Mexican-origin men have the highest rates of non-alcoholic fatty liver disease (NAFLD) among men in the U.S. Current evidence regarding the effects of lifestyle behaviors and risk for NAFLD among Mexican-Origin men is scarce.

Purpose: To assess the influence of lifestyle behaviors risk for NAFLD, in a sample of Mexican-origin men from the Cameron County Hispanic Cohort (CCHC). Methods: The CCHC is a randomly selected cohort of community-dwelling Mexican Americans living in the U.S.-Mexico border. Participants completed physical assessments and questionnaires on demographics, medical/medication use history, and lifestyle factors. Liver elastography (FibroScan®) was performed for the assessment of liver steatosis based on controlled attenuation parameters (CAP, dB/m) scores. Survey-based linear regression for CAP score or logistic regression analyses for mild steatosis (CAP ≥ 260) were conducted to examine the relationships of lifestyle and cardiometabolic factors to NAFLD. Results: 207 Mexican-origin men (mean age: 53.5 (SE 2.5) years; mean BMI: 31.4±0.5 kg/m²; 43.9 % Spanish monolingual; 44.0 % born in U.S.) were included in the analysis. Mean CAP score was 290.4 (SE 7.3) dB/m and the prevalence of steatosis was 66.9% (SE 4.5%). There was no significant relationship of education, marital and uninsured status, smoking, physical activity levels, or age and physical activity levels to steatosis (p-values >0.05). There were significant associations between cardiometabolic risk factors including log transformed glucose (OR= 8.20, 95%CI 1.63-41.25, p=0.0108), HbA1c (OR=1.43, 95%CI 1.08-1.90, p=0.013), HDL-C (OR=0.56, 95%CI 0.93-0.996, p=0.029) and log transformed triglyceride levels (OR=7.21, 95%CI 12.58-28.16 p<0.0001), and steatosis. A one-unit increase in BMI was significantly associated with 36% increase in odds of steatosis (OR=1.36, 95%CI 1.18-1.55, p=0.0011). Having metabolic syndrome (OR=4.93, 95%CI=1.84-13.19, p=0.0016) was significantly associated with steatosis in age-and BMI adjusted models. Conclusion: NAFLD was associated with cardiometabolic risk factors among Mexican-origin men in a community-based sample. Efforts to develop health promotion programs to address these risk factors, particularly body weight, are warranted.

Purpose: Several studies have reported obesity is associated with hypohydration at the population level. However, these studies typically used simple urine osmolality thresholds to assess hydration, which may be inappropriate given that the amount of body mass a person has impacts urine solute (creatinine, urea) levels. To address this issue, our study compared differences in hypohydration prevalence using common urine methods (osmolality, flow rate, their combination) and examined whether obesity was differentially associated with these measures. Methods: Data of 6,999 adults from the 2009-2012 National Health and Nutrition Examination Survey (NHANES) were analyzed. Hypohydration status was categorized using five thresholds; 1) absolute obesity (850 mOsm/L), 2) age-specific obesity morphology, 3) urine flow rate (850 mL/day), 4) a combination of absolute obesity and urine flow rate, and 5) a combination of age-specific obesity morphology and flow rate. Logistic regression was used to examine whether body mass index ≥23 kg/m² (vs. less) was associated with the various hypohydration definitions. Results: The prevalences of hypohydration were as follows: 21.7% (absolute urine osmolality), 36.8% (age-specific urine osmolality), 37.1% (urine flow rate), 13.6% (absolute urine osmolality and flow rate combined), and 21.5% (age-specific urine osmolality and flow rate combined). Obesity was associated with increased likelihood of hypohydration when using absolute (odds ratio [OR]: 1.63; 95% confidence interval [95CI]: 1.39, 1.92), and age-specific (OR: 1.78; 95CI: 1.48, 2.13) urine osmolality. However, associations were not significant when using urine flow rate (OR: 0.95; 95CI: 0.81, 1.12) or the combination of absolute urine osmolality and flow rate (OR: 1.26; 95CI: 0.98, 1.60). The association was weak, significant, when using the combination of age-specific urine osmolality and flow rate (OR: 1.92; 95CI: 1.26, 2.94). Conclusion: Common methods used in epidemiological research to assess hydration status result in substantially different prevalences of hypohydration. The association between hypohydration measures and obesity is strongest for urine osmolality measures, though this is perhaps a product of increased urine solutes and not actual differences in hydration.
PURPOSE: To perform a large-scale population-based cross-sectional analysis from the (2001-2006) National Health Assessment and Nutrition Examination Survey (NHANES). METHODS: The population included non-institutionalized non-Hispanic American men and women who self-reported their age and sex, and who had complete anthropometric and body composition data from NHANES. Body composition variables included BMI, waist circumference, and total body fat percentage, measured with dual-energy x-ray absorptiometry (DXA). All study participants provided written informed consent prior to enrollment. Descriptive statistics, frequency distributions and percentiles were computed for the total population, and by age, sex and BMI.

RESULTS: Of the included population, 48.8% were men and 51.2% were women. Those with a BMI between 18.0-24.9 kg/m² (normal weight) had a total body fat between 19.6-31.8% and a waist circumference between 64.5-88.0 cm (18th - 54th percentile). Those with a BMI between 25.0-29.9 kg/m² (overweight) had a total body fat between 31.9-39.3% and a waist circumference between 88.1-102.3 cm (55th and 78th percentile). Those with a BMI ≥ 30 kg/m² (obese) had a total body fat ≥ 39.4% and a waist circumference ≥ 102.4 cm (79th - 99th percentile).

CONCLUSIONS: We performed a large-scale population-based cross-sectional analysis from NHANES to standardize metrics of waist circumference and body fat percentage to the WHO's general population guidelines for body weight classification. Our findings may provide healthcare practitioners with a more comprehensive assessment of body composition and serve as a supplemental resource to BMI when determining body weight status for Americans.

Prenatal syndrome is common in female athletes, and related symptoms, such as anxiety, breast tenderness, and bloating, can negatively affect performance. However, there are very few studies on prenatal syndrome in female athletes worldwide. A survey of PMS is needed to provide proper medical support and to improve performance. PURPOSE: The purpose of this study was to investigate the prevalence of prenatal syndrome and related risk factors in elite female athletes.

Methods: A survey about prenatal syndrome was conducted among female athletes training at national training centers. Prenatal syndrome was diagnosed using the Prenatal Symptom Screening Tool (PSST). Mann-Whitney test was performed to determine differences in age, training time, and body mass index (BMI) according to prenatal syndrome. The chi-square test was performed to investigate differences in alcohol and coffee intake, diet for weight loss, stress fracture, and menstrual irregularity according to prenatal syndrome. Results: The average age of 124 female athletes across 17 sports was 24.36 ± 4.68 years, and the mean BMI was 22.19 ± 3.81. Of the 124 patients, 17 met criteria for moderate to severe PMS, and one met the criteria for prenatal discomfort. Athletes diagnosed with moderate to severe PMS complained of fatigue (100%), irritability (78%), difficulty concentrating (78%), joint and muscle pain (56%), bloating (56%), and weight gain (56%). Age, type of sport, BMI, training time per week, menarche age, and coffee and alcohol consumption were not significantly related to the prevalence of prenatal syndrome. Overall, 76.6% of the female athletes felt that prenatal symptoms interfered with their performance; however, only five out of the 18 athletes with moderate to severe PMS visited their doctors to discuss it. Conclusions: This cross-sectional study of the prevalence of and risk factors for prenatal syndrome in Korean female athletes found that 18 (14.55%) of 124 athletes had moderate to severe PMS, and no risk factors for prenatal syndrome were discovered.

Knowledge of physical activity in preschool populations is important for public health promotion. However, little is known about physical activity and sedentary patterns in low-income children, suggesting an urgent need for data covering this population. Purpose: to describe physical activity levels and sedentary time of low-income preschool children during preschool time; to describe physical activity patterns of active children during preschool time at public preschools in João Pessoa/Brazil. Method: a random sample of 237 preschool was randomly selected and 204 provided valid accelerometer measurements (boys: 4510±0.8eyes, girls: 4510±0.7eyes). Measured levels of physical activity and sedentary time, and physical activity patterns were observed during preschool time (7am to 5pm) (Actigraph, WGT3-X). Data were presented in quartiles of total physical activity by sex and age. Univariate General Linear Model was used to analyze differences between the quartiles. Data were performed using SPSS (version 25, Inc., Chicago, USA). Level of significance: 95%. Results: physical activity at preschool range from 68 to 114% of total physical activity daily’s recommendation and from 28 to 83% of moderate...
to vigorous physical activity recommendation. For the two most active quartiles, the daily total physical activity recommendation was achieved during preschool time. Physical activity patterns were similar between the least and the highest actives, and all the evaluated children were more active outdoors than indoors. For the least actives, preschool time correspond 30% of daily moderate to vigorous physical activity recommendation. Physical activity patterns are quite similar between the least and the highest actives. Conclusion: this information is important for tailoring interventions.

Athletes continue to seek new and improved strategies to preserve skeletal muscle strength and attenuate effects of skeletal muscle fatigue during resistance training. The ingestion of carbohydrates prior-to and during resistance training was hypothesized to improve both skeletal muscle performance and attenuate fatigue. Vitargo®™ is a high molecular weight carbohydrate supplement that promotes enhanced performance with its consumption prior-to and during physical activity. PURPOSE: To examine the influence of high molecular weight carbohydrate (HMC) consumption on skeletal muscle performance and fatigue following exhaustive lower-limb resistance training exercise. METHODS: Five-female and seven-male (n = 12) healthy college-aged individuals participated (26.1 ± 3.8 yrs) in a double-blinded crossover trial. Participants took part in three sessions across the study period: familiarization, Test Day 1 and Test Day 2. Participants were randomly assigned to one of two conditions [control (CON) or high molecular weight carbohydrate supplement (HMC)] for each of the two testing sessions. Lower-limb isometric and isokinetic concentric peak torque, blood glucose concentration, and rate of perceived exertion (RPE) were assessed. Outcome measures included lower-limb isometric and isokinetic concentric peak torque, blood glucose concentration, and rate of perceived exertion (RPE). RESULTS: The HMC condition elicited a significant increase in blood glucose concentration from Pre-Workout to Post-Workout (Pre-Workout: 92.1±14.4 mg/dl and Post-Workout: 118.3±15.2 mg/dl) compared to the control condition (Pre-Workout: 95.6±15.6 mg/dl and Post-Workout: 108.1±14.5 mg/dl). Isometric strength was reduced by 25.4 Nm (HMC) and 35.0 Nm (CON) following the lower-limb resistance training session; however, no group effect was found (p>0.05). Isokinetic concentric strength did not differ (p>0.05) following the HMC supplementation compared to the CON condition. No difference was found in RPE between the HMC and CON condition (p>0.05). CONCLUSIONS: The consumption of HMC supplementation prior to and during resistance-training exercise did not improve skeletal muscle performance and attenuated skeletal muscle fatigue following a lower-limb resistance-training exercise session.

Purpose: The purpose of this study was to investigate changes in resistance exercise performance, serum insulin, epinephrine, glucose, and muscle glycogen from carbohydrate supplementation. Methods: Participants completed four sets to failure at 70% of 1-RM with 45s rest on angled leg press with or without pre-exercise carbohydrate (2g/kg) after a 3hr fast. Serum glucose, epinephrine, and insulin were assessed at baseline, 30 min post-ingestion, immediately after, and 1hr post-exercise with or without carbohydrate supplementation. Muscle glycogen was measured at baseline, immediately after exercise, and 1hr post-exercise.

RESULTS: There was no main effect of supplement on resistance exercise performance (F= 2.169, p=.18). There was a main effect for set on repetitions showing a decrease over sets completed (F=26.18, p<.001) There was no interaction between supplement and set on reps to fatigue (F= 3.37, p=.07). There was a time effect showing muscle glycogen decreased immediately post-exercise for both groups and remained lower than baseline after 1hr (F= 14.305, p<.001). No main effect of supplement on glycogen concentration was found (F=2.847, p=.13). No supplement time interaction was found on glycogen (F=1.191, p=.33). There was an interaction showing pre-exercise carbohydrate supplementation led serum glucose to be utilized more during exercise (F= 3.791, p=.026). No main effect for supplementation on blood glucose was found (F= .472, p=.79). Pairwise comparisons indicated no time effect on serum glucose (p=.05). An interaction occurred showing muscle decreased during exercise in the carbohydrate condition (F= 47.14, p<.005). Also, there was a main effect of insulin being elevated with carbohydrate consumption (F= 7.72, p=.027). Pairwise comparisons indicated there was no time effect on insulin concentration (p>.05). There was a main effect of carbohydrate supplement decreasing epinephrine (F= 7.924, p=.023). No time effect was found on epinephrine concentration (F=1.475, p=.258). No interaction effect was found on epinephrine (F=1.94, p=.181). Conclusions: Carbohydrate supplementation before resistance exercise does not improve leg press performance to fatigue or glycogen recovery during 1hr resist despite increased glucose availability.
engaged in three times (separated by 1 week) of 1-hour ergometer cycling (Monark 839E, Sweden) at 60% VO2peak intensity while ingesting two types of beverages with different GI values (LGI:47, HGI:90), and water (control). Carbohydrate intake was set at 0.2g/kg every 15 minutes, and blood samples were collected pre-exercise and 0h-, 1h-, 2h-post-exercise for glucose, insulin, free fatty acid (FFA) and triglyceride analyzing. Substrate utilization was measured using metabolic cart (Cortex Metalyzer R-2i, Germany) at 5min, 30min, 50min during exercise.

RESULTS: There were no significant differences in carbohydrate oxidation rate between LGI and HGI beverage treatment (p=0.36). Fat oxidation rate was significantly higher in LGI (0.22±0.08 g/min) compared to HGI treatment (0.18±0.07 g/min) and water (0.16±0.06 g/min) at 30 minutes during exercise (p<0.05). Blood glucose concentration was higher in HGI (5.64±0.72 mmol/L) and LGI (5.35±0.66 mmol/L) compared with water treatment (4.82±0.76 mmol/L) 0h-post-exercise (p<0.05). Plasma insulin concentration in HGI treatment was significantly increased (15.11±5.94 µU/mL) compared with LGI (9.64±2.10 µU/mL) and water (3.53±1.22 µU/mL) (p<0.05). Plasma triglyceride (0.97±0.30 mmol/L) and FFA (0.48±0.18 mmol/L) concentration were lower in LGI treatment compared to water treatment 0h-post-exercise (p<0.05), but not in HGI treatment (p=0.05).

CONCLUSIONS: Compared with HGI beverage before and during exercise supplementation, LGI beverage consumption may elevate fat substrate utilization during moderate intensity exercise.

2215 Board #134 May 28 3:00 PM - 4:30 PM Effects Of Repeated Carbohydrate Rinse On Lacrosse Performance

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(No relevant relationships reported)

While carbohydrate rinse has been demonstrated to be an effective strategy for improving endurance performance, the effects of rinse on anaerobic performance, particularly within team sport athletes, are equivocal. Additionally, it is not yet known whether repeated carbohydrate rinses in the context of a high intensity training session may provide additional benefit.

PURPOSE: The purpose of this investigation was to determine the effects of repeated carbohydrate rinse during a typical lacrosse team practice on lacrosse performance. METHODS: A randomized, double-blind, placebo-controlled design was used to determine the effects of carbohydrate rinse on 11 male, division 1 lacrosse players. Shot velocity and accuracy, 40-yard dash time, and concentration (measured via Trail Making Test) were assessed prior to a typical practice, and the test battery was completed again following practice on two subsequent days of similar intensity/duration. During both practice sessions, the athletes completed 4 rinses (carbohydrate-CHO or placebo-PLA), equally spaced throughout the session, and practice intensity was measured using RPE and HR. Changes from pre-post were calculated for each test and paired t-tests were used to determine effect of other performance measures. RESULTS: Shot velocity and accuracy were significantly reduced following practice, however the reduction in shot accuracy was blunted in the CHO v. PLA (9.01±14.4 v. 19.49±21.7, p=0.01). 40-yard dash was not significantly reduced by the training session, and no differences were detected between groups (CHO: 5.057±0.25 sec v PLA: 5.051±0.27 sec). RPE was significantly lower for CHO (9.0±4.3 v. 12.7±2.7, p=0.04) at timepoint 2, but not at any other time. Changes in TMT following practice were not significantly different between groups. CONCLUSION: When used during a typical lacrosse practice, repeated carbohydrate rinse may reduce the effects of fatigue on shot accuracy and perceived exertion, however it does not appear to effect other performance measures.
A 16% Carbohydrate-hydrogel Beverage Reduces Gastrointestinal Permeability And Enterocyte Damage After Cycling in Hot-humid Conditions

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(No relevant relationships reported)

Background. Carbohydrate ingestion during exertional heat stress can reduce enterocyte damage and preserve gastrointestinal permeability. Athletes have begun to use drinks which encapsulate carbohydrate within a pectin-alginate hydrogel, yet little evidence exists to support their preferential use versus traditional carbohydrate-gels and/or beverages with multiple transportable carbohydrates. Purpose. To compare the effects of consuming a 16% carbohydrate-hydrogel drink to a nutrient matched maltodextrin-fructose (MF) drink on enterocyte damage and gastrointestinal permeability after cycling in hot and humid conditions. Methods. Fourteen endurance trained cyclists (7 men, age 27 ± 8 yr, 176 ± 10 cm, 74 ± 11 kg, VO2peak: 55.2 ± 9.5 ml·kg⁻¹·min⁻¹) cycled (45% VO2max) for 90 minutes before completing a 15-minute time trial in hot humid conditions (32°C, 70%) on 3 occasions separated by 7 days. During trials participants consumed either water (W), a traditional MF drink, or an encapsulated carbohydrate hydrogel drink (HYDRO) in a randomised order. Each CHO drink provided 90 g CHO hr⁻¹ (16% w/v). Twenty minutes into exercise a 50 mL drink containing lactulose (L; 5 g) and rhamnose (R; 2 g) was provided and intestinal permeability determined by the percent ratio of lactulose to rhamnose recovered in post exercise urine samples. Venous blood samples were obtained before and 5 minutes after the time trial for assessment of intestinal fatty acid binding protein (IFABP), and data analysed using mixed linear models with fixed effects for condition (W/ MF/HYDRO) and time (before and after exercise). Results. L-R was greatest in W, and lower in both HYDRO by [0.019 (95% CI: 0.010 to 0.027), p = 0.0003] and MF by [0.014 (95% CI: 0.006 to 0.022), p = 0.0018]. No differences in L-R were found between the H and GF conditions (p = 0.083). Post-exercise IFABP concentrations were greater in W compared to HYDRO by [349 pg·mL⁻¹ (95% CI: 137 to 561 pg·mL⁻¹), p = 0.007] and GF by [427 pg·mL⁻¹ (95% CI: 152 to 701 pg·mL⁻¹), p = 0.018]. There was no difference in post exercise IFABP concentrations between H and GF (p = 0.90). Conclusion. Both CHO drinks preserved intestinal permeability and reduced the appearance of circulating IFABP compared to W. HYDRO offered no additional benefit beyond those achieved with a traditional MF drink.

Effects Of Weight Regain In Obese Individuals With NAFLD After Cycling In Hot-humid Conditions

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(No relevant relationships reported)

Low-carbohydrate diets (LCD) for weight reduction and the management of the metabolic syndrome are increasingly popular, but there is a paucity of research about the negative effects of LCD on mental status and physical fitness. Purpose. We examined the effects of LCD vs. caloric restriction on mental status and physical performance in untrained subjects with overweight and/or glucose intolerance. Methods. We recruited 24 sedentary young subjects (20 ± 2 years) and randomly assigned them to an LCD group (carbohydrate intake <40 g) and a caloric restriction (CR) diet group (ideal weight × kcal). We measured the subjects’ body composition, blood metabolic parameters (fasting glucose, insulin, lipids, uric acid, liver enzymes, ketone bodies, C-reactive protein, adiponectin, growth hormone, testosterone and dehydroepiandrosterone), mental status (State-Trait Anxiety Inventory [STAI] and brain-derived neurotrophic factor) and various physical performance aspects (leg extension, handgrip dynamometry, sit-up, and bicycle ergometer) before and after 1 month of the diets. Results. The body mass index decreased significantly in both the LCD group (42.9 ± 3.5 kg/m² vs. 23.5 ± 3.5 kg/m², p < 0.001) and CR (24.7 ± 3.8 kg/m² vs. 24.1 ± 3.8 kg/m², p = 0.026) groups. Waist circumference decreased significantly in the LCD group (84.9 ± 3.5 cm vs. 81.1 ± 10.2 cm, p = 0.001) but did not change significantly in the CR group (83.8 ± 12.0 cm vs. 82.6 ± 11.8 cm, p = 0.145). The physical performance aspects were similarly maintained in both groups. Other blood parameters and the mental status did not change significantly in either group. Conclusions. Our results demonstrated that an LCD for a relatively short term can decrease obesity measures more effectively than caloric restriction, without negative effects on mental status or physical performance.

Effects Of Low-carbohydrate And Caloric Restriction Diets On Mental Status And Physical Performance

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(No relevant relationships reported)

Hepcidin is a liver-derived hormone to attenuate iron metabolism. Recent studies suggest that negative energy balance promotes hepcidin elevation. Purpose. The purpose of the present study was to examine the effect of caloric restriction (CR) with low carbohydrate intake on hepcidin responses. Methods. Twenty-two young females (age: 21.2 ± 0.2 yrs, body weight: 54.6 ± 1.3 kg) were divided into two different groups, either CR with low carbohydrate intake group (LCHO: 22%PRO, 39%Fat, 39%CHO, 1132 kcal) or CR with neutral carbohydrate intake group (NCHO: 18%PRO, 19%Fat, 63%CHO, 1162 kcal). During three consecutive days of CR program, subjects consumed only the prescribed diet and maintained their usual physical activity levels. Before and after intervention, body composition, basal hepcidin levels or iron status were evaluated following the overnight fast. Six subjects (LCHO: n = 3, LCHO; n = 3) were excluded from data analysis due to severe iron deficiency (serum ferritin < 10 ng/mL) or infection. Results. After intervention, body weight and fat mass were significantly decreased (P < 0.05), with no significant difference between groups. Following the intervention, blood glucose level significantly decreased in LCHO group (P < 0.05). Serum iron and ferritin levels were significantly elevated following the intervention (P < 0.05). Moreover, the magnitude of increased serum iron level tended to be higher in LCHO group than in NCHO group (P = 0.06). In contrast, total iron-binding capacity (TIBC) did not differ following the intervention in either group. Also, plasma IL-6 level did not change following the intervention (LCHO: before 8.4 ± 0.14 pg/mL, after 6.06 ± 0.06 pg/mL, NCHO: before 7.19 ± 0.23 pg/mL, after 7.92 ± 0.19 pg/mL). Serum hepcidin level significantly increased after the intervention in both groups (LCHO: before 13.11 ± 4.16 ng/mL, after 29.9 ± 4.76 ng/mL, NCHO: before 13.03 ± 3.10 ng/mL, after 19.94 ± 4.41 ng/mL, P < 0.05). In addition, the relative change in hepcidin level was significantly higher in LCHO group (263.4 ± 87.2%) than in NCHO (68.9 ± 22.1%, P < 0.05). Conclusions. Three consecutive days of CR with low carbohydrate intake augmented basal hepcidin level compared with CR with neutral carbohydrate intake. Supported by Urakami Foundation for Food and Food Culture Promotion
PURPOSE: While the brain is usually wholly dependent on glucose for fuel, prolonged carbohydrate deprivation results in adaptations that allow the brain to access fat via ketone bodies. Given the depletion of carbohydrate that takes place during prolonged exercise, a shift toward ketone bodies may maintain central nervous system function, preventing the central fatigue observed during long-duration exercise. In addition, enhancing peripheral muscle’s use of free fatty acids and intramuscular lipids might prolong contractions. Thus, high fat/carbohydrate diets have been proposed to delay fatigue during endurance exercise. However, studies utilizing periods of 1 to 5 weeks of adaptation to high fat diets have shown equivocal changes in performance at moderate or high intensities. We compare endurance and time trial performance of a ketoadapted male runner (KETO) to 8 subjects (NORM) on whom we have previously reported.

METHODS: We measured peripheral and central fatigue in 8 men runners (38±2 yrs; VO2peak 59±3 ml/kg/min) who habitually ate a carbohydrate-liberal diet (NORM) and in a runner (41 yrs, 70 ml/kg/min) who followed a high fat/carbohydrate diet for ≥2 years. Water was provided at 1% of body mass/hr, during a 2-h run at ventilatory threshold (~65% VO2peak), followed by a self-paced 2-km time trial (TT). RPE and respiratory measures were determined every 20 minutes. Strength was tested in a semi-reclined position (75° hip flexion, to facilitate femoral nerve stimulation) pre-exercise, after the 2-h run and post-time trial as follows: voluntary isometric quad strength was measured on the Biodex with the knee flexed 60°, and with superimposed peripheral magnetic stimulation of the femoral nerve to determine central activation (CAR).

RESULTS: Respiratory exchange ratio indicated that KETO (0.78) used less carbohydrate than NORM (0.86±0.01) during the 2-h run. While we measured no fatigue of any kind in KETO, NORM declined in voluntary strength (16±5%) and experienced loss of central drive to the muscle (CAR decreased from 0.85±0.04 to 0.76±0.05). KETO ran the TT at a mean pace of 16.4 km/hr compared to 14.8±0.7 km/hr in NORM.

CONCLUSIONS: Our KETO runner did not display strength loss and may have had better TT performance after exhausting exercise as compared to our NORM runners who exhibited central fatigue.

Impact Of Cardiorespiratory Fitness On Carbohydrate Utilization In Overweight And Obese Adults

Obese individuals have impaired metabolic flexibility compared to lean individuals. During exercise, this population relies more heavily on fat oxidation than carbohydrate oxidation for energy even at higher intensities. Although increased fat oxidation during exercise can be beneficial in lean individuals, increased fat oxidation during exercise in obese populations is a paradox. Examining the relationships of fat versus carbohydrate oxidation in obese subjects with different cardiiorespiratory fitness levels, may help to explain these differences further. PURPOSE: To determine whether overweight and obese (OW/OB) individuals with higher versus lower cardiopulmonary fitness differ in their carbohydrate and fat utilization at 35, 50, 65, and 80% of VO2max during a graded exercise test. METHODS: Adults (n=34), 28-55 years old with BMI 27-36 kg/m² were measured for their age-predicted VO2max using a modified Bruce protocol on a treadmill. 85% of age predicted heart rate maximum. Participants were first split into groups based on sex and then divided for comparison into upper and lower halves based on age-predicted VO2max. After they were split into within sex low and high groups, their carbohydrate and fat utilizations were compared at 35, 50, 65, and 80% of VO2max and normalized to body mass.

RESULTS: An intensity by fitness group interaction (p=0.05) was measured for both sexes. For women (n=10 per group), the low and high fitness groups were similar in carbohydrate oxidation at 35 and 50 of VO2max and the high fitness women oxidized more (p=0.05) carbohydrate at 65% (mean ±SD: 0.08 ±0.02 vs 0.06 ±0.03 kcal/kg/min) and 80% (0.20 ±0.09 vs 0.12 ±0.05 kcal/kg/min) VO2max. For men (n=7 per group), both groups had similar carbohydrate oxidation at 35, 50, and 80% of VO2max and the high fitness men utilized more (p=0.05) carbohydrate (0.16 ±0.07 vs 0.09 ±0.02 kcal/kg/min) at 65% VO2max. Fat utilization did not differ between groups for either males or females. CONCLUSIONS: OW/OB adults with better cardiopulmonary fitness utilized more carbohydrates for energy during a graded exercise test at moderate or high intensities. Despite this, both OW/OB groups with higher versus lower cardiorespiratory fitness did not differ in their fat oxidation at any intensity.

Board #140 May 28 3:00 PM - 4:30 PM

Long Term Habituation To Carbohydrate-Restricted Diet Preserved Performance And Central Drive After 2 Hours Of Running: A Case Study

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INTRODUCTION: During exercise women are better able to initiate aerobic metabolism and are less reliant on anaerobic energy stores. Whether this metabolic difference persists during resistance exercise remains unknown. PURPOSE: To characterize fuel utilization patterns during a bout of low-intensity, high-repetition (LL-HR) resistance exercise and determine whether sex influences the fuel utilization pattern. METHODS: Twenty young, healthy participants (n=10 men and women) were recruited and matched for VO2max relative to fat-free mass and habitual resistance training. The LL-HR bout consisted of a circuit of chest press, leg extension, lat pulldowns, hamstring curl, shoulder press, and leg press for 25-35 repetitions at 30% of 1RM with 30s rest between each exercise and 2 minutes rest between circuits. Muscle biopsies were taken prior to and following exercise and finger prick assessment of blood lactate was taken during the exercise bout. Western blot analysis was completed for assessment of the high-energy phosphate transfer (CK, phosphorylated CK, AMPD2) and glycolytic (GP, PFK, LDH H and M, PDHE1α, PDHκ4, MCT 1 and 4, phosphorylated PDH1α) pathways. Muscle content of creatine, ATP, lactate, P, pyruvate, and glycogen were also determined. Muscle fibre type was determined using myosin heavy chain immunofluorescence staining. RESULTS: Women had a higher proportion of type I muscle fibres than men (p=0.007). There were no sex differences in the protein content of any of the enzymes at rest. Men had higher content of muscle glycogen (p=0.001), lactate (p=0.02), ATP (p=0.01), and P (p=0.007) than women. Glycogen, ATP, and phosphorylation of CK and PDH1α decreased in men and women with exercise (p=0.001). Phosphorylation of CK decreased to a greater extent in women (Norm 0.23) and women tended to use more glycogen (p=0.081) during exercise. Alternatively, creatine increased to a greater extent in men (p=0.026) and men tended to have a greater lactate concentration at the end of the exercise bout (p=0.097).

CONCLUSION: Sex differences in fuel metabolism during LLHR resistance exercise exist. While women tend to utilize more glycogen during LLHR, men have a higher muscle lactate content, suggestive of a greater reliance on anaerobic metabolism.

Board #141 May 28 3:00 PM - 4:30 PM

Impact Of Cardiorespiratory Fitness On Carbohydrate Utilization In Overweight And Obese Adults

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POST BREAKFAST RESISTANCE EXERCISE AND REDOX STATUS RESPONSES IN PATIENTS WITH THALASSEMAIA MAJOR EXHIBITING INSULIN RESISTANCE

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Beta-thalassemia major is an inherited hemoglobin disorder that manifests within the first few months of life. Especially insulin resistance and diabetes mellitus are common consequences of iron overload in the pancreas. PURPOSE: To examine whether a session of resistance exercise can affect the redox status and improve postprandial hyperglycaemia in patients with beta-thalassemia major exhibiting insulin resistance.

METHODS: Six patients (weight: 66.0 ± 16.6 kg, body fat: 37.6 ± 5.1 %, SBP: 104.5 ± 9.7 mmHg, DBP: 67.5 ± 8.7 mmHg) underwent two trials (exercise and control) following breakfast meal ingestion, in a counterbalance order, separated by at least three days. In exercise trial, patients performed chest and leg press (3 sets of 10 maximal repetitions), while in control trial they rested. Blood samples were obtained in both trials: pre-meal, 45 min post-meal, immediately post, 1 hour post, 2 hours post and 24 hours post. Blood was analysed for TBARS, catalase, total antioxidant capacity (TAC) and glucose. RESULTS: No time or condition interaction was found for TBARS, catalase and TAC (Table 1). Blood glucose levels increased significantly following breakfast meal ingestion and were not differed between trials at the same time points.

Table 1: Redox and glucose responses following a post-breakfast resistance exercise session

<table>
<thead>
<tr>
<th>Time (hours)</th>
<th>TBARS (µmol/mL)</th>
<th>Catalase (U/mL)</th>
<th>Total Antioxidant Capacity (µmol/mL)</th>
<th>Glucose (mmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>1.2 ± 0.3</td>
<td>0.9 ± 0.2</td>
<td>12.3 ± 2.4</td>
<td>5.6 ± 0.2</td>
</tr>
<tr>
<td>Post 1</td>
<td>1.5 ± 0.4</td>
<td>0.8 ± 0.1</td>
<td>11.9 ± 2.1</td>
<td>6.8 ± 0.3</td>
</tr>
<tr>
<td>Post 2</td>
<td>1.6 ± 0.5</td>
<td>0.7 ± 0.1</td>
<td>11.5 ± 2.0</td>
<td>6.9 ± 0.4</td>
</tr>
<tr>
<td>Post 24</td>
<td>1.7 ± 0.6</td>
<td>0.8 ± 0.2</td>
<td>11.4 ± 2.1</td>
<td>6.8 ± 0.3</td>
</tr>
</tbody>
</table>
CONCLUSIONS: A session of resistance training consisting of two major muscle exercises is not enough to influence changes in redox status or glucose metabolism in patients with beta-thalassemia major exhibiting insulin resistance.

Supported by the Postgraduate Program of Study “Exercise & Health: Testing & Prescription”, School of P.E. & Sports Science, University of Thessaly, GREECE

2225 Board #144 May 28 3:00 PM - 4:30 PM
Effect Of Wearing Lower-body Compression Garments During Prolonged Running On Substrate Oxidation And Running Kinematics
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(No relevant relationships reported)

Lower body compression garments (CG) have been suggested previously to provide favorable effects during running. One of explanation for the benefits of wearing CG might be explained by augmented arterial blood flow by external pressure applied length. Enhanced muscle perfusion can increase oxygen delivery to exercising muscle, thereby affecting oxygen uptake and substrate oxidation. Furthermore, wearing CG might assist the propulsive force by optimizing running kinematics as a result of the elastic nature of the garment, leading to less metabolic cost of running at a given speed. These insights may be advantageous in situations with prolonged running, which is required large metabolic demand under development of fatigue. However, little information is available for effect of wearing CG during prolonged running (>1h) on energy metabolism and running kinematics. PURPOSE: To determine influence of wearing CG on energy metabolism and running kinematics during prolonged running. METHODS: Eight healthy male adults (24±2 years, 168±5 cm, 63.9±5 kg, VO2max: 54.8±4.3 mL/kg·min-1) completed 2 exercise trials in the different days. The exercise consisted of 120 min of uphill running (7% gradient) at 60% of VO2max (6.8±0.6 km h-1). The exercise trials included 1) wearing CG with exerting 15 mmHg [CG]; and 2) wearing garment with exerting below 5 mmHg [CON] to thigh and calf. Respiratory gas variables (carbohydrate oxidation) and running kinematics (step length and frequency, ground-contact time, flight time, joint angles) were assessed every 30 min of exercise. Blood samples were collected to determine blood glucose and lactate, and plasma IL-6 as indication of carbohydrate metabolism. P<0.05 was considered to be statistically significant. RESULTS: Time course of changes in carbohydrate oxidation, running kinematics and blood glucose and lactate did not differ between the two trials (P>0.05). Area under the curve (AUC) of plasma IL-6 concentration for 120 min of exercise tended to be lower in the CG trial (803±452 pg·mL-1) compared with in the CON trial (1219±542 pg·mL-1, P=0.07). A positive relationship was observed between the AUC of plasma IL-6 concentration and the total carbohydrate oxidation (r=0.2). CONCLUSION: Wearing CG did not alter energy metabolism and running kinematics during prolonged running.

2226 Board #145 May 28 3:00 PM - 4:30 PM
Comparing The Effects Of Different Modes Of Exercise On Glucose Handling In Young Recreational Activity Men
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(No relevant relationships reported)

PURPOSE: The prevalence of type 2 diabetes (T2D) is increasing dramatically and is characterized by insulin resistance (IR). Exercise training is an effective modality to improve IR and acutely can increase post-exercise glucose handling for up to 72 hours. However, there is conflicting evidence as to which mode of exercise elicits the greatest positive effect on glucose handling. The purpose of this study was to compare the effectiveness of different modes of exercise on post-exercise glucose handling in young recreationally active men. METHODS: Twelve (age: 22±3 years) recreationally active men completed 4 separate oral glucose tolerance tests (OGTT) either at rest, or 1.5 hours after a high-intensity interval training bout (HIIE; 10×1min at 90% HRmax) or LLHR average concentrations. Similar to c-peptide there were no significant differences between blood insulin concentrations post exercise. CONCLUSION: In young, healthy men none of the exercise modes showed a significant influence on glucose handling as compared with baseline. However, LLHR resistance exercise did result in greater glucose clearance than MICE, suggesting that it may be a better modality to improve glucose control. Future work should examine the acute and chronic effects of LLHR exercise resistance on glucose handling in individuals with IR to determine the potential effectiveness of this exercise modality to improve insulin sensitivity.

2227 Board #146 May 28 3:00 PM - 4:30 PM
The Effect Of Arm Versus Leg Dominant Physical Activity On Postprandial Blood Glucose Levels
Kabre C. Madrigal, Emma R. Powley, Matthew J. Laye. The College of Idaho, Caldwell, ID.
(No relevant relationships reported)

PURPOSE: The aim of this investigation was to assess the effects of different exercise trials that used different amounts of muscle mass on postprandial blood glucose levels. METHODS: Subjects (n=8) participated in a series of three tests after ingesting a 75g 100% glucose solution: a control, a bout of arm-only exercise, and a bout of leg-only exercise following the standard OGTT protocol. Each exercise bout was thirty minutes in length, the intensity of which was matched at 0.5 watts/kg of body weight between trials. RESULTS: The average postprandial blood glucose was significantly different between conditions (Two Way Repeated Measures ANOVA, p<0.05). At 20 minutes blood glucose was significantly lower in the legs condition versus the arm only conditions (p=0.003). There was no difference in mean HR or RPE between trials. CONCLUSION: The data suggests that when factors such as workload are matched, the amount of muscle mass recruited for light physical activity can impact postprandial blood glucose control. The results of this pilot study help to further define the role exercise could play in the prevention of increasingly prevalent metabolic disorders, helping people to live longer, healthier lives utilizing exercise as medicine.

2228 Board #147 May 28 3:00 PM - 4:30 PM
Does Energy Expenditure Of Activity Interruptions In Prolonged Sitting Impact On Glycemic Responses?
Zhen-Bo Cao, Sheng-Xia Ma, Yan-Yu Lin, Xiao-Mei Liu, Zheng Zhu. Shanghai University of Sport, Shanghai, China. Email: caozb_edu@yahoo.co.jp
(No relevant relationships reported)

PURPOSE: To explore the impact of energy expenditure (EE) on glycemic responses when prolonged sitting is interrupted by three regular activity bouts. METHODS: Fourteen healthy, sedentary adults (8 women; age 23.7±2.9 y; BMI, 22.2±2.4 kg/m2; VO2 max, 38.5±5.2ml·kg·min-1) completed four 26 h interventions in randomized order, including 22.5 h in an EE-testing calorimeter chamber. The four 9 h intervention periods were as follows: uninterrupted sitting (SIT); 3 min sitting/5 min brisk treadmill walk (60% VO2 max; WALK5); 45 min sitting/5 min brisk treadmill walk (WALK5); or 60 min sitting/8 min brisk treadmill walk (WALK8). Meals and meal times were standardized across the trials for all participants. After adjustment for age, sex, percent of body fat, relative VO2 max, treatment order, and corresponding baseline interstitial glucose concentrations, the relationship between EE and the incremental area under the curve (iAUC) for interstitial glucose was examined during the whole 26 h observation period and each segmentation period (intervention period, evening period, and sleep period). The interstitial glucose was obtained via continuous glucose monitoring. Random effects mixed model analyses were performed and data were represented as unstandardized coefficients with 95% confidence intervals. RESULTS: Model parameter estimates revealed that EE was negatively associated with glucose iAUC during the intervention period (β= -1.87 mmol·h·L-1·MJ-1[-3.68 - -0.05], P=0.04) and positively associated with glucose iAUC during the 2 h post-dinner period immediately following the intervention period (β=0.64 mmol·h·L-1·MJ-1[0.27 - 1.00], P=0.001). There was no significant association between EE and glucose iAUC during the entire 26 h observation or the other segmentation periods. The 2 h post-dinner iAUC was higher in men than in women (mean difference: 0.74 mmol·hL-1[0.16 - 1.33], P=0.01). CONCLUSIONS: Higher EE after the interruption of sitting time was associated with lower interstitial glucose responses during the intervention period in healthy, sedentary adults, but the opposite was true in the 2 h postprandial period immediately following the intervention period.
Interrupting Sitting With Short Walks Or Repeated Chair Stands Improves Glycemic Control In Healthy Adults

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(No relevant relationships reported)

Uninterrupted sedentary time is an independent risk factor for the development of metabolic diseases. Interrupting prolonged sitting with brief, intermittent walks can improve postprandial glucose metabolism; however, the efficacy of other types of exercise that do not require equipment nor space beyond one’s immediate sedentary area remain to be investigated. PURPOSE: To determine the impact of interrupting prolonged sitting with practical ‘activity snacks’ on postprandial glycemia and insulinenia in healthy adults. METHODS: Fourteen participants (7 males, 7 females; 23±5yr; 24.5±1kg/m²; 408±16kg/min; 458±213steps/d) completed three 7.5hr trials in a randomized order consisting of uninterrupted sitting (SIT), sitting with intermittent (every 30 min) walking (WLK; 2min at 3.1mph) or sitting with intermittent squats (SQT; 15 ‘chair stands with calf raise’). Mixed-macronutrient liquid meals (~55:30:15% carbohydrate:fat:protein) provided 20% (‘breakfast’; 406±87kcal) and 30% (‘lunch’; 609±130kcal) of daily energy needs to mimic traditional Western meal patterns. Blood was obtained every 30min and analyzed for plasma glucose and insulin concentration. Positive incremental area under the curve (iAUC) for glucose, insulin and insulin:glucose ratio were calculated and 1h postprandially using the trapezoidal rule. RESULTS: Postprandial glucose and insulin did not differ across conditions following breakfast. After lunch, peak insulin concentration was lower in SQT (51.6±26.7, p<0.001) and WLK (62.2±34.9, p<0.05) compared to SIT (78.9±43.0μU/ml). The insulin-glucose iAUC 3h following lunch was also reduced by the activity snacks (SQT; 489±300, WLK: 541±401) compared to SIT (700±398, p<0.05). Insulin iAUC 1h following lunch was lower in SQT (142±90, p<0.01) and WLK (175±114, p<0.05) relative to SIT (223±11540μU/ml 1h, p<0.01), however 3h insulin iAUC was only reduced in SQT (SQT: 5992±1735 vs. SIT: 3954±2260μU/ml 3h, p<0.05). CONCLUSION: Interrupting prolonged sitting with short walks or repeated chair stands reduces postprandial insulinenia following lunch in healthy adults. Our results add to the evidence suggesting that short ‘activity snacks’ can help mitigate cardiometabolic risk factors associated with prolonged sitting. Supported by ACSM Research Endowment Grant.
RESULTS: Exogenous glucose oxidation rate was lower (P < 0.05) at HA (0.35 ± 0.07 g/min) compared to SL (0.44 ± 0.05 g/min). Total glucose R\textsubscript{2} was lower (P < 0.05) at HA (12.3 ± 1.1 mg/kg/min compared to SL (15.1 ± 2.0 mg/kg/min). Exogenous glucose R\textsubscript{2} was lower (P < 0.05) at HA (8.9 ± 1.3 mg/kg/min) compared to SL (10.9 ± 2.2 mg/kg/min), but there was no difference between endogenous glucose R\textsubscript{2} at HA compared to SL. Glucose R\textsubscript{2} and MCR were lower (P < 0.05) at HA (12.7 ± 1.7 mg/kg/min and 9.0 ± 1.8 mg/kg/min) compared to SL (14.3 ± 2.0 mg/kg/min and 12.1 ± 2.3 mg/kg/min).

CONCLUSION: Ingesting carbohydrate during steady-state aerobic exercise performed 5 h after arrival at HA is associated with lower endogenous glucose R\textsubscript{2} glucose R\textsubscript{2} and MCR compared to SL. These data suggest that altered glucose kinetics, indicative of either a reduction in exogenous glucose absorption or release from the gut, may contribute to lower exogenous carbohydrate oxidation during exercise upon initial exposure to HA.

2235 Board #154 May 28 3:00 PM - 4:30 PM
Hand Heating Lowers Fasting And Postprandial Blood Glucose
Jeff Moore, Jochen Kressler, Michael Buono, FACSM, San Diego State University, San Diego, CA. (Sponsor: Dr. Michael Buono, FACSM)
Email: Jmoore714@gmail.com

Reported Relationships: J. Moore: Industry contracted research; AVACEN Medical.

Purpose: Examine the effect of hand heating with negative pressure on postprandial blood glucose (PPG) and fasting blood glucose (FBG).

METHODS: Design: Double-blind randomized controlled trial.
Subjects: Subjects were 25 healthy adults (13 healthy young adults, 2 males), 13 healthy older adults (86±7 mg/dL vs. 93±8 mg/dL in young and old, respectively), as well as young had 31% lower plasma glucose area above baseline (AAB) in response to the mixed meal tolerance test compared to old (P<0.05). No differences between young and old were observed in lean body mass, fasting plasma insulin, or maximal mitochondrial ATP production. However, AAB was significantly (P<0.05) inversely correlated with VO\textsubscript{2} peak relative to body mass (r = -0.38) and knee extensor power/lean mass (r = -0.47).

CONCLUSIONS: These data suggest that glucose tolerance may be a function of skeletal muscle quality rather than total lean mass. However, the inverse relationship with AAB and measurements of whole body functional tests do not appear to be related mitochondrial energy production, suggesting the need for further mechanistic investigations. Supported by NIH grant R01AG05454

2236 Board #155 May 28 3:00 PM - 4:30 PM
EFFECTS OF INTERMITTENT LOW DOSE CARBON MONOXIDE INHALATION ON BLOOD GLUCOSE REGULATION IN OVERWEIGHT ADULTS: A RANDOMIZED CONTROLLED CROSSOVER TRIAL
Jesse A. Goodrich\textsuperscript{1}, Dillon J. Frisco\textsuperscript{1}, Shane P.P. Ryan\textsuperscript{2}, Alyssa A. Newman\textsuperscript{1}, S. Raj J. Trikha\textsuperscript{1}, Barry Braun, FACSM\textsuperscript{1}, Christopher Bell\textsuperscript{1}, William C. Byrnes, FACSM\textsuperscript{1}, \textsuperscript{1}University of Colorado Boulder, Boulder, CO; \textsuperscript{2}Colorado State University, Fort Collins, CO. (Sponsor: William C. Byrnes, FACSM)
Email: jesse.goodrich@colorado.edu

(No relevant relationships reported)

PURPOSE: Low dose carbon monoxide (CO) inhalation upregulates several proteins important for glucose metabolism. However, it is not known whether CO’s ability to upregulate proteins associated with glucose metabolism has consequences for whole body glucose metabolism which could have implications for both research and clinical fields. We hypothesized that low dose CO inhalation would improve the glucose and insulin responses to ingestion of an oral glucose bolus in overweight humans.

METHODS: Eleven young adults (5 male, 6 female; body mass index: 25-35 kg/m\textsuperscript{2}) were included in this randomized, placebo-controlled, single blinded crossover study. Following screening, subjects completed two 7-day protocols, separated by at least 4 weeks. Prior to (24-hours) and following 5 consecutive days of either once daily CO (males: 1.2 mL/kg body mass; females: 1.0 mL/kg body mass) or placebo (room air) inhalation, subjects underwent two-hour oral glucose tolerance tests (OGTT).

RESULTS: Although blood glucose was on average 5 mg/dL lower post-intervention compared to pre-intervention (P<0.001), there were no significant main effects or interactions across experimental conditions for any OGTT parameters (presented as overall average and [95\% CI]), including fasting glucose (84.0 [78.8-89.2] mg/dL; intervention x pre/post interaction P=0.53), two hour post glucose (96.9 [87.2-107.0] mg/dL; P=0.71), fasting insulin (4.82 [2.63-7.00] μU/mL; P=0.33), the homeostatic model of insulin resistance (1.04 [0.53-1.55]; P=0.45) or the Matsuda Index (17.3 [6.24-28.3]; P=0.60).

CONCLUSION: 5 days of low dose CO administration did not influence the glucose and insulin responses to an OGTT in overweight adults. Since low dose CO inhalation is used in the assessment of hemoglobin mass and other physiological parameters, these findings allow researchers to utilize these procedures without concern of altering glucose metabolism.

2237 Board #156 May 28 3:00 PM - 4:30 PM
Effects of 12-weeks Of Post-meal Walking on Glycemic Control And Body Composition In Older Adults
Kelsey R. Day\textsuperscript{1}, Michelle M. Stevens\textsuperscript{1}, William Rumpf\textsuperscript{1}, Loretta DiPietro, FACSM\textsuperscript{1}, \textsuperscript{1}Milken Institute School of Public Health, The George Washington University, Washington, DC. (Sponsor: Loretta DiPietro, FACSM)
Email: ldp1@gwu.edu

(No relevant relationships reported)

There is strong evidence that short bouts of light-intensity post-meal exercise are effective at lowering post-prandial and 24-h glucose concentrations in older people with impaired glucose tolerance (IGT). It is unknown, however, whether these transient benefits result in more enduring improvements in glycemic control after training.

Purpose: To determine the effects of a home-based, 12-week post-meal walking program on improvements in glucose metabolism, as well as on changes in body composition in overweight (BMI=30±1.8 kg/m\textsuperscript{2}) older adults (N=6; 72±5.3 years) with IGT. Methods: Participants performed three 15-minute bouts of low-intensity (3 METs) walking beginning 30 minutes after each meal on five days per week for 12 weeks. Glucose and insulin responses to an oral glucose tolerance test were determined 48 h after the last exercise bout before and after training. Changes in body composition were determined using DXA. Results: Overall adherence to the total training program (180 post-meal walking bouts) was 65%; however, participants reported completing an average of 82% of the post-dinner walks across the 12 weeks. Total areas under the curve for both glucose [29.5±9.3 vs. 29.5±8.9 (mg·dL\textsuperscript{-1}·h\textsuperscript{-1})] and insulin [9.2±5.4 vs. 9.0±4.4 (mg·dL\textsuperscript{-1}·h\textsuperscript{-1})] responses did not change between baseline and follow-up; however, HbA1c levels (6.4±5% vs. 5.8±5%) and the Whole Body Insulin Sensitivity Index (4.5±3.6 vs. 5.8±8.7) showed promising improvements following training. There were no changes to body weight, body fat, or lean mass; however, visceral fat volume decreased (688.7±311.4 vs. 584.3±306.0 cm\textsuperscript{3}), and four of the six participants reduced their visceral fat mass by over 37g.

Conclusions: Data from this pilot study suggest that the benefits of regular, low-intensity post-meal walking on glycemic control may not last beyond 24h in older adults with IGT. On the other hand, if
Increases in physical activity without proper nutritional knowledge may expose recreational athletes to compromised energy needs and macronutrient profiles. **Purpose:** To examine the energy needs across a 2-week high-intense functional exercise program in female and male recreational athletes. **Methods:** Thirty adults (age: 31.2 ± 8.1; females: 164.7 ± 7.1 cm, 69.9 ± 11.1 kg; body fat%: 29.2 ± 5.5%; males: n=12, 176.9 ± 6.2 cm, 89.5 ± 15.1 kg, body fat%: 23.2 ± 8.8%) participated in a larger cross-sectional study. Participants completed a demographic survey, a 7 day online dietary and exercise log across 2 weeks. Measurements included; height, weight, and DXA scan (body fat%) at the beginning of the study. Exercise energy expenditure (EEE) was calculated using Ainsworth/Heyward equations, energy availability (EA) = energy balance (EB) = energy intake (EI) - TDEE - PAL. Macronutrients (CHO, PRO, and fats) were assessed using ACSM recommendations (recs.). Low EA (LEA) was defined as energy intake <73.7 kcal/FFM.kg-1 and EB was defined as negative, balanced, or positive, and Macrocs were defined as low, within or above recs. (week 1: 25 ± 10.1 kcal/FFM.kg-1, week 2: 25.1 ± 9.8 kcal/FFM.kg-1), demonstrated similar energy needs including: EI (week 1: 1752.3 ± 599.8 kcal, week 2: 1752.3 ± 599.8 kcal), DXA %Fat (week 1: 27.1 ± 3.2 % fat; week 2: 27.3 ± 3.1 % fat), CHO intake was extremely low (week 1: 96.7%, n=29; week 2: 93.1%, n=28) and fats were within recs. (week 1: 62.1%, n=18; week 2: 46.7%, n=9). **Conclusion:** Participants demonstrated similar EI and EEE habits over the 2 weeks, however, the recreational athletes under consumed CHO and presented at risk for LEA and negative EB. This leads to compromised fueling for the EEE utilized during training.

**Funded by Avadim Technology**

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Specific energy needs of team-sport female athletes have been understudied, particularly with regard to scheduled daily activities. **Purpose:** To examine the difference between energy expenditure changes in NCAA Div II female basketball (BBALL) and lacrosse (LAX) athletes depending on scheduled team activities. **Methods:** All athletes (BBALL: n=10; 19.8±1.3 yrs, 173.9±13.6 cm, 74.6±19.1 kg, 27.1±3.2 % fat; LAX: n=20; 20.4±1.8 yrs, 168.4±6.6 cm, 68.8±8.9 kg, 27.9±3% fat) were outfitted with heart rate and activity monitors during four consecutive days on five different occasions (20 days total) across their competitive seasons to assess differences in activity energy expenditure (AEE), total daily energy expenditure (TDEE) and physical activity level (PAL). Data collected was categorized by type of scheduled daily activities: Practice, Game, Conditioning or Off. All dependent variables were analyzed using a mixed factorial ANOVA with pairwise sample T-Tests as post-hoc when necessary. **Results:** All results are outlined below in Table 1. Independent of day type, TDEE, AEE, and PAL levels were greater (p<0.05) in BBALL athletes. Changes between day types for each sport were significantly different (p<0.05) for TDEE, AEE, and PAL. **Conclusion:** Calculated levels for TDEE, AEE, and PAL in female collegiate BBALL and LAX athletes were determined to all be different, irrespective of the scheduled daily activity. LAX athletes, regardless of scheduled activities, had greater TDEE, AEE, and PAL compared to BBALL athletes. Caloric expenditure in female collegiate athletes varies significantly depending on scheduled team activities with energy needs progressively increasing between Off, Conditioning, Practice, and Games.

**Funded by Avadim Technology**

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Achieving and maintaining energy balance (EB) is a key nutritional goal for competing athletes. Recently published formulas have allowed for the estimation of EB using measured body composition values, but limited data is available in team sport athletes, particularly female rugby athletes. **Purpose:** To determine the changes in EB in female rugby athletes across an entire competitive season by assessing body composition using DEXA at three time points: pre-season, post-season and off-season. **Methods:** Female rugby athletes (Mean ± SD; 18.5 ± 0.8 yrs, 166.8 ± 4.0 cm, 73.7 ± 9.73 kg, 28.9 ± 4.3 % fat, n=8) had three DEXA scans completed during pre-season (day 0-30), post-season (day 100 - 120), and off-season (day 300-365) for determination of fat mass (FM), fat-free mass (FFM), and percent body fat. Changes in FFM and FM between scans were assessed for changes across the season in addition to estimating EB (kcal•d-1 = 1.0 × 9.5 ). Data was analyzed using factorial ANOVA with repeated measures on time with paired samples t-test being used for post-hoc comparisons. A p-value of 0.05 was used for statistical determinations. **Results:** No statistically significant changes were noted for fat mass (p = 0.83), fat-free mass (p = 0.76), or percent body fat (p = 0.53) were observed across the competitive season (see Table 1). In addition, EB did not exhibit any changes (p = 0.77) across the season (EB = -9.96 ± 69.3 kcals/day). **Conclusion:** Over the measured time period, female rugby athletes were found to largely be in energy balance as no statistically significant changes were observed for body composition or EB. These data help to inform coaches and athletes about the anticipated energy needs within the sport of rugby.

**Table 1: Body composition and energy balance in female rugby athletes.**

<table>
<thead>
<tr>
<th></th>
<th>PRE</th>
<th>POST</th>
<th>OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>DXA Fat Mass (kg)</td>
<td>20.6 ± 5.7</td>
<td>20.7 ± 4.7</td>
<td>20.2 ± 6.2</td>
</tr>
<tr>
<td>DXA Fat-Free Mass (kg)</td>
<td>47.5 ± 4.5</td>
<td>47.2 ± 4.1</td>
<td>47.5 ± 4.7</td>
</tr>
<tr>
<td>DXA % Fat</td>
<td>28.9 ± 4.3</td>
<td>29.3 ± 3.8</td>
<td>28.5 ± 4.4</td>
</tr>
<tr>
<td>EB (kcal/day)</td>
<td>PRE vs. POST</td>
<td>POST vs. OFF</td>
<td>PRE vs. OFF</td>
</tr>
<tr>
<td>Days between DXA scans</td>
<td>136 ± 4</td>
<td>242 ± 84</td>
<td>378 ± 6</td>
</tr>
</tbody>
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**Article information**

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D-66 Free Communication/Poster - Energy Availability in Athletes

**Thursday, May 28, 2020, 2:00 PM - 4:30 PM**

**Room:** CC-Exhibit Hall

**2238 Board #157**

**May 28 3:00 PM - 4:30 PM**

**Examination Of Energy Needs Across 2-week High-Intensity Functional Exercise Program In Recreational Athletes**

Erin M. Moore1, Toni M. Torres-McGeehe2, Justin M. Goins3, Samantha R. Weber4, Tim Bailey5, University of South Florida, Tampa, FL. 2University of South Carolina, Columbia, SC. (No relevant relationships reported)

**2239 Board #158**

**May 28 3:00 PM - 4:30 PM**

**BODY COMPOSITION AND ENERGY BALANCE CHANGES IN FEMALE RUGBY ATHLETES ACROSS ONE COMPETITIVE SEASON**

Johnathan L. Boring, Jessica M. Moon, Anthony M. Hagele, Travis Russo, Kayla M. Ratliff, Blumkaitis C., Julie, Richard A. Stecker, Petey W. Mumford, Richmond Scott, Kyle Sunderland, Chad M. Kerkavick, FACSM, *Lindenwood University, Saint Charles, MO.* 1Towson University, Towson, MD. 3Texas Tech University, Lubbock, TX. *McMaster University, Hamilton, ON, Canada.* 4Mayo Clinic Health System, Onalaska, WI. (Sponsor: Chad Kerkavick, FACSM) (No relevant relationships reported)

**2240 Board #159**

**May 28 3:00 PM - 4:30 PM**

**Comparison Of Energy Expenditure Observed Between Scheduled Activities In Female Collegiate Basketball And Lacrosse Athletes**

Jessica M. Moon1, Hannah Zabriskie2, Bre R. Zanders3, Patrick S. Harty1, Brad S. Currier1, Richard A. Stecker1, Petey W. Mumford1, Andrew Jagim1, Chad M. Kerkavick, FACSM1, *Lindenwood University, St. Charles, MO.* 2Towson University, Towson, MD. 3Texas Tech University, Lubbock, TX. *McMaster University, Hamilton, ON, Canada.* 4Mayo Clinic Health System, Onalaska, WI. (Sponsor: Chad Kerkavick, FACSM) (No relevant relationships reported)
METHODS: Twelve male athletes from the University soccer team in Korea participated in this study. The subjects completed subjective condition check form for one month and dietary record for energy intake (EI) with heart-rate monitoring for exercise energy expenditure (EEE) during one week. Body composition was measured using dual-energy x-ray absorptiometry (DXA) and physiological biomarkers were analyzed using blood and urine samples. Resting energy expenditure (REE) was measured using the Douglas bag method and predicted REE was calculated for REE_{obs} (measured REE/predicted REE) to evaluate metabolic status. The subjects were categorized into two groups by EA level as having relative energy deficiency (RED; EA <30 kcal/kg FFM/d, n=5) or moderate energy status (MES; EA ≥30 kcal/kg FFM/d, n=7).

RESULT: Total mean EA was 31.9 ± 9.8 kcal/kg FFM/d and the RED group showed significantly lower EA (22.4 ± 2.9 vs 38.7 ± 6.6 kcal/kg FFM/d, p<0.05) with lower REE_{obs} (96.0 ± 0.7 vs 1.09 ± 0.06, p<0.05) and REE/FFM (26.0 ± 1.7 vs 28.8 ± 1.4 kcal/kg/d, p<0.05) than the MES group. There was no difference in bone turnover markers. FSH was higher in the RED group (5.50 ± 1.01 vs 3.64 ± 1.41 mIU/mL, p<0.05) and IGF-1 was higher in the MES group (248.6 ± 51.2 vs 218.9 ± 45.3 ng/mL, p<0.05). The regression analysis showed that the athletes with lower EA were more likely to have the lower REE_{obs} and IGF-1 levels.

CONCLUSION: Relative energy deficiency can result in lower metabolic status and IGF-1 levels, but there are no relations with bone health status and other endocrine status in Korean male collegiate soccer players.

2242 Board #161 May 28 3:00 PM - 4:30 PM Effects Of Relative Energy Deficiency On Metabolism And Biomarkers In Korean Male Athletes Sihyung LEE1, Kuniko Moto1, Seungah Han2, Taewoong Oh3, Motoko Taguchi4, 1Waseda University, Tokorozawa-shi, Japan. 2Yongin University, Yongin-si, Korea, Republic of. Email: move3210@gmail.com (No relevant relationships reported)

2014 International Olympic Committee (IOC) consensus statement suggested the concept of ‘Relative Energy Deficiency in Sport’ (RED-S) presenting impaired physiological function caused by inadequate energy availability (EA) and it has been studying in many athletes. However, there are limited studies on Asian and male athletes.

PURPOSE: To investigate EA and its relationship with metabolic status, bone health, and endocrine changes which have been studied for RED-S consequences in Korean male collegiate soccer players during regular training season.

METHODS: Twelve male athletes from the University soccer team in Korea participated in this study. The subjects completed subjective condition check form for one month and dietary record for energy intake (EI) with heart-rate monitoring for exercise energy expenditure (EEE) during one week. Body composition was measured using dual-energy x-ray absorptiometry (DXA) and physiological biomarkers were analyzed using blood and urine samples. Resting energy expenditure (REE) was measured using the Douglas bag method and predicted REE was calculated for REE_{obs} (measured REE/predicted REE) to evaluate metabolic status. The subjects were categorized into two groups by EA level as having relative energy deficiency (RED; EA <30 kcal/kg FFM/d, n=5) or moderate energy status (MES; EA ≥30 kcal/kg FFM/d, n=7).

RESULT: Total mean EA was 31.9 ± 9.8 kcal/kg FFM/d and the RED group showed significantly lower EA (22.4 ± 2.9 vs 38.7 ± 6.6 kcal/kg FFM/d, p<0.05) with lower REE_{obs} (96.0 ± 0.7 vs 1.09 ± 0.06, p<0.05) and REE/FFM (26.0 ± 1.7 vs 28.8 ± 1.4 kcal/kg/d, p<0.05) than the MES group. There was no difference in bone turnover markers. FSH was higher in the RED group (5.50 ± 1.01 vs 3.64 ± 1.41 mIU/mL, p<0.05) and IGF-1 was higher in the MES group (248.6 ± 51.2 vs 218.9 ± 45.3 ng/mL, p<0.05). The regression analysis showed that the athletes with lower EA were more likely to have the lower REE_{obs} and IGF-1 levels.

CONCLUSION: Relative energy deficiency can result in lower metabolic status and IGF-1 levels, but there are no relations with bone health status and other endocrine status in Korean male collegiate soccer players.

2243 Board #162 May 28 3:00 PM - 4:30 PM Energy Requirements And Intake Of Collegiate Athletes Anita M. Gust, Ryan Ratcliff. University of Minnesota Crookston, Crookston, MN. (Sponsor: Charles Fountaine, FACSM) Email: agust@umn.edu (No relevant relationships reported)

Nutrition is an important aspect of sport performance, yet many athletes are unaware of how many calories they should, or do, consume on a daily basis. Limited literature exists comparing perceived energy requirements with actual energy requirements based on body composition. PURPOSE: To determine student athletes’ awareness of energy requirements based on their body composition and physical activity level. METHODS: Athletes (N=41; 20 male and 21 female) were recruited from 7 of the 11 existing sports at a NCAA Division II institution. Knowledge of daily energy needs was assessed using a pre-assessment survey to determine student athletes’ awareness of energy requirements based on their body composition and physical activity level. RESULTS: Significant differences were found between gender and RMR (males: 2296.7±400.3 kcal; females: 1767.7±341.6 kcal; P<0.001), EI (males: 2027.5±694.5 kcal; females: 1568.9±461.1 kcal; P=0.038) and EEE (males: 357.8±60.3 kcal; females: 279.3±44.4 kcal; P<0.01). No significant differences were found between gender and LEA (males: 24.8±7.12 kcal; females: 25.0±8.9 kcal). Overall risk for LEA was 66.7% (n = 20); however independently LEA was 50% (n=6) for males and 77.8% (n=14) for females. Overall, 63.3% (n=19) recreational athletes report poor sleep. No significant differences were found across gender and poor sleep, independently poor sleep for males was 50% (n=6) and females 72.2% (n=13). No significant differences were found between gender, poor sleep, and LEA. Of those at risk for LEA (n=20), 60% (n=12) also had reported poor sleep. CONCLUSIONS: Recreational athletes were at risk for both LEA and poor sleep, with a majority at risk for both. A combination of LEA and poor sleep can lead to poor performance and recovery from high-intensity exercises. Therefore, education to recreational athletes on the importance of dietary intake to match energy needs and encouragement for positive sleeping habits is imperative to optimize physiological recovery.
requirements, estimated caloric intake, and a subjective indicator of physical activity level were assessed. Body composition, resting metabolic rate (RMR), and energy requirements were assessed via dual-energy x-ray absorptiometry (DXA) (Pandora). Comparisons of in-season and out of season perceived caloric needs, estimated caloric intake, and actual energy requirements were made using paired sample T-tests.

**RESULTS:** For males, significant difference were found between estimated caloric intake during in-season and energy requirements, if very active (2745 ± 973 vs. 4339 ± 564), t(20) = -7.21, p < .001, and if active (2627 ± 917 vs. 3672 ± 395), t(21) = -4.51, p < .001. Significant differences were also found between in-season perceived and estimated intake (3085 ± 698 vs. 2745 ± 973), t(20) = 2.89, p = .009. For females, significant differences were also found between estimated intake during in-season and energy requirements if very active (2376 ± 653 vs. 3188 ± 378), t(21) = -4.32, p < .001, and estimated intake out of season and energy requirements if very active (1971 ± 880 vs. 3184 ± 378), t(21) = -5.42, p < .001, and if active (1971 ± 880 vs. 2676 ± 318) t(21) = -3.30, p = .004. **CONCLUSIONS:** Student athletes have limited knowledge of caloric needs as they relate to energy requirements as active or very active athletes. If estimated caloric intake represents actual daily intake, student athletes are not consuming adequate calories to meet energy needs. A follow-up study, using a three-day diet record, is being conducted and will be added to present study for further analysis.

**2244**

**Board #163**

**May 28 3:00 PM - 4:30 PM**

**Risk Factors For Relative Energy Deficiency In Sport In Costa Rican Female Runners**

Andrea Calvo-Castillo, Paula Delgado-Valverde, Catalina Capitán-Jiménez. *Hispanoamerican University, San José, Costa Rica.* (Sponsor: Anita M. Rivera-Brown, FACSM)

Email: andre_93_c@hotmail.com

(No relevant relationships reported)

Competing in weight sensitive sports increases the risk for low energy availability (EA) which is associated with health impairments. Most of the available evidence on syndromes that result from low energy availability is in female athletes.

**PURPOSE:** To identify body composition, caloric intake, physical activity, and other risk factors for developing the syndrome of Relative Energy Deficiency in Sport (RED-S) in female runners. **METHODS:** 31 female recreational runners completed a sociodemographic and an adaptation to the RED-S CAT tool to evaluate 12 risks factors for RED-S, a 7-day weekly exercise record based on calories spent on training activities, during in-season and exercise energy expenditure (EEE) were assessed throughout the intervention. EA was calculated and classified as:

- Risk (≤245 kcal/kg LBM/day)
- Moderate risk (246-384 kcal/kg LBM/day)
- High risk (≥384 kcal/kg LBM/day)

Estimations were made using paired samples T-tests. Comparisons of in-season and out-of-season perceived caloric needs, estimated caloric intake, and actual energy requirements were assessed via paired T-tests. **RESULTS:** During in-season (Year 1: 50.2 ± 4.8 kg, 22.4 ± 5.7%), and FFM were observed across time (Year 1: 47.0 ± 5.3 kg vs. Year 2: 50.2 ± 4.8 kg). **CONCLUSION:** Assessments of changes in body composition and energy balance are important considerations for athletes and coaches regarding the health and performance of athletes. From Year 1 to Year 2, female swimmers were largely successful at maintaining their energy balance while significantly improving fat mass (FM), fat-free mass (FFM), and body fat percentage (BF%) were evaluated with dual-energy x-ray absorptiometry (DEXA) and changes in energy balance (EB) were calculated as 1.0(MFM/Δtime) + 9.5(AFM/Δtime). Data was analyzed using paired samples t-tests. A p-value of 0.05 was used for statistical determinations. **RESULTS:** Approximately 406 days separated each DEXA scan. Although body mass was not significantly affected (Year 1: 68.9 ± 8.9 kg vs. Year 2: 69.4 ± 8.2 kg, p > 0.05), a negative EB was observed (-67.0 ± 51.3 kcal·day·1) across the season. Significant changes (p < 0.001) in FM (Year 1: 18.6 ± 5.0 kg vs. Year 2: 15.4 ± 5.1 kg), BF% (Year 1: 28.0 ± 4.9% vs. Year 2: 23.4 ± 5.7%), and FFM (observed across time: Year 1: 47.0 ± 5.3 kg vs. Year 2: 50.2 ± 4.8 kg). **CONCLUSION:** Assessments of changes in body composition and energy balance are important considerations for athletes and coaches regarding the health and performance of athletes. From Year 1 to Year 2, female swimmers were largely successful at maintaining their energy balance while significantly improving FM, FFM, and %BF. Body composition derived assessment of energy balance can be used to provide general indications of energy balance status in athletes across large periods of time.

**2246**

**Board #165**

**May 28 3:00 PM - 4:30 PM**

**Body Composition And Energy Balance Changes In Collegiate Female Swimmers**

Kayla M. Ratliff, Julia C. Blumkaitis, Johnathan L. Boring, Anthony M. Hagele, Jessica M. Moon, Richard A. Stecker, Petey Mumford, Kyle S. Sunderland, Scott Rickmond, Chad M. Kerkisick, FACSM. *Lindenwood University, St. Charles, MO.* (Sponsor: Dr. Chad Kerkisick, FACSM)

(No relevant relationships reported)

Maintaining energy balance (EB) throughout training and competition should be a primary goal for competing athletes. Female athletes, in particular, may be prone to low energy availability which can reduce performance and negatively impact training adaptations observed. Regular determination of EB is challenging due to the need for accurate dietary intake and energy expenditure. However, recently published formulas have allowed for the estimation of energy balance using body composition derived computation, but comparisons across competitive seasons in various sports are limited.

**PURPOSE:** To examine the changes in body composition and EB in collegiate female swimmers across an entire competitive season. **METHODS:** Thirteen female NCAA Division II swimmers (mean ± SD: 19.5 ± 1.2 years; 68.9 ± 8.6 kg; 169.9 ± 8.8 cm) were evaluated annually at the beginning of two competitive seasons. Fat mass (FM), fat-free mass (FFM), and body fat percentage (BF%) were evaluated with dual-energy x-ray absorptiometry (DEXA) and changes in energy balance (EB) were calculated as 1.0(MFM/Δtime) + 9.5(AFM/Δtime). Data was analyzed using paired samples t-tests. A p-value of 0.05 was used for statistical determinations. **RESULTS:** Approximately 406 days separated each DEXA scan. Although body mass was not significantly affected (Year 1: 68.9 ± 8.9 kg vs. Year 2: 69.4 ± 8.2 kg, p > 0.05), a negative EB was observed (-67.0 ± 51.3 kcal·day·1) across the season. Significant changes (p < 0.001) in FM (Year 1: 18.6 ± 5.0 kg vs. Year 2: 15.4 ± 5.1 kg), BF% (Year 1: 28.0 ± 4.9% vs. Year 2: 23.4 ± 5.7%), and FFM (observed across time: Year 1: 47.0 ± 5.3 kg vs. Year 2: 50.2 ± 4.8 kg). **CONCLUSION:** Assessments of changes in body composition and energy balance are important considerations for athletes and coaches regarding the health and performance of athletes. From Year 1 to Year 2, female swimmers were largely successful at maintaining their energy balance while significantly improving FM, FFM, and %BF. Body composition derived assessment of energy balance can be used to provide general indications of energy balance status in athletes across large periods of time.
Limited data is available using body composition-derived metrics to establish energy balance (EB) in team-sport athletes, especially female athletes. Tracking EB is important for coaches and athletes to understand how well the energy demands of training and competing are being met by the diet. It is important for coaches and athletes to understand how well the energetic demands across the fiscal season. This information is useful for athletic performance purposes, and provided a means to estimate exercise energy expenditure during rehearsals and gameday performances, and provided a morning urine sample to measure urine specific gravity (Usg). The maintenance of energy status is an important dietary goal for competing athletes to properly fuel efforts, promote recovery, and prevent onset of illness or decrements in performance. Recent work in competing male athletes has reported on energy balance using body-composition derived parameters, but limited data is available highlighting changes in female athletes, and in particular female athletes who participate in physique sports. PURPOSE: To assess the changes in body composition and energy balance in female collegiate gymnasts across multiple competitive seasons. METHODS: 19 NCAA Division II collegiate female gymnasts (Mean ± SD; 18.4 ± 0.68 yr, 59.4 ± 4.5 kg, 160.9 ± 5.4 cm, 22.6 ± 2.2 % fat, 18.0 ± 1.2 kg/m² fat free mass index) underwent dual-energy x-ray absorptiometry (DEXA) scans at the start of the season. Data was collected on all 19 subjects over three years with nine subjects being extended to a fourth year. Energy balance (EB) was calculated using a previously validated equation (EB=1.04(MATime) + 9.5(MATime)) using fat free mass (FFM), time (days between scans) and fat mass (FM). A factorial ANOVA with repeated measures on time was used to conduct changes in FFMI and Δ EB. Individual paired samples T-Tests were conducted when significance was found. RESULTS: Significant differences (p<0.05) between EB at year 1 (261.1 ± 46.7 kcals/day) and year 2 (-203.5 ± 57.9 kcals/day). Differences were also found (p<0.05) between years 2 (283.1 ± 57.9 kcals/day) and year 3 (489.1±97.7) among the 9 subjects whose data extended to a fourth scan. No statistical significance was found (p > 0.05) between FFMI levels at 1 year (18.0 ± 1.2 kg/m²), year 2 (18.1 ± 0.8 kg/m²) and year 3 (18.3 ± 1.3 kg/m²). CONCLUSION: Changes in energy balance were largely stable in competitive female gymnasts across three years periods of time. Additionally and in concert, FFMI levels were also found to be stable across the measurement period. While statistically significant differences were present, the practical significance of these differences is not deemed to be relevant. Additional research is needed in all female athlete population to help identify and understand what dietary changes may be needed to best promote health, performance, and recovery.
Across all states, the number of adults with RMDs who could improve their anxiety could improve their anxiety and depression by exercising was estimated. This information should be useful to both interventionists and decision-makers.

**CONCLUSIONS:** These findings provide important state-level information regarding the number of physically inactive adults in the United States with RMDs who could improve their anxiety and depression by exercising. This information should be useful to both interventionists and decision-makers.

State-level estimates of the number of physically inactive adults with arthritis and other rheumatic and musculoskeletal diseases (RMDs) who can improve their anxiety and depression is currently unknown but important given that national data may not be appropriate for the conditions observed in each state. **Purpose:** Provide state-level estimates of the number of physically inactive adults in the United States with RMDs who could improve their anxiety and depression by exercising.

**METHODS:** Utilizing (1) number-needed-to-treat (NNT) data from two prior meta-analyses of randomized controlled trials addressing the effects of exercise on anxiety and depression in adults with RMDs, (2) recent age-adjusted, state-level prevalence estimates on arthritis and physical inactivity in adults with arthritis and other RMDs, and (3) state-level 2000 US Census population data, the number of physically inactive adults with RMDs who could improve their anxiety and depression by exercising was estimated. **Results:** Across all states, the number of adults with RMDs who could improve their anxiety and depression by starting an exercise program was estimated at 2,622,907 for anxiety and 2,245,962 for depression. For anxiety, numbers ranged from 3,583 (95% CI = 2,592 - 4,683) in the District of Columbia to 201,173 (95% CI = 156,923 - 254,135) in Texas. For depression, numbers ranged from 3,068 (95% CI = 2,160 - 4,164) in the District of Columbia to 172,762 (95% CI = 134,37 - 217,613) in Texas. **Conclusions:** These findings provide important state-level information regarding the number of physically inactive adults in the United States with RMDs who could improve their anxiety and depression by exercising. This information should be useful to both interventionists and decision-makers.

**Purpose:** The current study aimed to evaluate Sports Dietitian’s methods of assessing energy availability (EA) in the field.

**Methods:** Eligible participants were provided with a detailed web-based survey evaluating relevant elements of the assessment of EA among other related indicators.

**Results:** A total of 112 Sports Dietitians (n = 105, 93.8% female) participated. Over half (n = 62, 55.4%) were Board Certified Specialists in Sports Dietetics (CSSD), with a majority practicing in a colleague (n = 41, 36.6%), private practice (n = 31, 27.7%), or professional team (n = 31, 27.7%) setting. While 67% (n = 75) reported measuring energy balance while assessing athletes, only 41% noted evaluating energy availability. A higher proportion of Sports RDs practicing >/=7 years compared to <7 years acknowledged assessing EA (59.5% vs. 27.6%, p = 0.001, X^2 = 10.3). Sports RDs used a variety of methods to evaluate energy intake, including evaluating “typical intake,” during one-on-one session (n = 54, 48.2%), food log(s) (n = 30, 26.8%), 24-hour recall (n = 15, 13.4%), a combination (n = 5, 4.5%), or “other” method (n = 8, 7.1%), exercise energy expenditure, including activity factor estimates (n = 58, 51.8%), exercise logs (n = 32, 28.6%), a combination (n = 11, 9.8%), heart rate monitor (n = 6, 5.4%), or “other” methods, and body composition, including bioelectrical impedance analysis (n = 15, 13.4%), air displacement plethysmography (n = 15, 13.4%), dual energy x-ray absorptiometry (n = 14, 12.5%), and skinfold thickness (n = 11, 9.8%). **Conclusions:** A majority of Sports Dietitians did not report regularly evaluating energy availability in their assessments of athletes. The majority of MB members had LEA and over half (n= 62, 55.4%) were Board Certified Specialists in Sports Dietetics (CSSD), with a majority practicing in a colleague (n = 41, 36.6%), private practice (n = 31, 27.7%), or professional team (n = 31, 27.7%) setting. While 67% (n = 75) reported measuring energy balance while assessing athletes, only 41% noted evaluating energy availability. A higher proportion of Sports RDs practicing >/=7 years compared to <7 years acknowledged assessing EA (59.5% vs. 27.6%, p = 0.001, X^2 = 10.3). Sports RDs used a variety of methods to evaluate energy intake, including evaluating “typical intake,” during one-on-one session (n = 54, 48.2%), food log(s) (n = 30, 26.8%), 24-hour recall (n = 15, 13.4%), a combination (n = 5, 4.5%), or “other” method (n = 8, 7.1%), exercise energy expenditure, including activity factor estimates (n = 58, 51.8%), exercise logs (n = 32, 28.6%), a combination (n = 11, 9.8%), heart rate monitor (n = 6, 5.4%), or “other” methods, and body composition, including bioelectrical impedance analysis (n = 15, 13.4%), air displacement plethysmography (n = 15, 13.4%), dual energy x-ray absorptiometry (n = 14, 12.5%), and skinfold thickness (n = 11, 9.8%). **Conclusions:** A majority of Sports Dietitians did not report regularly evaluating energy availability in their assessments of athletes. The variables used to calculate EA (i.e, EI, EEE, fat free mass) were evaluated using a variety of methods ranging in their level of potential error. Due to the potential difficulty and limitations of evaluating EA, development of a protocol for assessing EA may aid in increasing frequency and accuracy EA assessments in the field.

**Purpose:** To investigate if 12 weeks of maximal strength training (MST) would restore MFGC and functional performance.

**Methods:** Forty-eight outpatients (28 men, 35±10 yrs; 20 women, 35±12 yrs) were randomized to a training group (TG) or control group (CG). Forty-eight age and gender matched healthy controls (28 men/20 women, 35±11 yrs) were tested to establish reference values. TG performed leg press MST (4x4 repetitions) 2d/week for 12 weeks at ~90% one repetition maximum (IRM). CG received two sessions of MST and encouragement to follow traditional physical activity guidelines. **Results:** 17/24 patients in the TG (12 men/5 women, 34±11 years) completed 79% of training sessions and 19/22 patients in the CG (9 men/10 women, 37±12 years) completed the study. The improved IRM (28%, 12.6±4.1 to 16.2±5.0 Kg m^-1·mb, p<0.01) and rapid force development (20%, 18.6±8.6 to 22.4±10.8 N·m·s^-1·mb, p=0.01), reaching 106±10% and 85±8% of healthy reference values, respectively. TG improvements differed from CG (p<0.01) where no changes occurred (IRM; 11.4±3.0 to 12.0±2.7 Kg·m^-1·mb). Both TG and CG improved 30-second sit-to-stand test (30STS) performance (15±3 to 17±4 s and 13±3 to 14±3 s, respectively, p<0.05). Changes were not apparent as between group difference nor close the gap to reference levels (27±5 s). **Conclusion:** MST restored the patients’ lower extremity MFGC and improved 30STS performance. Supported by grants from the Norwegian Extrafoundation for Health and Rehabilitation, The Liaison Committee between the Central Norway Regional Health Authority and the Norwegian University of Science and Technology, and The Norwegian Directorate of Health.
training or certification. PA intervention administration included input on PA duration, frequency location, time of day, resources needed, motivators (e.g., buddy systems, competitions, rewards) and overcoming common SMI barriers (e.g., transportation). CONCLUSIONS: CPS were willing to facilitate EIM interventions and offered valuable insights on current practices, program feasibility and administration. Findings will aid development of a PA intervention delivered through mental health services to address low rates of PA and reduce health disparities in adults with SM.

The incidence of nasopharyngeal carcinoma (NPC) is high in endemic areas. The long-term chemotherapy and radiotherapy cause bodily dysfunction and extended psychological stress in NPC cancer survivors. The meditative exercise, especially Taichi-Qigong exercise (TQE), are getting more common and continue to grow among cancer survivors. Empirical evidence found positive effects in improving side effects induced by cancer therapy from practicing TQE, however, scientific evidence is still lacking. PURPOSE: to evaluate the effects of a 10-weeks TQE, as an non-pharmacological treatment, on mental health of NPC survivors. METHODS: 43 NPC survivors (age 32-79 yrs-old; men 45.3%) recruited from the Cancer Patient Resource Centers of a local hospital, were randomly assigned into either a TQE (n=23) or a control group (n=20). The TQE group practiced TQE for at least 3 times a week (one 60-min instructor-led session and two 30-min self-practice sessions) for 10 weeks, whereas control group maintained usual care. Both TQE and control groups received health & diet education once a month. The pre- and post- outcome measures included: questionnaires on cancer-related quality of life (FACT-G), cancer-related fatigue (Brief Fatigue Inventory; BFI), depression (Center for Epidemiologic Studies Depression Scale; CES-D) and sleep quality (Pittsburgh Sleep Quality Index; PSQ). Same measures were obtained 3-months after the intervention (maintenance tests). RESULTS: Two-way (group x pre-post) repeated measure ANCOVA with age, gender, and body mass index (BMI) as covariates, found TQE exhibited significant better-overall quality of Life (FACT-G); (p<.05), and emotional sub-scale of FACT (p<.01). The benefits did not change at maintenance (p>.10). There were no group difference in BFI and CES-D. (p>.05) CONCLUSIONS: The present study provides preliminary findings to suggest that, Taichi-Qigong exercise, as a typical mind-body exercise, may contribute to better quality of life, emotion, and sleep quality during the course of NPC rehabilitation. Further study with longer intervention is needed to examine the effects of TQE on other mental health outcomes of cancer survivors such as fatigue and depression, as well as physical health outcomes.

RESULTS: Participants’ scores indicated greater life satisfaction than frustration (p = 0.042) for each of the three basic psychological needs. Qualitative analysis confirmed predominance of psychological resources (e.g., self-efficacy, character strengths), as well as motivation for social relations, competence, interest, and relatedness. Fitness was the highest scoring motivational construct on the MPAM-R, but was not frequently cited as motivational during the interviews. CONCLUSIONS: Active older adults showed greater satisfaction than frustration with the basic psychological needs, suggesting a potential association with moderate-high levels of PA. Motivational factors influencing PA varied among participants, but they shared many common beliefs (e.g., high value of PA and fitness) and experiences (e.g., free play as children).

Cognitive impairment is a common symptom of Multiple Sclerosis that directly impacts patients’ quality of life. Yet, evidence of treatments is mixed. Exercise reveals high potential as a supportive non-pharmacological therapy. PURPOSE: To investigate the effects of a three-week high-intensity interval training (HIIT) on processing speed, verbal and visual-spatial memory in cognitively impaired persons with MS (pwMS). METHODS: 66 persons with relapsing-remitting (RR) or secondary-progressive (SP) MS were randomly assigned to an intervention (HIIT: 5x 1.5min intervals at 95-100% HFx 3x/week) or an active control group (CG: 24min continuous exercise at 65% HFx 3x/week). For subgroup analysis participants with cognitive impairment were identified (deviation of ≤ 1.5 SD from normative test data from at least one test). Cognitive performance was assessed pre and post to the intervention period with the Brief International Cognitive Assessment for Multiple Sclerosis (BICAMS). Potential within (pre vs. post) and between –subject (group, MS-)type effects and their interactions were investigated by analysis of variance (ANOVA) with repeated measures. Post-hoc tests (Bonferroni) were conducted for significant main effects of within or between-subjects. RESULTS: 28 pwMS were identified as cognitively impaired. ANOVA revealed no significant interactions for any outcome and showed no significant main effects for visual-spatial memory. Significant main effects (factor time) were observed for processing speed (F (1, 24) = 15.65, p = .001) and verbal memory (F (1, 24) = 4.85, p = .037). In the HIIT-group participants with RRMS significantly improved processing speed over time (MD: 4.67, 95%-CI [34.41, 43.81], p = .023), whereas no changes (p>.05) were shown for participants with SPMS. No improvements were observed for the CG. Pairwise comparisons revealed no significant changes for verbal memory. CONCLUSION: Compared to the CG, HIIT shows stronger impact on processing speed for RRMS. SPMS-type showed no changes. However, results should be interpreted cautiously, as the data set reveals no significant main effects for group and MS-phenotypes.

Supported by: The Swiss Multiple Sclerosis Society, the trust Grenzen überschreiten, the Stiftung für Ergotherapie and the Blumenau-Léonie Hartmann-Stiftung.

PURPOSE: The prevalence of physical inactivity (PA) has remained largely unchanged in the USA, despite extensive informational campaigns calling for individuals to participate in more PA. Self Determination Theory (SDT) provides a well-researched framework for understanding motivation, and proposes that the satisfaction of three primary psychological needs (autonomy, competence, and relatedness) fuels motivation for physical activity and promotes wellness. This mixed-methods study used SDT to identify experiences and beliefs that affect individual motivation for physical activity in older adults. METHODS: The International Physical Activity Questionnaire was used to establish a moderate-high level of PA for all participants (3 moderate-intensity; age range: 70-85 yrs.). The Basic Psychological Needs Satisfaction and Frustation Scale (BPNSFS), and Motives for Physical Activities Measure Revised (MPAM-R) were used along with semi-structured interviews to elucidate the experiences and beliefs of the participants A Wilcoxon signed rank test was used to evaluate BPNSFS data for psychological satisfaction/frustration with the alpha-value set at 0.05. Researchers independently coded interview responses for motivational type (Competence, Social, Interest/Enjoyment, Fitness, Appearance) as well as statements of satisfaction and frustration. MPAM-R data identified motivational priorities and were compared with coding results to establish consistency.
Young adults with Attention Deficit Hyperactivity Disorder (ADHD) have higher fracture rates than healthy adults. While exercise is recommended for people with ADHD to alleviate hyperactivity-impulsivity, little is known about the relationship between exercise and fracture in this population. PURPOSE: To explore the association between exercise and fractures in young adults with ADHD, not using medication. METHODS: We performed a retrospective analysis of data of young adults with ADHD treated at the University of Alabama at Birmingham Health Systems. We selected a case if an individual was previously diagnosed with ADHD using ICD-10 code F90 and ages between 21 and 35 years. The comparison group were individuals with ADHD and have not had a fracture within the same age limits. The exclusion criteria was whether a patient with ADHD diagnosed with a fracture or not during this period. Exercise files included data about exercise status (i.e., yes or no), frequency (i.e., low, moderate, or high), and type (i.e., aerobic or non-aerobic). Exercise assessment was within the year before the fracture date for fracture group and within the year before data acquisition for the non-fracture group. We ran a multivariable logistic regression analysis to test the association between fractures and 1) exercise status, 2) exercise frequency, and 3) exercise type, controlling for sex. We analyzed the data using STATA SE 15.1. RESULTS: Our analyses included 296 persons with a mean age of 27.29 ± 4.17 years for the comparison group and 28.0 ± 3.58 years for the fracture group. The mean age of fracture in the fracture group was 25.09 ± 3.42. Also, the logistic regression that was controlled for sex, showed that individuals who had significant fracture odds of having a fracture compare to those that reported no exercise [OR: 0.14, 95% CI: 0.08, 0.27]. Of those, females compared to males, were also significantly associated with sustaining fewer fractures, controlling for exercise status [OR: 2.86, 95% CI: 1.53, 5.35]. Finally, exercise frequency and exercise type were not significantly associated with fracture risk. CONCLUSIONS: Engaging in exercise might decrease the odds of sustaining a fracture in young adults with ADHD. Exercise needs to be studied more in young adults with ADHD to determine how exercise may protect against fractures.

Geriatric depression is a common late-life mental health disorder that increases mortality and morbidity. It has been shown that exercise is effective in reducing symptoms of geriatric depression. However, inconsistencies across studies and lack of optimal dose-response of exercise for improving geriatric depression have made it challenging to draw solid conclusions on the effectiveness of exercise in late-life depression. Purpose: To further investigate the moderators of the effectiveness of exercise on geriatric depression across the current body of evidence. Methods: Based on the Arkesy and O’Malley framework, an extensive search strategy was performed by exploring PubMed, Scopus, Sport Discus, PsycInfo, ERIC, and IBSS without limitations in the time frame. Eighty systematic reviews with empirical results and evaluated the effect of exercise on depression among people aged 60 years and older were identified, and their individual studies were screened for inclusion. One additional study was found through the hand searching of reference lists. After full-text screening and applying inclusion and exclusion criteria, 21 studies were retained. Results: The review revealed high variability in characteristics of the exercise interventions and outcome measures. Sample characteristics, nature of comparators, main outcome assessment, and baseline severity of depression also varied notably. Mind-body and aerobic exercises were found to significantly reduce geriatric depression. However, results on the relationship between resistance training and improvements in geriatric depression were inconsistent, and results of the intensity-related antidepressant effects of exercise interventions were mixed. Extensive use of self-reported questionnaires for the main outcome assessment and lack of evidence on the relationship between depression severity and observed effect were of the other important highlights of the review. Conclusion: Several literature gaps were found regarding the potential effect modifiers of exercise and geriatric depression. While acknowledging the complexity of establishing recommendations on the exercise variables and geriatric depression, future studies are required to understand the threshold effect of exercise for treating geriatric depression.
To investigate the effect of a 6-week moderate-intensity aquatic exercise program on sleep efficiency, sleep quality, pain, stress and physical activity among adults.

METHODS: A quasi-experimental trial was conducted with a sample of 30 adults with chronic musculoskeletal pain, assigned to two groups (Intervention Group and Control Group). Subjects were recruited by convenience sampling through a community physiotherapy Centre in Hong Kong. Subjects allocated to the intervention group followed a structured, 6-week, bi-weekly, 60-minute aquatic exercise program. The 12 sessions were supervised by a qualified aquatic fitness instructor. Six exercises were performed in each session with one old exercise replaced by a new one in each session. During the session, heart rate and RPE were monitored. Control Group was reminded to not change their exercise habits or medication regimen. Data regarding sleep efficiency by Actigraph, sleep quality by Chinese version of the Pittsburgh Sleep Quality Index (CPSQI), pain by numeric pain rating scale, and water temperature were collected before and after the 6-week aquatic exercise program. Data were analyzed with SPSS 25 and a value less than 0.05 indicated statistical significance of results.

RESULTS: No statistically significant differences on all demographic data and outcome measures between intervention and control group in the baseline measurement, except there was significantly higher average BMI (p<0.05) and fewer total true sleep hours (p<0.001) in intervention group. Significantly longer total true sleep time (27 minutes, p<0.01), greater sleep efficiency (3% improvement, p<0.01), less pain (p<0.05) and better sleep quality (p<0.05) were found in intervention group. Significant group-time interaction found only in total true sleep time (p<0.001).

CONCLUSION: Aquatic exercise has been proven effective in improving sleep efficiency, and it shows that there is a statistically significant improvement in terms of sleep efficiency and reduction of pain. This study helps to extend the work by studying the effect of aquatic-based exercise on adults with chronic musculoskeletal pain.
Heading the ball in soccer is associated with impaired cognition and may increase the risk of neurodegenerative disease. This may be explained by an accelerated decline in cerebral perfusion, a major risk factor for cognitive impairment, stroke and dementia, for reasons that remain unclear.

**Purpose** To determine if a history of recurrent heading of a football predisposes to cerebral hypoperfusion and cognitive impairment.

**Methods** Twenty-nine amateur male soccer players (age: 28 ± 6 yrs) with a playing history of 15 ± 6 yrs and a self-reported heading frequency of 9 ± 4 balls per game were recruited for the study. They were compared to 32 age and fitness-matched controls who had not participated in contact sports with no history of concussion. All participants completed a battery of psychometric tests that assessed learning and memory (Rey-Auditory Verbal Learning Test), working memory (Repetition of Digits Backwards; Trail Making Test B) and attention and information processing (Repetition of Digits Forwards; Trail Making Test A; Digit Symbol Substitution Test). A sample of the soccer players (n = 13) and controls (n = 22) also completed a cerebrovascular screening whereby middle cerebral artery velocity (MCAv) and mean arterial blood pressure (MAP) were assessed using transcranial Doppler ultrasound and finger photoplethysmography, respectively. Cerebrovascular conductance/resistance were calculated as MCAv/MAP and MAP/MCAv.

**Results** Soccer players were characterized by impaired learning and memory, and attention and information processing compared to controls (P < 0.05; Table 1). However, no between group differences were observed in MCAv, CVC or CVR between groups (P > 0.05; Table 1).

**Conclusion** Heading the ball in soccer is associated with impaired cognition that appears to be independent of cerebral hypoperfusion.

### Table 1. Cognitive function and cerebral perfusion

<table>
<thead>
<tr>
<th></th>
<th>Controls</th>
<th>Soccer Players</th>
<th>P Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCAv (cm.s⁻¹)</td>
<td>59 ± 12</td>
<td>61 ± 10</td>
<td>0.587</td>
</tr>
<tr>
<td>MAP (mmHg)</td>
<td>88 ± 20</td>
<td>90 ± 11</td>
<td>0.620</td>
</tr>
<tr>
<td>CVC (cm.s⁻¹.mmHg)</td>
<td>0.71 ± 0.20</td>
<td>0.69 ± 0.15</td>
<td>0.959</td>
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<tr>
<td>CVR (mmHg, cm.s⁻¹)</td>
<td>1.49 ± 0.32</td>
<td>1.51 ± 0.33</td>
<td>0.922</td>
</tr>
<tr>
<td>Rey Auditory Verbal Learning Test A1-A5 (n)</td>
<td>53 ± 8</td>
<td>46 ± 9*</td>
<td>0.002</td>
</tr>
<tr>
<td>Rey Auditory Verbal Learning Test B1 (n)</td>
<td>7 ± 2</td>
<td>5 ± 2*</td>
<td>0.001</td>
</tr>
<tr>
<td>Rey Auditory Verbal Learning Test A6 (n)</td>
<td>12 ± 3</td>
<td>10 ± 2*</td>
<td>0.002</td>
</tr>
<tr>
<td>Rey Auditory Verbal Learning Test A6-A5 (n)</td>
<td>-1 ± 2</td>
<td>-1 ± 1</td>
<td>0.450</td>
</tr>
<tr>
<td>Repetition of Digits Backwards (n)</td>
<td>6 ± 2</td>
<td>5 ± 2*</td>
<td>0.429</td>
</tr>
<tr>
<td>Trail Making Test B (s)</td>
<td>57 ± 14</td>
<td>62 ± 13</td>
<td>0.186</td>
</tr>
<tr>
<td>Repetition of Digits Forwards (n)</td>
<td>8 ± 2</td>
<td>6 ± 2*</td>
<td>0.001</td>
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<tr>
<td>Trail Making Test A (s)</td>
<td>26 ± 6</td>
<td>30 ± 9</td>
<td>0.066</td>
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<tr>
<td>Digit Symbol Substitution Test (n)</td>
<td>61 ± 10</td>
<td>57 ± 10</td>
<td>0.134</td>
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</tbody>
</table>

- **RESULTS**: Although no significant differences were observed in behavioral task performance at posttest between conditions, F(1, 49) = 1.3, p = 0.28, f² = 0.02 [95% CI: 0 to 0.08], fewer experimenter redirections were required following the physically-active lessons (2.5 ± 2.8) relative to the following the conventional sedentary lessons (5.0 ± 3.6), F(1, 49) = 20.7, p < 0.001, f² = 0.61 [95% CI: 0.24 to 1.29]. On average, children accrued 931.3 ± 8.2 more steps during the physically-active lessons relative to the sedentary lessons, t(95) = -19.1, p < .001, d = 3.91 [95% CI: 3.19 to 4.55].

**CONCLUSION**: Physically-active lessons on emerging numeracy skills do not impede teachers of the approximate number system and result in greater on-task behavior relative to conventional sedentary lessons in preschoolers. Future studies should explore the integration of such approaches into early childhood education.

**Funding**: Supported by funds from the Department of Kinesiology at Michigan State University.

- **INTRODUCTION**: Evidence suggests vagal tone may be a viable physiological marker of exercise readiness and recovery. However, whether vagal tone is associated with feeling states (i.e., affect) prior-to, during, and following exercise is poorly understood. Consistent with psychological hedonism, individuals will pursue exercise that elicits pleasure while avoiding displeasure. Thus, it is of interest whether an index of physiological readiness is associated with displeasure while engaging in high-intensity interval exercise. PURPOSE: Explore the psychophysiological relationship between reactivity and recovery of phasic vagal tone and affect occurring during high-intensity interval exercise (HIIE).

**METHODS**: Participants (N= 25, 13 females, 23.3 ± 4.0 yrs) completed a 20-minute session of HIIE (5-blocks of 3-min exercise to 1-min rest) where vagal tone (i.e., High Frequency Power) and affect (via Feeling Scale) was recorded prior to, during (vagal tone recorded during rest-intervals), and up to 15-min post-exercise. RESULTS: Prior to exercise, vagal tone (6.5 ± 1.6) and affect (2.4 ± 1.4) were positively related (r= 0.58). Upon HIIE initiation, both vagal tone and affect significantly declined during Block 1 (1.6 ± 1.7, P < 0.001; 1.7 ± 2.0, P < 0.001, respectively). Vagal tone remained withdrawn (Rest-2: 1.2 ± 1.5; R3: 0.8 ± 1.5; R4: 1.3 ± 1.5; P > 0.05) until post-15 (4.1 ± 2.9). Affect significantly declined during each exercise block (Block 1A: -0.6; B2A: -0.7; B3A: -1.1; B4A: -1.6; B5A: -1.0; P > 0.05), but also significantly increased following each rest-interval (Rest-1A: +0.4; R2A: +0.5; R3A: +0.7; R4A: +1.3; P < 0.05), with post-15 affect (3.0 ± 1.9) significantly exceeding pre-affect (P < 0.01). Time-lagged correlations suggested small-to-moderate relationships between vagal tone and affect during the HIIE (r= 0.22-0.47), with a disconnection at post-15 (r= -0.03). CONCLUSIONS: As expected, participants experienced vagal tone withdrawal at HIIE initiation and a decline in pleasure during high-intensity exercise blocks, with affective rebounds during recovery. This suggests vagal tone cab be a psychophysiological marker of affective readiness and displeasure experienced during exercise, but not as an index of affective recovery.
way to delay cognitive decline in older adults, but the effects of MBE on working memory function and mechanisms by which MBE may improve cognition in older adults remain unknown. PURPOSE: This study explores whether long-term MBE will influence working memory function by comparing MBE experts with novices. These findings will provide theoretical and empirical basis for maintaining the cognitive function of older people. METHODS: A total of 39 healthy older people (all female, mean age = 65.23 ± 2.43 years) from a community in Beijing participated in this experiment. 13 subjects of the Tai Chi group experienced more than 5 years of TC exercise. 13 subjects without systematic MBE were assigned to the control group. Each participant was administered the N-back task to evaluate working memory function. The primary outcome was reaction time (RT) and accuracy rate (AR) for the N-back task. RESULTS: the TC group and BD group had RT for N-task back compared with the RT for the BD group was faster than the TC group, but the difference was not significant (p = 0.05). The AR of TC group was higher than BD group, but the difference was not significant (p = 0.05). CONCLUSION: Different BMEs are beneficial to the working memory function of the elderly. Compared with the novices, long-term BME can significantly improve the working memory function of older adults, which is an effective exercise to maintain the cognitive function of the elderly.

2272  Board #191 May 28 2:00 PM - 3:30 PM Effects Of Acute Caffeine Ingestion Following A Period Of Sleep Loss On Cognitive And Physical Performance: A Systematic Review And Meta-analysis

Christopher Irwin1, Saman Khalesi2, Ben Desbrow1, Danielle McCartney1, Griffith University, Gold Coast, Australia. 1Central Queensland University, Brisbane, Australia. 2The University of Sydney, Sydney, Australia. (Sponsor: Prof. Louise Burke, FACSM)

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PURPOSE: This systematic review and meta-analysis examined the impact of acute caffeine consumption on cognitive and physical performance in sleep deprived/ restricted individuals. METHODS: Electronic databases were searched for studies measuring cognitive and/or physical performance following sleep restriction (≤6h sleep within 24h) or deprivation (≥24h wakefulness) under intervention (caffeine) conditions. Studies were included if performance was assessed within 6h of caffeine consumption. Individual effect estimates (EEs) were calculated as Hedges’g for independent groups. Random effects meta-analyses were performed to determine intervention efficacy. Statistical significance was attained if the 95% CI did not include zero. Multiple meta-regression analysis was conducted to determine effects of caffeine dose and period of wakefulness on the magnitude of the effect. RESULTS: 36 publications providing 250 EEs were included. Caffeine improved performance on reaction time tasks (12 EEs; g = 1.11; 95% CI: 0.75-1.47) and both response time (44 EEs; g = 0.86; 95% CI: 0.53-0.83) and accuracy (27 EEs; g = 0.68; 95% CI: 0.48-0.88) on attention tasks. The magnitude of the effect increased as caffeine dose increased, but was not influenced by the period of wakefulness for either task. Caffeine improved executive function (38 EEs; g = 0.35; 95% CI: 0.15-0.55) and the magnitude of the effect increased as caffeine dose increased (p = 0.007) and period of wakefulness decreased (p = 0.021). Caffeine also improved response time (20 EEs; g = 1.95; 95% CI: 1.39-2.52) and accuracy (34 EEs; g = 0.43; 95% CI: 0.30-0.55) on information processing tasks, but neither caffeine dose (p = 0.785) nor period of wakefulness (p = 0.373) influenced the magnitude of the effect. No other performance outcomes were appropriate for meta-analysis. However, studies typically indicated a benefit of caffeine on memory (25 EEs), crystallized intelligence (11 EEs) and physical (39 EEs) performance. CONCLUSION: Caffeine is an effective counter-measure to the cognitive and physical impairments associated with sleep loss.

Research has demonstrated higher cognitive abilities are often linked to physical activity participation. PURPOSE: To examine the impact that 45 minutes of daily physical education on the aerobic capacity and perceptual speed of elementary school children. METHODS: An analysis of variance (ANOVA) mixed effect linear model was used to evaluate the effectiveness of 45 minutes of daily physical education on fitness and perceptual speed among youth in grades 6th-8th attending Legacy Early College, a Title I school in the southeastern US. Gain scores (final post-test assessment in May 2019 - original pre-test assessment in September 2017) were calculated and analyzed for significance. The interaction between school and time was estimated for each outcome. Each analysis was stratified by gender and adjusted by age to control for baseline differences by school. A Title I control school that provided physical education one per week was utilized as a comparison. CONCLUSION: Legacy Early College children significantly improved on perceptual speed compared to controls. A significant gain increase at post-test for sections 1, 2, and the Total score (p = 0.002 F = 29.7, p < 0.05 F = 4.54, p < 0.05 F = 5.54, p < 0.003 F = 9.17) respectively, was found. Legacy females had significant gains for sections 1 and 2 compared to controls (p = 0.041 F = 4.25, p = 0.010 F = 6.8). Male Legacy students had a similar trend with significantly higher gains for sections 1, 3, and Total (p = 0.041 F = 4.26, p < 0.050 F = 4.80, p = 0.038 F = 4.38) compared to controls. Additionally, Legacy children improved significantly on PACER laps compared to controls (8.64 vs. 2.08; F = 34.30) over time. Legacy females had significantly higher gains in PACER laps compared to controls (p < 0.000, F = 34.30). Legacy males also had significant gains in PACER laps over time compared to controls (p = 0.010 F = 6.86). CONCLUSIONS: 45 minutes of daily physical education led to increases in fitness and processing speed over time. Supported by Campbell Young Leaders

Although a growing number of studies have examined the effects of regular exercise on cognition and academic performance in children, the findings have remained controversial due to divergent experimental approaches. PURPOSE: The present study investigated baseline cognitive performance as a moderating factor underlying the effects of regular exercise intervention on cognition, with the goal of determining whether baseline variance may account for the lack of consensus in the literature.
METHODS: We reanalyzed data from three randomized controlled trials in which the effects of regular exercise intervention on cognition were examined using executive function tasks (e.g., flanker task), with a cumulative total of 292 participants (9-13 years). To test the moderation effects of baseline performance on the relationship between exercise intervention and changes in cognitive performance, we used hierarchical generalized multiple regression analysis predicting pre-post changes in cognitive performance.

RESULTS: Results indicated that the beneficial effects of regular exercise intervention on cognitive performance were greater in lower baseline performers. Additionally, the pre-post changes in cognitive performance did not differ between the control and intervention groups, even for high baseline performers.

CONCLUSIONS: These findings suggest that baseline cognitive performance is an individual difference variable that moderates the effects of regular exercise intervention on changes in cognition. Thus, future studies should account for baseline cognitive performance when examining the exercise - cognition relationship. The present study also supports recent views that increased time spent in physical exercise does not detract from cognitive performance and academic achievement in children.

Supported by NICHD Grant R01 HD055352 and the Gottfried and Julia Bangerter-Rhyner-Foundation (8472/HEG-DSV).

2275 May 28 2:00 PM - 3:30 PM
The Effects Of High-altitude Mountaineering On Cognitive Function In Mountaineers: A Meta-analysis
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PURPOSE: Nowadays, high altitude mountaineering is increasingly popular among different populations with a dream to challenge high-altitude exercises facilitated by the convenience of global traveling. In view of this, the authors performed a meta-analysis in the hope of finding the effects of high-altitude mountaineering on cognitive function in mountaineers prior to and after the climbing.

METHODS: After a thorough electronic literature search and selection, eight studies were included in this meta-analysis, and test cycle ranged from 8 to 140 days. The eight variables included in this meta-analysis were: trail-making test part B (TMB), finger tapping test–left (FTL), digit span test forward (DSF), digit span test backward (DSB), wechsler memory scale visual (WMSV), aphasia screening test–visual motor errors (AST-vis), aphasia screening test–verbal items (AST-ver). The effect sizes and Forest Plots of these eight variables were generated.

RESULTS: After a thorough electronic literature search and selection, eight studies were included in this meta-analysis, and test cycle ranged from 8 to 140 days. The eight variables included in this meta-analysis were: trail-making test part B (TMB), finger tapping test–left (FTL), digit span test forward (DSF), digit span test backward (DSB), wechsler memory scale visual (WMSV), aphasia screening test–visual motor errors (AST-vis), aphasia screening test–verbatim items (AST-ver). The effect sizes and Forest Plots of these eight variables were generated.

CONCLUSIONS: Our findings have some limitations arising from methodological issues inherent in the meta-analysis and we could not explain the high heterogeneity between studies. Despite such limitations, the current study has the strength of being the first meta-analysis trying to specify cognitive function of mountaineers compared with before and after high-altitude mountaineering. High-altitude mountaineering, as a short-term plateau exercise, has no significant negative impact on the cognitive performance. Future research is needed for a long period of high-altitude mountaineering.

2276 May 28 2:00 PM - 3:30 PM
Excess Body Mass Attenuates The Effects Of Acute Exercise On Preadolescent Brain Function And Cognition
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(No relevant relationships reported)

Purpose
This study investigated the transient effects of an acute bout of aerobic exercise and excess body mass on cognitive and brain function in preadolescent children.

Methods
Thirty-nine children (8-10yrs; 16 females) completed baseline and demographic questionnaires, and dual-energy X-ray absorptiometry and VO2max tests. Children were randomly allocated into a within-subjects crossover intervention design including 20-minutes of restful reading and 20-minutes of treadmill walking. Children completed post-intervention cognitive tasks that tap inhibition (Go-NoGo, flanker) with EEG (P3-ERP), and standardized tests of academic achievement in reading and math.

Summary of Results
Following the treadmill walking intervention, children of normal weight (NW) demonstrated improved accuracy (p<0.05), shorter reaction times (p<0.05), and larger P3-ERP amplitudes (p<0.05) during the Go task, relative to children with obesity (OB). Additionally, after the walking intervention, NW children demonstrated a trend for larger P3 amplitude (p=0.068) during the NoGo task. NW children also demonstrated shorter reaction times (p=0.041), and reduced perceptual interference (p=0.039) compared to OB children during the flanker task. Lastly, NW children demonstrated improved performance on academic achievement tests of reading and math after the walking intervention, compared to OB children (p<0.05).

Conclusion
These findings indicate that the beneficial effects following an acute bout of aerobic exercise on cognitive and brain function may be attenuated in children with obesity. These results provide evidence indicating that neuroelectric and behavioural indices of attention, inhibition, and academic achievement are influenced by aerobic exercise and body mass in children. Given that childhood obesity is a public health concern with an array of health complications, these results have important implications for the physical and cognitive health of children.

Grant Funding
Supported by NIH Grant R01 HD094054

2277 May 28 2:00 PM - 3:30 PM
Effect Of Mental Fatigue Induced By A Cognitive Task On A Subsequent Handgrip Endurance Exercise
Michel Francis Audiffren, Thomas Mangin, Nathalie André, Abdel Benraiss, Benjamin Pageaux. University of Poitiers, Poitiers, France. (Sponsor: Phillip TOMPOROWSKI, FACSM)
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(No relevant relationships reported)

Mental fatigue is commonly observed when using the sequential task protocol. In this protocol, participants perform a first task that requires effortful control or that does not. Then, they have to perform a second task that systematically requires effortful control. Participants generally give up earlier the second task when they have exerted effortful control in the first task. Despite an extensive literature on this phenomenon, researchers still debate about its real existence and failed to define its conditions of occurrence.

PURPOSE: To replicate the mental fatigue effect with a long cognitive task tapping executive functions on a subsequent effortful physical task.

METHODS: Fifty-five young adults completed 4 sessions separated by a minimum of 48h. The first session was a learning session in which participants familiarize with the Stroop task and the handgrip task. During the second session, participants only performed the endurance handgrip task at 13% voluntary maximal contraction until exhaustion. During the third and fourth sessions, participants performed a 30-min cognitive task (modified Stroop task vs. Video task) followed by the same handgrip task than in the 2nd session. The order of sessions 2 and 3 were counterbalanced across participants.

RESULTS: As expected, participants squeezed the handgrip during a shorter time (5.36 min) after the Stroop task than after watching an emotionally neutral movie (5.82 min). In addition, there was a significant difference between the performance of the second session (5.80 min) and the performance after the Stroop task. CONCLUSION: This study clearly shows that a long task overloading execution functions leads to an early disengagement of mental effort in a subsequent physical task. The cause of this earlier dropout is explained in different ways: (1) a quicker depletion of brain resources, (2) energetic and computational costs higher than the benefits associated with the achievement of the task goal, or (3) a reorientation of attention and intention to more pleasant tasks. Further studies are needed to confront these different explanations and manipulate the difficulty of the first task (duration and effortful control load) to determine the conditions of occurrence necessary to induce mental fatigue.

2278 May 28 2:00 PM - 3:30 PM
Abstract Withdrawn

2279 May 28 2:00 PM - 3:30 PM
Effect Of Intermittent Isometric Handgrip Exercise On Cognitive Function
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(No relevant relationships reported)

Previous study reported that an isometric handgrip (IHG) exercise improves cognitive function. However, an isometric exercise may increase the risk for cardiovascular disease because of a larger increase in arterial blood pressure (ABP) compared with dynamic exercise, especially in elderly patients. PURPOSE: The purpose of the present study was to examine the effect of acute intermittent IHG exercise without a large...
increase ABP on cognitive function. **METHODS:** Five healthy subjects performed a cognitive task (Go/No-go task) before and immediately after IHG exercise protocols; 16 sets of 30 s IHG at 30% of maximum voluntary contraction and 45-s recovery. ABP was measured continuously throughout the experiment. Cognitive function was evaluated by the Go/No-go task. **RESULTS:** Mean arterial pressure at the end of IHG exercise protocol (92 ± 12 mmHg) was not significantly different from the baseline (86 ± 4 mmHg, P < 0.05). Also, the number of error trials in the Go/No-go task was unchanged; however, the reaction time was increased during 5 subjects after IHG exercise. **CONCLUSION:** These results provided the possibility that intermittent isometric exercise may improve cognitive function without an elevation in ABP. However, further investigation with large sample size is needed to identify our questions.

**2280**  
**Board #199**  
**May 28 2:00 PM - 3:30 PM**  
**Relationship Between Aging-related Declines In Leg Muscle Volume And Quality And Cognitive Functions**  
Kento Dori1, Takeshi Sugimoto1, Okubo Sahomi1, Keigo Katayama1, Akifumi Maeda1, Hayato Tsukamoto1, Takuma Arimitsu1, Naokazu Miyamoto1, Takeshi Hashimoto, FACSM1.  
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3Juntendo University, Inzai, Japan.  
(Sponsor: Takeshi Hashimoto, FACSM)  
(No relevant relationships reported)

**PURPOSE:** Aging is associated with declining in not only skeletal muscular function but also cognitive function including speed of processing, working memory, and long-term memory. However, it remains unclear whether aging-related decline in muscular function is related to impaired cognitive function. In addition to decreased muscle volume, aging-related decline in muscular function can be attributed to impaired muscle quality such as increased intramuscular fat and connective tissue (Akima et al, 2018; Goodpaster et al, 2006). The aim of the present study was to examine whether the aging-related declines in lower body muscle volume and quality are associated with cognitive function in Japanese adults. **METHODS:** The participants in this study were 86 adults (43 males, 43 females; age range 30 to 77 years old). The participants’ thigh muscle volume was assessed by bioelectrical impedance analysis. Muscle quality (i.e., levels of intra- and extra-cellular lipid and connective tissue) of the vastus lateralis was determined using 1H-magnetic resonance spectroscopy at 3T MR system and echo intensity was correlated to impaired inhibitory control score (p < 0.05). There were aging-related increases in both male and female (p < 0.05). In addition, aging-related increase in echo intensity was correlated to impaired inhibitory control score (p < 0.05). There were no relationships between those muscle properties and short memory score or working memory score. **CONCLUSIONS:** These findings suggest a link between aging-related impairment in inhibitory control and reduction in muscle volume and quality. Further studies are needed to determine whether ameliorating muscular function can be a therapeutic target against the aging-related decline in cognitive function.

**2281**  
**Board #200**  
**May 28 2:00 PM - 3:30 PM**  
**Effectiveness Of Modeling Videos On Psychological States Of Patients Undergoing Rehabilitation Following Arthroplasty**  
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2Korea University Anam Hospital, Seoul, Korea, Republic of.  
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(No relevant relationships reported)

To date, much of the rehabilitation following anterior cruciate ligament reconstruction (ACLR) has centered on physical components. However, return to sports depends on not only physical recovery but also psychological readiness. According to a systematic review published in 2017, there is limited evidence on the efficacy of psychological interventions. **PURPOSE:** To examine the effectiveness of modeling videos to reduce preoperative kinesiophobia and fear of reinjury as well as to increase postoperative self-efficacy after ACLR. **METHODS:** Following baseline assessment of psychological states through ACLR-Return to Sport after Injury (ACLR-SI), Knee Self Efficacy Scale (K-SES), and Tampa Scale of Kinesiophobia (TSK) and knee function (International Knee Documentation Committee [IKDC] system), patients scheduled for ACLR were randomly assigned to intervention, placebo, or control group. Six modeling intervention videos were developed in four out of five sessions; pre-operation, during hospitalization, 2 weeks, 6 weeks, 3 months, and 6 months post operations. Another six videos were developed to serve as placebo. Intervention and placebo groups watched their respective videos during their follow-up visits while control group did not. All groups completed psychological and functional assessments during their follow-up visits. **RESULTS:** Ten patients were assigned to intervention group, 11 to placebo group, and 11 to control group. No significant changes in ACLR-SI, K-SES, and TSK scores over six-month period were found among groups (p=0.574, p=0.880, p=0.888, respectively). Although three groups all showed improvement in ACLR-SI, K-SES, and TSK at six months, their improvements were not linear (p=0.467, 0.364, 0.274, respectively). All groups demonstrated a small-to-moderate decrease in ACLR-SI and TSK after out of sport period. **CONCLUSIONS:** Watching modeling videos compared to placebo and control did not reduce kinesiophobia or fear of reinjury as well as improve self-efficacy after ACLR. However, there may be potential room for psychological intervention at three months, and it is important to recognize psychological readiness for successful return to sports.

**2282**  
**Board #201**  
**May 28 2:00 PM - 3:30 PM**  
**Abstract Withdrawn**
differ across the exercise vs. rest interventions, p’s > 0.18. Tonic pupil diameter was larger for the exercise intervention in the flanker task, p = 0.04, and at trend level in the Simon task, p = 0.09.

**Conclusion:** The tonic pupillary response may be a sensitive biomarker for examining transient changes in LC-NE activity as a function of acute exercise bouts. Moderate intensity exercise did not significantly affect phasic pupillary response. These findings indicate that the pupillary response can be manipulated by aspects of inhibitory control and physical activity, which suggests it may be a sensitive biomarker for examining changes in LC-NE activity.

2285  
**Board #204**  
**May 28 2:00 PM - 3:30 PM**  
**Perception Of Trust In Physicians Based On Somatotype: A Student And Non-student Comparison**  
Danielle Hemingson, Felicia Raybourn. Baker University, Baldwin City, KS. (Sponsor: Justin Kraft, FACSM)  
(No relevant relationships reported)

Appearance is the first piece of information available that can powerfully influence perception. Credibility, which includes trust, has been shown to be impacted by a person’s somatotype. **PURPOSE:** The purpose of this study was to determine if students and non-students perceived trust of a physician based on the physician’s somatotype. **METHODS:** A survey was administered to 1,631 students, faculty, and staff at a small Midwestern university using Formstack. Images of an endomorph, mesomorph, and ectomorph somatotype were displayed along with a 5-point Likert scale with 1 meaning “would not trust this physician” to 5 meaning “would completely trust this physician.” Participants were asked to select the answer that best correlated with the perceived trust they would have in a physician who had the somatotype shown. **RESULTS:** There were 1,631 emails sent with 333 (20%) responses collected. Of the 333 respondents, 189 (57%) were students and 144 (43%) were non-students (faculty and staff). Perceptions of trust were analyzed using a repeated measure ANOVA which determined there is a significant difference in rank order of the three somatotypes (p-value < 0.001). A Tukey post-hoc test was then conducted to compare the three somatotypes. When comparing the means for the endomorph (M = 2.7, SD = 1.1) and mesomorph (M = 3.8, SD = 0.7), the endomorph somatotype was ranked lower than the mesomorph somatotype (t = -15.583, p-value < 0.001). Lastly, when comparing the means for the endomorph and ectomorph (M = 3.6, SD = 9) somatotypes, the endomorph somatotype was ranked lower than the ectomorph somatotype (t = 15.583, p-value < 0.001). This indicated that both status groups (students and non-students) ranked the mesomorph somatotype as most trustworthy for a physician, the ectomorph somatotype as second most trustworthy for a physician, and the endomorph somatotype as least trustworthy for a physician. Further research is needed to determine the influencing factors of somatotype perceptions.

2286  
**Board #205**  
**May 28 2:00 PM - 3:30 PM**  
**Primes For The Mind: Additive Effects Of Verbal Priming And Acute Exercise On Convergent Creativity**  
Emily Frith, Stephanie E. Miller, Paul D. Loprinzi. University of Mississippi, University, MS. (Sponsor: Dr. Jeremy P. Loenneke, FACSM)  
(No relevant relationships reported)

**PURPOSE:** The Remote Associates Test (RAT), assesses creative convergence on a single solution. The effects of physical exercise on convergent creativity are equivocal; although, priming has been shown to improve convergent thinking. To this end, we hypothesized that acute, moderate-intensity treadmill-walking while solving anagram primes would stimulate additive effects capable of facilitating convergent creativity, relative to priming alone. **METHODS:** Participants (n=45) completed two laboratory visits in this within-subject experiment. Six anagram lists were presented during each visit (twelve total lists), with the order of the twelve lists counterbalanced across conditions. Participants randomly assigned to the anagram priming + exercise visit first, performed fifteen minutes of moderate-intensity treadmill-walking (moderate-intensity; 40-45% of heart-rate reserve while solving anagrams). Participants, randomized into the anagram only visit first, sat on a stool placed on the treadmill for fifteen minutes while solving anagrams. Following fifteen minutes of exercise + anagram-solving or seated rest + anagram-solving, participants were escorted to a quiet room, free of distraction, where they solved RAT problems. After a minimum 24-hour interval, participants returned for the second visit. Paired t-tests were used to test differences between both conditions. Post-hoc Bayesian analysis was also performed to quantify evidence for or against the null hypothesis. **RESULTS:** A significant difference was evident between exercise + anagram-solving (t = 10.51, SD = 3.25) and seated rest + anagram-solving (t = 9.29, SD = 4.12, t(44) = 2.385, p = 0.021, d = 0.36, 95% confidence interval for the effect size = 0.052 - 0.655). Post-hoc Bayesian analysis indicated that the data were 2.05 times more likely under the alternative hypothesis (median Δ = 0.46, 95% credible interval for the effect size = 0.053 - 0.86).

**CONCLUSION:** This experiment offers a novel contribution to the exercise and creativity domains, suggesting a potential additive effect of exercise plus verbal priming on convergent creativity. Continued empirical research is warranted to identify precise mechanisms underlying these additive effects, and to establish novel exercise and priming strategies that may benefit creative thinking.

2287  
**Board #206**  
**May 28 2:00 PM - 3:30 PM**  
**Parent-report Of Children’s Motor Skills Are Selectively Related To Interference Control Among School-aged Children**  
Shelby Keye1, Caitlyn G. Edwards1, Corinne N. Cannavale1, Samantha J. Iwinski1, Ginger E. Reeser1, Anne D.M. Walk2, Emiliano Mazzoli1, Lisa M. Barnett1, Naiman A. Khan1.  
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(No relevant relationships reported)

**PURPOSE:** Previous research has demonstrated that aerobic fitness and adiposity impact children’s cognitive function. However, whether children’s motor skills independently impact childhood cognition remains unclear. This study examined relationships between children’s motor skills and executive function, relational memory, and academic achievement among school-aged children without diagnosed coordination disorder. **METHODS:** Participants were children ages 7-12 years old (N=90 [46 females]). Intellectual abilities and academic achievement were measured using the Woodcock-Johnson IV Test (WJCI). Selective attention was assessed using a Flanker task, and relational memory was assessed using a spatial reconstruction task. Aerobic fitness and whole-body adiposity (%Fat) were assessed using a VO2max test and DEXA, respectively. Parents completed the Developmental Coordination Disorder Questionnaire (DCDQ) as an assessment of the child’s current motor skill abilities. Spearman and partial spearman correlation tests were conducted to explore potential relationships. **RESULTS:** 14% of participants indicated a possible developmental coordination disorder and 50% had a score of 67 and above on the DCDQ. Covariates adjusted for included sex, IQ, socioeconomic status (SES), fitness, and %Fat. Following adjustment, higher scores on the control during movement subscale of the DCDQ were related to greater performance in story recall (Rho = 0.29; P=0.039), a subscale of the WJCI. There was no significant relationship between relational memory and any of the DCDQ outcomes. However, higher scores on the control during movement subscale were related to lower accuracy interference during the Flanker task (Rho=0.25; P=0.03), indicating that children who had higher motor control while moving exhibited greater selective attention, compared to those who had poorer control abilities during movement. **CONCLUSION:** Motor control abilities were associated with recall memory and attentional abilities in school-aged children, independent of aerobic fitness and adiposity. **Funding:** This work was funded by the University of Illinois and the Egg Nutrition Center.

2288  
**Board #207**  
**May 28 2:00 PM - 3:30 PM**  
**Influence Of Acute Resistance Training On Memory, Executive Function, And Mood**  
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Acute exercise has been shown to improve performance on several domains of cognitive function. The majority of research has focused on the benefits of aerobic exercise, but research on the cognitive and mood effects of acute heavy resistance training (RT) is limited. **PURPOSE:** To determine how an acute bout of RT affects cognitive function and mood. **METHODS:** This was a within subjects design. College-aged males (n=21) visited the laboratory on 3 days, separated by at least 1 week. During session 1, subjects were tested for their 5 repetition maximum (5RM) on the box squat, bench press, and lat pulldown. During sessions 2 and 3, participants completed a rest or RT condition in a counterbalanced order. Prior to both sessions, participants completed trials 1-6 of the Key Auditory Verbal Learning Task (RAVLT). During the RT session, participants completed 3 sets of 8-12 repetitions at 70% of estimated 1RM on the box squat, bench press, and lat pulldown. Training took ~40 minutes (including warm-up and cool-down). After the RT or 40 min seated rest, participants completed the recall and recognition trials of the RAVLT and a cognitive test battery in the Automated Neuropsychological Assessment Metrics (ANAM) Test System. The test battery included 10 tests that assessed memory, processing speed, executive function, and mood. Comparisons in cognitive performance and mood were made using a paired t-test. **RESULTS:** Higher scores on the color subtest of the Stroop Task, a test of processing speed, were found after RT compared to rest.
2289

Board #208
May 28 2:00 PM - 3:30 PM

Psychological State Of A World-Class Ultramarathon Runner: A Case Study
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Purpose: While previous studies have revealed various physiological effects of ultramarathon running, the psychological profile and well-being of ultramarathon runners is less often examined and therefore inadequately understood. According to Self-Determination Theory (Ryan & Deci, 2000; 2002), an individual’s well-being can be enhanced by participating in activities that support, not thwart, their basic needs of competence, autonomy, and relatedness. Psychological constructs of basic needs satisfaction, well-being, and mental toughness can be considered relatively stable. Yet, it is unknown whether these constructs vary before and after a highly intense exercise bout such as an ultramarathon. In previous studies, the timing of assessing endurance athletes varied from 5 minutes to 4 weeks post-event (Holt, Lee Kim, & Boreham, 2017; Lee Kim, 2019). This study sought to examine the psychological states of an athlete 2 hours pre and post a 2289 mile ultra-marathon run.

Methods: A 32-year old participant was a highly-talented ultramarathon runner. At 20 hours prior to the race, the participant completed a quantitative survey about basic needs satisfaction, basic needs thwarting, self-esteem, mental toughness, and affect. When asked to complete the same survey 100 minutes post-race, the participant said he could not focus and asked to complete the survey the following day.

Results: A paired sample t-test was used to compare pre- to post-race psychological constructs of the participant. Compared to pre-race, there were significant decreases in the participant’s scores on combined basic needs satisfaction (M(pre) = 6.65, M(post) = 6.25 on a 7-point scale), self-esteem (M(pre) = 4.00, M(post) = 4.00 on a 4-point scale), mental toughness (M(pre) = 6.50, M(post) = 6.63 on a 7-point scale), and positive affect (M(pre) = 4.90, M(post) = 5.00 on a 5-point scale), all at the p<0.05 significance level. A paired sample t-test was used to compare the participant’s scores on basic needs thwarting (M(pre) = 4.00, M(post) = 1.00 on a 7-point scale) and negative affect (M(pre) = 1.25, M(post) = 1.25 on a 5-point scale), which were significantly reduced from pre-race to post-race, also at the p<0.05 significance level. The participant reported feeling very tired during the race but happy and satisfied with his performances.

Conclusion: While previous studies have revealed various physiological effects of ultramarathon running, this study sought to examine the psychological states of an athlete 2 hours pre and post a 2289 mile ultra-marathon run. There were significant decreases in the participant’s scores on combined basic needs satisfaction, self-esteem, mental toughness, and affect. When asked to complete the same survey 100 minutes post-race, the participant said he could not focus and asked to complete the survey the following day.

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Board #209
May 28 2:00 PM - 3:30 PM

Long-term Exercise Training Prevents Anxious-depressive-like Behavior In Transgenic Alzheimer Rats
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Purpose: This study examined the effects of long-term treadmill exercise training on the anxious-depressive-like behavioral phenotype of transgenic Alzheimer rats in the early stage of Alzheimer’s disease (AD). The primary objective was to provide evidence that exercise alleviated fear-avoidance behavior deficits. METHODS: 2-month-old Male TgF344-AD and wild-type (WT) rats were separated into WT (n = 9), AD (n = 8), and AD + treadmill exercise (Exe) groups (n = 12). Following 8 months of exercise, the passive avoidance test, Barnes maze task, novel object recognition test, and object location test were performed to assess learning and memory function. The body mass, elevated plus maze, sucrose preference test, and forced swim test were conducted to measure anxious-depressive-like behavior of AD rats. Immunofluorescence staining, Western blot analysis, enzyme-linked immunosorbent assay (ELISA) analysis, and related assay kits were used to measure levels of inflammatory cytokines, oxidative stress, amyloid-beta production, and tau hyperphosphorylation. RESULTS: Behavioral tests indicated that AD rats exhibited deficits in learning and memory deficits, but did display anxious-depressive-like behaviors (open field, Center time: P = 0.008; Center entries: P = 0.009; Line crossings: P = 0.001). Long-term exercise significantly prevented anxious-depressive-like behaviors in AD rats (Center time: P = 0.016; Center entries: P = 0.004; Line crossings: P = 0.033). In addition, AD animals displayed enhanced AjP deposition (P < 0.001), Tau hyperphosphorylation (P < 0.001), microglial activation (P < 0.001), inflammatory cytokine release (P < 0.05), and oxidative damage (P < 0.05) that was attenuated significantly after long-term exercise training (P < 0.05). CONCLUSIONS: Long-term exercise training alleviated anxious-depressive-like behaviors and improved fear-avoidance behavior in transgenic AD rats, supporting exercise training as an effective strategy to prevent or reduce anxiety, depression and fear-avoidance behavior deficits in the early stages of AD pathogenesis.

2291

Board #210
May 28 2:00 PM - 3:30 PM

The Effect Of Treadmill Desk Walking On Creative Thinking
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Purpose: Most research on treadmill desks in the workplace report no significant change in productivity. However, most of these studies focused on cognitive performance measured by tests in attention, memory or reasoning. While aerobic exercise has been linked to producing a positive effect on creative potential, few studies have tested workplace creativity thinking. The purpose of this study was to examine the effect of treadmill desk walking on convergent and divergent creative thinking.

Methods: Twelve (n=12) male and female college-age students were recruited and completed three tests of creative function: the verbal Guilford’s Alternate Uses Task (VGAT) of divergent thinking, written Guilford’s Alternative Uses Task (WGAT), and the Remote Associations Task (RAT) of convergent thinking. Participants completed all tests while seated at a traditional desk and while walking on a treadmill desk at 1.5 mph. Step length, stride length, and gait cycle were assessed by the OptoGait analysis system. A paired sample t-test was used to compare creative test scores and gait variables.

Results: There were no significant differences between any test scores while seated and walking (p>0.05). There was a significant difference between baseline gait and divergent thinking (VGAT, WGAT) task gait in any variable (p=0.05). There was a significant increase in step length (p=0.049), stride length (p=0.046), and gait cycle (p=0.039) between the walking only condition and the treadmill desk walking during the RAT. Conclusions: Results of this study suggest neither convergent nor divergent creative thinking are improved when walking on a treadmill desk. While gait patterns are not changed during divergent thinking, this study suggests gait during convergent thinking may be altered.

2292

Board #211
May 28 2:00 PM - 3:30 PM

Acute But Not Chronic Aerobic Exercise Enhances Attention And The Neuroelectric Mismatch Negativity Among Fatigued Individuals
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Purpose: Symptoms of fatigue are a public health burden, comorbid with both cardiovascular disease and cancer. While exercise requires considerable energy expenditure, both acute and chronic aerobic exercise reduce feelings of fatigue. However, the brain mechanisms underlying this effect are not well-understood. To explore the neural mechanisms of this effect, we examined EEG correlates of attention before and after acute and chronic aerobic exercise. We hypothesized that the lo-intensity acute and chronic effects of exercise would produce increased attention. METHODS: In this pilot study, 13 students, ages 18-36, with elevated levels of fatigue, were randomly assigned to lo-intensity, hi-intensity, and a no exercise control. Each participant was evaluated pre- and post-exercise three times (e.g., baseline, week 3, and post-intervention) during the 6-week study. At each session participants were outfitted with hi-density EEG and completed an auditory odd-ball task that resulted in a mismatch negativity (MMN). The MMN is an index of pre-attentive change detection, and its amplitude decreases with fatigue. EEG was analyzed by established guidelines including ICA algorithms for artifact-removal. To extract the MMN, the N1 was located in each recording and a difference wave was calculated by subtracting the electrocortic activity to the standards minus targets, in the 100ms after the N1 (120-220ms). Results: A repeated-measures, mixed model ANOVA (3 Group (lo-intensity, hi-intensity, control) x 2 Time (pre/post intervention) x 3 Week (baseline, week 3, post-intervention)) revealed a marginally significant interaction between Group, Time, and Week [F(4,16)=2.79, p=0.06, η²=0.41] such that the MMN was reduced after hi-intensity exercise at the final session. In addition, the 2-way interaction between Group and Time [F(2,8)=4.05, p=0.06, η²=0.50]
revealed a marginally significant interaction such that the lo-intensity group showed an increased MMN amplitude post exercise, the hi-intensity group showed a decrease, and the control group showed no change. Non-significant effects were observed (all p>0.24, n=29). DISCUSSION: Our data suggest that automatic pre-attentive change detection is only altered after lo-intensity acute aerobic exercise among our sample of fatigued individuals.

**Results**

**Purpose:** To analyze the differences in quick thinking tasks and reaction time before and after a 3-hour treadmill run, in trained endurance males.

**Methods:** 10 male endurance runners (32 ± 6.0yr; 161.3 ± 20.7 lb, 68 ± 1.6 in; 14.7 ± 6.6% body fat) ran for 3-hours on the treadmill (6.1 ± 0.2 mph, 57 ± 1.1 mph) immediately after the treadmill run (POST). There was a significant improvement in reaction time POST vs. PRE (0.44 ± 0.68 vs. 0.284 ± 0.99 sec; p<0.05). There was a significantly slower average reaction time when responding to different word colors, vs. the same color for the word (p<0.05). There was a significant improvement in reaction time POST vs. PRE (0.44 ± 0.004, 0.48 ± 0.006 sec; p<0.05). There was no significant difference between PRE and POST 3-hr run finger-tapping test pre-run (PRE) and immediately after the treadmill run (POST).

**Results**

**Purpose:** To test the differences in quick thinking tasks and reaction time before and after a 3-hour treadmill run, in trained endurance males.

**Methods:** 10 male endurance runners (32 ± 6.0yr; 161.3 ± 20.7 lb, 68 ± 1.6 in; 14.7 ± 6.6% body fat) ran for 3-hours on the treadmill (6.1 ± 0.2 mph, 57 ± 1.1 mph) immediately after the treadmill run (POST).

**Results**

**Purpose:** To analyze pre-competition emotions in a final cheerleading university competition. The evaluation is based on an assessment of strength, flexibility, and perfection to analyze pre-competition emotions in a final cheerleading university competition. The evaluation is based on an assessment of strength, flexibility, and perfection.

**Methods:** A sample of higher- and lower-fit college-aged adults was recruited to participate in the study based on maximal oxygen consumption (VO2max). Participants performed a complex arithmetic approximation task presenting operands a ± b and were instructed to indicate whether the sums were greater than or less than 100. Problems were equally distributed across conditions that varied in the extent to which the operands required arithmetic approximation: extra small split (i.e., ± 2% or 3%); 63±19, medium split (i.e., ± 5% or 8%; 69±26), large split (i.e., ± 10% or 15%; 48±62), and massive split (i.e., ± 50% or 55%; 64+68). To determine the extent to which arithmetic strategy differed between fitness groups, behavioral and neural indices of cognitive processing were assessed. Results: Numerical conditions requiring relatively lower levels of arithmetic approximation were not observed to differ between higher- and lower-fit participants whereas the numerical conditions requiring arithmetic approximation exhibited fitness-related differences. Conclusion: These findings suggest that high-fit individuals may engage in more efficient mathematical reasoning strategies relative to their low-fit counterparts. Therefore, fitness-related differences in mathematics achievement may result from differences in strategy execution. Future research should examine the degree to which physical activity interventions designed to enhance aerobic fitness also result in shifts in arithmetic approximation strategy.

**Conclusions:** The possible mechanism of dance training regulating emotion of college students may be relevant to the changes of structure, function and functional connections of emotion related brain areas. The effect of dance training on emotion regulation is highly related to the years of dance training (Supported by The Innovation ability promotion Plan Foundation of Beijing Municipal Education Commission No.TJSH20161005101).

**References:**

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Although cheerleading’s history is long until relatively recently it was not considered a sport. The evaluation is based on an assessment of strength, flexibility, and perfection of routine. Despite positive energy, charisma, and joy, during a competition, athletes can experience positive and negative emotions that could influence performance. **Purpose:** To analyze pre-competition emotions in a final cheerleading university games participation, assessing differences between male and female cheerleaders and associating positive and negative emotions with the score obtained in the competition. **Methods:** From six universities 40 cheerleaders (n=22 male; n=18 female), mean age was 21.03 yr (SD 1.51), participated in the study, they competing at the National University Games in Bahia, Brazil. The teams were finalists in the first time of cheerleading participation in 67 editions of this competition. The twenty-two items of the Pre-Competitive Emotion Scale in the Portuguese language were selected from the original scale developed earlier (Jones et al., 2005). This scale has positive (e.g., happy, excited, enthusiastic) and negative (e.g., angry, sad, tense) emotions. Athletes were asked to rate how intense they were experiencing the emotions through self-evaluation 30min before the competition, on a scale in Likert format anchored by 1 (not at all) to 5 (very much so). **Results:** Cheerleaders athletes experienced positive emotions (3.82 ± 0.69) more intensely than negative emotions (1.94 ± 0.44). In gender comparison, the independent sample t-test showed a significant difference in negative emotions (m. 1.78 ± 0.36 vs f. 2.14 ± 0.46; p=0.009) and a non-significant difference in positive emotions (m. 3.91 ± 0.64 vs f. 3.72 ± 0.76; p=0.42). Pearson correlation also indicated a significant, weak, positive correlation (r=0.35; p=0.02) between positive emotions and final score, while the negative emotions demonstrated a non-significant correlation (r=-0.03; p=0.81). **Conclusions:** Cheerleaders experienced both, positive and negative pre-competitive emotions. As well, female athletes experienced more intense negative emotions than male athletes, and the intensity of positive emotions was related to the final score. This information may be useful for training psychological aspects and emotional control.

**Purpose:** The purpose of the study is to evaluate the effect of dance training on emotion regulation of college students and explore the possible mechanism by using a magnetic resonance imaging (MRI) technique. **Methods:** 30 healthy college students were selected, 15 majored in classical Chinese dance (Dance Training group, DTG) and 15 (Control Group, CG) have no previously experience of regular training. MRI technique was used to observe the effect of dance training on the structure and function of emotion related brain areas. Siemens MAGNETOM Trio 3.0T MRI was selected and data analyzed by ALFF/FC with GRETRA.

**Results:** Compared with CG , whole brain (1366±88ml) , gray matter (674±49ml), white matter (488±39ml) was no significant difference with DTG (P>0.05). The structural of left BA20 of DTG was increased significantly (voxels=142, t=5.91). The structural of left anterior cingulate gyrus, right central cingulate gyrus and insula gray matter decreased significantly in DTG (P<0.05). With the increase of training years, the structural volume of BA20 gray matter increased significantly (voxels=420, t=0.80). In DTG the ALFF value and ReHo value in BA48 and BA23 were significantly increased (P<0.05). The functional connections between the left insula and the right transverse temporal gyrus and the left superior temporal gyrus were enhanced (P<0.05). Also right insula and the left amygdala, transverse temporal gyrus, superior temporal gyrus, middle temporal gyrus, inferior temporal gyrus and transverse temporal gyrus were significantly enhanced (P<0.05).

**Conclusions:** The possible mechanism of dance training regulating emotion of college students may be relevant to the changes of structure, function and functional connections of emotion related brain areas. The effect of dance training on emotion regulation is highly related to the years of dance training (Supported by The Innovation ability promotion Plan Foundation of Beijing Municipal Education Commission No.TJSH20161005101).
The Effect Of Behavioral Automaticity On Behavior Is Moderated By Cognitive Self-control Abilities

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(No relevant relationships reported)

PURPOSE: Dual-process theories assume that physical activity (PA) behavior is regulated by two different processes: implicit (i.e., automatic, unconscious) and explicit (i.e., effortful, conscious) processes. In this study we examined the interaction of implicit (i.e., behavioral automaticity) and explicit (i.e., cognitive self-control abilities) processes on PA behavior. We expected significant interaction effects between behavioral automaticity and cognitive self-control abilities (i.e., inhibition): highly automatized behaviors will prevail when inhibition abilities are poor, while high inhibition abilities might help to inhibit unwanted automatic behavioral tendencies (e.g., highly automatized sedentary behaviors [SB]).

METHODS: A prospective study with two points of measurement (N = 114 undergraduate and graduate students) was conducted. At t1 age, sex, past PA behavior (control variables) and automaticity of a) PA and b) SB were assessed with standardized questionnaires. Inhibition was assessed with a computerized Stop-Signal and a Go/No-Go task. At t2 (4 weeks later), PA behavior was measured as dependent variable with a standardized questionnaire. Hierarchical multiple linear regression analyses with interactions Automaticity × Inhibition on PA behavior and subsequent moderation analyses were calculated for automaticity of a) PA and b) SB respectively.

RESULTS: The expected interaction effects Automaticity × Inhibition on PA behavior were significant for automaticity of a) PA (β = 55.23, p < .01) as well as b) SB (β = -27.40, p < .05). Moderation analyses revealed that PA automaticity was a significant positive predictor of PA behavior when inhibition abilities were poor (β = 105.75, SE = 23.13, t = 4.57, p < .001), but not when they were high (β = -11.10, SE = 24.71, t = -0.45, p = .65). Furthermore, automaticity of SB was a significant negative predictor of PA behavior when inhibition abilities were poor (β = -42.83, SE = 20.87, t = -2.05, p < .05), but not when they were high (β = 13.67, SE = 17.61, t = -0.77, p = .44).

CONCLUSIONS: In line with theoretical assumptions, automatic behaviors prevailed when the ability to inhibit prepotent responses was poor. However, higher inhibition abilities erase the significant associations between automaticity and behavior for both, PA and SB automatically.
2020 THURSDAY, MAY 28, 2020

2301 Board #220 May 28 2:00 PM - 3:30 PM
Sentiment Analysis Of Journal Articles, Press Releases, And News Articles Pertaining To Chronic Traumatic Encephalopathy
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-No relevant relationships reported-

PURPOSE: Previous research has called for media balance when reporting on chronic traumatic encephalopathy (CTE) in order to avoid harmful bias towards readers. This call is raised from concerns that the media’s representation of CTE has moved beyond what science has proven. The purpose of this study was to use word sentiments to directly compare journal articles with corresponding news articles to evaluate these concerns. The news articles were split into three groups: press releases reporting the articles’ findings, news articles about CTE from upper tier news outlets, and articles from lower tier news outlets.

METHODS: Research articles (n=10) directly associated with CTE that were heavily covered in the media were selected for this sample. An equivalent number of press releases (n=10), upper tier articles (n=10), and lower tier articles (n=10) were collected in order to compare semantics. The “AFFINN” sentiment analysis dictionary rates the emotional valence of each word with an integer between minus three (negative connotation) and plus three (positive connotation). Words not recognized by the dictionary or with a zero weight were omitted from the analyses. Mean sentiment score was adjusted for total word count.

RESULTS: The mean sentiment scores, adjusted were words count, were as follows: 0.086 for journal articles, -0.096 for press releases, -0.122 for upper tier sources, and 0.026 for lower tier sources. An analysis of variance calculation yielded no significant differences between the groups (F = 0.758, p = 0.513). However, the ACLR-group showed a moderate effect for a significant increase of negativity (ACLR: F(16)=36, p<0.001, η²=0.68). The mean sentiment for ACLR was higher than for all other conditions.

CONCLUSIONS: Despite recent calls for a less biased reporting of CTE in mainstream media, our analysis indicates essentially equal sentiment weighting between peer-reviewed journal articles and news reports on CTE, whether the report was a press release, an article from an upper tier source, or from a lower tier source. Additionally, these sentiment weights each approached a value of zero (true neutrality). Future research should take into account the context in which the words appears in the articles in addition to using sentiment averages.

2022 Board #221 May 28 2:00 PM - 3:30 PM
Abstract Withdrawn

2023 Board #222 May 28 2:00 PM - 3:30 PM
Does ACL-reconstruction Lead To Higher Use Of Neurological Resources To Prepare & Initiate Challenging Jump-landings?
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-No relevant relationships reported-

Increased cortical motor planning has been suggested to compensate the loss of mechanoreceptors after anterior cruciate ligament (ACL) injury in simple motor tasks. PURPOSE: To investigate the cortical processes associated with motor- and injury-related movements. METHODS: Ten males with ACL-reconstructed knee (28±1 yrs, 25±3 kg/m2 63±35 months since surgery; ACLR) and 17 knee-injury free controls (28±1 yrs, 26±3 kg/m2) all males) completed 70 countermovement jumps with single-leg landings on a pressure plate. Pre-planned (landing leg shown before take-off; PP) and non-pre-planned (visual cue during flight, 360° minus prior ground contact; NPP) landings (35 each) were performed in random order. Movement-related cortical potentials (MRCPs) were analysed to quantify the neural involvement needed to initiate the jump (higher negative potentials indicate more motor planning) using electroencephalography. The mean activity was calculated for fronto-central (FC1, FC2) and central electrodes (C3, C4, CZ) in three successive epochs prior to movement onset (acceleration sensor): Early (−1.500 to −1.000 ms; RP1), late readiness potential (−0.500 to −0.000 ms; RP2) and negative slope (≥ 0 ms/movement onset; NS).

RESULTS: In both groups, MRCPs occurred at CZ only. A 3 x 2 ANOVA revealed a main effect for a significant increase of negativity (ACLR: F(16)=36, p<0.001, η²=0.68; controls: F(9)=22, p<0.001, η²=0.60) across the three epochs (ACLR: RP1: F15=0.8, RP2: 1.8, NS: 5.8 µV, p=0.01; ACLR: RP1:0.9, RP2: 3.2, NS: 8 µV, p<0.01; controls: RP1:0.2, RP2: 1.5, NS: 5.9 µV, p<0.01; controls: RP1:0.2, RP2: 1.1, NS: 4.3 µV, p<0.01). Between groups, no significant effects were found for time (F(2)=0.2, p=0.6) or the interaction of both factors (F(2)=2.0, p=0.6). However, the ACLR-group showed a moderate effect for a higher negativity at all epochs in the NPP condition (d=0.5).

CONCLUSION: Our jump-landing task evoked MRCPs irrespective from group and condition. The trends in our data suggest that ACLR-individuals may use more motor planning resources to initiate a challenging motor task. Research is warranted to elucidate the possible implications of such potential central compensations for injury risk. No funding.

2304 Board #223 May 28 2:00 PM - 3:30 PM
Study On Correlation Between Cognitive Function And Exercise Intensity, Frequency And Types Of People At Advanced Age
Xiaona Cao, Yu Li. Beijing sports university hospital, Beijing, China. (Sponsor: Zhengzhen wang, FACSMS)

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-No relevant relationships reported-

PURPOSE: To explore the correlation between cognitive function and exercise intensity, frequency and type of people at advanced age.

METHODS: 418 elderly people aging from 80 to 85 were recruited from Shangdi community, Haidian District, Beijing, China from April to August 2019. Based on scores of Mini-Mental State Exam(MMSE)of the elderly, the elderly were divided into normal group (≥ 27 points), cognitive impairment group(< 27 points), dementia group(Reference MMSE). To investigate sports in the past five years by surveying the elderly and their family members. Exercise intensity (refer to the “metabolic equivalent table of common daily life, entertainment and work activities”) classification: 1-1.9met (eating, dressing, washing hands), 2-2.9met (walking less than 3km / h, simple housework), 3-4.4met (cooking, housekeeping, medium speed walking, Tai Chi), 4-5.5met (fast walking, jogging), > 6met (running); exercise type: housework exercise, leisure sports, sports; sports frequency: 1-2 times / week, 3-4 times / week, ≥ 5 times / week. RESULTS: A total of 401 effective questionnaires (96%) were collected. Except 91 of them who had interrupted their normal exercise habits due to emergencies such as diseases in the past five years, the rest 310 were investigated, including 139 cases in the normal group, 109 in the cognitive impairment group and 37 in the dementia group (mild, moderate and severe). The rate of exercise in MMSE score normal group with metabolic equivalent between 2-4.5MET was high, compared with that of cognitive impairment group and dementia group(p<0.05). Frequency of exercise in MMSE score normal group and cognitive impairment group was high, compared with that of dementia group(p<0.05).

There was no correlation between the MMSE score and the type of exercise.

CONCLUSIONS: Long-term participation in the exercise with metabolic equivalent between 2-4.5met of people at advanced age can slow down the occurrence of cognitive dysfunction, so does the high exercise frequency (≥ 5 times / week). There is no evident correlation between exercise type and cognitive function of people at advanced age.

2305 Board #224 May 28 2:00 PM - 3:30 PM
Exercise’s Effect On Reaction Time And Answer Accuracy During Memory Recall
Lucas Van Horn. West Chester University of Pennsylvania, West Chester, PA. (Sponsor: Dr. William A. Braun, FACSMS)

-No relevant relationships reported-

Short and long-term memory recall can be improved by regular exercise, based on rat and human brain studies. Regular exercise, by promoting brain blood flow, has been shown to decrease the rate of decline of memory consolidation and recall in adults. Acute exercise can cause an immediate increase of blood flow to the brain thus potentially increasing oxidative supply for memory encoding. Conversely, a hyperglycemic state may interfere with memory encoding. PURPOSE: To determine the effects of light exercise (LEC), heavy exercise (HEC), and exogenous glucose (GLU) on reaction time and response accuracy during a computer-based memory recall test. METHODS: 15 subjects (20.8±1.26 yr) completed four trials: resting control (CON), low-intensity cycling (LEC), heavy cycling (HEC), and resting glucose (GLU): a 25% glucose solution supplied at 1g/kg of body mass followed by a 25 min rest. For each trial, subjects observed 75 images prior to the assigned treatment and were then asked to recall the images after the treatment. During the post-test, 25 images were replaced with new images; subjects were then asked to recall whether the images had been viewed during the pre-test. Accuracy and reaction time (RT) were assessed. Exercise trials (20 min) were conducted using 20% (LEC) and 40% (HEC) of Wingate anaerobic test work rate. Blood lactate, glucose, and heart rate were collected at specific time points throughout. RESULTS: Mean HR was significantly increased during LEC and HEC (117± 1.4± bpm in the p<0.01 and 16.5± bpm, respectively) vs. CON (68.0±9.4 bpm). Blood glucose was significantly increased during GLU (p<0.01) vs. CON (68.0±9.4 bpm) and GLU (67.8±7.7 bpm). Blood glucose was significantly increased during GLU (p<0.01) and blood lactate significantly increased during HEC (p<0.01) vs. all conditions. Despite these physiologic alterations, no significant differences were observed in reaction time during LEC, HEC, and GLU vs. CON (p>0.05). CONCLUSIONS: Long-term participation in the exercise with metabolic equivalent between 2-4.5met of people at advanced age can slow down the occurrence of cognitive dysfunction, so does the high exercise frequency (≥ 5 times / week). There is no evident correlation between exercise type and cognitive function of people at advanced age.

Abstracts were prepared by the authors and printed as submitted.
A Single Bout of Aerobic Exercise Improves Cognitive Function in Older Adults. Changes in cognitive function commonly occur in older adults. These changes can range from mild cognitive impairment to dementia. With the number of older adults projected to double in the next 30 to 40 years, it is important to determine interventions capable of improving cognitive function in this sector of the population. PURPOSE: To determine if a single bout of moderate intensity aerobic exercise improves cognitive function in older adults. METHODS: Older adults were recruited from an independent living community to participate in a single 20-minute bout of moderate intensity exercise performed on a recumbent stepper. Immediately before and 10 minutes after the bout of exercise, participants completed the pattern comparison cognitive assessment to determine the impact of a single bout of aerobic exercise on cognitive function. This instrument includes 30 problems with two patterns side by side per problem where participants denote whether the patterns are the same “s” or different “d” during the 30 second time limit given. Results were scored as correct or incorrect and a higher overall score reflects better cognitive functioning. A paired-samples t-test was used to compare pre- to post-exercise cognitive function scores. RESULTS: Participants included 23 adults between the ages of 69 and 94, with an average age of 81.91. Of those, 5 were males and 18 were females. There was a significant improvement from pre to post aerobic exercise in the number of correct responses on the cognitive assessment (pre=11.95 ± 3.60, post=13.12 ± 2.80, P=0.01). CONCLUSION: A single 20-minute bout of moderate intensity aerobic exercise can improve cognitive function in older adults. With a dramatic increase in the number of older adults in the United States, research on mitigating the decline in cognitive function, such as through exercise, is imperative to meet the needs of this growing segment of the US population.

A Single Bout Of Aerobic Exercise Improves Cognitive Function In Older Adults
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(No relevant relationships reported)

Head strikes are legal and commonly used in mixed martial arts (MMA) competitions, putting MMA fighters at substantial risk for brain injury. Following a knockout (KO) or technical knockout (TKO), fighters typically receive time-based medical suspensions that do not include objective determinations for safe return-to-play. Fighters who do not suffer a KO or TKO may not receive any medical suspensions, even though they may have incurred an undiagnosed concussion or subconcussive brain injury. PURPOSE: To determine if participating in a single MMA competition is associated with impaired neurologic function of MMA fighters. METHODS: Ten amateur and professional MMA fighters (8 men, 2 women; 26.3 ± 2.6 years) were evaluated before (61 ± 91.8 days; T1) and after (3.8 ± 1.3 days; T2) competition. Control participants were evaluated for eye movement speed and accuracy (King-Devick test; KD); VOMS, near point convergence (Vestibular / Ocular-Motor Screening; NC), hand-eye reaction time (FitLight Trainer; RT), visuomotor ability (FitLight Trainer; VM), static balance (Wii Balance Board; SB), and multiple object tracking speed (NeuroTracker; MOT). RESULTS: Total KD times were significantly faster following a training session (35.86 ± 8.05 vs. 43.34 ± 8.92 s; P < 0.001). Likewise, RT (0.43 ± 0.04 vs. 0.48 ± 0.04 s; P = 0.003) and VM (1.06 ± 0.22 vs. 1.20 ± 0.25 s; P = 0.011) times significantly improved following training. MOT speed (2.15 ± 0.26 vs. 2.03 ± 0.34 m/s; P = 0.042) and NC distance (5.18 ± 5.12 vs. 6.62 ± 5.85 cm; P = 0.284) also improved following training, although these changes were not significant. SB was virtually identical from baseline to post-training (2.27 ± 0.95 vs. 2.27±1.30 cm; P = 0.994). CONCLUSION: Compared to baseline measures, some assessments of neurologic function revealed significant changes after a single MMA training session. Contrary to what was expected, all significant changes were the result of improved performance from baseline to post-training. Based on these findings, neurologic function of MMA fighters does not appear to impair following a single fighting session. Furthermore, MMA training bouts may be associated with acute improvements in eye movement, reaction time and visuomotor ability.
Brain-derived neurotrophic factor (BDNF) has been implicated in repair and regeneration of peripheral neurons, and is important for brain health. Acute exercise (EX) increases circulating BDNF in an intensity dependent manner in able-bodied individuals. However, the response of BDNF to EX in people with spinal cord injury (SCI) is poorly understood. PURPOSE: To investigate the hypothesis that submaximal EX will increase serum and plasma BDNF in people with SCI.

METHODS: Nine adults with SCI participated (M age = 39.2 ± 11.0 years; M years post-injury = 16.5 ± 9.2). After a maximal exercise test on an electromagnetically braked arm-crank ergometer to determine peak power output (PPO), participants completed two visits in randomized order: 1) submaximal EX (30 minutes maintaining 55-65 rpm @ 60% PPO); and 2) seated control (CTL). Ratings of perceived exertion (RPE) were measured during EX using the 6-20 Borg RPE scale. Heart rate (HR) and blood pressure (BP) were measured pre- and post-EX. BDNF was measured via ELISA in both serum and plasma from venous blood sampled at pre-, post-, and 90 min post-EX. For the CTL visit, participants rested quietly for 120 min and blood was sampled at equivalent time points to EX. A 2-factor repeated measures ANOVA was computed to assess BDNF responses by time and condition. Paired t-tests were computed to assess HR and BP responses to EX. Pearson correlations were computed to explore relationships between BDNF and physiological responses to EX and work rate. RESULTS: The average EX work rate was 47 ± 17 W and RPE was 13 ± 1. HR increased by 26 ± 33 bpm (+41%; p=0.059), whereas systolic and diastolic BP remained unchanged after EX. Contrary to our hypotheses, EX had no effect on serum (Pre vs. Post-EX = 22447.9 ± 9071.1 pg/mL vs. 26552.8 ± 6563.4 pg/mL; F1,10 = 0.51, p=0.53) or plasma (Pre vs. Post-EX = 1802.7 ± 1031.1 vs. 1662.7 ± 1390.0 pg/mL; F1,10 = 0.77, p=0.45) BDNF. Exploratory correlational analyses showed no relationships between changes in BDNF and the outlined parameters.

CONCLUSIONS: Submaximal EX did not increase BDNF in people with SCI. Future studies should systematically investigate BDNF responses to higher EX intensities given the intensity-dependent response in able-bodied people. FUNDING: Rick Hansen Foundation through the Blusson Integrated Cures Partnership

Cannabis use has been gaining wider social acceptance, and with increased legalization cannabis users are taking more openly about how and why they consume cannabis. While there is growing interest in combining cannabis with physical activity, there is a distinct lack of cannabis research in humans, particularly as it relates to physical activity.

PURPOSE: To investigate how and why people use cannabis with exercise as well as categorizing the types of exercise users engage in.

METHODS: 126 subjects (n = 63 male, 62 female, 1 non-binary) were recruited to complete an anonymous online survey if they reported both participation in regular physical activity and cannabis use. The survey consisted of five sections: cannabis with exercise, general exercise participation, general cannabis use, unanticipated experiences, and demographics.

RESULTS: Over 44% of participants reported that they use cannabis every or almost every time before they exercise. Most smoke cannabis (53%) and use Sativa-dominant strains (65%) before exercise. Only 18% of participants used non-psychotropic CBD products during exercise. The highest reports of exercise participation under the influence of cannabis include hiking (61%), yoga (58%), aerobic machines (50%), walking (45%), and weight lifting (43%). The top reasons to use cannabis before exercise include: helps me focus/concentrate (66%), helps me enjoy exercise (65%), enhances mind-body-spirit connection (64%), keeps me in the zone (61%), and enhances body awareness (52%). The majority (70%) of respondents reported feeling more satisfied with their workouts under the influence of cannabis compared to when they do not use cannabis prior to exercise and have not suffered any unanticipated negative experiences (61%).

CONCLUSIONS: This is the first study to investigate how and why people use cannabis with exercise. This study provides a starting point for future studies investigating the impact that cannabis consumption has on exercise participation and performance.
are unclear. The effect of cumulative head impact exposure at the high school level is understudied despite long-term neurophysiological deficits reported in retired professional football players. Studying neurophysiological responses in young football players may provide important insights into addressing cerebrovascular function and other late-life physiological health in athletes.

**2314 Board #233** May 28 2:00 PM - 3:30 PM

**Validation Checks Decrease Sandbagging On Baseline Neurocognitive Tests**

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(No relevant relationships reported)

**PURPOSE:** To examine whether a second baseline test (Group 2B) in those scoring an invalid first test on CNS Vital Sign (CNSVS) is comparable to those achieving a valid baseline initially (Group 1).

**METHODS:** This is a retrospective cohort of 817 Division I collegiate student-athletes ages 17-26 who completed at least one valid baseline examination. Subjects were asked to complete a pre-participation computerized neurocognitive test (CNSVS) and those with invalid baseline exams were retested. The valid scores for the re-take group (Group 2B) were compared to subjects who earned a valid baseline exam on their first visit (Group 1). Standard scores were included for all CNSVS domains. The mean scores for all outcome variables of Group 1 and Group 2B were compared using ANOVA analyses with significance set at p<0.05.

**RESULTS:** In the majority (61/132) of cognitive test scores, subjects with an initial invalid baseline performed similarly in their second attempt (Group 2B) compared to subjects who had a valid baseline exam after one attempt (Group 1). The general memory (92.17 ± 15.56) and visual memory (93.26 ± 13.21) scores for Group 2B remained significantly lower than Group 1 (99.96 ± 15.15; 101.33 ± 13.97) (p=0.015, p=0.006), respectively, while motor speed for the re-test group (109.91 ± 12.48) was significantly higher than Group 1 (102.90 ± 12.30) (p=0.02). Interestingly, the total test time (seconds) and the testing duration (seconds) were significantly faster (p=0.001; p=0.008) during the second testing session (Group 2B = 1745.74 ± 205.72; 1599.09 ± 196.59) compared to those who earned valid scores in their initial attempt (Group 1 = 2042.53 ± 276.76; 1693.53 ± 167.16).

**CONCLUSIONS:** Subjects initially completing an invalid baseline examination for concussion testing show significantly worse results than those who perform complete valid baseline testing initially, but these poor results do not persist when given a retest. When computerized neurocognitive tests include validity measurements, “sandbagging” of results can be significantly mitigated, improving overall accuracy of post-injury concussion monitoring, thus decreasing the probability of returning an athlete too early following a concussive injury.

**2315 Board #234** May 28 2:00 PM - 3:30 PM

**NEUROPHYSIOLOGICAL CHANGES AFTER UPPER AND LOWER LIMB GRADED EXERCISE TESTING.**

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(No relevant relationships reported)

Aerobic exercise, including graded exercise testing (GXT), may cause neurophysiological changes of circuits in the primary motor cortex (M1) related to mechanisms of fatigue and/or plasticity. Investigating M1 inhibitory circuit changes over time in exercising compared to non-exercising muscles after GXT of the upper limbs (UL) and lower limbs (LL) may distinguish between different post-exercise mechanisms. **PURPOSE:** To evaluate M1 inhibitory circuit changes resulting from UL and LL GXT and determine their associations with fitness. **METHODS:** Six healthy subjects (30 ± 6 yrs) participated. Transcranial Magnetic Stimulation (TMS), Peripheral Nerve Stimulation (PNS), and Electromyography (EMG) were used for neurophysiological testing. Gas analysis was performed to evaluate VO2max (UL: 24.2 ± 4.8; LL: 35.1 ± 5.9 ml/kg/min) during GXTs. Surface electrodes were placed over the first dorsal interosseous (FDI) and tibialis anterior (TA) muscles. Measures of M1 and M1-related afferent inhibition included cortical silent period (CSP) and short-latency afferent inhibition (SAI), respectively. SAI inter-stimulus intervals (ISI) between PNS and TMS stimulations were 21-23 ms (UL), and 32-35 ms (LL). TMS coil orientation (CO) was altered between posterior-anterior (PA) and anterior-posterior (AP) for both measures of CSP and SAI. CSP and SAI were taken 0-45 min (POST1) and 45-90 min (POST2) post-exercise and compared to pre-exercise. Repeated measures ANOVAs were performed to evaluate effects of exercise type, CO, time, and ISI. **RESULTS:** CSP decreased at POST1 and increased at POST2 in FDI (97 ± 1.2% vs. 104.5 ± 2.5%, p<0.05) with a trend toward significance in TA (99.3 ± 2.5% vs. 103.5 ± 4.9%, p=0.19). Although SAI was found for the TA at 32ms (p<0.05) and FDI at 21-23ms (p<0.05), the interaction of exercise type, CO, and ISI did not reach significance after Huynh-Feldt correction (FDI: p = 0.10, TA: p = 0.10). Univariate linear regression of VO2max and SAI revealed a potential relationship reliant on exercise type and CO (UL: R2 = 0.91, LL: R2 = 0.68). **CONCLUSIONS:** Changes in CSP suggest that exercise may cause early diastolic inhibition followed by greater inhibition in M1 while changes in SAI may be influenced by fitness levels. Collectively, the results support UL and LL GXTs cause measurable M1 neurophysiological changes.

**2316 Board #235** May 28 2:00 PM - 3:30 PM

**Vestibular, Spatial Cognition And Mental Fatigue Status Of Female Soccer Players Before A Competitive Season**

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(No relevant relationships reported)

**PURPOSE:** To examine visuo-vestibular interaction and the relationship to visuospatial cognitive, mental fatigue, and concussion history in female soccer players before the start of a competitive season. **METHODS:** Twenty-four NCAA Division 1 women’s soccer athletes participated in the study. All players completed medical history including dates and number of prior concussions. Vestibular and visual interaction was assessed using the Dynamic Visual Acuity Test (DVAT) which examines the loss in visual acuity when the head is moving in the yaw plane at 85 deg/sec or more compared to head stationary. Visuospatial cognition was assessed using the Symbol Digit Modalities Test (SDMT) and the Ray-Osterrich Complex Figure (ROCF) while current fatigue level was assessed using the Mental Fatigue Scale (MFS). Spearman’s correlations examined the correlations between DVAT loss and MFS, SDMT, and ROCF. Comparison of MFS, SDMT score, and ROCF score between groups based on number of concussions was completed using t-tests. **RESULTS:** Of the 24 participants (mean age 19.3 ± 1.3), 15 had a prior history of concussion (range 1-7). Mean loss of visual acuity in the pitch plane in logMAR upwards was 0.14 ± 0.08 and downwards was 0.19 ± 0.1, and in the yaw plane was 0.15 ± 0.08 to the right and 0.14 ± 0.1 to the left (normative values for this age group are 0.08 ± 0.17 logMAR). The SDMT score was 59.88 ± 6.7, ROCF score was 29.9 ± 5.4, and MFS score was 6.9 ± 5.8. Spearman’s correlations showed significant relationships between DVAT loss to the right (p=0.04) and mental fatigue (p=0.04). Comparisons of athletes who had sustained 2 or more concussions compared to those with 0-1 shown significant differences in the MFS (p=0.03).

**CONCLUSIONS:** Greater loss of dynamic visual acuity was seen in female soccer players before the start of a competitive season. Gaze stability deficits are correlated with higher mental fatigue and athletes who had 2 or more concussions had more mental fatigue.

**2317 Board #236** May 28 2:00 PM - 3:30 PM

**Stress Response And Performance Changes Of Law Enforcement Officers' Marksmanship Under Varied Levels Of Stress**

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(No relevant relationships reported)

**PURPOSE:** To investigate changes in shooting performance of law enforcement officers under varying levels of stress. This study determined how increasing levels of stress from operating a firearm on static targets changed when participants were subjected to simulated life threatening situations.

**METHODS:** Thirty-three law enforcement officers completed three tests of hangn shooting trials using a battery-operated laser marking pistol. Trial one included a modified course from the Illinois State Firearms Qualification Course of Fire. Officers completed two separate simulation trials separated by 48 hrs (SIMCON1, SIMCON2), a modified course from the Illinois State Firearms Qualification Course of Fire. Officers completed two separate simulation trials separated by 48 hrs (SIMCON1, SIMCON2), a modified course from the Illinois State Firearms Qualification Course of Fire. Officers completed two separate simulation trials separated by 48 hrs (SIMCON1, SIMCON2). All officers engaged in dangerous encounters with virtual suspects using a TI Simulator (TI Training, Golden, Colorado) requiring each officer to draw his weapon and fire against an armed assailant. Heart rate, blood pressure, salivary cortisol, and shooting performance data were collected throughout the courses of fire.

**RESULTS:** Compared with the qualification course of fire (99.23% hit rate of intended target), there was a statistically significant reduction p<0.01 in percentage of shots hit during both SIMCON1 (hit rate 47.48%) and SIMCON2 (hit rate 50.13%) conflicts. Compared to trial 1 mean heart rate increased 16.46 BPM and 19.7 BPM and systolic blood pressure 18.77 mm Hg and 23.08 mm Hg respectively for SIMCON1 and SIMCON2. Comparison of MFS, SDMT score, and ROCF score between groups based on number of concussions was completed using t-tests.

**CONCLUSIONS:** Future research should collect physiological variables such as heart rate and blood pressure when the officers are on duty. This real-life situation would likely heighten the physiological responses versus that of simulated setting used in this study. It may provide better insight how real-life scenarios may negatively affect marksmanship performance.
Effects Of Acute Aerobic Exercise On Working Memory Of Male Smoking College Students: An ERP Study

Purpose: To investigate the effects of different load exercise on the hippocampal neurogenesis markers DCX and Aβ-42 in adult AD mice.

Methods: The 3-month-old APP/PS1 dual-transgenic AD mice were randomly divided into four groups: Control group (ADC), Low-load exercise group (ADL), Medium-load exercise group (ADM), and High-load exercise group (ADH). The wild-type control group (WTG) was also set. Six mice in each group. ADC and WTG group mice were fed naturally for 5 months. Intervention with different loads of aerobic exercise for every exercise group. Low load running speed was 12 m/min, medium load running speed was 15 m/min, and high load running speed was 18 m/min. 5d/w for 30 min/d for 5 months. Then, the Morris Water Maze (MWM) test was performed to estimate mice' learning and memory abilities, the immunofluorescence technique was used to determine the expression levels of DCX and Aβ-42 in the hippocampus.

Results: (1) In the process of navigation training, all mice' escape latencies gradually shortened. On the second day, the average escape latency of the ADC group was significantly higher than that of the WTG group (p<0.05). Compared with the ADC group and the ADL group, the mice in the ADM group were significantly reduced from the third day, and the mice in the ADH group were significantly reduced from the fourth day (p<0.05). In the MWM navigation experiment, for the time of through the area of the original platform, ADC group was significantly reduced than WTG group (p<0.01), ADM group and ADH group was significantly higher than ADC group and ADL group (p=0.01, p<0.05). (2) Compared with the WTG group, the expression of DCX in ADC group was lower but Aβ-42 was higher (P<0.05). Compared with ADC group and the ADL group, the expression of DCX in ADM group was higher but Aβ-42 was lower (P<0.05).

Conclusions: Medium and high load exercise can significantly improve the spatial learning memory ability of AD mice. Exercise, especially medium load exercise, can enhance the expression of DCX in AD mice and reduce the expression of Aβ in hippocampus.
to influence corticospinal excitability, which may reflect the underlying differences in neuromechanics between the two movements. Supported by the Department of Defense W81XWH-16-PHTBIRP-CR3A.

2322 Board #241 May 28 2:00 PM - 3:30 PM FRONTAL ASYMMETRY: A POTENTIALLY NOVEL BIOMARKER FOR SEDENTARY BEHAVIOR Battogtokh Zagtserlen1, Hunter Threadgil2, Hayley V. MacDonald1, Mark Richardson1, Philip Gable1,1 The University of Alabama, Tuscaloosa, AL, 2Florida State University, Tallahassee, FL.

(No relevant relationships reported)

Consistent with other human behaviors, sedentary behavior appears to be modulated, at least in part, by emotional and motivational processes. Past research has found that various emotion and motivation interactions show different patterns of asymmetric frontal cortical activity (FCA). It is possible that the decision, motivation, or the intention to engage in sedentary behavior may depend on the FCA. However, FCA has yet to be investigated as a potential neurobiological marker to predict sedentary behavior. PURPOSE: To examine the relationship between sedentary behavior and resting frontal asymmetry using electroencephalography (EEG).

METHODS: Forty-five college students participated in this study in exchange for partial course credit. A modified short version of the International Physical Activity Questionnaire was administered to determine habitual level of physical activity and sedentary time. Standard processing of EEG data was performed using BrainVision Analyzer software. Univariate correlation analyses were used to examine the relationship between frontal asymmetry and sedentary time. RESULTS: Average number of minutes spent sitting on a weekday (r(22) = 0.45, p = 0.027) and on a weekend day (r(22) = 0.55, p = 0.003) correlated with relative left frontal activity. CONCLUSION: To our knowledge, our data are the first to find a link between neurobiological markers of approach/avoidance motivation and sedentary activity, suggesting that reduced left frontal activity might be a novel neurophysiological marker for sedentary behavior.

2323 Board #242 May 28 2:00 PM - 3:30 PM Test-retest Reliability Of Cognitive And Neuroimaging Measures In Older Adults Timothy R. Macaulay, Judy Pa, Dominique Duncan, Jason Kutch, Lirong Yan, Christianne Lane, E. Todd Schroeder, FACSM. University of Southern California, Los Angeles, CA. Email: tmacaula@usc.edu

(No relevant relationships reported)

PURPOSE: Exercise is a promising strategy to help maintain brain function during aging. Determining the efficacy of exercise interventions requires reliable clinical outcome measures. In addition to measurement error and biological variability, long-term test-retest values can also be influenced by biasing factors - namely aging and practice effects. The purpose of this study was to determine the 12-week test-retest reliability of cognitive and neuroimaging measures in older adults.

METHODS: Twenty healthy older adults (14 females, 60-80 years of age) participated in two sessions of cognitive testing and multimodal 3T MRI scanning (Siemens MAGNETOM Prisma). All tests were performed by a single rater separated by a 12-week control period. The NIH Toolbox Cognition Battery (NIHTB-CB) was used to assess fluid and crystallized cognitive function. T2 FLAIR images were processed for white matter lesion volume (WMLV, ml) using the Lesion Segmentation Toolbox. T1 MPRAJE images were processed for gray matter volume (GMV, mm3) in 3 subcortical regions using FreeSurfer cortical segmentation. Statistical analyses were performed in SPSS (v.25) including mean percent difference, effect size, paired t-test, and two-way mixed intraclass correlation coefficient (ICC) with absolute agreement.

RESULTS: Results are presented in Table 1. There were no significant t-test values indicating good agreement between the two sessions. As expected, reliability was excellent in crystallized cognition and moderate to good in fluid cognition. Last, all brain segmentations showed good to excellent reliability.

CONCLUSIONS: The long-term (12-weeks) test-retest reliability of standard cognitive and neuroimaging measures were within an acceptable tolerance for use in future intervention studies. Although fluid cognition has the greatest implications for and neurobiological link to cognitive aging, investigators should consider the greater variability in these measures.
differences between conditions concerning performance, perceived exertion, and exercise intensity. However, little is known concerning its effects during sprint performance. The ergogenic effects of music seem to be influenced by its choice and exercise intensity. Music is widely used as an ergogenic aid before and during exercise to enhance performance. The ergogenic effects of music seem to be influenced by its choice and exercise intensity. However, little is known concerning its effects during sprint interval training (SIT).

PURPOSE: The purpose of this study was to analyze the effects of self-selected and experimenter-selected music on perceptual (affective responses, perceived exertion, attentional focus, and enjoyment), and performance (power output) during a SIT protocol compared to a control condition. METHODS: 14 active males (27.0 ± 3.9 years; 79.0 ± 9.1 kg; 176.4 ± 5.3 cm) performed SIT sessions composed by 8 x 15s all-out bouts against a fixed load of 9% of body mass interspersed by 120s of passive recovery under three conditions: self-selected music (playlist of high-tempo subject's favorite music), experimenter-selected music (“Power Workout” playlist from an online streaming music platform) and no-music (control). Affective responses, perceived exertion, and power output were measured throughout the protocols. Enjoyment and attentional focus (effort and recovery) were measured after each exercise session. RESULTS: Perceived exertion did not differ between conditions, but a main effect of time was detected (F2,26 = 4.02; p = 0.030; ηp2 = 0.236), but the post-hoc indicated only a tendency (p = 0.067) of lower values for the self-selected music (1.3 ± 1.3 a.u.) compared to experimenter-selected music (2.0 ± 1.2 a.u.). Attentional focus also differed between conditions (F2,26 = 6.62; p = 0.005; ηp2 = 0.337), however, just between self-selected (70.2 ± 30.3 a.u.) and no-music conditions (42.9 ± 27.1 a.u.; p = 0.043). Enjoyment and power output measures did not differ between conditions, however, a main effect of time was observed for peak power (F2,26 = 0.96; p = 0.59; ηp2 = 0.069), and mean power (F2,26 = 1.23; p = 0.307; ηp2 = 0.087), throughout the bouts (p = 0.001). CONCLUSIONS: Although there were no significant differences between conditions concerning performance, perceived exertion and enjoyment, the self-selected music during the SIT session increased the attentional focus.

Studies have shown that the ratio of blood lactate concentration to Rating of Perceived Exertion (HLa/RPE) and session RPE (sRPE) may be considered useful to detect overreaching and accumulated fatigue. However, no study has investigated their relationship. PURPOSE: To examine the relationship between HLa/RPE and sRPE during a period of intensified training. METHODS: Twelve young adults performed incremental exercise to assess their max power output (MPO). They performed 30 and 60-min interval workouts on a cycle ergometer over a 2-week period. Each session started with a 5-min warm-up at 25% MPO followed by 5-min at 50% MPO, 2-min at 75% MPO, 5-min at 75% MPO, 2-min at 25% MPO, 2-min at 25% MPO and 7-min at 50% MPO, which finished the 30-min session. During the first week, 4 sessions consisting of 30-min on Monday, Tuesday, Wednesday and a 60-min (30-min session back to back) on Thursday, were organized. After 3 days off,
the second week consisted of 3 consecutive 60-min sessions (Monday to Wednesday) with the last day (Thursday) being of 30-min. HLa and RPE were measured at the end of each stage of the interval training, and HLa/RPE computed for each session. sRPE was obtained after the sessions. Non-linear regression analysis was used to assess the relationship between HLa/RPE and sRPE. RESULTS: A very large negative relationship (r = -0.70, Root-mean-squared error =0.59, p<0.0001) was found (Figure 1). CONCLUSIONS: The negative relationship supports the concept that sRPE is a sensitive tool that, in addition to information about relative exercise intensity, might provide further information on accumulated fatigue. Coaches and exercise scientists without access to HLa measurement may gain insight into accumulated fatigue during periods of increased training by using sRPE.

Figure 1. Relationship between HLa/RPE and sRPE

Black dots represent all subjects’ training session; black line represents the predicted mean; the grey shade area represents the 95% confidence interval of the predicted mean.

2330 Board #249 May 28 2:00 PM - 3:30 PM
Association Between Perceived Recovery And Heart Rate In A Submaximal And Maximal Task In Firefighters
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The job of a firefighter is physically and mentally demanding and requires maximal or near maximal effort. As time on a shift progresses, these tasks may be performed in an under recovered state due to stressors of the work. Prior research in athletes has explored the relationship between subjective measures of stress/recovery and performance on exercise tests. As such, it is possible that a firefighter’s subjective assessment of recovery may influence objective measures of performance on an exercise test.

PURPOSE: To determine the association between perceptions of recovery and heart rate (HR) response in both a submaximal and maximal task in firefighters.

METHODS: 16 (14 male, 2 female) active-duty firefighters (35.3 ± 8.0 years, 179.1 ± 6.2 cm, 91.1 ± 16.9 kg) volunteered to participate. Participants completed a submaximal Queens College Step Test (SUBMAX) and a maximal treadmill test (MAX) with 24-72 hours separating each test. Prior to testing, participants stated their perceived recovery status (PRS; 0-10 scalar measure) to assess the relationship between PRS, RPE, HRPEAK, and HR.

RESULTS: An alpha of 0.05 determined statistical significance. RESULTS: Significant correlations were identified in the SUBMAX test between HRpeak (137.5 ± 12.7 bpm) and RPE (10.8 ± 1.8) (r = 0.707, P = 0.002), and HR (95.4 ± 18.8 bpm) and RPE (r = 0.619, P = 0.011), but neither were related to PRS (6.8 ± 2.4). On the MAX test, HRpeak (183.0 ± 9.7 bpm) and HR (147.4 ± 13.7 bpm) were not related to PRS (6.0 ± 2.1). Neither were related to either RPE (18.2 ± 1.1) or PRS (6.0 ± 2.1). CONCLUSION: These results suggest that among firefighters, PRS may not be a meaningful instrument to understand readiness for performance, regardless of task intensity. In addition, the task specific response for RPE may suggest self-reporting of effort is not an effective method to evaluate intensities greater than a submaximal level. Firefighter-specific measures should be developed to better determine subjective recovery and effort to guide implementation strategies with which to optimize health and performance readiness.

2331 Board #250 May 28 2:00 PM - 3:30 PM
Reducing Sedentary Time In Fibromyalgia (ReSeT-FM): A Feasibility Study
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Fibromyalgia (FM) is characterized by chronic widespread musculoskeletal pain, impaired functional mobility and extreme sedentary behavior (SB). Research suggests that individuals with FM who spend more time in SB experience greater clinical pain and overall impact of FM, irrespective of time spent in moderate to vigorous physical activity (PA). To date, no studies have investigated the potential impact of reducing SB on key clinical outcomes in FM. PURPOSE: To evaluate the feasibility of an 8-week behavioral intervention designed to replace SB with light PA in Veterans with FM. METHODS: Nine veterans with FM completed an 8-week intervention designed to reduce sedentary time, which included: 1) Education on the risks of being sedentary, 2) Wearing an activity tracker that provided behavioral prompts to move during prolonged sedentary behavior and synched with a phone app to self-monitor activity and stationary time, 3) Weekly 30-minute meetings with a study coach to set and review progress towards goals aimed at reducing time in SB. PA levels (Sedentary, High and Low light PA, High and Low moderate PA) were objectively measured at baseline and during the last week of the intervention with accelerometers worn for 1-week at each assessment. Participants also completed the Fibromyalgia Impact Questionnaire-Revised (FIQ-R) and Brief Pain Inventory pre and post intervention.

RESULTS: While the results trended in the right direction, the paired t-tests indicated no significant differences between pre and post sedentary levels (p=.23), low light PA (p=.32), high light PA (p=.12), low moderate PA (p=.18) and high moderate PA (p=.89). Pain severity (p=.022), pain interference (p=.002), and total FIQR score (p=.035) significantly decreased from pre to posttest. Bivariate correlations indicated that greater increases in high light PA were associated with greater reductions in pain severity (r = -.750, p=.020) and total FIQR score (r=.803, p=.009). CONCLUSION: While the intervention did not significantly decrease sedentary time or increase light PA in veterans with FM, these results suggest that increasing light PA in FM patients could potentially have a positive impact on pain outcomes. This study was funded by the School of Health and Human Sciences at IUPUI.
Short-term grit and resilience training, as well as internal self-talk training have increased physical performance. However, little is known about longer mental training.

**PURPOSE:** Perform 21 days of mental training to observe how performance and physiological variables change.

**METHODS:** Participants were 33 college-aged (16 mental strength (MS), 17 control (CON)) individuals (20.7 +/- 1.2yrs, weight 72.3 ± 9.3kg, height 1.77 ± .09m, VO
dynamometer at 30% of their baseline for as long as they could tolerate. Participants’ inhalation of the essential oils was performed by placing a small amount of each essential oil under the noses of all participants. Participants in the placebo group had a strip with no essential oil. After establishing participants’ baseline, the essential oils were randomly administered from 5-100% in 5% increments. The results are presented as mean ± standard deviation. Chi square analyses indicated that participants in the Bergamot essential oil group had a statistically significant longer duration of effort (p < 0.05) than the Placebo group. The results of this study suggest that the Bergamot essential oil may contribute to a reduced perception of effort. Finally, MS training reduced O2 consumption, contributing to a decreased RPE and increased TTE duration.

**RESULTS:** TTE significantly increased for MS (8.8 ± 13.2%) and decreased for CON (-6.6 ± 14.6%, p < 0.05). VO2, VE, RR, and fatigue, and pain as a percentage of total time as well as absolute times (0-3 minutes) were also analyzed. A VO2 peak was performed on a cycle ergometer on day one. Subsequent visits consisted of four test sessions to exhaustion (TTE) performed 10% above ventilatory threshold. Each session was separated by 48 hours. A VO2 peak was used on a cycle ergometer on day one. VO2, ventilation (VE), respiratory rate (RR), tidal volume (TV), heart rate (HR), VO2, and RPE scores (0-100) for pain and fatigue were determined during pre- and post-test. Participants took GRIT-S and CD-Risc psychological surveys before pre-and post-TTE. RM-ANOVA were done to compare group, time, and trial differences as a percentage of total time as well as absolute times (0-3 minutes).

**RESULTS:** TTE significantly increased for MS (8.8 ± 13.2%) and decreased for CON (-6.6 ± 14.6%, p < 0.05). VO2, VE, RR, and fatigue, and pain as a percentage of total time as well as absolute times (0-3 minutes) were also analyzed. RM-ANOVA were done to compare group, time, and trial differences as a percentage of total time as well as absolute times (0-3 minutes). Chi square analyses indicated that participants in the Bergamot essential oil group had a statistically significant longer duration of effort (p < 0.05) than the Placebo group. The results of this study suggest that the Bergamot essential oil may contribute to a reduced perception of effort. Finally, MS training reduced O2 consumption, contributing to a decreased RPE and increased TTE duration.

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Neuromuscular electrical stimulation (NMES) evokes involuntary muscle contraction and may be a safe and effective treatment option for muscle strengthening. However, little research exists on exercise tolerance to NMES in older adults. PURPOSE: The aim of this study was to determine changes in stimulation intensity and perceived pain pre-post 4 weeks of NMES training in older adults. METHODS: Participants (n = 9) were healthy, older adults (69.9 ± 2.4 years). Subjects performed maximal voluntary contractions (MVC) of the quadriceps muscles on an isokinetic dynamometer to determine maximum voluntary contraction (MVC) and isometric peak torque with the knee at 60° and a 40-min NMES treatment was applied to the quadriceps muscles of each leg 3 times per week for 4 weeks. Stimulation frequency was 60 Hz with repeated cycles of 10s on and 15s off. Stimulation intensity was set to achieve 15% MVC and was increased every 5 minutes if the torque dropped below 15% MVC. Using a standard pain scale, participants were asked to rate perceived pain (0 = no pain, 10 = worst pain possible) during the NMES at 1, 20, and 40 minutes of stimulation on each leg during treatment day 1, 7, and 12. Stimulation intensity was also recorded. Pain scores and stimulation intensity were averaged across right and left leg. Pain score and stimulation intensity were each analyzed with a 3 x 3 repeated measures analysis of variance (DAY x MIN), with significance set at p ≤ 0.05. RESULTS: For perceived pain, there was a significant main effect for DAY (p < 0.001) and DAY x MIN (p = 0.004). For MIN, perceived pain significantly increased (MIN 1: 3.2 ± 0.8 vs MIN 20: 4.5 ± 0.7; p = 0.009) and then remained stable (MIN 40: 5.2 ± 0.8; p = 0.052). For DAY, perceived pain decreased 36.2% (DAY 1: 5.8 ± 0.8 vs DAY 7: 3.7 ± 0.7; p = 0.001) and then remained stable (DAY 12: 3.4 ± 0.9; p = 0.488). For stimulation intensity, there was a significant main effect for DAY (p = 0.001). Stimulation intensity for DAY increased significantly (DAY 1: 13.3 ± 0.9 vs DAY 7: 16.3 ± 1.5 mA; p = 0.003) and then decreased (DAY 12: 14.8 ± 1.3 mA; p = 0.012). CONCLUSION: Findings indicate that participants experienced moderate discomfort during the first NMES treatment. However, perceived pain decreased significantly by day 7, demonstrating that NMES may be a feasible muscle strengthening option for older adults.

Exercise-induced fatigue and pain negatively affect exercise tolerance; however, the influence of these sensations on regulation of neuromuscular (NM) and perceptual responses during locomotor exercise has yet to be determined. PURPOSE: To investigate the effects of one leg exercise-induced fatigue and pain on the contralateral leg exercise tolerance, NM and perceptual responses. METHODS: Nine healthy young men (age: 26.7 ± 7 years) performed right leg sustained contraction at 25% of isometric maximal voluntary contraction (25%MVC) to task failure. In three separate sessions, the 25%MVC protocol was preceded by either right leg interventions including: 1) 6 min rest (CON) ii) cycling to exhaustion at 80% of peak power output (CYCL) and iii) CYCL immediately followed by blood flow occlusion to right leg task failure (OCCL). The experimental sessions were selected randomly. NM function was characterized by assessing IMVC and voluntary activation (VA) using twitch interpolated technique. Right leg pain and rating of perceived exertion (RPE) were also recorded during sustained contraction. RESULTS: 25%MVC to task failure was longer in CON (221 ± 106 s) than CYCL (141 ± 67 s) and OCCL (119 ± 51 s) (p < 0.05). Relative to baseline, the drop on IMVC was similar for CON (40±10%), CYCL...
The current study shows that S-RPE was strongly related to average of entire exercise session O-RPE. Previous literature has shown that a single session-RPE rating may accurately reflect the intensity of an exercise session (Haddad, 2017). Future studies should explore the effect of varied duration, intensity, and mode of exercise on S-RPE.

2344 Board #263 May 28 2:00 PM - 3:30 PM
Exercise-induced Hypoalgesia Differ At Sites Local And Remote To The Exercising Muscle Group
Ashley M. Ventura, Jessica A. Peterson, Cameron Lohman, Michael G. Bemben, FACSM, Rebecca D. Larson, Christopher D. Black, FACSM. The University of Oklahoma, Norman, OK. (Sponsor: Christopher D. Black, FACSM) (No relevant relationships reported)

Disfunction of endogenous pain-inhibitory function such as exercise-induced hypoalgesia (EIH) may predict development of chronic pain conditions. While EIH has been shown to occur in both the exercised muscle group and in remote unexercised muscle groups, few studies have compared the magnitude of EIH in an exercised muscle group and remote muscle groups in the same individuals following the same exercise bout. PURPOSE: The purpose of the study was to examine the EIH response at four different sites following a bout of single leg isometric exercise. METHODS: Pressure pain thresholds (PPT) of 102 participants (50 females; 52 males) were assessed bilaterally in the vastus lateralis (VL) and brachioradialis (BR) using a pressure algometer before and after isometric knee extension at 25% of maximal voluntary contraction held until task failure using their dominant leg. The percent change was calculated for the exercised leg and the remote, unexercised limb. RESULTS: PPT increased in the left BR (18.1% ± 24.7%; p<0.001, d=0.275), right BR (14.4% ± 26.1; p<0.001, d=0.233), non-dominant VL (17.4% ± 24.0; p<0.001, d=0.318) and the dominant VL (34.5% ± 28.3; p<0.001, d=0.643). There were no differences between the left and right BR and the non-dominant VL with regards to the EIH response (p>0.05), however the exercised leg demonstrated a greater EIH response compared to the remote, unexercised limbs (p<0.001). CONCLUSION: EIH occurred in all sites. Possible limitations include convenience sample and self-reported data. More work is needed to examine the magnitude of EIH in different muscle groups using varying modes of exercise.

2341 Board #260 May 28 2:00 PM - 3:30 PM
Internal Load Metrics In Division III Men's And Women's Soccer: The Significance Of Sleep Quality
Andreas Stamatia1, Grant Morgan2, SUNY Plattsburgh, Plattsburgh, NY. 1Baylor University, Waco, TX. Email: astam004@plattsburgh.edu (No relevant relationships reported)

Weearable technology is the number one fitness trend for 2019. Sleep quality (SQ), sleep duration, mood, stress, and fatigue have been shown to affect performance in sports through physiological and psychological mechanisms. Division III (DIII) schools are the biggest participants in NCAA. In terms of number of athletes, soccer is the second most popular sport in NCAA. PURPOSE: To study the relationship of S-RPE with differentiated SQ, sleep duration, mood, stress, and fatigue in a DIII men’s and women’s soccer team. METHODS: All 56 players agreed to participate (M=19.4, SD= 1.09). Data were collected using readiness surveying based on the Titan 1+ sensor protocol. Subjective information on SQ, sleep duration, mood, stress, soreness, and fatigue was reported by each athlete before every practice and game. All data, but sleep (in hours), were quantified via a 0-10 visual analog scale (e.g., SQ: 0=Excellent, 10=Poor). In total, 200 assessments took place in pre- and in-season. The analysis consisted of Pearson correlations, t tests, and regression analysis in R. RESULTS: The correlations of SQ with the other variables were: sleep duration (r=-.43), mood (r=-.70), stress (r=-.62), soreness (r=-.53), and fatigue (r=-.83). There were no statistically differences between male and female athletes on any of the variables included in the analysis. Therefore, the data were analyzed in aggregate. The regressions were estimated to examine the expected increase in these outcomes for a one-point improvement in reported SQ (e.g., a one-point improvement in SQ is associated with an expected 0.98-point improvement in reported fatigue; p<.001). CONCLUSIONS: On average, the findings indicate a strong relationship between SQ and hours of sleep, mood, stress, fatigue, and soreness in this DIII soccer program. Therefore, there is preliminary evidence to support that all stakeholders may need to focus on SQ strategies (including sleep duration) as means to manipulate several internal load variables that affect performance in sports. Future studies should add external metrics (e.g., speed/sprint/impact metrics), investigate differences between practice and game-day data and Divisions, and collect information from larger samples. Possible limitations include convenience sample and self-reported data.

2342 Board #261 May 28 2:00 PM - 3:30 PM
Session RPE During A Constant Load Submaximal Treadmill Exercise
Anjuli Gairola, Tharaina Salazar, Ruth Georges, Kristen Betterman. Cabrini University, Radnor, PA. Email: ag3456@cabrini.edu (No relevant relationships reported)

Session-RPE (S-RPE) is a measure of perceived exertion experienced for an entire exercise session but estimated post-exercise following a prior defined period of rest (Thekkada, 2006). PURPOSE: To study the relationship of S-RPE with differentiated (Leg-RPE, Chest-RPE) and undifferentiated (Overall-RPE) RPE during constant load submaximal treadmill exercise. METHODS: A total of 18 participants (Males = 8, and Females =10; 21.5 years ± 2.4 years) were healthy physically active (as per ACSM guidelines) participants from Cabrini University volunteered for the study. Each subject completed a 15-minute moderate intensity constant load treadmill exercise. During exercise, at minute 5, 10, and 15; L-RPE, C-RPE, and O-RPE were estimated using the Adult OMNI-Walk/Run Scale. The average RPE for leg (L-RPEavg), chest (C-RPEavg), and overall body (O-RPEavg) for entire exercise session was also calculated. 5-minute post-exercise S-RPE was obtained for overall body. RESULTS: S-RPE was significantly correlated (r=-0.41-0.55, p<0.01) with O,L,C- RPEavg and O,L,C- RPE for 5,10, and 15 minute. The highest correlation (r=0.55, p<0.01) was observed between S-RPE and O-RPEavg. CONCLUSION: The current study shows that S-RPE was strongly related to average of entire exercise.
High-intensity interval training (HIIT) is a popular and effective time-efficient alternative to moderate-intensity continuous training for improving cardiorespiratory fitness in a wide range of populations. However, there is limited research investigating the most effective and practical way to prescribe training intensities for HIIT.

**PURPOSE:** The purpose of this study was to identify a practical method for engaging in exercise that could improve cognitive function. We tested whether cognitive function improves after exercise at subjectively selected intensity by using ratings of perceived exertion (RPE). In addition, we examined the relationship between the improvement in cognitive function and cardiac autonomic nervous system.

**METHODS:** Twelve participants performed cognitive tasks in a running or resting condition with a randomized crossover design. In the running condition, the participants ran on a treadmill for 10 min at the running speed corresponding to the RPE10-12 for each participant. Cognitive tasks including the Spatial Delayed Response task and Go/No-Go task were performed before and after running or resting. Cardiac autonomic nervous activity was obtained by calculating from heart rate variability during cognitive tasks.

**RESULTS:** In the running condition, the RPE was 11.1 ± 0.8 immediately after running. Running at the RPE10-12 significantly improved reaction time in the Go trials (688 ± 191 [Pre] vs 568 ± 159 ms [Post], P < 0.05). In the resting condition, cognitive performance was unchanged throughout the experiment (628.5 ± 163.1 ms [Pre] vs 669.6 ± 139.7 ms [Post], P = 0.05). Parasympathetic nervous activity remained lower after running at RPE10-12 (586 ± 424 ms [Pre] vs 373 ± 322 ms [Post]), but sympathetic nervous activity was not changed. Moreover, the Δ reaction time (Post-Pre) tended to be positively correlated with Δ parasympathetic nervous activity (r = 0.514, P = 0.088). In contrast, a reaction time was not associated with Δ sympathetic nervous activity (r = 0.177, P = 0.581).

**CONCLUSIONS:** The present study demonstrated that subjectively selected intensity of exercise can improve cognitive function. The improvement in cognitive function after exercise may be associated with cardiac autonomic nervous activity.
The opioid crisis has made imperative the need for effective biopsychosocial interventions for chronic pain. The Empower Veterans Program (EVP) at the Atlanta VA is an interdisciplinary 10-week outpatient program involving group psychoeducation, psychotherapy, and physical therapy for Veterans with chronic pain. The aim is to improve patients’ self-management of pain through increasing coping skills and functioning. Increasing psychological flexibility, the ability to persist or change behavior in pursuit of goals and values, and decreasing pain catastrophizing are two processes that may contribute to the impact of pain, and therefore may influence the efficacy of physical therapy.

**PURPOSE:** To determine whether psychological flexibility and pain catastrophizing predict pressure-induced pain interference in Veterans with chronic pain.

**METHODS:** Baseline measures were assessed in a sample (N=373) of Veterans enrolling in EVP. Stepwise linear regression was used to predict self-reported pain interference (Multidimensional Pain Inventory-Interference/MPI). Model predictors included general and pain-specific measures of psychological flexibility (General Acceptance and Action Questionnaire/AAQ-II; Specific Chronic Pain Acceptance Questionnaire/CPAQ), pain catastrophizing (Pain Catastrophizing Scale/PCS), and average pain intensity (Numeric Rating Scale/NRS). Demographic (age, gender and race) and physical performance (Timed Up and Go) were included in the model as covariates.

**RESULTS:** Sample characteristics were age (55.5 ± 0.4, gender: 69.2% male), and race (15.9% white/ 79.1% black). The overall adjusted R² of the model was 0.30 (p = 0.008). Psychological flexibility (CPAQ β=-.26; AAQ β =.23), pain catastrophizing (PCS β =-1.15), and pain intensity (NRS β = 24) were significant predictors of pain interference.

**CONCLUSIONS:** Psychological flexibility and pain catastrophizing are two important psychological processes that contribute to pain interference. Rehabilitation strategies should consider the impact and response to treatment related to these constructs, especially aligning exercise and physical activity with values and behavior change principles.
PURPOSE: To quantify the reoccurrence of EOV during CPET in HF patients that previously demonstrated EOV during a CPET prior to their LVAD implantation surgery.

METHODS: A retrospective analysis of HF patients that received LVAD implantation surgery from 1988-2018 was conducted. CPET data was collected and evaluated for EOV from patients that had testing done within one year both pre and post LVAD. EOV was defined as oscillatory ventilations that persist for at least 60% of the exercise test and amplitude of 15% or more of the average resting value.

RESULTS: Among 117 female participants (age: 38.7 ± 7.6 years) underwent muscle mass (dual-energy x-ray absorptiometry), muscle strength (knee extensors isokinetic peak torque at 60 °/s), and physical function (sit-to-stand, timed up-and-go, and six-minute walk tests) evaluation. Spearman's rank correlation coefficient was used to identify associations. Mann-Whitney U test was used to compare the physical function of participants in the lowest and highest quartiles of muscle mass and strength.

RESULTS: The table below presents the association between muscle mass, muscle strength and physical function of the studied muscle-related phenotypes, only muscle strength was significantly related to physical function. Compared to the highest quartile of muscle strength, participants in the lowest quartile exhibited significantly worse performance in the timed-up-and-go test (6.3 ± 0.9 vs. 5.8 ± 0.9, p= 0.048), but did not reach statistical significance the sit-to-stand (14.6 ± 2.9 vs. 16.3 ± 4.0, p= 0.124) and six-minute walk (569.6 ± 54.9 m vs. 599.8 ± 82.1 m, p= 0.178) tests.

CONCLUSION: Muscle strength, but not muscle mass, is associated with physical function in long-term gastric by-pass women; which support a growing body of evidence demonstrating that strength has a better prognostic value compared to muscle mass to predict worsening disability.

Key words: Gastric bypass, Muscle strength, physical functional performance.

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<th>The association between muscle mass, muscle strength and physical function in long-term gastric by-pass women.</th>
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<td>Sit-to-stand test</td>
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* Denotes significant correlation (p<0.05).

Patients referred for cardiovascular stress testing with limited functional capacity due to age, deconditioning, or clinical comorbidities may be unable to achieve an adequate exercise stress level to render a diagnostic cardiovascular stress test. The Bruce treadmill protocol is the current clinical standard, but may be inappropriate for some patients due to large changes in speed/grade between stages. The Duke Activity Status Index (DASI), a validated 12-item questionnaire that utilizes self-reported physical work capacity to estimate metabolic equivalents (METS), may help clinicians select the most appropriate stress test protocol. PURPOSE: To determine if DASI estimated MET levels can predict the achievement of an adequate diagnostic exercise stress test using the Bruce treadmill protocol. METHODS: DASI questionnaires were administered to patients prior to stress testing. DASI estimated METS were calculated from the total score. Measured METs were determined from peak treadmill speed and grade. Criteria for determining a suboptimal exercise stress was defined as inability to complete stage 1 of a Bruce protocol. RESULTS: A total of 400 patients completed the same questionnaires. Mean DASI estimated METS and measured METS were 8.1 ± 1.7 and 8.4 ± 2.8, respectively. Logistic regression analysis showed DASI estimated and measured METs predicted a suboptimal test result (P=0.001). Receiver operator characteristic curve (Figure 1) demonstrated a DASI estimated MET level ≤ 7.4 was the optimal threshold to predict a suboptimal test result, AUC=0.883, SE=0.037 (0.811-0.956), sensitivity= 94%, specificity= 73%, P=0.001. CONCLUSIONS: Findings suggest the Duke Activity Status Index may be an effective way to stratify stress type in the clinical setting. Further study is needed to assess if more conservative stress protocols with smaller incremental changes in workload would increase the likelihood of achieving a diagnostic cardiovascular stress result.

Muscle strength, but not mass, is associated with physical function in long-term gastric by-pass women

Muscle-related phenotypes have been linked to physical function in the general population; however, this relationship has yet to be examined in long-term gastric by-pass women.

PURPOSE: To examine the association between muscle mass, muscle strength and physical function in women who have been doing gastric by-pass for over 2 years.
The systolic RV function remained unchanged. Training per week for six weeks. This was not proportional to changes in VO₂ max.

Larger RV chamber size was present after less than 5 min high-intensity exercise. The minimum volume of exercise training required for the right ventricular (RV) adaptation’s changes to occur is unknown. We aimed to determine possible effects on RV size and function with extremely low volume, high-intensity exercise training (HIT) in previously untrained subjects.

METHODS
Healthy, young subjects not performing regular training were recruited for six weeks of supervised HIT, three times per week. Each of the 18 sessions consisted of three 30 seconds all-out sprints on a bicycle ergometer (breaking force 7.5% of the subject’s body weight), separated by two minutes of low intensity cycling. A maximal cardiopulmonary exercise test (CPX) and an echocardiogram (echo) at rest were performed before and the week after the last session. Right atrial volume (RAV), RV inflow-tract diameter (RVId) and end diastolic area (RVEDA) were measured. RV systolic function was determined as fraction area change (FAC), tricuspid annular plane systolic excursion (TAPSE) and global longitudinal strain based on 2D speckle tracking in 6 segments of free wall and septum (RVGs).

RESULTS
Maximal oxygen uptake (VO₂ max) was determined in 27 subjects and increased from 3.0±0.8 L/min to 3.4±0.8 L/min post training, mean ±14%, p<0.001. Pre- and post HIT echo data were available in 28 subjects (27±5 yrs, 16 male, BMI 24±2 kg/m²). RVId and end diastolic area (RVEDA) were measured. RV systolic function was determined as fraction area change (FAC), tricuspid annular plane systolic excursion (TAPSE) and global longitudinal strain based on 2D speckle tracking in 6 segments of free wall and septum (RVGs).

CONCLUSION
The Bruce protocol (Bruce) is a progressive treadmill test with an aggressive initial grade that was developed for use in adults, and is often used to assess cardiac patients. Due to the steep grade, young children may terminate the Bruce prematurely. The University of Kentucky Pediatric Exercise Physiology Lab has developed a protocol (Pep Lab) with lower grades which we hypothesized would be better tolerated and potentially elicit greater peak VO₂ and cardiovascular responses.

PURPOSE: To compare peak oxygen uptake (pVO₂), heart rate (pHR, bpm), systolic blood pressure (pSBP, mmHg), and respiratory exchange ratio (pRER) responses to the Bruce versus the Pep Lab in 43 (22) young (7-11 yr old) children of varying adiposities. We also evaluated each subject’s perception of difficulty between the two protocols.

METHODS: Subjects completed the Bruce and the Pep Lab protocols in a random order 1 week apart. pVO₂ and pHR were determined with an integrated metabolic system, and pSBP was determined by manual auscultation. Verbal encouragement was provided during both testing sessions and test completion based on volitional fatigue. Results are expressed as mean ± SE and significance p < 0.05.

RESULTS: The Bruce versus Pep Lab pVO₂ (43.6 ± 1.5 vs 41.9 ± 1.5) and pHR (186.6 ± 2.0 vs 188.2 ± 2.2) did not significantly differ. However, pSBP during the Bruce was significantly lower (136.4 ± 1.4 vs 143.1 ± 1.1) and the Bruce pRER was significantly higher (1.065 ± 0.018 vs 1.013 ± 0.014) than the Pep Lab. Bruce and Pep Lab protocol pVO₂, pHR, pSBP, pRER were significantly correlated (r = 0.61, 0.47, 0.53 and 0.42, respectively). The majority (88%) of the children perceived the Bruce to be more difficult.

CONCLUSIONS: A less steep protocol can elicit similar cardiopulmonary results as the Bruce. Protocols that are perceived as less difficult may help guarantee that children do not terminate their exercise tests prematurely to reaching their true pVO₂.

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and VO2 (3.32±0.51 vs 2.98±0.29 liters, p<0.05) were seen in the low IC/Vc group (>65%) compared to the high group (>65%). LFEL% and VT1%/C% did not correlate with PWV or VO2.

CONCLUSIONS: Ventilatory constraint analysis yielded normative data. EFL was associated with ventilatory reserve. However, unlike previous data in cystic fibrosis, VE/MVV was not correlated to ventilatory constraint. While a shift in EELV (IC/VC%) may be considered abnormal in underlying respiratory diseases, the ratio in this study was associated with increased exercise performance reflecting different underlying compensatory breathing mechanics.

2359  Board #278  May 28 3:00 PM - 4:30 PM
The Index Of Physical Performance In Muscle Damage Biomarker In Young Athletes
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(No relevant relationships reported)

PURPOSE: To investigate the index of the physical performance among different levels of serum creatine kinase in youth athletes.

METHODS: 53 youth male athletes ages of 12 to 18 years were divided into three groups, low-level group (LL, n=17), middle-level group (ML, n=20), and high-level group (HL, n=16) by CK level of serum (reasonable CK range: 82-1,083 U/L for male athletes). Fasting blood samples of CK and myoglobin were collected in the morning. The physical performance test included griping, low back muscle strength, curl up, standing broad jump, lower limb flexibility, 30m sprint, vertical jump, whole-body reaction time, agility, and yo-yo test for aerobic endurance. One-way ANOVA and Pearson’s correlation were used to determine the difference between physical performance and biomarkers.

RESULTS: In biomarkers, the value of CK had positive correlation between low back muscle strength (r=0.278, p <0.05) and reaction time (r=0.412, p<0.01). There was a negative correlation between CK and aerobic endurance (r=-0.288, p <0.05). The myoglobin of LL(19.76 ng/ml) was significantly lower than ML and HL (25.18 ng/ml; 28.96 ng/ml) (p <0.05). The aerobic endurance of LL was significantly higher (26.6%) than HL (p<0.05). In reaction time, LL and ML(267.12ms; 284.95ms) were significantly faster than HL(367.27ms)(p<0.05). There were no significant differences in other physical performance.

CONCLUSIONS: This study suggested that the performance of whole-body reaction time and yo-yo test perhaps to be reminded for muscle damage or fatigue in the reasonable CK range. In addition, future research can regularly implement both physical indexes to track muscle fatigue.

2360  Board #279  May 28 3:00 PM - 4:30 PM
Chronic Fatigue In Children With Chronic Lyme Disease Identified By Serial Cardiopulmonary Exercise Testing
(No relevant relationships reported)

In the U.S., annual incidence of Lyme disease is approximately 300,000. In an estimated 5-30% of cases, post-treatment Lyme disease syndrome (PTLDS) develops; symptoms include post-exertional malaise characteristic of myalgic encephalomyelitis. The contribution of autonomic regulation has not been elucidated. PURPOSE: To evaluate cardiovascular responses to serial cardiopulmonary testing in patients with PTLDS. METHODS: 14 patients with PTLDS and 8 sedentary controls underwent 2 maximal exercise tests separated by 24 hours. Heart rate (HR) was measured continuously via electrocardiogram. Expired air was collected for determination of anaerobic threshold (AT) using V-slope methodology and maximal exertion was defined as a respiratory exchange ratio >1.09. Independent-samples t-tests compared baseline characteristics of PTLDS patients and controls. Linear regression determined the effect of PTLDS diagnosis on HR at AT and peak holding workload constant. RESULTS: Patients were 44.0±11.0 years old, weighed 69.8±16.2 kg, and achieved a peak VO2 of 23.8±6.2 mL/kg/min during test 1. HR was 116.2±21.8 bpm at AT and 162.6±25.1 at peak. PTLDS and controls did not differ in peak VO2 during test 1 (p=0.161), test 2 (p=0.134). The difference between test 1 and test 2 (p=0.498) was noted. HR at AT was comparable in test 1 (p=0.127) but different in test 2 (p=0.001). HR at peak was different in test 1 (p=0.001) and test 2 (p=0.001). During test 1, holding workload constant, PTLDS patients had lower peak HR by 19.5 bpm (p=0.033; 95% CI: -37.3 to -1.8). During test 2, holding workload constant, PTLDS predicted a lower HR by 26.8 bpm at AT (p=0.004; 95% CI: -39.9 to -8.8) and 24.3 bpm at peak (p=0.007; 95% CI: -42.7 to -7.7). CONCLUSIONS: Patients with PTLDS demonstrated abnormal cardiovascular responses to exercise. Despite accomplishing the same VO2, and holding workload constant, the HR response was diminished in the post-exertional state, potentially indicating dysautonomia in PTLDS.

2361  Board #280  May 28 3:00 PM - 4:30 PM
Normalizing Cardiorespiratory Fitness To Fat-free Mass Improves Mortality Risk Prediction In Overweight Adults From The Ball St Cohort
Mary T. Imboden1, Leonard A. Kaminsky, FACSM2, James E. Peterman3, Haylee L. Hutzler2, Mitchell H. Whaley, FACSM2, Bradley S. Flenor2, Matthew P. Harber, FACSM2. 1George Fox University, Newberg, OR. 2Ball State University, Muncie, IN. (Sponsor: Matthew P Harber, FACSM)
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(No relevant relationships reported)

PURPOSE: Cardiorespiratory fitness(CRF) is a significant predictor of mortality outcomes in various populations, including overweight and obese adults. However, CRF is commonly expressed normalized to total body weight (VO2peak) which may weaken the relationship in obese adults as fat-free mass (FFM) is directly related to CRF, and increased body fat is associated with lower CRF in adults. Therefore, this study aimed to assess the relationship between CRF normalized for FFM(VO2peak) and all-cause mortality, as well as compare the predictive ability of VO2peak and VO2peak normalized in a cohort of self-referred overweight and obese adults.

METHODS: Participants included 1,021 overweight and obese adults (520 men, 501 women; BMI: 30.8±5.3) who completed a cardiopulmonary exercise test (CPX) and body composition assessment between 1970-2016 to determine CRF. Participants were included if their BMI >25 kg·m-2 and/or waist circumference was >88 cm in women and >102 cm in men. FFM was estimated using the skinfold method to estimate FFM. Participants were followed for 17.8 ± 10.8 years after their CPX and body composition assessments for mortality outcomes. Cox-proportional hazard models were performed to determine the relationship of VO2peak with mortality outcomes. A Wald Chi-square test of equality was performed to compare the predictive ability of CRF expressed as VO2peak and VO2peak normalized.

RESULTS: Overall, VO2peak was inversely related to all-cause mortality, with an 11.8% lower risk per 1 ml·kgFFM·min-1·kg−1·min−1 improvement, respectively (p<0.01). VO2peak normalized was shown to be a significantly stronger predictor of all-cause mortality than VO2peak (parameter estimates: -0.44 vs. -0.18, p<0.05 respectively).

CONCLUSIONS: Body composition is an important factor when considering the relationship between CRF and mortality risk. Clinicians should consider normalizing CRF to FFM when feasible, especially in individuals with excess body fat as it will strengthen the predictive power of the measure.

2362  Board #281  May 28 3:00 PM - 4:30 PM
Hemodynamic Performance In Patients With A Bicuspid Aortic Valve During Treadmill Ramp Exercise Testing
Mallorc C. Rice, Wayne A. Mays, Andrau L. Grzesczak, Sandra K. Knecht, Justine D. Shertzer, Samuel G. Wittekind, Clifford Chin, Adam W. Powell, Michael Khoury. Cincinnati Children’s Hospital Medical Center, Cincinnati, OH.
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(No relevant relationships reported)

PURPOSE: To evaluate the effect of a bicuspid aortic valve on the hemodynamic response to a treadmill ramp protocol in pediatric patients. METHODS: We evaluated 18 patients with a bicuspid aortic valve (BAV) and 18 normal subjects (C), age and size matched, using a Ramp Treadmill protocol. Neither group was treated with a B Blocker. Resting aortic valve peak gradient (PG) and shortening fraction (SF) were evaluated by echocardiography for the BAV group. Systolic blood pressure (SBP), cardiac output and stroke volume (SV) were obtained at rest and maximal exercise. Maximal oxygen pulse (MO2P), percent predicted oxygen pulse (%PO2P) and respiratory exchange ratio (RER) were obtained at maximal exercise. RESULTS: There were no significant differences between the BAV and C groups in age (14.6 ± 2.1 vs 15.8 ± 3.1 (yr), height (1.63 ± 0.1 vs 1.66 ± 0.12 (m)) or weight (55.7 ± 15.1 vs 57.6 ± 13.2 (kg)). The BAV group had a resting PG of 16.5 ± 8 mmHg and a SF of 39.5 ± 4.9 %. The SBP in the BAV group was significantly decreased at rest (131 ± 9 vs 120 ± 10 mmHg) (p<0.05) and exercise (160 ± 14 vs 174 ± 19 (mmHg) (p<0.02) compared to the C group. BAV group had a significantly decreased SV (56 ± 13 vs 64 ± 21 (ml/beat)) (p<0.04) compared to at rest. The decreased MO2P in the BAV group approached significance (66 ± 1.7 vs 76.1 ± 1.6 (ml/beat) P=0.06) compared to C. In BAV, %PO2P was significantly decreased (94 ± 24 vs 113 ± 18 %) (p=0.01). Max RER was not significantly different in BAV and C groups (1.19 ± 0.08 vs 1.19 ± 0.06), MO2P significantly correlated to cardiac output (r=0.67 p<0.05). Significance was set at p< 0.05. CONCLUSION: BAV and C groups reached the same intensity of exercise as reflected by the RER. The BAV group had decreased systolic blood pressure and O2 Pulse response to exercise. These data suggest that in the face of a mild aortic valve gradient and normal shortening fraction, these BAV patients had a diminished hemodynamic response to exercise.

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CONCLUSIONS: The purpose of this study was to determine if patient characteristics could predict ability to achieve an adequate heart rate response during exercise stress testing.

METHODS: Baseline characteristics including age, race, gender, height, weight, body mass index (BMI), referring provider type, Duke Activity Status Index (DASI) score and stress type (pharmacologic versus exercise) were collected on all patients who completed cardiovascular stress testing. All exercise tests were performed using a standard Bruce treadmill protocol. Criteria for determining an adequate exercise stress test was ≥85% of age-predicted maximal heart rate. RESULTS: Of 608 cardiovascular stress tests, 354 performed exercise stress. Patient characteristics of those who underwent exercise stress was as follows: female= 175 (49%), Caucasian=173 (47%), African American=146 (45%), mean age was 57 ± 13 years, mean BMI=31.4 ± 8.1 kg/m², mean DASI estimated METS= 8.1 ± 1.7 and mean METS achieved= 8.4 ± 2.8. Fifty-eight (19%) patients did not achieve ≥85% APMHR. Exercise time, DASI estimated METS and METS achieved were significant predictors of achieving ≥85% APMHR (all P's <0.02). Age, race, gender, height, weight, BMI, provider type were not significant (all P's >0.11). CONCLUSIONS: In conclusion, exercise duration during graded exercise testing predicted achievement of adequate stress response during cardiovascular stress testing. Strategies to select an appropriate exercise test protocol allowing longer exercise duration may improve the ability to reach target heart rate during cardiovascular stress testing.

PREDICTION OF SUBOPTIMAL EFFORT (<85%APMHR) BY DASI EST.METS

AUC = 0.659 (0.589-0.730) P=0.0001

Optimal Threshold for Suboptimal Effort

= 8.0 DASI est.METS

Sensitivity=65%, Specificity=65%

2364 Board #283 May 28 3:00 PM - 4:30 PM
PREDICTORS OF ACHIEVING AN ADEQUATE HEART RATE RESPONSE DURING CARDIOVASCULAR EXERCISE STRESS TESTING
Rachel Myers. Virginia Commonwealth University Health System, Richmond, VA. (Sponsor: Ross Arena, FACSVM)
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(No relevant relationships reported)

 Cardiovascular exercise stress testing is a noninvasive, diagnostic tool to assess for myocardial ischemia. Achievement of ≥285% of age-predicted maximal heart rate (APMHR) is commonly used as criteria to define an adequate stress test. PURPOSE: The purpose of this study was to determine if patient characteristics could predict ability to achieve an adequate heart rate response during exercise stress testing.

METHODS: Baseline characteristics including age, race, gender, height, weight, body mass index (BMI), referring provider type, Duke Activity Status Index (DASI) score and stress type (pharmacologic versus exercise) were collected on all patients who completed cardiovascular stress testing. All exercise tests were performed using a standard Bruce treadmill protocol. Criteria for determining an adequate exercise stress test was ≥85% of age-predicted maximal heart rate. RESULTS: Of 608 cardiovascular stress tests, 354 performed exercise stress. Patient characteristics of those who underwent exercise stress was as follows: female= 175 (49%), Caucasian=173 (47%), African American=146 (45%), mean age was 57 ± 13 years, mean BMI=31.4 ± 8.1 kg/m², mean DASI estimated METS= 8.1 ± 1.7 and mean METS achieved= 8.4 ± 2.8. Fifty-eight (19%) patients did not achieve ≥85% APMHR. Exercise time, DASI estimated METS and METS achieved were significant predictors of achieving ≥85% APMHR (all P's <0.02). Age, race, gender, height, weight, BMI, provider type were not significant (all P's >0.11). CONCLUSIONS: In conclusion, exercise duration during graded exercise testing predicted achievement of adequate stress response during cardiovascular stress testing. Strategies to select an appropriate exercise test protocol allowing longer exercise duration may improve the ability to reach target heart rate during cardiovascular stress testing.

PREDICTION OF SUBOPTIMAL EFFORT (<85%APMHR) BY DASI EST.METS

AUC = 0.659 (0.589-0.730) P=0.0001

Optimal Threshold for Suboptimal Effort

= 8.0 DASI est.METS

Sensitivity=65%, Specificity=65%

RESULTS: FEV1 showed interaction effects group x time, FVC and FEV1 were significantly increased in the exercise group. Vitamin D and calcium showed interaction effects between group x time, vitamin D was significantly increased in the both group, and calcium was decreased in the control group. Calcitonin and osteocalcin of bone metabolism showed interaction effects group x time, osteocalcin was significantly decreased in control group.

CONCLUSIONS: Our findings indicate that combined exercise were effective in improving the lung function and bone metabolism hormones in elderly women due to decreased physical activities.

2366 Board #285 May 28 3:00 PM - 4:30 PM
Pilot Study On Effect Of Ipsilateral Long Kinetic Chains On Shoulder Elevation Strength
Andre A. Abadin, Edsel Bittencourt, Peter T. Dorsher, George G.A. Pujaltce, FACSVM. Mayo Clinic, Jacksonville, FL. (Sponsor: George G.A. Pujaltce, FACSVM)
(No relevant relationships reported)

There is growing evidence to suggest that kinetic chains extend far beyond the core muscles, following myofascial meridians that interestingly appear to overlap with classically-known acupuncture channels. Strengthening programs during the rehabilitation of musculoskeletal injuries utilize kinetic chain exercises; however, how lower extremity strength potentially directly affects upper extremity strength has not been quantified. PURPOSE: To examine quantitatively the effect on shoulder elevation strength (SES) in the sagittal plane on ipsilateral lower extremity tibia anterior muscle activation. METHODS: Twenty young healthy adult volunteers (half women, half men), ages 20-60 years, having no shoulder pain were recruited. Participants had baseline SES evaluated with a hand-held dynamometer applied just proximal to the radial styloid with the arm held in 90-degree elevation in the sagittal plane. The participants underwent the following interventions: SES and ipsilateral anterior tibialis muscle activation (IATMA) while standing, SES and IATMA while seated with legs dangling, and SES with ipsilateral gastrocnemius activation while seated with legs dangling. RESULTS: In females, IATMA, in standing and seated position, reduced SES by a mean percentage of 12.57 and 14.88, respectively, from baseline. SES with gastrocnemius activation (reciprocal relaxation of anterior tibialis) reduced SES by a mean percentage of 3.93 from baseline. In males, IATMA, in standing and seated position, reduced SES by a mean percentage of 5.58 and 10.84, respectively, from baseline. SES with gastrocnemius activation (reciprocal relaxation of anterior tibialis) reduced SES by a mean percentage of 3.3 from baseline. CONCLUSIONS: IATMA directly reduces SES; it also produces a greater decrement in SES compared to ipsilateral gastrocnemius activation. This kinetic chain effect appears coincident with known myofascial meridians.

2367 Board #286 May 28 3:00 PM - 4:30 PM
CARDIOVASCULAR RESPONSE DURING EXERCISE IN PATIENTS WITH HYPERTENSION AND PATIENTS WITH HYPERTENSION WITH DIABETES
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(No relevant relationships reported)

Purpose: Heart rate product (RPP) can be used to predict cardiovascular diseases (CVD) and can be regarded as an index for continuous monitoring of ejection fraction and myocardial oxygen consumption. Exercise can improve patients’ cardiovascular function and reduce the risk of having CVD. The purpose of this study was to investigate changes in heart rate (HR) and blood pressure (BP) of patients who suffer from hypertension or hypertension with diabetes mellitus during exercise and at post-exercise recovery period.

Methods: This study recruited 85 diagnosed hypertension subjects and 85 diagnosed hypertension with diabetes mellitus subjects (40-69 years of age), who were divided into hypertension group (HTN, n = 66) and hypertension with diabetes mellitus group (HDM, n = 19). The modified Bruce protocol was adopted in this study, in which patients pedaled the cycle ergometer, starting from the level of 25W, for 3min per stage and then increasing the levels gradually. HR, BP, RPE and oxygen saturation (SPO2) were measured at rest, during exercise and at recovery and RPP and pulse pressure difference (SBP minus DBP) were calculated.

Results: (1) The HTN group had a significantly lower resting HR than the HDM group (P<0.05, 76.12±10.73 vs 86.50±16.80 bpm, respectively). Resting RPP is significantly lower in HTN group than in HDM group (P=0.05, 88.30±26.57 vs 106.50±40.44 times mmHg/100, respectively) (2) RPP at 50W is significantly lower in the HTN group , compared with the HDM group (P=0.01, 160.86±41.10 vs 186.68±29.86 times mmHg/100, respectively) (3) SBP at 100W (P=0.05, 186.62±17.10 vs 206.25±17.58 mmHg, respectively) and pulse pressure difference (SBP minus DBP) were calculated.

Abstracts were prepared by the authors and printed as submitted.
group had a significantly lower pulse pressure at the time of 5-minute post-exercise recovery than the HDM group (P<0.05, 54.2±9.5 vs. 72.9±5.8 mmHg), respectively.

Conclusions: The responses of heart rate and blood pressure of patients with hypertension were superior to those with hypertension and diabetes both in exercise and at post-exercise recovery period.

D-72 Free Communication/Poster - Obesity/Weight-loss

Thursday, May 28, 2020, 2:00 PM - 4:30 PM
Room: CC-Exhibit Hall

2370 Board #289 May 28 3:00 PM - 4:30 PM
ACUTE RESPONSE OF BLOOD LIPID PROFILES TO DIFFERENT INTENSITIES OF EXERCISE IN OBSESE MEN
Sophia Lilian LaMarca, Michel Hernandez, Margaret Huss, Jinkyung Park, Georgia College and State University, Milledgeville, GA.
Email: sophia.lamarca@bobcats.gcsu.edu
(No relevant relationships reported)

PURPOSE: This study was conducted in order to examine the blood lipid profile changes following lower or higher-intensity exercise in obese men. The changes in blood lipid profiles include TC, TG, LDL-C, HDL-C following moderate or high intensity exercise in obese males. METHODS: In a randomized, cross-over design, fifteen obese (BMI > 30 kg/m2) sedentary (less than 2 days per week of physical activity) male volunteers, the ages between 18 and 30 were assigned to two groups. The participants performed a single bout of cycling exercise (average energy expenditure ~300 kcal) at two different intensities in random order [moderate-intensity: 60% of estimated maximum heart rate; high-intensity: 80% of estimated maximum heart rate]. Overnight fasting blood samples were collected at baseline, immediately post-exercise (IPE), 1-hr PE, and 24-hr PE for each intensity of exercise to determine blood lipids and lipoproteins (TC, TG, LDL-C, and HDL-C). A 2(intensity) X 4 (time) ANOVA with repeated measures was used to examine the mean differences in intensity and time on blood lipids and lipoproteins. The Bonferroni pairwise comparisons were conducted as post hoc to locate the significant mean differences. A p-value <.05 was set for the statistical significance. RESULTS: TC, LDL-C or HDL-C did not change, while TC (209.31±28.89 mmol/L) at 24-hr PE decreased (p<.041) from IPE (217.80±32.55 mmol/L) following higher-intensity exercise. However, the main effects of time (p=.272) or intensity (p=.735) demonstrated no statistically significant differences in TC. CONCLUSIONS: The acute-higher-intensity exercise can lower TC. However, acute different intensities of exercise may not alter significantly different blood lipid profiles in obese men due to the short volume and duration. Therefore, future research should determine if different intensities of chronic exercise alter blood lipid profiles in obese men.

2369 Board #288 May 28 3:00 PM - 4:30 PM
Determining An Appropriate Cardiopulmonary Exercise Testing Protocol For Individuals With Neuromuscular Disease
Tina Duong, John Day, Sally Dunaway-Young, Veronica Stevens. Stanford University, Palo Alto, CA.
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(No relevant relationships reported)

PURPOSE: To review published standards and recommendations for people with neuromuscular disease and establish a graded ramp-up protocol to assess exercise tolerance for individuals who have moderate to severe muscle weakness.

METHODS: A review of literature for muscular dystrophy or neuromuscular disease and exercise testing was performed to assess different methodologies in Cardiopulmonary Exercise Testing (CPET) using cycle ergometry CPET. A progressive ramp-up protocol was developed and administered with patients who attend Stanford’s multidisciplinary clinic to determine feasibility and test termination criteria that may limit the ability to achieve maximum oxygen consumption. RESULTS: Literature search resulted in 43 research studies. The study breakdown included Myopathies and degenerative muscle disease-15; Pompe’s-5; FSHD, SMA, Metabolic Myopathies-3; DMD/BMD-2; Myotonic Dystrophy-2; CMT-1; IBM-1. Studies generally ranged in mode of testing. Most study participants were ambulatory. Most protocols used a graded 1-2 minute progressive ramping protocol until the point of exhaustion indicated by a Visual Analog Scale and heart rate. Early termination resulted from participants voluntarily stopping due to muscle weakness.

We developed a progressive ramp up protocol with 1-minute increment increase in workload at 5-watt intervals to avoid early termination from large increases in workload. We tested 3 individuals with neuromuscular disease and 2 controls. Only 2 participants (1 with NMD and 1 control) were able to reach an RER of 1.1 of maximal oxygen uptake (VO2max). Reasons for early termination were consistent with the published literature including heart rate, voluntary stop and muscle weakness.

CONCLUSIONS: With promising treatments on the horizon for neuromuscular diseases, physical therapists are asked to determine appropriate exercise prescriptions for individuals with a range of functional abilities and muscle weakness. Currently, CPET protocol methodology varies for weaker individuals. Our results will contribute to developing a proposed submaximal clinical exercise tolerance test protocol to establish safe exercise prescriptions and determine treatment intervention benefits for patients with neuromuscular disease.

2368 Board #287 May 28 3:00 PM - 4:30 PM
Effect Of Graded Exercise On RoR And Blood Oxidative-stress In Trained And Untrained Subjects
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(No relevant relationships reported)

Submaximal graded exercise testing is a commonly used method to assess cardiovascular stress. Reserve of repolarization of the heart (RoR) is an ECG-based, non-invasive method to monitor the heart’s stress response, and assesses cardiac cells ability to reestablish their membrane potential. RoR has been shown to be a useful indicator of cardiovascular disease risk in cardiac patients. This study examined RoR differences between trained (T) and untrained (U) individuals and correlate this outcome with blood stress markers.

PURPOSE: To determine if RoR and blood stress markers in response to a graded exercise in T and U cohorts differ.

METHODS: Thirty-nine (male and female) subjects (23.6±5.6 years) were recruited. Subjects arrived after overnight fast between 7:9 am and rested for 20 minutes. Subjects completed a fitness questionnaire to determine training status (T or U). ECGs (12 lead) were monitored before, during and after exercise to obtain RoR. A graded walking test (GXT) on a treadmill until 85% of estimated maximum heart rate was performed. Blood obtained at rest and immediately after exercise were analyzed using HPLC for glutathione (oxidized [GSSG], reduced [GSH], total [TGSH]). Repeated measures ANOVAS were utilized to analyze the results using SPSS v24 with significance set at α = .05.

RESULTS: There were significantly lower resting RRs (p = .023) and higher workloads achieved during testing (p = .002) between T vs U groups. Resting RoR (independent of group) was significantly reduced from 75.5±5% pre-test to 26±1% RoR at the end of exercise (p < .001). Final stage RoR was significantly lower for T compared to U group (T: 20±9.4%; U: 31±9.4%, p = .041), but T group performed significantly greater stages (p=0.002). The GXT induced a reduction in blood GSH (Pre 366±161 μM; Post 273±180 μM, p < .001) and an increase of GSSG (Pre 135±62 μM, Post 157±83 μM, p = .038) with no difference between groups. GSSG/TGSH decreased after GXT (p=0.028) independent of group. CONCLUSIONS: These data suggest that a GXT induces a different stress response in T and U individuals. The oxidative stress at GXT was similar but needed more workloads to get to this same internal stress level in the T group. Further studies are needed to ascertain stress responses with RoR and relative workloads.

2367 Board #286 May 28 3:00 PM - 4:30 PM
ACUTE RESPONSE OF BLOOD LIPID PROFILES TO DIFFERENT INTENSITIES OF EXERCISE IN OBSESE MEN
Sophia Lilian LaMarca, Michel Hernandez, Margaret Huss, Jinkyung Park. Georgia College and State University, Milledgeville, GA.
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(No relevant relationships reported)

PURPOSE: To determine if RoR and blood stress responses with RoR and relative workloads.

MEDICINE & SCIENCE IN SPORTS & EXERCISE®

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ACSM May 26 – May 30, 2020 San Francisco, California
Bariatric surgery is an effective treatment option for children and adolescents with severe obesity. Yet, pediatric post-bariatric surgery (PBS) exercise recommendations are elusive. PURPOSE: To perform a systematic review assembling professional pediatric PBS exercise recommendations. METHODS: To gather PBS exercise recommendations, databases were searched from inception to 2/22/19 with terms related to exercise, pediatric obesity, bariatric surgery, and weight status. This search located no records so another PubMed search was performed to identify randomized controlled trials (RCTs), published in peer-reviewed English language journals, examining the effects of exercise on body mass index (BMI) and percent body fat (%BF) among participants 2-19yr with obesity from inception to 3/20/19. The standardized mean difference effect sizes (d) were calculated following random-effects models for BMI and %BF and then back-converted to the original unit for clinical interpretation. We assessed inconsistencies in d with the F statistic transformed from the Q statistic. RESULTS: The second search identified 556 reports with 9 qualifying RCTs. Of these, 7 were combined resistance and aerobic and 4 aerobic interventions only. All participants (n=342, 53.8% girls, 131.2±yr) had obesity. The moderate-to-vigorous intensity exercise interventions lasted 13.5±4.0 wk, 3.5±0.8 d/wk for 56.8±6.4 min/session. Exercise interventions (k=11) elicited moderate BMI reductions (d=-0.40, 95%CI: -0.73, -0.06, -1.03kg·m⁻²) vs non-exercise control, with moderate-to-high heterogeneity (F=61.3%, 95%CI: 25.3, 80.0). Exercise interventions (k=7) also elicited moderate %BF reductions (d=-0.61, 95%CI: -0.90, -0.31, -4.63%) vs non-exercise control, with low heterogeneity (F=20.5%, 95%CI: 0.0, 64.0). CONCLUSIONS: We found limited but favorable evidence of the effects of moderate-to-vigorous exercise training on BMI and %BF among children and adolescents with obesity who were unable to locate any professional pediatric PBS exercise recommendations. Due to the increasing number of pediatric bariatric surgeries performed, there is an urgent need for professional guidance on exercise in this clinical population.

Supported by the University of Connecticut Center on Excellence in Teaching and Learning
Obesity epidemic is a complex and multifactorial chronic condition affecting one in three adults globally while it is strongly associated with high metabolic risk factors leading to chronic illness. On the other hand, high-intensity interval training (HIIT), group training, body weight training, and functional fitness have been recently reported as some of the top worldwide trends in the health and fitness industry. PURPOSE: This randomized controlled trial investigated the effects of a 5-month high-intensity interval-type neuromuscular training program (DoIT) with adjunct portable modalities on cardiometabolic health in previously inactive obese women. METHODS: Forty-nine premenopausal Caucasian obese female volunteers (n = 49; 36.4 ± 4.4 years; 29.1 ± 2.9 kg/m²; 46.8 ± 5.0% body fat; 0.87 waist-to-hip ratio) were randomly assigned to control group (C, n = 21) or to training group (TR, n = 28). The exercise protocol was a super Set interval, low-volume, progressive, and time-efficient (<30 min) training program incorporating HIIT and functional fitness into a real-world gym setting. Neuromotor exercises (10-12 integrated movements) with alternate portable modalities at prescribed work-to-rest intervals (20-40 sec) in a circuit fashion (2-3 rounds) were implemented on nonconsecutive days for 5 months. Blood samples were drawn to determine blood biomarkers at pre- and post-training. RESULTS: After 20 weeks, TR demonstrated changes in waist circumference (-7.2%, p < 0.05; TR vs. C: -6.6%, p < 0.05; TR vs. C: -6.3%, p < 0.05), total cholesterol/high-density lipoprotein ratio (14.1%, p < 0.05; TR vs. C: -17%, p < 0.05), mean arterial blood pressure (-4.1%, p < 0.05; TR vs. C: -4.1%, p < 0.05), and metabolic syndrome severity z score (-327%, p < 0.05; TR vs. C: -17%, p < 0.05), mean arterial blood pressure (-4.1%, p < 0.05; TR vs. C: -4.1%, p < 0.05). No differences in homeostatic model assessment of insulin resistance (HOMA-IR) were observed from pre- to post-intervention in both groups, whereas HOMA-IR did not differ between groups at any time-point. CONCLUSIONS: These findings suggest that high-intensity interval neuromuscular training may improve cardiometabolic health in previously inactive obese women following a 20-week intervention. This study provides critical evidence for implementation of this nontraditional hybrid-type exercise regimen from adults with obesity into a real-world gym setting.

## Exercise Suppresses The Ubiquitin-Proteasome System In The Skeletal Muscle Of Obese Women Following Bariatric Surgery


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(No relevant relationships reported)

Muscle wasting observed in obese women undergoing bariatric surgery is likely related to altered abnormal intramyocellular signaling. Exercise may reestablish the anabolic capacity in this condition. PURPOSE: We examined the effects of exercise training on the main pathways related to skeletal muscle plasticity in obese women undergoing bariatric surgery. METHODS: Women with severe obesity were randomly allocated to either bariatric surgery (RYGB) or bariatric surgery followed by exercise (RYGB+ET). A 6-month, three-times-a-week, supervised, combined aerobic and resistance training program started 3 months after surgery for RYGB+ET, while RYGB followed standard of care. We assessed the transcriptome (RNA-seq) from skeletal muscle samples obtained by muscle biopsies (n = 6 per group) at baseline (PRE) and 9 months after surgery (POST9). We tested whether a set of genes defined a priori were differentially expressed utilizing the Gene Set Enrichment Analysis. Significance was assessed at a fold change > 1.5, P-value < 0.05, and FDR (false discovery rate) < 0.1. To validate the RNA-seq findings, we performed real time-polymerase chain reaction assays (n = 15 per group) for targeted genes. RESULTS: Pathway-level analysis showed that exercise significantly suppressed ubiquitin mediated proteolysis pathway (normalized enrichment scores [NES]: 1.7, P = 0.01, FDR = 0.09). Atrogin-1 gene expression was suppressed in the exercised group at POST9 in comparison to PRE and POST3. and also when compared with the non-exercised group at POST9 (estimated mean difference [REGB vs. RYGB+ET at POST9]: -1.97, CI95%-3.0 to -0.8, P < 0.01). Moreover, expression was altered after surgery and kept reduced after the intervention for both groups (main time effect: P < 0.01 for both). CONCLUSIONS: Our data suggest that a 6-month, exercise training program suppresses the ubiquitin-proteasome system via the downregulation of Atrogin-1 in obese woman undergoing bariatric surgery. This may elucidate a molecular mechanism that partially explains muscle wasting following bariatric surgery and the exercise-induced hypertrophic effect in this condition.

## Estimation Of Visceral Adipose Tissue: A Device Comparison

### Katie R. Rirsch, Gabrielle J. Brewer, Malia N.M. Blue, Abbie E. Smith-Ryan, FACSM. University of North Carolina at Chapel Hill, Chapel Hill, NC. (Sponsor: Abbie Smith-Ryan, FACSM)

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(No relevant relationships reported)

Many body composition devices now provide an estimate of visceral adipose tissue (VAT), a significant risk factor for cardiometabolic disease. PURPOSE: to evaluate the relationship between estimates of VAT from bioelectrical impedance (BIA), ultrasound (US), and dual-energy x-ray absorptiometry (DXA). METHODS: VAT was estimated in 124 adults (66% Female; Mean ± SD: Age: 25 ± 8.9 years; BMI: 25.4 ± 5.5 kg/m²; %BF: 29.7 ± 8.8). VAT area (cm²) was estimated from BIA system specific algorithm. VAT thickness (cm) was estimated using US, quantified as the distance between the linea alba and aorta. VAT volume (cm³) was estimated from the DXA predefined android region. Linear regression was used to evaluate the relationship between estimates and to identify factors that may contribute to estimate differences in the entire group and by sex. RESULTS: In the full group, VAT estimates from all three methods were significantly correlated [BIA-DXA (R²=0.768; R²adj=0.589); BIA-US (R²=0.455; R²adj=0.297); DXA-US (R²=0.785; R²adj=0.616) (p<0.001)]. In men, stronger relationships were observed with DXA [BIA-DXA (R²=0.852; R²adj=0.727); BIA-US (R²=0.784; R²adj=0.600); DXA-US (R²=0.772; R²adj=0.600) (p<0.001)] in women, weaker relationships were observed with US [BIA-DXA (R²=0.809; R²adj=0.793); BIA-US (R²=0.567; R²adj=0.321); DXA-US (R²=0.690; R²adj=0.477) (p<0.001)]. In men, total body water (TBW) explained 31.9% and 12.0% of the variance in the difference between BIA-DXA and BIA-US, respectively; %BF explained 13.1% of the variance in the difference between DXA-US (all p<0.05). In women, %BF explained 28.9%, 34.0%, and 15.6% of the variance in the difference between BIA-DXA, BIA-US, and DXA-US, respectively (all p<0.05). CONCLUSIONS: BIA and US are cost-effective alternatives to DXA. BIA may provide a more comparable estimate to DXA, while greater variability may occur when comparing with US, especially in women. Differences between estimates may be influenced by TBW and %BF.
51.2% and 79.1% of overweight and obese youth estimated to respond. Inter-individual variation resulting from moderate-intensity ET was observed in VO\textsubscript{2max} (29.9 to 32.7 ml \textsuperscript{kg}\textsuperscript{-1} \textsuperscript{min}\textsuperscript{-1}, p=0.005), with no change in HIIT group. However, at the beginning of the study, VO\textsubscript{2max} was significantly lower in the MICT group when compared to the HIIT group (p=0.04). During the intervention, no significant difference was found in cardiometabolic risk factors in the MICT group. However, HIIT resulted in statistically significant reduction in triglycerides levels (1.91 to 1.58 mmol/l, p=0.046) even though waist circumference was significantly increased (98.0 to 107.0 cm, p=0.038) after the 12-week intervention program. In addition, the HIIT group increased self-determined motivation toward physical activity in a greater magnitude when compared with the MICT group (p=0.016). CONCLUSION: HIIT appears to provide greater benefits to MICT for improving cardiometabolic risk levels. In addition, as HIIT is associated with a greater improvement in self-determined motivation toward physical activity, HIIT could be associated with promising long-term adherence to exercise.

2379  Board #298  May 28 3:00 PM - 4:30 PM  Effects Of High-Intensity Interval Training On Cardiometabolic Risk Factors And Motivation To Exercise In Women With Abdominal Obesity Patricia Blackburn, Bruno Martel, Maxime St-Pierre, Claudine Emond, Jacques Plouffe. Université du Québec à Chicoutimi, Saguenay, QC, Canada.

(No relevant relationships reported)

There has been recent interest in high-intensity interval training (HIIT) as an alternative to moderate-intensity continuous training (MICT) to reduce body composition, adiposity and cardiometabolic risk factors in obese patients. Despite the promising evidence supporting HIIT in this population, there is limited research targeting women with abdominal obesity. PURPOSE: The objective of this study was to compare the effects of MICT and energy-matched HIIT on cardiometabolic risk factors in women characterized by abdominal obesity. METHODS: Twenty abdominally obese women (age range, 28-56 years) were submitted to 12 weeks of intervention and were randomly allocated into 2 groups: MICT (n=10) and HIIT (n=10). The MICT group performed a 38 to 62-minute continuous exercise at 70% of the maximal heart rate. The HIIT group training performed 3 to 6 sets of 4-minute bouts at a running velocity corresponding to 90% - 95% maximal heart rate, interspersed by a 4-5 minute active recovery period at 50% - 55% maximal heart rate. Anthropometric parameters, maximal oxygen uptake (VO\textsubscript{2max}) and cardiometabolic risk variables were measured at the beginning and after 12 weeks. Self-determined motivation toward physical activity was also evaluated with a validated questionnaire. RESULTS: MICT intervention led to significant improvements in VO\textsubscript{2max} and cardiometabolic risk factors in HIIT. However, at the beginning of the study, VO\textsubscript{2max} was significantly lower in the MICT group when compared to the study group (p=0.04). During the intervention, no significant difference was found in cardiometabolic risk factors in the MICT group. However, HIIT resulted in statistically significant reduction in triglycerides levels (1.91 to 1.58 mmol/l, p=0.046) even though waist circumference was significantly increased (98.0 to 107.0 cm, p=0.038) after the 12-week intervention program. In addition, the HIIT group increased self-determined motivation toward physical activity in a greater magnitude when compared with the MICT group (p=0.016). CONCLUSION: HIIT appears to provide greater benefits to MICT for improving cardiometabolic risk levels. In addition, as HIIT is associated with a greater improvement in self-determined motivation toward physical activity, HIIT could be associated with promising long-term adherence to exercise.

2381  Board #300  May 28 3:00 PM - 4:30 PM  Do Different Wet Bulb Globe Temperature Reading Cutoffs Change Outdoor Heat Injury Frequency And Severity? Christina S. Gutta\textsuperscript{1}, Ellen E. Shanley\textsuperscript{2}, Vicki R. Nelson\textsuperscript{1}, Prisma Health, Greenville, SC, \textsuperscript{2}ATTI Physical Therapy, Greenville, SC. (Sponsor: Dr. Franklin Sease, FACSM)

(No relevant relationships reported)

PURPOSE: To evaluate differences in injury frequency and severity between two different heat participation policies in South Carolina high school and collegiate athletics. METHODS: Retrospective cohort study of Division II collegiate & high school athletes looking at injury frequency & severity between 2 different heat participation policies. Fifty middle & high schools as well as 2 Division II colleges with a total of 16,832 athletes were investigated over 3 years. Inclusion criteria were reported heat illnesses between July 1 & November 30 inclusive of all outdoor sports resulting in 86 injuries that were analyzed. Chi square analysis was used to compare injury frequency & severity between no outdoor workouts with a wet bulb globe temperature (WBGT) >90 (policy 1) versus WBGT< 92 (policy 2). RESULTS: For policy 1 there was a mean of 31 heat illnesses/year with an average of 16 days of illness resolution. For policy 2 there was a mean of 24 heat illnesses/year but the average of 41 days for illness resolution was significantly higher (p=0.02). Grading heat illness severity was based on guidelines developed by Rauh et al. Mild to moderate injury was defined as 0-21 days for return to activity while severe injury >21 days for return to activity. With policy 1, 4.8% of heat illnesses met severe criteria while 20.8% of heat illnesses in policy 2 were severe showing an odds ratio of 5.2 times higher than policy 1 (OR 5.2, 95% CI 1.1-23.7). Conversely the percentage of mild to moderate illness was statistically lower with policy 2 compared to policy 1 (p=0.022) suggesting that policy 2 resulted in more severe heat illness. Policy 1 was in place for several years with no record of EMS transport for heat illnesses however within the first season of policy 2, there were 3 athletes transported. The average age at time of injury was 16 years old & not statistically different between policies. There was an average of 45 minutes of practice per week lost with the WBGT cutoff of 90 compared to cutoff of 92.

CONCLUSIONS: Although the total number of heat illnesses did not change between policies, there was a statistically significant increase in severity of heat illness & time for return to sport with raising the WBGT participation cutoff from 90 to 92. Our data suggests that a cutoff of 90 reduces the frequency of severe heat illness in athletes.

D-73  Free Communication/Poster - Sports Medicine Fellow Research Abstracts

Thursday, May 28, 2020, 2:00 PM - 4:30 PM  Room: CC-Exhibit Hall

2380  Board #299  May 28 3:00 PM - 4:30 PM  Intensive Behavioral Therapy For Obesity Utilizing Cardiopulmonary Exercise Testing: The Bridge Project Pilot Study. Matthew Kampert, Debasish Sahoo. Cleveland Clinic, Cleveland, OH. Email: mkampert1@gmail.com

(No relevant relationships reported)

PURPOSE: To gather preliminary pilot data on dietary and exercise prescription utilizing Cardiopulmonary Exercise Testing (CPET) incorporated into Medicare and Medicaid Services-based Intensive Behavioral Therapy for Obesity (IBT-O) in a primary care setting. METHODS: A prospective cohort of 30 subjects completed a World Health Organization Quality of Life (WHOQOL) questionnaire, and performed a cardiopulmonary exercise test (CPET) on a treadmill using a modified Balke protocol at baseline as well as following 6 and 12 months of exercise conditioning. With a cardiovascular exercise prescription developed from CPET data delivered to the subjects' Smartphone through an interactive app. Subjects were also provided with a resistance training prescription and YMCA membership. Consistent with CMS criteria, subjects participated in weekly physician directed IBT-O appointments throughout the first month, and then bi weekly for the next 5 months. If subjects lost 6.6 lbs (3 kg) in the initial 26 weeks (6 months) they qualified to continued physician once a month for an additional 6 months. RESULTS: With the 30 subjects initially enrolled, there were 9 enrollment failures. There was an overall follow up rate of 76% of the 21 successfully enrolled, with 19 completing all 6 months. At the 6 months, 14 subjects lost 6.6lbs required by CMS to continue for an additional 6 months, and 11 completing all of the 12 months. Data reported in table using mean ± standard deviation for all continuous variables. All analyses were 2-tailed and were performed at a significance level of 0.05.

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Abstracts were prepared by the authors and printed as submitted.
2382 Board #301 May 28 3:00 PM - 4:30 PM

Differences In Baseline Concussion Symptom Reporting Across Age And Gender
Joshua Pacious, Franklin Sease, FACSM, Vicki Nelson. Prisma Health- Center for Family Medicine, GREENVILLE, SC. (No relevant relationships reported)

Purpose: Previous studies have identified significant differences across age and gender in post-concussion symptoms reporting, with female and high school aged athletes reporting both a higher number of symptoms and a greater symptom severity. This study evaluates differences in baseline symptom reporting across age group and gender.

Methods and Study Design: Between 2007-2019, concussive symptoms were reported by middle school (MS), high school (HS) and collegiate athletes (CA) utilizing the post-concussion symptom scale at baseline. Excluded athletes included those with invalid testing, age ≥ 24y or < 10y, learning disabilities, ADHD, autism, or a prior history of concussion. ANOVA was performed assessing the total number of symptoms and the total symptom severity score as reported by age group, and gender. Results: (1000/2/9/4/6 athletes (60% male and 40% female) were included: 4.6% MS (n=1,179), 89.7% HS (n=23,047) and 5.7% CA (n=1,468). Among the different age groups, there were no significant differences in number of symptoms (p=0.21) or symptom severity score (p=0.48). However, there were significant differences noted between male and female athletes. Males reported fewer symptoms (1.7±0.1) vs. females (2.2±0.3, p<1x10-10). Males also reported a lower baseline symptom severity (3.3±0.7 vs 4.9±0.8, p<1x10-6). This difference between genders held true across age levels with significant differences in the number of baseline symptoms reported (MS p<0.001, HS p<1x10-6, CA p=0.001) and symptom severity score (MS p<0.001, HS p<1x10-6, CA p=0.01).

Conclusion: This study identifies symptom differences between genders at baseline. These baseline differences may contribute to the post-concussive discrepancies seen previously. In contrast, baseline differences are not present between age groups possibly suggesting a pathophysiologic underpinning to the post-concussive symptoms.

Significance of Findings: Significant differences in concussive symptom reporting by age level, despite comparable baselines shown here, may reflect pathophysiologic, rather than reporting discrepancies, necessitating specific evaluation and management strategies across age levels.

2383 Board #302 May 28 3:00 PM - 4:30 PM

Assessing Knowledge And Confidence in Musculoskeletal Medicine Among Primary Care Specialists
Jessica Mofidi, Cindy Ong, Michael Fong, Marissa Vasquez. Kaiser Permanente Los Angeles Medical Center, Los Angeles, CA. (Sponsor: Aaron Rubin MD, FACSM) (No relevant relationships reported)

Purpose: Studies have shown that primary care clinicians lack knowledge and confidence in how to diagnose and treat musculoskeletal (MSK) disorders. One showed 64% of academic primary care attendings scored <70% on an MSK knowledge exam, while another noted that primary care residents scored an average of 56% on an MSK competency exam. Few studies examine differences among Family Medicine, Internal Medicine, and Pediatrics in knowledge and confidence in diagnosing and treating MSK conditions. To assess whether a focused lecture series can increase resident knowledge and confidence in diagnosing MSK disorders.

Methods: An anonymous shoulder, hip, knee, and ankle survey was administered to primary care residents in knowledge and confidence in diagnosing MSK conditions. To assess whether a focused lecture series can increase resident knowledge and confidence in diagnosing MSK disorders. A course included 60-minute lectures at MSK clinics. Each joint was evaluated from 1-5 with a Likert scale.

Conclusion: Dedicated lectures related to the MSK exam and common MSK conditions can increase the knowledge and confidence among primary care residents, but further studies with a greater number of subjects are needed.

2384 Board #303 May 28 3:00 PM - 4:30 PM

Documentation Of Obesity On The Problem List And Referral Rates Among Obese Children And Adults
Heidi Walls, Christina Holt, Amy Haskins, William Dexter, FACSM. Maine Medical Center, Portland, ME. (No relevant relationships reported)

Obesity is a serious public health concern that is overwhelming primary care providers. Studies have shown that simply documenting obesity on the problem list promotes action about obesity. Purpose: To determine the rate of obesity documentation on the problem list and referrals to obesity medicine specialists and dietitians among obese adult and pediatric patients at 14 primary care offices in a regional health network in Southern Maine. Methods: All patients with BMI ≥ 30 (adults) or BMI > 95%ile for age (pediatrics) between 5 - 100 years old, who were seen at one of 14 primary care clinics in Maine between July 1, 2017 and June 30, 2019 were included for retrospective review. Variables requested included age, BMI, inclusion of obesity on the problem list, various comorbidities, and any referrals to dietitian or obesity medicine specialists. The percentage rate of inclusion of obesity on the problem list and rate of referrals were calculated for both pediatric and adult patients.

Results: We obtained records for 20,461 patients, 2,780 under 18 and 17,681 over 18. Obese children had obesity on the problem list in 31.2% of cases, and received any referral 12.5%. Obese adults had obesity on the problem list 54.2% of the time, and a referral in 8.4% of cases. For both children and adults, more referrals were made for patients with obesity on the provider alert compared to those without this problem list. (in children: 20.2% vs 9.0%; for adults: 12.12% vs 5.9%, p values < 0.0001). Similarly, a statistically significant higher proportion of referrals were made for those with higher BMI (in children: 26.6% vs 8.6% for those with a BMI ≥ 99 percentile; adults: 19.88% vs 7.57% for those with a BMI ≥ 40, p values < 0.0001), and for those with a greater number of comorbidities (referrals in 20.2% vs 10.7% for children with ≥1 comorbidity vs 1 or fewer, and in 22.68% vs 5.13% of adults with ≥3 comorbidities compared to 0 comorbidities, p values < 0.0001).

Conclusions: The inclusion rate of obesity on the problem list for obese children and adults was found to be low overall, but inclusion was associated with higher proportion of referrals to obesity medicine specialists and dietitians. There was also more likely to be a referral among patients with higher BMI and multiple comorbidities.

2385 Board #304 May 28 3:00 PM - 4:30 PM

Improving The Diagnosis Of Menstrual Dysfunction Through Quality Improvement
Kayla E. Daniel, Amy Valasek. Nationwide Children’s Hospital, Columbus, OH. (Sponsor: Anastasia Fischer, FACSM)

Email: Kayla.Daniel@nationwidechildrens.org (No relevant relationships reported)

Purpose: Prevalence of menstrual dysfunction in female high school athletes ranges from 19-54%. Menstrual dysfunction can be screened and treated. Consequences of menstrual dysfunction include decreased bone mass, increased risk of stress fractures, increased rate of musculoskeletal injuries with prolonged recovery time, endometrial dysfunction, and effects on future fertility. Early recognition and intervention are crucial to prevent long term complications. The purpose of this Quality Improvement (QI) project is to optimize the institution’s Epic Best Practice Advisory (BPA) screening tool and synthesize new patient questionnaire responses to diagnose menstrual dysfunction in female athletes at 12 years of age presenting to a pediatric sports medicine clinic.

Methods: Using QI methodology, we evaluated the clinic workflow, Epic BPA tool, and actions by the physician following appropriate firing of the menstrual dysfunction BPA. Menstrual dysfunction was defined in our BPA as criteria for amenorrhea, oligomenorrhea, or irregular Mestruation Unspecified which was further specified as menstrual cycles extended by training in sport. Staff education, patient education, and BPA problem list were identified as appropriate areas for intervention. Staff were educated to ensure appropriate intake and implementation of survey data, a menstrual dysfunction handout was created and provided to newly diagnosed patients, and the BPA alert was changed to promote identification and diagnosis of menstrual dysfunction. We implemented interventions using progressive monthly Do-Study-Act (PDSA) cycles to encourage change and optimize our screening process.

Results: The rate of appropriate diagnosis of menstrual dysfunction in female athletes greater than 12 years of age seen at a pediatric sports medicine clinic increased from a baseline of 1.5% to 27% over a 3-month period.

Conclusions: Through QI methodology we are optimizing our menstrual dysfunction screening tool and subsequently increasing the rate of appropriate diagnosis of menstrual dysfunction among our female athletes. Identifying the appropriate diagnosis improves patient education and provides the framework for applicable interventions, further work-up, and follow-up.
CONCLUSIONS

derived models to predict which participants were wearing shoes, a heel lift or barefoot were recorded and processed successfully. The overall accuracy of the computer-supported vector machine, k-nearest neighbor and discriminant analysis classifier were discriminant analysis to highlight differences among the data sets and to minimize processed using short-time Fourier transform, principal component analysis and linear set of squat jumps was performed barefoot, with shoes and with a 2cm heel lift at both detect known differences in biomechanics among Division III athletes. Each participant

METHODS

differences in human movement patterns.

using a handheld, portable and cost effective device. The purpose of this study was to potential to provide objective data on limb and torso variations at a granular level exam lacks evidence for the detection of biomechanical subtleties that predispose

RESULTS

The individual events with the highest percent of athletes injured were gymnastics (38.5%, 95% CI 22.4-62.0), tennis (31.5%, 95% CI 21.5-44.7) and stand-up paddleboard (28.6%, 95% CI 11.6-59.4). The individual event with the lowest percent of athletes injured was golf (12.9%, 7.9-19.9). Among the gymnastics and tennis injuries, 53.3% and 58.6% were MSK, respectively. For stand-up paddleboard there were no MSK injuries with the majority being non-MSK (66.7%). Per 1000 athlete exposures, gymnastics had the highest rate of MSK injuries at 25.6 (95% CI 11.9-48.7), while stand-up paddleboard had the highest rate of both non-MSK injuries at 92.5 (95% CI 30.3-230) and minor injuries at 47.6 (95% CI 8.0-157.3). The team sports with the highest rates of injuries per game were softball at 1.9 (95% CI 1.6-2.4), followed by soccer at 1.7 (95% CI 1.4-2.0), and flag football at 1.6 (95% CI 1.3-1.9).

Conclusion: The Special Olympics 2018 USA Games required a well-staffed and organized medical team to meet the injury needs of athletes. Based on our findings, future events should provide a team with many medical personnel divided amongst the competition venues. A unique feature of the Special Olympics is the high rates of non-MSK injuries requiring medical attention, and appropriate measures should be taken to address these conditions.

CONCLUSION

CI=0.03-0.65), while calcified bone callus was the most specific (0.88, 95% CI=0.47-0.97) USI finding but the least specific (0.25, 95% CI=0.03-0.05) USI finding and 0.75 specificity (95% CI, 0.35-0.97) in detecting BSI, with a PPV of 0.92 (95% CI=0.77-0.98) to MRI, USI demonstrated 0.77 sensitivity (95% confidence interval [CI], 0.59-0.90) and 0.75 specificity (95% CI, 0.35-0.97) in detecting BSI, with a PPV of 0.92 (95% CI, 0.75-0.99) and NPV of 0.46 (95% CI, 0.19-0.75). Subcutaneous edema was the most sensitive (0.81, 95% CI=0.63-0.93) USI finding but the least specific (0.25, 95% CI=0.03-0.05), while calcified bone callus was the most specific (0.88, 95% CI=0.47-1.00) but least sensitive (0.26, 95% CI=0.12-0.45).

PURPOSE: To examine the sensitivity and specificity of ultrasound imaging (USI) in the diagnosis of MSIs, utilizing MRI as the gold standard.

STUDY DESIGN: Cohort Study (diagnosis)

METHODS: NCAA division 1 athletes (mean age, 21.64 years; standard deviation [SD], 7.24; range 18-62) underwent USI and MRI for clinical suspicion of a BSI in the lower extremity. 32 females and 7 males enrolled, with running as the most common sport (44%). An 8-point assessment system was utilized on USI for detecting BSI, and the Fredericson Criteria was used to classify MRI findings. Sensitivity, specificity, positive and negative predictive values (PPV and NPV) of USI compared to MRI were calculated.

RESULTS: Using MRI, there were 31 (79%) athletes with a positive 8 and participants with a negative BSI diagnosis. The most common bone injuries were metatarsal (51%) and tibia (33%). Average days to onset was 31.87 (SD = 34.20). Compared to MRI, USI demonstrated 0.77 sensitivity (95% confidence interval [CI], 0.59-0.90) and 0.75 specificity (95% CI, 0.35-0.97) in detecting BSI, with a PPV of 0.92 (95% CI, 0.75-0.99) and NPV of 0.46 (95% CI, 0.19-0.75). Subcutaneous edema was the most sensitive (0.81, 95% CI=0.63-0.93) USI finding but the least specific (0.25, 95% CI=0.03-0.05), while calcified bone callus was the most specific (0.88, 95% CI=0.47-1.00) but least sensitive (0.26, 95% CI=0.12-0.45).

CONCLUSION: USI is a reliable screening tool for sports medicine providers to combine with their clinical evaluation in the diagnosis of bone stress injuries. Further research is ongoing to determine the role of USI in follow-up care and return-to-play protocols.

PURPOSE: Retrospectively analyze data related to the recovery of 31 Division 1 female collegiate lacrosse athletes obtained over an entire regular season, and then determine if athletes who suffered injuries had lower recovery scores in comparison to athletes who did not suffer injuries.

METHODS: The data related to the recovery of the Collegiate Female Lacrosse athletes was obtained using a web-based application developed through the Restwest division of Recovery Science and Technology. An overall Recovery score was calculated based on the athlete’s heart rate, weight, pulse oximetry, and their responses to questions about quality and amount of sleep, energy level, presence of illness, and mood state. Athletes submitted their respective responses using the online Restwest application prior to each practice and game. Injury reports were then analyzed to determine specific dates of injuries. A logistic regression analysis was performed to determine if there was a statistically significant association between overall recovery scores as well as the specific components of overall recovery scores, and future injury.
RESULTS: 21 total injuries took place throughout the regular season. Overall recovery scores were not shown to be associated with future injury (p = 0.518). Previous injury (p = 0.118), illness (p = 0.48), mood (p = 0.58), amount of sleep (p = 0.648), sleep quality (p = 0.686), and energy state (p = 0.211) were also not shown to have a statistically significant relationship with future injury.

CONCLUSION: Restwise Recovery Data was not shown to have a statistically significant association with future injury in the Division 1 Female Lacrosse Athlete.

CONCLUSION: Adolescent athletes taking psychotropic medications reported a significantly greater number of prior lifetime concussions and higher concussion symptom scores at baseline. Similar trends were seen in those with a history of depression or anxiety, suggesting that these diagnoses alone may be correlated with concussion history and symptom burden regardless of medication use. Future research is warranted to further examine how psychotropic medication use alone may influence these variables, as well as how psychotropics may affect post-concussion symptoms and recovery.

BACKGROUND: Social media use among young adults has increased significantly in recent years. Existing literature suggests that increased social media use is linked to poor sleep quality, but this is unexplored in college athletes, who pose a unique risk for poor sleep given academic, social, and sport demands. PURPOSE: 1) To examine the effect of social media use on sleep quality among college athletes. 2) To compare the effect of social media use on sleep quality by sex. METHODS: Study participants included local NCAA Division III college athletes. Across sectional study design was employed. Data was collected using social media use and PROMIS sleep disturbance questionnaire. Main outcome measures were social media volume measured in hours of social media use per day over 7 days and collected using iPhone screen time function. Sleep quality was determined using the PROMIS T-score. Statistical analysis utilized Pearson’s correlation (little: r < .25, weak: r = .25-.30, moderate: r = .30-.50, strong: r > .50) test (p < .05), and effect size (small: Cohen’s d = .20, medium: Cohen’s d = .50, large: Cohen’s d > .80). RESULTS: 87 athletes (age: 19±3.1 years, 40 males, 47 females) completed the survey. Mean social media use was 4.6±3.4 hours/day. Female athletes spent more time on social media compared to male athletes (5.0±3.2 and 4.1±3.5 hours/day respectively, p < 0.01, Cohen’s d = .27). No correlation was found between increased social media time and reduced sleep quality (r < .20, p > .05). Similarly, analysis by sex revealed no correlation in sleep quality (female: r = .22, p = .131, males r = .18, p = .276). College athletes who spent more time on social media thamned the mean of 4.6 hours/day demonstrated worse sleep quality (51.0±8.1 vs. 47.8±6.7, p < .05, Cohen’s d = .41). When stratified by sex this finding held true for female athletes but not for male athletes (53.2±8.5 vs. 49.1±8.3, p = .186, Cohen’s d = .39, and 46.3±6.6 vs. 47.6±6.6, p = .505, Cohen’s d = .20, respectively). CONCLUSION: Female college athletes use social media more than male college athletes. Social media use appears to have a negative impact on sleep quality among female college athletes, although more research is needed to explore this. These findings may have implications for developing social media use guidelines for college athletes to improve their sleep quality.

An estimated 5-8% of children and adolescents in the United States take prescription psychotropic medications, including antidepressants, stimulants, anxiolytics, antipsychotics, and mood stabilizers. Psychotropics are occasionally used for patients with concussion to treat both cognitive and psychological symptoms, but little is known about the association between psychotropic medication use and concussion history. PURPOSE: To examine the relationship between psychotropic medication use with concussion history and concussion symptom burden among adolescent athletes tested at baseline. METHODS: Data was collected prospectively by the Massachusetts Concussion Management Coalition that contains demographics, medications, and concussion symptom scores from junior high and high school athletes in Massachusetts. Independent samples t-tests were used to investigate differences in concussion history and in symptom scores between those who were and were not on psychotropic medications at the time of baseline testing. RESULTS: Data was collected from a total of 18,833 adolescent athletes (mean age 14.8 ± 1.7 yrs; 39.6% female). Individuals who were on psychotropics had significantly greater average number of prior lifetime concussions (0.63 ± 0.99 vs. 0.34 ± 0.72 concussions; p < 0.001, Cohen’s d = .34), and significantly higher symptom scores at baseline (8.67 ± 11.63 vs. 4.81 ± 8.25; p < 0.001, Cohen’s d = .38). Those with a history of depression or anxiety had a significant but smaller increase in number of prior concussions compared with healthy controls (0.55 ± 0.91 vs 0.34 ± 0.72 concussions; p < 0.001, Cohen’s d = .26), and a greater difference in symptom scores (4.24 ± 4.05 vs 4.54 ± 7.8; p < 0.001, Cohen’s d = .69). CONCLUSIONS: Adolescent athletes taking psychotropic medications reported a significantly greater number of prior lifetime concussions and higher concussion symptom scores at baseline. Similar trends were seen in those with a history of depression or anxiety, suggesting that these diagnoses alone may be correlated with concussion history and symptom burden regardless of medication use. Future research is warranted to further examine how psychotropic medication use alone may influence these variables, as well as how psychotropics may affect post-concussion symptoms and recovery.

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RESULTS: The study included 64 female dancers and 92 non-dancer athletes. Dancers were younger (p=0.001), had a higher Bodyheight score (p=0.006), and were more likely to be hypermobile (p=0.005) compared to non-dancer athletes. Dynamic US femoroacetabular translation was not different in dancers with and without dysphagia (N, p=0.55; NF, p=0.78; EER Rectx, p=0.93). Dancers showed greater dynamic US femoroacetabular translation when compared to non-dancer athletes in both the NF position (5.0±2.57 mm, 4.2±2.50 mm; p=0.04) and EER Rectx position (6.0±2.52 mm, 5.2±2.41 mm, respectively; p=0.04).

CONCLUSION: Acetalbar dysphagia was not associated with increased dynamic US femoroacetabular translation in this cohort. Dancers showed increased US femoroacetabular translation compared to non-dancer athletes. This finding is likely related to increased ligamentous laxity and stretched ligaments inherent to dance training. Future research is warranted to collect data in asymptomatic dancers with and without acetabular dysphagia.

ACSM FPAES abstract

**Level of evidence:** IV Objective: To evaluate the work up and outcomes of athletes with exertional leg pain, specifically the co-existence of functional popliteal artery entrapment syndrome (FPAES) and chronic exertional compartment syndrome (CECS), in athletes who were unable to return to sport or have significant symptomatic improvement after lower leg compartment fasciotomy. Design: Retrospective case series Setting: Outpatient musculoskeletal sports clinic, outpatient vascular surgery clinic Participants: 36 patients aged 15-67 (average age 26.9) diagnosed with functional popliteal artery entrapment syndrome using CT-angiogram with provocative maneuvers or MRI-angiogram with provocative maneuvers. In our cohort, a moderate number of patients (11/36 athletes, 19/39 affected limbs) were referred for evaluation by vascular surgery after already having undergone leg fasciotomies for chronic exertional compartment syndrome. Interventions: Partial debulking of anterolateral compartment of the quadrilateral of the medial head of the gastrocnemius muscle with or without fasciotomy Main Outcome Measures: Return to sport/previous activities Results: Mean follow up was 52.3 ± 22.2 months. 78% (28/36) of the patients were able to fully return to their previous athletic competitive levels. All patients were able to resume their athletic sport at a recreational level. The patients participated in a myriad of sports and athletic activities: 14 runners, 9 soccer players, 3 unspecified, 2 lacrosse, 2 basketball, 1 triathlete, 1 jumper, 1 diver, 1 water polo, 1 rugby, 1 skier. At 6-month follow-up, there were 13% of affected limbs that had recurrent symptoms, at 12 months, only 5% had recurrent symptoms and at three years, no patients had symptoms present.

Conclusions: Many of these patients were unable to return to participate in high levels at their respective sport even after initial fasciotomy for CECS, suggesting that FPAES was unidentified, overlooked, or possibly developed after fasciotomy. FPAES can be a co-existing diagnosis that warrants screening during the evaluation of CECS. Provocative CT-A and MRA-A protocols can help guide the diagnosis as well as location of muscle debulking to alleviate the functional entrapment that occurs in these athletes with exercise. It is important to consider and screen for this diagnosis to allow for proper treatment and return to sport.

D-74 Free Communication/Poster - Sports Medicine Fellow Clinical Cases

**Thursday, May 28, 2020, 2:00 PM - 4:30 PM**

**Room:** CC-Exhibit Hall

**Board #314 May. 28 3:00 PM - 4:30 PM**

**19 Y/o Male Marine Experiencing Exercise-induced Laryngeal Obstruction (elio) During Military Training.** Matthew Kampert1, Claudio Milistein2. 1Cleveland Clinic, Shaker Heights, OH. 2Cleveland Clinic, Cleveland, OH.

(NO relevant relationships reported)

**HISTORY:** 19 year old male with a long history of shortness of breath on exertion. States that since childhood he has had inspiratory wheezing and tightness in chest with exertion, but he was told he would outgrow it. More recently, he has noted that he has worsened with maximal exertion during military training. He states that he is unable to run all out once around the track without experiencing inspiratory difficulty with gasping. It takes about 10 minutes for him to recover. If he resumes exercise it will recur. Asthma inhalers have not helped. Episodes are associated with pain and dysphagia. PHYSICAL EXAMINATION: Laryngeal examination shows that there is reduced abduction of the vocal folds, with a maximum glottic space of about 6 mm. During high ventilatory output tasks there is evidence of paradoxical movement of the vocal folds, most prominently on inspiration, resulting in shortness of breath, and loud stridor on inspiration. Cardiac: without murmur LVEF: 60% RRR, without murmur LVEF: 60% (No relevant relationships reported)

**D-74**
He required assistance off the field and complained of pain with breathing. He was immediately escorted to the sports medicine office on-site for examination.

**PHYSICAL EXAMINATION:** On examination there was bruising over the lower right abdomen and anterior hip along with tenderness to palpation over the right lower quadrant. No rebound tenderness or guarding. There was marked tenderness over the right ASIS and iliac crest. There was tenderness over the rectus abdominis and right hip flexor. No tenderness over the right upper quadrant. He had decreased strength and decreased range of motion during internal rotation and flexion. He did not have any neurovascular concerns, test of motion revealed no tenderness to palpation over the hip or lower extremity. Ultrasound guidance, the superior aspect of the right iliac crest was injected with 6cc of lidocaine/Sensorcaine in a ratio of 1:2. The patient experienced a 50% reduction in pain and did not return to the game.

**DIFFERENTIAL DIAGNOSIS:** 1. Iliac crest contusion (hip pointer)2. Core muscle injury/avulsion3. Abdominal contusion

**TESTS AND RESULTS:** ultrasound: No free fluid, hematoma or evidence of avulsion or bony disruption. X-ray right hip: No acute fracture. MRI pelvis within limits: 1. Full-thickness detached tears of the right transversus abdominis and internal oblique muscles at their attachment to the right iliac crest. 2. Grade 1-2 strain of the overlying external oblique muscle. 3. Grade 1 strain of the lateral portion of the right iliacus muscle.

**FINAL WORKING DIAGNOSIS:** Core muscle injury/avulsion

**TREATMENT AND OUTCOMES:** 1. Aspiration of hematoma, rest and NSAIDs. 2. Surgical repair of the obliques and rectus abdominis muscles 10 days after initial injury

3. 6-week progressive physical therapy/rehabilitation plan 4. Progressed back to full activity without setback 8 weeks following injury.

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**MEDICINE & SCIENCE IN SPORTS & EXERCISE®**

**Acute Hip Pain In A Female Adolescent Runner**

**HISTORY:** A 13-year-old female presents for evaluation of left hip pain. Initial injury occurred one day prior to presentation during cross-country practice. She states she was approximately three quarters of a mile into a run on the track when she felt/heard a pop and immediately endorsed pain along the anterior left hip. She described it as sharp in quality with immediate discomfort with ambulation. She was not able to continue to complete the remainder of practice and given the severity and intensity of pain she was taken to the emergency department for further evaluation. While there, plain films were obtained and read as negative for acute fracture. She was given Motrin, placed on crutches and instructed on close follow-up. Since this time, she points to her ASIS and iliac crest as the source of pain with exacerbations during resisted and range of motion. She is taking ibuprofen and weight bearing type maneuvers. She denies any lower extremity radicular symptoms, paresthesias, temperature variations or nocturnal awakenings. Denies any fevers, chills, sweats or loss of bowel/bladder function. She does report some mild hip discomfort over the preceding couple of weeks however this was transient and self-limiting. She currently runs cross-country and participates in a travel softball team 3 days a week. **PHYSICAL EXAMINATION:** Examination of the left hip revealed no lesion/abrasion or overt deformity; normal alignment, no erythema, swelling or ecchymosis. On palpation she had point tenderness over ASIS and iliac crest, more so at the ASIS, no crepitus or tenderness at greater trochanter or anterior groin; slight pain over the hip flexor. Patient had full ROM of the left hip but noted pain with both internal rotation and flexion. Patient had mildly decreased strength with resisted hip flexion (4/5), but strength was otherwise normal in the left lower extremity. For provocative testing she had a negative Log Roll, negative FABER; neg FADIR; negative SLR; negative Slump test; positive Trendelenburg; neg Adductor squeeze test. She had normal neurovascular exam of the left lower extremity. The contralateral leg was normal to inspection, palpation, ROM and strength and stability testing. **DIFFERENTIAL DIAGNOSIS:** 1. Sartorius Strain/Rupture 2. Iliac Crest Apophyseal Avulsion Fracture 3. Psoas Strain 4. Stress Fracture/Reaction

**TEST AND RESULTS:** Imaging: 1. hip/pelvis x-rays showed avulsion of the superior aspect of the lateral left innominate bone with the cortical fragment laterally offset. The contralateral leg was normal to inspection, palpation, ROM and strength and stability testing. **DIFFERENTIAL DIAGNOSIS:** 1. Iliac Crest Apophyseal Avulsion Fracture **TREATMENT AND OUTCOMES:** After consultation with surgical colleagues it was decided to proceed with conservative management including ice/heat/NSAID therapy and non-weightbearing with crutch assistance. Patient followed up 2 weeks after the initial clinic visit with improving symptoms. She no longer required crutch assistance for ambulation. Patient was symptom free at 4-week follow up with further radiographic evidence of healing. At this time she was placed in a formal physical therapy program. Completed gradual return to play and was fully participating in running and softball at 8 weeks post injury.
workup for female athlete triad.

### Treatment and Outcomes

1. Patient made non weight bearing with crutches.
2. Patient was given options of surgical or conservative management of her compression-fractured side and chose to pursue surgical route given the fracture extended across. 50% across the femoral neck and her level of activity prior to the fracture.
3. Closed reduction with percutaneous pinning of the left hip.
4. Using a walker for immobilization she was made 25% weight bearing.

5. Week post operatively her pain was improving and she was compliant with weight bearing status.
6. After 2 weeks post operatively she continued to improve, she is advanced to 50% weight bearing status using walker and starting physical therapy.

### Final/Working Diagnosis

1. Concerning for a syrinx.
2. Fracture or subluxation.
3. MRI of the cervical spine without contrast showed a small disc herniation.
4. Spinal cord syrinx.
5. Spear tackler’s spine.

### Differential Diagnosis

1) Septic arthritis
2) Transient synovitis
3) Lyme disease
4) IgA Vasculitis

### Final/Working Diagnosis

1. Spinal cord syrinx
2. Cervical stenosis
3. Spear tackler’s spine
4. Septic arthritis
5. Transient synovitis
6. Lyme disease
7. IgA Vasculitis

### History

A 16 year old female high school basketball player presented to the athletic training room with a rash on the bilateral lower extremities. It was first noticed 1 week prior to presentation and had progressed from the feet and ankles proximally to the thighs. She stated that she initially had right ankle pain but at presentation felt her left knee was particularly swollen and painful. She denied any significant itching related to the rash but felt her legs were swollen and heavy. She denied any specific joint trauma and had been participating in her usual physical activities. She endorsed that she was currently recovering from an upper respiratory viral illness that occurred prior to the appearance of the rash. She had tried taking oral diphenhydramine for the rash which did not help.

### Physical Examination

1. She was in no acute distress. Nasal congestion and cough were noted.
2. The legs were diffusely swollen from the ankles to the proximal third of the thighs bilaterally with scattered, non-blooming and non-tender purpuric lesions.
3. There was no specific tenderness to palpation about the left knee without warmth. It was difficult to assess for a knee effusion as there was significant soft tissue swelling.
4. Knee flexion range of motion was 0 to 150 degrees, pain-free and flexion and extension strength was 5/5.
5. Ligamentous structures of the knees were intact. Sensation to light touch of the bilateral lower extremities was intact. She reported pain in the left knee with gait but was not observed as having a limp. Balance was intact.

### Differential Diagnosis

1) Septic arthritis
2) Transient synovitis
3) Lyme disease
4) IgA Vasculitis

### Tests and Results

1. The patient was sent to the emergency department for further evaluation.
2. Blood pressure was 116/69, pulse was 90, respiration rate was 19 breaths per minute with 100% oxygen saturation, and temperature was 97.5°F. A complete blood count showed normal platelets and no leukocytosis, while a basic metabolic panel showed normal renal function. A urinalysis showed trace blood and low lower extremity vascular ultrasound was negative for DVT. Muscle-skeletal ultrasound did not show any intra-articular effusion in the left knee.

### Final/Working Diagnosis

IgA Vasculitis (formally known as Henoch-Schonlein Purpura) with suspected female athlete triad.

### Treatment and Outcomes

1. Physical therapy, home exercises and relative rest from running and jumping.
2. Calcium and Vitamin D supplementation.
3. FU DEXA scan to assess female athlete triad.
experience dorsal wrist pain. She described diffuse pain about the dorsal aspect of the wrist radiating into the left hand. She denied mechanical symptoms, swelling, discoloration, or paresthesias. She also denied neck pain.

PHYSICAL EXAMINATION: Skin was grossly negative for erythema, breakdown, or concerning lesions in the left wrist/hand region. Neurologic exam: 5/5 strength in all forearm and hand muscles without atrophy, sensation was intact to light touch C5-T1, and pin test was negative over the superficial radial nerve. Musculoskeletal wrist exam: no swelling or deformity. No focal tenderness or mass. Full active and passive range of motion of the wrist. There was no pain or laxity with distal radial ulnar joint shuckung. There was no snuffbox tenderness and Watson’s test was negative.


TEST AND RESULTS: Ultrasound examination revealed an extensor digitorum brevis manus accessory muscle traversing from the deep side of the 4th dorsal extensor compartment, extending across the dorsal hand, and terminating into a tendon slip that merged with the dorsal extensor hool of the 3rd digit. The muscle was notably larger on the left side than the right. She had no evidence of tenosynovitis or other abnormalities in the dorsal wrist.

MRI of the wrist revealed a tiny ganglion cyst along the volar margin of the radioscaphoid articulation and a normal variant extensor digitorum manus brevis muscle.

FINAL WORKING DIAGNOSIS: Symptomatic extensor digitorum brevis manus

TREATMENT AND OUTCOMES: 1. Immobilization 2. Diclofenac Gel 3. Ultrasound guided Botox injection since she had minimal relief from immobilization.

We discussed different management options and she elected to proceed with an ultrasound guided botulinum injection since she had minimal relief from immobilization.

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Toe Pain—Cross-Country

HISTORY: A 12-year-old female cross-country runner presented to the pediatric sports medicine clinic with 3 months of right second toe pain. Initially, the pain started after stubbing her toe. She developed a constant dull ache that was present at rest and worsened with prolonged walking and during cross country. She noted that her symptoms gradually worsened with time, and she was having no improvement with rest, icing and anti-inflammatories.

PHYSICAL EXAMINATION: Overlying skin with no rashes or lesions. Tenderness along the plantar surface of her right second metatarsophalangeal (MTP) joint. ROM was limited in both passive and active flexion and extension of the affected joint.

Sensation was intact, and strength with flexion and extension of the toe was normal, however there was significant pain with testing. MT squeeze test was negative. Varus and valgus stress to MTP joint elicited no laxity, and “drawer test” of MTP joint showed mild instability.


TEST RESULTS: X-ray R foot: --- Flattening of the second metatarsal head.

MRI R foot without contrast: --- Flattening/collapse of the 2nd metatarsal head/distal epiphysis with prominent marrow edema of the 2nd metatarsal head and neck. Mild MTP joint space narrowing.

FINAL WORKING DIAGNOSIS: Osteochondrosis of the metatarsal head (Freiberg Disease) - Stage 4

TREATMENT AND OUTCOMES: 1. Placed in short leg walking boot with protected weight-bearing, ice 1-2 times daily, Foot/Akle Surgery consultation with discussion of conservative care vs surgical (chondral drilling and/or chondroplasty). Patient opted for conservative care.

2. At 4-week follow-up, patient’s pain significantly reduced. Continued walking boot additional 4 weeks with transition into stiff-soled shoe.

3. At 8-weeks post treatment, follow-up MRI showed no progression of disease.

Clinically with almost complete resolution of pain.

4. By 10 weeks, transitioned into a custom foot orthotic with added support to float 2nd MTP joint. Restrictions included low impact sports only with plan for repeat MRI at 6 months.

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Bilateral Shoulder Pain—Baseball

HISTORY: A 14-year-old right-handed baseball player presents with two and a half years of insidious-onset bilateral shoulder pain. The pain is generalized in both shoulders, but worse anteriorly and in the right shoulder. He has continued to play year-round at an elite level, but he had to stop pitching due to pain. His shoulders “catch” and pain is exacerbated with rapid movements.

PHYSICAL EXAM: Examination in clinic demonstrated tenderness of the anterior and posterior humeral head on the right and anterior humeral head on the left. Range of motion is limited in extension, internal rotation, and external rotation, and is full in flexion and abduction. Strength is full in all ranges of motion with pain in abduction, internal and external rotation. Hawkins, O’Brien’s, and Crank tests are positive for pain. He is distally neurovascularly intact.

DIFFERENTIAL DIAGNOSIS: Labral tear 2. Proximal Humeral Epiphysiodesis 3. Synovial Osteochondromatosis 4. Dysplasia Epiphysealis Hemiulnea 5. TEST and RESULTS: Bilateral shoulder radiograph: Abnormal rounded ossific densities anterior to the right humeral head and metaphysis. Similar pattern of ossification anterior to the left humeral head, which is less well-defined than that seen in the right shoulder. Bilateral shoulder MR without contrast: Bilateral symmetric irregularly-shaped osteochondral fragments within the anterior glenohumeral joint spaces with evidence of erosions of the humeral head. Bilateral shoulder CT without contrast: Bony irregularity along the medial, proximal aspect of both humeri with clustered ossicles adjacent to the bony irregularity. No evidence of free intra-articular bodies.

FINAL WORKING DIAGNOSIS: Bilateral Synovial Osteochondromatosis of the Shoulders TREATMENT AND OUTCOMES: 1. Referred for a surgical consult, where non-operative treatment was recommended. 2. Started in physical therapy (PT). 3. Continued full participation in sports despite pain. 4. 10-15% improvement after 3 months of PT. 5. Currently travelling for the winter baseball season and continuing PT at a distant site.
Acute Blindness In An Athlete
Sarah Abdellatif, Kevin Lisman, Rehal Bhojani. UT Health in Houston, Houston, TX. (Sponsor: Mark Chassy, FACSM)
(No relevant relationships reported)

TITLE: Acute Blindness in an Athlete
PRESENTER: Sarah Abdellatif

HISTORY: A 24 yo weightlifter with a past medical history of mitral valve prolapse and Raynaud’s syndrome experienced sudden right eye blindness about one month ago after training at the gym. She finished her session at the gym that day with no issues. Once patient returned home, she decided to sit down and read for a bit when she suddenly lost vision of her right eye. She had no precipitating symptoms. Patient took an aspirin and her vision returned in about thirty minutes. She states that the image was slightly pixelated when it returned. Patient had never had anything like this happen before and had not happened again after that episode.

PHYSICAL EXAMINATION: Height- 66 inches Weight- 112 pounds Blood Pressure- 132/76 HEENT- Extraocular movements intact. Pupils equal and reactive to light. Neck- JVP normal, carotid pulses are full and equal bilaterally without bruits Cardiac- Regular rhythm and rate, S1 normal, S2 normal, so S3 or S4, no murmurs, no rubs detected. Peripheral pulses- Femoral, popliteal, dorsalis pedis, and posterior tibial pulses are full and equal bilaterally with no bruits auscultated. Neuro- Cranial nerves 2-12 intact.

DIFFERENTIAL DIAGNOSIS: 1. Patent Foramen Ovale2. Central Retinal Artery Occlusion3. Hypertensive Migraine4. Multiple Sclerosis TEST AND RESULTS: Complete 2D Echocardiogram- The left ventricular systolic function is normal with an estimated EF 60-64%. Patent foramen ovale is seen with left to right shunting. - Qp:Qs ratio is 0.72. - There are no hemodynamically significant valvular abnormalities or insufficiencies noted on this study.

FINAL WORKING DIAGNOSIS: Large bidirectional shunting via patent foramen ovale with possible aborted central retinal artery occlusion stroke

TREATMENT AND OUTCOMES: 1. Start aspirin and Plavix daily. 2. TEE and a cardiac CTA to include origin of great vessels and carotid arteries. 3. Check a seven day cardiac monitor. 4. Schedule for PFO closure once results return. Risks and benefits discussed, given patient’s level of activity. 5. Refer to stroke neurologist for multidisciplinary evaluation.

Mesenchymal Stem Cell Use For ACL Repair: A Case Report
Navid Javan1, Andrew Blevner1. Dignity Health Northridge, Northridge, CA. 1Southern California Orthopedic Institute, Van Nuys, CA.
(No relevant relationships reported)

HISTORY: The subject of this case is a 41-year-old stuntman who was referred for non-surgical consultation for left knee pain and inability to return to work after being hit by a car 2 years prior. He had been treating his knee with rest and a hinged knee brace which had partially improved his pain. He did not report any instability but had not yet “tested” his knee. He had no injuries to this knee prior to that incident. He takes no medications and had no prior surgeries.

PHYSICAL EXAMINATION: He had no effusion, deformity or focal tenderness. He had full AROM and strength was 5/5. He had 1+ laxity on Lachman maneuver and anterior drawer testing. McMurray, varus stress, and valgus stress were all negative.

DIFFERENTIAL DIAGNOSIS: 1. ACL Sprain 2. ACL Rupture

TEST AND RESULTS: KT1000 testing was performed and showed a 4 mm difference at the 15 lb. level and a 5 mm difference with quadriceps active displacement. MRI of the left knee demonstrated a grade 2 ACL sprain with only a few fibers left intact. MRI also demonstrated an impaction contusional injury of the medial tibial plateau and a small medial meniscal tear. Grade 2 ACL Sprain of the Left Knee

TREATMENT AND OUTCOMES: Hematologic Migraine5. Multiple Sclerosis

Final Working Diagnosis: Large bidirectional shunting via patent foramen ovale with possible aborted central retinal artery occlusion stroke

TREATMENT AND OUTCOMES: The patient was referred to hand surgery for evaluation due to the fracture extending through the bone. He underwent ORIF for pathologic fracture 7 days post injury. He was placed in a plint post-operatively. At initial follow-up he demonstrated good wound healing and significant improvement in pain. He was placed in a custom splint which he wore for six weeks. At this time he started in hand therapy to work on return to full function.

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PHYSICAL EXAMINATION: He had no effusion, deformity or focal tenderness. He had full AROM and strength was 5/5. He had 1+ laxity on Lachman maneuver and anterior drawer testing. McMurray, varus stress, and valgus stress were all negative.

DIFFERENTIAL DIAGNOSIS: 1. ACL Sprain 2. ACL Rupture

TEST AND RESULTS: KT1000 testing was performed and showed a 4 mm difference at the 15 lb. level and a 5 mm difference with quadriceps active displacement. MRI of the left knee demonstrated a grade 2 ACL sprain with only a few fibers left intact. MRI also demonstrated an impaction contusional injury of the medial tibial plateau and a small medial meniscal tear. Grade 2 ACL Sprain of the Left Knee

TREATMENT AND OUTCOMES: The patient was referred to hand surgery for evaluation due to the fracture extending through the bone. He underwent ORIF for pathologic fracture 7 days post injury. He was placed in a plint post-operatively. At initial follow-up he demonstrated good wound healing and significant improvement in pain. He was placed in a custom splint which he wore for six weeks. At this time he started in hand therapy to work on return to full function.

Phalanx Fracture
Adam M. Thompson, Crozer Keystone Health System, Springfield, PA. (Sponsor: Thomas Kaminski, FACSM)
(No relevant relationships reported)

PHYSICAL EXAM: Vital signs were within normal limits. Examination of the patient’s left hand demonstrated swelling and ecchymosis over the middle phalanx of the middle and ring fingers along with tenderness to palpation. There was equal range of motion in pronation, supination, wrist extension and wrist flexion bilaterally. There was decreased active flexion and full extension in those fingers as well - MP 0/85,PIP 0/75, DIP 0/35. Skin was warm and dry. Capillary refill was brisk.

DIFFERENTIAL DIAGNOSIS: Left middle finger phalanx fracture, consistent with bone cyst/ectrochondroma with pathologic fracture.

TREATMENT AND OUTCOMES: The patient was referred to hand surgery for evaluation due to the fracture extending through the bone. He underwent ORIF for pathologic fracture 7 days post injury. He was placed in a splint post-operatively. At initial follow-up he demonstrated good wound healing and significant improvement in pain. He was placed in a custom splint which he wore for six weeks. At this time he started in hand therapy to work on return to full function.
Hand Injury

Marcin Jungiewicz, Kaleigh Suh. Advocate-Aurora Lutheran General Hospital, Park Ridge, IL. (Sponsor: Mark Hutchinson, FACSM)
Email: moli791@gmail.com

(History: A 15 year old H.S football quarterback sustained a right thumb injury while throwing a pass. His hand hit a defender’s chest during follow through, jamming his thumb. He noted swelling and bruising over thenar eminence and his 2nd MCP joint. This resulted in limited ROM of the right thumb especially of abduction and opposition. Physical Examination: Examination of the right hand showed edema along the 1st MCP joint, thenar eminence with ecchymosis in 1st web space extending into 2nd MCP joint. Skin was intact. Thumb was well vascularized. No tenderness over 2nd metacarpal or 2nd MCP joint. Thumb opposition and 1st MCP flexion and extension less than 20° were limited by edema and pain. IP ROM was within functional limits. Tenderness over ulnar aspect of 1st MCP joint. Pain and tenderness present during MCP extension with mild laxity with UCL stressing. Laxity at the CMC joint with some dorsal subluxation, reducible. Tenderness proximal to trapezium. Contralateral side thumb revealed also some laxity at the CMC.


Treatment and Outcomes: Restriction from all contact sports for 6 weeks 2. Consultation with Hand Orthopedist to evaluate for enable graduated ROM as tolerated and Occupational Therapy 3. Moderate grade sprain of UCL and RCL at the thumb MCP joint with partial tearing of proximal RCL at the avulsion fracture. 4. Diffuse low grade muscle strain with superimposed partial musculotendinous tear of flexor pollicis brevis muscle. Treatment and Outcomes: 1. Wrist and thumb immobilization in Custom thumb spica splint to enable graduated ROM as tolerated and Occupational Therapy 2. Restriction from all contact sports for 6 weeks. 3. Consultation with Hand Orthopedist to evaluate for surgery necessity determined patient to be appropriate for conservative treatment. Patient seen in Sports Medicine Clinic 39 days after initial injury. Returned to sports after 6 weeks of immobilization with thumb/wrist taped. Patient denied pain with activity.

Chronic Shoulder Pain Secondary To Trampolining Injury

Johnel Mayberry1, Terry Nicola, FACSM1, Kevin Machino2
1University of Illinois at Chicago, Chicago, IL. 2Rush University, Chicago, IL. (Sponsor: Terry Nicola, FACSM)
Email: jaymayberry15@gmail.com

(History: 14 year old female with right shoulder pain and arm paresthesias after trampolining injury 17 months prior to visit. Her right arm was yanked down and she heard a pop. Pain initially improved but recurred during basketball tryouts 6 months later. At presentation she noted right shoulder “spasm” pain rated 2/10 at rest and her strength is significantly improved. She continues to have right 3rd-5th digit paresthesias with prolonged activities despite focused physical therapy and is undergoing surgical evaluation.

Estimated daily physical activity in all groups. Data presented as mean±SD and a mean ΔChange

<table>
<thead>
<tr>
<th>Time (hours)</th>
<th>Wear Time (minutes)</th>
<th>Unilateral Amputation (n=8)</th>
<th>Bilateral Amputation (n=8)</th>
<th>Control (n=13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 ± 1</td>
<td>918 ± 41</td>
<td>916 ± 55</td>
<td>918 ± 45</td>
<td>914 ± 42</td>
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<td>5 ± 0</td>
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<td>916 ± 55</td>
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<td>916 ± 55</td>
<td>918 ± 45</td>
<td>914 ± 42</td>
</tr>
</tbody>
</table>

PA Counts (day)-1

64058±86078 534248±96125 -110836 492569±534248
283357±314960 -209212 70732±197009

PAEE (local day)-1

839±88 733±87 -106 410±68 217±85 -194 948±155

Discussion:
Restoration of physical function and physical activity (PA) is considered a vital therapeutic component in the short-term rehabilitation and long-term recovery of individuals with traumatic lower-limb amputation(s) (LLA). Unfortunately, evidence suggests an increased prevalence of physical inactivity and reduced functional status in this population. PURPOSE: To determine the impact of free-living environment (rehabilitation vs. home) on PA and function in UK military personnel following traumatic LLA, compared to active non-injured controls (CON). METHODS: Sixteen LLA (8 unilateral (UNI), 30±5yrs; 8 bilateral (BI), 29±3yrs), near the end of their clinical rehabilitation care pathway, attended one 4-week residential rehabilitation admission and one 6-week recovery block at home. Thirteen physically active, age-matched males (28±5yrs) represented CON. Estimated daily ambulatory PA energy expenditure (PAEE) was estimated from an accelerometer (Actigraph GT3X+) worn on the hip of the shortest residual limb in each environment, using validated population specific prediction algorithms. Six minute walk distance (6MWD) was recorded at baseline and 10 weeks (general population 6MWD norms is >459m). RESULTS: Whilst at home, mean PA counts.day-1 reduced by 17% (p=0.018) and 42% (p=0.001) in the UNI and BI group, respectively. UNI group demonstrated a similar capacity for PAEE to CON, both of which were greater (p<0.05) than BI (Table 1). No significant changes in 6MWD were demonstrated within groups (P=0.05), however, significant differences (P=0.05) were demonstrated between all groups at baseline (UNI, 574±66m; BI, 337±85m, CON, 705±32m). CONCLUSION: UNI group demonstrate a similar capacity for PA and function to active non-injured CON. To support and manage the long-term health and well-being of more severely injured BI LLA, future research should investigate strategies that promote regular engagement in PAEE, particularly when they return home.
There is no consensus about the absolute maximum immobilization time interval and whether the rehabilitation should start in the first or in the third week after Bankart Repair. PURPOSE: The aim of this study was to compare the clinical outcomes of 1 and 3 weeks of absolute immobilization time after the surgery and evaluate their effects on recurrent instability.

METHOD: Forty-two patients with arthroscopic Bankart surgery were included to the study. Patients were randomly allocated into two groups. One week of absolute immobilization was performed to the patients in group-1 (n=21, age:24.7±7.1, BMI: 25.3±3 kg/cm²) and 3 weeks of absolute immobilization was performed to the patients in group-2 (n=21, age: 22.1±6.7 years, BMI: 24.8±2.8 kg/cm²). All of the patients came to the clinic once in a week and performed supervised exercise program and the rehabilitation program was progressed. They were also prescribed home exercise program. Shoulder ROM, pain level and shoulder function were assessed, according their groups at the first or third weeks, 4, 8 and 12 weeks of post-operative period. The pain level during resting, activity and at night was assessed with VAS. Shoulder ROM was assessed with standard goniometer and shoulder function was assessed using ASES questionnaire. At the average of 30 weeks after the surgery, it was questioned whether there was a re-dislocation. The demographics of the patients on both groups were analyzed with student t test. Two-way repeated measures ANOVA was used for the statistical analyses.

RESULTS: There were no significant the “Group*Time” interactions for pain at rest and activity and flexion, abduction, external rotation and internal rotation at (p>0.05). The effect of time was significant at rest and activity pain and all ROM measurements (p<0.05). There was a significant “Group*Time” interaction for pain at night (p<0.05). Pain at night was higher in the group-1 at post-operative 1 and 4 weeks compared to group-2. There were no statistically significant differences between the two groups in shoulder function at post-operative 12 weeks (p>0.05) and 30 weeks compared to group-2. There were no re-dislocation in the group-2. CONCLUSION: One or three weeks of absolute post-operative immobilization period does not differ in terms of functional outcomes on patients with Bankart repair.
post ACLR, there is a lack of consideration for patient’s psychological readiness at the
time, for both sexes. If females are returning to sports before being psychologically
ready, they are likely to be hesitant and less confident in game situations, contributing
to injury risk. Future work is needed to determine if psychologically-focused
rehabilitation programs are needed to potentially reverse the reported sex differences.

2417 Board #6 May 28 6:00 PM - 7:00 PM
Diarrhea (Infectious Disease)-Swimming And Diving
Jordan P. Hilgiefot, Christina Murphy, Amy Miller, Keri Denay, FACSM. University of Michigan, Ann Arbor, MI.

No relevant relationships reported

History: 19-year-old men’s collegiate swimming athlete with PMH of anxiety & major
depressive disorder presented with 3 days of nausea, vomiting & diarrhea. He reported
several teammates with similar symptoms. He returned for reassessment 1 week
following initial evaluation endorsing 2 days of symptom improvement followed by
return of several episodes of emesis, diarrhea & fatigue.

Physical Examination:
General: Well-developed, Well-nourished, NAD
HEENT: -Head: NC, AT
-Eyes: conjunctiva clear, EOMI, PERRL, no discharge
-Ears: hearing normal on gross assessment, TM’s normal
-Nose: nasal clear, no deformity
-Throat: M, no erythema or exudate
NECK: normal ROM, no lymphadenopathy
PULM/CHEST: CTAB, no wheezes, rales or rhonchi
CV: RRR, no MRG. CR < 2 sec
ABD: BS/-, soft, non-tender, non-distended, no organomegaly
SKIN: no visualized rashes or skin lesions, skin is warm and dry
PSYCH: appropriate mood and affect

Differential Diagnosis:
1) Viral gastroenteritis
2) Bacterial gastroenteritis
3) Parasitic infection
4) Irritable bowel syndrome
5) Anxiety

Tests and Results: Initial CBC, BMP and TSH were remarkable only for mild
thrombocytosis (447 K/mm3) and hypoglycemia (63 mg/dL). After incomplete
resolution of symptoms, GI PCR panel was obtained and found to be positive for
cryptosporidium.

Final Diagnosis: Cryptosporidiosis

Treatment and Outcomes:
1) He was treated with Nitazoxanide 500 mg PO BID x 3 days and held out of the pool
for 2 weeks.
2) Athletes with exposure to university pools presenting with diarrhea were treated
for cryptosporidium via PCR. 6 were positive and all were held out of the pool for 2
weeks.
3) The public health department and environmental health experts were consulted to
assist with management.
4) Administrators from every university and local swimming clubs who shared a
common pool with our athletes were notified of potential exposure to cryptosporidium.

One head-to-head swimming meet was cancelled in an effort to limit potential

4. Range of motion and strengthening exercises for bilateral hip flexors with physical
therapy
3. Indomethacin PRN for pain
2. Close follow up with Infectious disease clinic with monitoring labs every 2 weeks
by infectious disease
1. He was treated with Nitazoxanide 500 mg PO BID x 3 days and held out of the pool
for 2 weeks.

Diarrhea (Infectious Disease)-Swimming And Diving

Differential Diagnosis:
- Labral tear
- Femoracetabular impingement
- Femoral neck stress fracture
- Loose body
- Chondral defect
- Athletic pubalgia

Tests and results:
X-rays were obtained and suggested minimal left femoral head collapse, and did
suggest mild right femoral head sclerosis; an MRI showed large areas of 2
avascular necrosis bilaterally. The left had a joint effusion, edema in addition to
necrotic fatty signal in the femoral head compatible with early collapse.

Final/Working Diagnosis:
Bilateral hip avascular necrosis with early left collapse.

Treatement/Outcome:
- Internal Medicine and Rheumatology referral for serological work up.
- Referred to Orthopedic Surgeon; recommended toe-touch weightbearing, counseled
on risk of progression. Aledronate was considered as well pre-collapse Ficat stages 0-III
- At 8 months, left hip pain was progressing, and noted onset of right hip pain. X-rays
showed visible left AVN on the entire weightbearing surface with collapse and
flattening of the superior articular surface; right hip now showed subcute sclerosis.
- His only pertinent history included a brief course of oral corticosteroids when
he got his wisdom teeth removed, which he did not initially disclose. This case
reports an unusual etiology of an avascular necrosis after taking a short-term dose of
corticosteroids. Case raises awareness to counsel health providers about collaborating
to provide patients with optimal care and avoid potential serious side effects.

2419 Board #8 May 28 6:00 PM - 7:00 PM
Bilateral Hip Pain - Soccer Player
Samantha Lucrezia (Sponsor: Dilip Kumar R. Patel, FACSM), Danielle Hirsch, Patrick Mularoni. Johns Hopkins All Children’s Hospital, St. Petersburg, FL.

No relevant relationships reported

History: A 16-year-old Asian male presented with 2 weeks of worsening groin pain.

Differential Diagnosis:
1. Ankylosing Spondylitis
2. Iliopsoas Abscess
3. Epidural abscess
4. Osteomyelitis
5. Malignancy

Test and Results:
-ESR: elevated at 94 mm/hr, CRP: elevated at 4.57 mg/dL
-CBC: mild normocytic anemia without leukocytosis or thrombocytopenia
-CK, CMP, Uric Acid, LDH within normal limits
-Blood culture: negative
-Rheumatologic studies: ANA, adolase, ANCA were negative
-Testicular US: negative
-MRI of lumbar spine and pelvis: signal enhancement within the bones of pubis
-Portable x-rays: suggested minimal left femoral head collapse, and did
suggest mild right femoral head sclerosis; an MRI showed large areas of 2
avascular necrosis bilaterally. The left had a joint effusion, edema in addition to
necrotic fatty signal in the femoral head compatible with early collapse.

Final/Working Diagnosis:
Tuberculous osteomyelitis of the pelvis

4. Range of motion and strengthening exercises for bilateral hip flexors with physical
therapy
5. Regular follow up with local department of health
3. After multiple rounds of chemotherapy, there is no evidence of residual lymphoma.

2. Cranial nerve symptoms resolved with chemotherapy and steroids.

1. Admitted for prompt initiation of chemotherapy.

Stage IV Burkitt lymphoma, with primary lesion in abdomen, and perimeningeal spread, causing cranial nerve V and VII palsies.

CSF Cytology: Enlarged B-cells most consistent with Burkitt lymphoma.

Complete Blood Count: WBC 19k, platelets 80, hematocrit 30.4

MRI Brain with and without contrast: Asymmetric enhancement of the left 7th cranial nerve, asymmetric nodular enhancement along the left 5th nerve with enhancement of muscles of mastication, diffuse bilateral pachymeningeal enhancement.

TESTS AND RESULTS:

Bell’s palsy
Intracranial hemorrhage

DIFFERENTIAL DIAGNOSIS:

palsy, decreased hearing in the left ear, and altered sensation to light touch over the middle lower lip. There was no focal tenderness or deformity of the skull or scalp.

PHYSICAL EXAMINATION:

Mild cognitive deficits in attention and memory, impaired balance on BESS, normal motor strength. Cranial nerve exam showed ptosis of the left eye, mild left facial nerve palsy, decreased hearing in the left ear, and altered sensation to light touch over the middle lower lip.

There was no focal tenderness or deformity of the skull or scalp.

Differential Diagnosis:

Mild traumatic brain injury
Intracranial hemorrhage
Cerebral mass
Bell’s palsy

Treatments and Outcomes:

1. Admitted for prompt initiation of chemotherapy.
2. Cranial nerve symptoms resolved with chemotherapy and steroids.
3. After multiple rounds of chemotherapy, there is no evidence of residual lymphoma.

Purpose: To evaluate differences in injury frequency and severity between two different heat participation policies in South Carolina high school and collegiate athletics.

Methods: Retrospective cohort study of Division II collegiate & high school athletes looking at injury frequency & severity between two different heat participation policies. Fifty middle & high schools as well as 2 Division II colleges with a total of 16,832 athletes were investigated over 2 years. Inclusion criteria were reported heat illnesses between July 1 & November 30th for 12 outdoor sports resulting in 86 injuries that were analyzed. Chi square analysis was used to compare injury frequency & severity between no outdoor workouts with a wet bulb globe temperature (WBT)≥90 (policy 1) versus WBT<90 (policy 2).

Results: For policy 1 there was a mean of 31 heat illnesses/year with an average of 16 days for illness resolution. For policy 2 there was a mean of 24 heat illnesses/year but the average of 41 days for illness resolution was significantly higher (p=0.02).

Grading heat illness severity was based on guidelines developed by Rauh et al. Mild to moderate injury was defined as 0-21 days for return to activity while severe injury ≥21 days for return. With policy 1, 4.8% of heat illnesses met severe criteria while 20.8% of heat illnesses in policy 2 were severe showing an odds ratio of heat illness with policy 2 is 5.2 times higher than policy 1 (OR 5.2, 95% CI 1.1-23.7). Conversely the percentage of mild to moderate illness was statistically lower with policy 2 compared to policy 1 (p=0.022) suggesting that policy 2 resulted in more severe heat illness. Policy 1 was in place for several years with no record of EMS transport for heat illnesses however within the first season of policy 2, there was 3 athletes transported. The average age at time of injury was 16 years old & not statistically different between policies. There was an average of 45 minutes of practice per week lost with the WBTG cutoff of 90 compared to cutoff of 92.

Conclusions: Although the total number of heat illnesses did not change between policies, there was a statistically significant increase in severity of illness & time for return to sport with raising the WBGT participation cutoff from 90 to 92. Our data suggests that a cutoff of 90 reduces the frequency of severe heat illness in athletes.

Purpose: Large population-based studies about sudden cardiac deaths (SCD) and survived sudden cardiac arrests (SCA) in athletes from the USA and Europe indicate regional differences in the underlying causes. A different ethnic and genetic mix between these regions may lead to such a heterogeneous distribution. It is of great relevance to investigate these regional patterns to possibly optimize existing screening and prevention procedures and reduce fatalities. This registry aims to investigate SCD and SCA in football (soccer) players worldwide, both at professional and recreational level.

Methods: From 2014 to 2018 cases of SCDs and SCAs were mainly recorded by media monitoring (Meltwater®), a confidential web-based data platform and data synchronization with existing national SCD registries (n=16). Inclusion criteria were met when SCD or SCA occurred during football-specific activity or up to one hour afterwards. Death during other activities was excluded.

Results: A total of 632 players (mean age 34±16 years, 96% males) were reported from 70 countries; 150 players (24%) survived. Elite players represented a small portion (6%). A diagnosis by autopsy or definite medical reports could be established in 219 cases (35%). The leading causes over the age of 35 years were coronary artery disease (CAD, 74%) and ≤35 years sudden unexplained death (22%), cardiomyopathy (CM, 17%) and CAD (11%). Hypertrophic CM and coronary artery anomalies showed the highest fraction in North America with 15% and 36%, respectively. Myocarditis was most frequently reported from Europe (7%). CAD ≤35 years prevailed in Africa (38%) and CM (42%) in South America. Commotio cordis occurred infrequently (3%). In North America and Australia survival rates were the highest (53% and 47%, respectively). Early use of an automated external defibrillator was associated with a higher survival rate (86%) compared to manual cardiopulmonary resuscitation (35%).

Conclusions: Differences between countries in the underlying cardiac diseases for SCA and SCD have to be taken into account to possibly improve and modify primary and secondary prevention measures in football players. The percentage of autopsied cases is difficult to increase because this reflects the law in most countries. Therefore, an expansion of national SCD registries is urgently needed.

Purpose: To determine the diagnostic and prognostic value of single-task and dual-task tandem gait by comparing performance of subjects with concussion relative to controls, as well as subjects who developed Persistent Post Concussion Symptoms (PPCS) and those who did not (No PPCS).

Methods: Subjects seen within 21 days of concussion and uninjured controls completed a single/dual-task tandem gait test battery and modified Balance Error Scoring System (mBESS) test. During the tandem gait test, subjects walked in a heel-toe manner along a 5m strip of fabric down and back as fast as possible. During dual-task trials, they completed a concurrent cognitive task. Outcomes included tandem gait time to completion, cognitive accuracy, and mBESS errors. Subjects with concussion were followed until symptom resolution and sub-grouped into those who developed PPCS (>28 d time to symptom resolution) vs. No PPCS.

Results: We evaluated 29 subjects with concussion who were classified PPCS (mean age=14±3 years; 62% female; tested 8.5 days post-injury) vs. No PPCS (mean age=16±1 years; 42% female). Subjects with concussion performed significantly worse than...
healthy controls on single-task tandem gait (24.4±12.6 vs. 14.9±3.6 s; p<0.001; area under curve [AUC]=0.85), dual-task tandem gait (33.3±14.9 vs. 20.6±7.1 s; p<0.001; AUC=0.84), dual-task cognitive accuracy (82.1±12.5 vs. 89.1±18.9 %; p<0.01; AUC=0.61), and mBESS (6.5±4.9 vs. 3.8±3.4 errors; p<0.001; AUC=0.68). The PPCS sub-group performed dual-task tandem gait significantly slower than the No PPCS group (38.8±17.7 vs. 30.6±12.7 s; p=0.016; odds ratio=1.04), but PPCS and No PPCS groups were not significantly different on other measures. **Conclusions:** Pediatric patients with concussion have impaired performance on balance and gait measures compared to healthy controls. Dual-task tandem gait test specifically showed diagnostic value for pediatric concussion and prognostic value in differentiating subjects who developed PPCS compared to those who did not.
The ingestion of sodium bicarbonate (NaHCO₃) to improve short duration, high intensity exercise performance is widely practiced in elite athletics, rowing and track cycling. However, gastrointestinal (GI) distress is a common side-effect of NaHCO₃ supplementation which has been suggested to mitigate the performance-enhancing potential of NaHCO₃ supplementation. With this in mind, a method of NaHCO₃ administration that bypasses the GI tract may be a favourable alternative to oral supplementation. PURPOSE: The purpose of this study was to compare the blood buffering profile and exercise responses between a commercially available topical NaHCO₃ lotion and a typical, orally ingested amount (0.3 g/kg body weight (BW) NaHCO₃). METHODS: 10 recreationally active participants completed two experimental trials (randomised and counterbalanced); oral NaHCO₃ (0.3g/kg BW + placebo lotion) or topical NaHCO₃ lotion (0.9036 g/kg BW + oral placebo) applied or ingested 90 min prior to a cycling task to exhaustion (repeat 30 s cycling efforts at 120% peak power output with 30 s rest). Capillary blood was collected and analysed for pH, bicarbonate (HCO₃⁻) and lactate every 10 min throughout the 90 min loading period and post-exercise at 5, 10 and 15 min. RESULTS: pH and [HCO₃⁻] were significantly elevated from baseline after 10 min in the oral NaHCO₃ condition and throughout recovery compared to the topical lotion (p ≤ 0.001). No differences in lactate (p ≥ 0.05) were observed between the oral NaHCO₃ condition (363 ± 80 s; p = 0.697) and the topical NaHCO₃ condition (349 ± 119 s; p = 0.390). CONCLUSION: Topical NaHCO₃ lotion (0.9036 g/kg BW) did not significantly increase blood buffering capacity, suggesting that concentrations used in the present study have limited transdermal absorption capacity into the wider circulation.

The Efficacy Of Topical Sodium Bicarbonate Application On Blood Buffering Capacity And Exercise Tolerance

Rebecca L. Cross¹, Alannah McKay², Peter Peeling³, Martyn Binnie⁴, Paul Goulds⁵, Marc Sim⁶, Jason Siegel, FACSM⁷, Western Sydney University, Penrith, Australia. ¹University of Western Australia, Crawley, Australia. ²Western Australian Institute of Sport, Mt Claremont, Australia. ³Edith Cowan University, Western Australia, Australia. (Sponsor: Jason Siegel, FACSM)

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Cognitive dysfunction during sustained military operations (SUSOP’s) may be related to the recruitment and infiltration of classical monocytes into the brain. Beta-alanine (BA) supplementation may attenuate cognitive dysfunction and improve resilience to stress exposure, which may be relevant during a SUSOP. PURPOSE: To examine the effect of BA on serum monocye chemotaxic protein-1 (MCP1), C-C chemokine receptor 2 (CCR2), macrophage-1-antigen (CD11b) and cognition (COG), and to examine the relationships between these variables during a SUSOP. METHODS: Nineteen recreationally active men ingested 12g·day⁻¹ BA (N = 9) or placebo (PL; N = 9) for 14-days prior to completing a simulated 24-h SUSOP. MCP1 was assessed via multiple assay. Classical monocyte CCR2 and CD11b expression were assessed via flow cytometry. Throughput (TP) scores were extracted from seven cognitive subtests administered via Automated Neuropsychological Assessment Metric (ANAM) software. The relative weight of each ANAM subtest was determined by dividing its outer weight by the standard deviation of all TP scores for that subtest. TP scores were multiplied by their relative weights, and the values summed to provide a value for COG. Assessments occurred at baseline (0H), 12-hours (12H), 18-hours (18H) and 24-hours (24H). A two-way mixed ANOVA was used to assess differences between BA and PL. The statistical significance of pathway (β) coefficients derived from partial least squares structural equation modeling were used to evaluate relationships between MCP1, CCR2, CD11b and COG. RESULTS: MCP1 was significantly greater at 12H, 18H and 24H relative to 0H (p < 0.001). CCR2 expression was significantly lower at 12H (p < 0.031), 18H and 24H (p < 0.001), while CD11b expression was significantly greater at 12H (p = 0.039) and 24H (p = 0.003) relative to 0H. COG was significantly lower at 18H and 24H compared to 0H and 12H (p ≤ 0.001). No significant differences were noted between BA and PL for any variable (p ≥ 0.05). MCP1 had a direct negative relationship with cognition (β = −0.395, p = 0.002). CCR2 and CD11b were not directly related to cognition (p ≥ 0.50). CONCLUSIONS: Greater serum MCP1 concentrations were associated with increased cognitive dysfunction during the SUSOP. BA did not affect MCP1, CCR2, CD11b or COG compared to placebo.

Efficacy Of Topical Sodium Bicarbonate Application On Blood Buffering Capacity And Exercise Tolerance

Rebecca L. Cross¹, Alannah McKay², Peter Peeling³, Martyn Binnie⁴, Paul Goulds⁵, Marc Sim⁶, Jason Siegel, FACSM⁷, Western Sydney University, Penrith, Australia. ¹University of Western Australia, Crawley, Australia. ²Western Australian Institute of Sport, Mt Claremont, Australia. ³Edith Cowan University, Western Australia, Australia. (Sponsor: Jason Siegel, FACSM)

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Betaine (B-ALA) is a non-essential amino acid thought to increase muscle buffering capacity and decrease muscle fatigue. Supplementation with B-ALA is known to commonly cause paresthesia in some individuals, an unpleasant sensory symptom. It is unknown whether B-ALA supplementation affects pain perception in a natural environment or hiking performance. PURPOSE: The aim of this study was to determine if supplemented B-ALA affected participants’ perceived pain before and after a bout of hiking. METHODS: Participants (N = 11) completed a double-blind crossover study. B-ALA (6.2 g) or placebo (PLA) was administered, followed by 45-min of seated immersion in nature. Participants completed the McGill Pain Questionnaire short form and then completed a 0.81 km (0.5 mile) hike on the Lightning Switch trail (Cedar City, UT) as fast as possible (elevation gain = 66m, 217 ft) before filling out the questionnaire again. Participants completed the alternate supplementation on a separate day. Data was analyzed using a 2 x 2 repeated measures ANOVA with significance accepted at p < 0.05. RESULTS: No interaction was noted for total pain score (PLA pre = 0.6±1.0, post = 2.8±3.0; B-ALA pre = 2.6±3.1, post = 3.2±4.2; p = 0.08) or treatment main effect (p = 0.07). No interaction was present for the sensory component of pain (PLA pre = 0.4±0.8, post = 1.7±2.0; B-ALA pre = 2.2±2.9; p = 0.13) but a main effect for treatment was observed (p = 0.02). Hiking performance was not different between treatment days (PLA = 8.4±1.3 min, B-ALA = 8.6±1.6 min, p = 0.27). CONCLUSION: While acute B-ALA increases the sensory perception of pain when administered in a natural environment, it does not affect hiking performance.
E-07  Thematic Poster - Microbiome and Immunity Across the Healthspan
Friday, May 29, 2020, 9:30 AM - 11:30 AM
Room: CC-2011

E-07  Thematic Poster - Microbiome and Immunity Across the Healthspan
Friday, May 29, 2020, 9:30 AM - 11:30 AM
Room: CC-2011

Chair: Melody D. Phillips, FACSM. Texas Christian University, Fort Worth, TX.
(No relevant relationships reported)

2453  Board #8  May 29 9:30 AM - 11:30 AM
The Efficacy Of Individualizing Sodium Bicarbonate Supplementation Strategies On Elite-level Rowing Performance
Jason C. Siegler, FACSM1, Susan Boegman2, Trent Stellingwerff, FACSM2, Greg Shaw3, Rebecca Cross4, Kenneth Graham5.
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A recent review has addressed a number of practical issues associated with traditional sodium bicarbonate (NaHCO₃) supplementation approaches, identifying ingestion timing as critical to maximising the potential of this ergogenic medium. Furthermore, contemporary empirical studies have also suggested that adjusting the start of exercise to commenceuraneous with an individual’s peak blood buffering response may result in better outcomes in terms of GI distress and exercise performance, however this concept has yet to be investigated in international level athletes. PURPOSE: The following study addressed the question of whether or not ingestion timing is critical to time-trial performance (2,000 m rowing time-trial) in elite-level rowers including Pan American, World Champion and Olympic team members) adhering to their own individualised pre-race strategies (e.g. nutrition, warm-up, etc.). METHODS: Twenty three (n = 23) elite rowers across two research centres (Canadian Sport Institute Pacific and the New South Wales Institute of Sport) completed three trials (one NaHCO₃ loading profile to determine the individual’s time-to-peak blood buffering capacity followed by two randomized experimental trials (Consensus Standard (CON): 2,000 m rowing time trial (TT) performed 60 min post 0.3 g kgBW⁻¹ NaHCO₃ ingestion; and Individualised Peak (IP): 2,000 m rowing TT performed at the rower’s individual peak bicarbonate concentration (HCO₃⁻) (determined from the profiling trial) after ingesting 0.3 g kgBW⁻¹ NaHCO₃). RESULTS: Significant interaction effects and post hoc comparisons revealed differences between CON and IP at pre-warm up for HCO₃⁻ however given the effect size this difference was likely trivial. CONCLUSIONS: The findings of the present study do not support the recent claims that targeting the onset of exercise to commence with an individual’s peak blood buffering capacity after NaHCO₃ supplementation is essential to maximise the ergogenicity of this supplement.

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2456  Board #2  May 29 9:30 AM - 11:30 AM
Mucosal-Associated Invariant T Cell Response To Acute Exercise In Overweight Older Women
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Mucosal Associated Invariant T (MAIT) cells have properties of both innate and adaptive immunity and are dysregulated in overweight/obese (OW) populations. MAIT cell proportion and number increase after acute exercise in healthy young men, but the effect of acute exercise on MAIT cells in OW women is unknown. PURPOSE: To investigate MAIT cell frequency and function after acute exercise, in OW, older women compared to lean controls. METHODS: Sedentary, OW women (n=15, 64 y ± 4, 32.9 kg/m² ± 3.69, 21.7 ml/kg/min ± 3.40) completed 25 min of walking at 70-80% heart rate reserve and 2 sets of 8 resistance training exercises. Immune cells were isolated at rest, 0h and 1h post exercise. Cells were stimulated with PMA/ionomycin. Cell frequency and intracellular cytokine expression were determined using flow cytometry. A reference group of lean women (n=8, 54 y ± 7, 21.5 kg/m² ± 2.0, 29.8 ml/kg/min ± 5.06) provided a resting blood sample. RESULTS: Lymphocyte number increased at 0h by 44% ± 41 (p = 0.001) before returning to resting levels at 1h. Compared to lean women, OW women had greater MAIT cell counts (OW 97 ± 29 cells/μL, Lean 27 ± 18, p=0.048) but lower MAIT cells frequencies at baseline (OW 0.4% ± 0.9, Lean 4.1 ± 2.1%, p<0.001). TNFα expression in stimulated MAIT cells was also lower in OW women (OW 79% ± 16%, Lean 98% ± 5% p<0.001). Following acute exercise, there was no change in MAIT cell frequency or absolute number in OW women. TNFα expression increased by 14% ± 34% (p=0.006) at 0h in the OW group. There were no differences in IFNγ expression between groups or with acute exercise. CONCLUSIONS: Obesity appears to attenuate the MAIT cell function and increase counts in OW women. Increased at 0h by 44% ± 41 (p = 0.001) before returning to resting levels at 1h. Compared to lean women, OW women had greater MAIT cell counts (OW 97 ± 29 cells/μL, Lean 27 ± 18, p=0.048) but lower MAIT cells frequencies at baseline (OW 0.4% ± 0.9, Lean 4.1 ± 2.1%, p<0.001). TNFα expression in stimulated MAIT cells was also lower in OW women (OW 79% ± 16%, Lean 98% ± 5% p<0.001). Following acute exercise, there was no change in MAIT cell frequency or absolute number in OW women. TNFα expression increased by 14% ± 34% (p=0.006) at 0h in the OW group. There were no differences in IFNγ expression between groups or with acute exercise. CONCLUSIONS: Obesity appears to attenuate the MAIT cell function and increase counts in OW women. Lower baseline TNFα expression suggests these cells have a reduced capacity to respond to stimulation with greater resting MAIT counts potentially being a compensatory response. Acute exercise did not alter MAIT cell counts or frequencies. However, TNFα expression increased with acute exercise, suggesting that exercise may increase MAIT cell sensitivity to mitogenic stimulation. This temporary increase in cell functionality may offset some of the detrimental effects of obesity on MAIT cells but the long-term training effects still need to be determined.
Exercise-induced alterations of circulating immune cells are well investigated in both healthy and clinical populations. In healthy individuals these alterations are mainly used to depict immunological recovery, while in clinical context the mobilization of immune cells is suspected to improve the course of various diseases (e.g. neoplastic diseases). Therefore, exercise might serve as add-on therapy to conventional therapeutic approaches. Since direct comparisons of the cellular immune response to different exercise types remain sparse, we compared two exercise sessions of clinical application in healthy subjects, to provide basic knowledge of potential differences.

**PURPOSE:** To compare the cellular immune response to an acute bout of endurance exercise (EE) and resistance exercise (RE).

**METHODS:** 24 healthy men conducted an acute EE (cycling at 60 % of peak power output) and RE session (5 exercises, 4 x 8-10 repetitions at 70 % of 1-repetition maximum) lasting 50 min on separate days.

**RESULTS:** Values of EE were significantly higher at t1 for LEUK (mean difference between groups (Δ) 1.53, p ≤ .001), LYM (Δ 1.04, p ≤ .001), NEUT (Δ 0.19, p ≤ .001), T cells (Δ 0.49, p ≤ .001), NK cells (Δ 0.45, p ≤ .001), CD56dim (Δ 0.4, p ≤ .001) and CD56bright (Δ 0.05, p ≤ .01). Regarding LYM subsets, EE caused a significant increase from t0 to t1 in T cells (mean difference between time points (Δ) 0.05, p ≤ .001) and B cells (Δ 0.05, p ≤ .001), while NK cells increased after both, EE (Δ 0.58, p ≤ .001) and RE (Δ 0.16, p ≤ .019).

**CONCLUSION:** An acute bout of EE is superior to RE in mobilizing immune cells. While the cellular immune response of T and B cells seems to be reserved to EE, RE does represent an appropriate stimulus for NK cell mobilization. Thereby, our results indicate that especially in neoplastic diseases where NK cell mobilization is crucial, RE might represent a suitable alternative to EE as potential add-on therapy to conventional therapeutic approaches. However, validation of our results in diseased populations is warranted.

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**Cellular Immune Response To Acute Endurance Vs. Resistance Exercise---A Randomized Crossover Study**

**Board #3**

**May 29 9:30 AM - 11:30 AM**

**S524 Vol. 52 No. 5 Supplement**

**Cellular Immune Response To Acute Endurance Vs. Resistance Exercise---A Randomized Crossover Study**

David Walzik, Marit Lea Schlagek, Niklas Joisten, Christine Kollmitz, Wilhelm Bloch, Alexander Schenk, Philipp Zimmer. German Sport University Cologne, Cologne, Germany. (No relevant relationships reported)

**CONCLUSION:** Immune responses to exercise training in women with an elevated risk of breast cancer are likely to vary depending on the intensity of exercise. Future research should focus on investigating the potential that exercise may have on T-cell phenotypes and their relation to breast cancer risk.

**Funded by:** NCI R25 CA057730, the MD Anderson Cancer Center/Energy Balance Assessment Supplemental Funding, MD Anderson Cancer Center, Center for Energy Balance in Cancer Prevention and Survivorship, UT T32CA009213.
markers of acute colitis were exacerbated by DSS treatment. Exercise preconditioning alleviated the severity of HF+DSS-induced colitis in conjunction with gut microbiota symbiosis in wild-type mice, implying a preventive/therapeutic potential of promotion of physical fitness via regular exercise against this experimentally-induced acute colitis. This study was supported by the National Research Foundation Grant funded by the Korean Government (NRF-2018R1D1A1B07048153 and 2019R1I1A1A01052817).

**RESULTS**: EX improved VO2peak by 15%, while CON did not change (p<0.001), with no differences between age-groups or sexes. Nr2 signaling response to acute exercise increased in EX compared to CON (p<0.001), in both young and older, in support of aerobic exercise restoring Nr2 signaling in previously inactive individuals. GCLC protein content was increased in EX with no change in CON (p<0.03). Interestingly, CON had higher basal levels of nuclear Nr2 after the intervention but did not respond to the acute stimulus indicating impaired signaling responses. Redox capacity was improved in EX compared to CON (p<0.05) as shown by lower F2-isOP responses to the I/R trial. Furthermore, there was a significant association between improvements in VO2peak and improvements in the I/R response (r = -0.46, p<0.01).

**Conclusion**: To our knowledge, this is the first study to show increased Nr2 activation in healthy humans, in response to an exercise intervention. These data support our hypothesis and demonstrate that older individuals can improve their cell signaling in response to exercise and systemic response to a non-exercise oxidative challenge.

**Frequency And Mode Of Physical Activity Influence Gut Microbial Composition In Overweight And Obese Adults**

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*No relevant relationships reported*

Chronic diseases are linked to adverse phylogenetic and functional alterations in the gut microbiota. Physical activity (PA) regimens may provide a low-cost and practical means to improve “gut health” in individuals at-risk of developing chronic disease. Endurance exercise has been shown to alter gut microbial composition in heavier sedentary individuals but it is not known how other PA modes impact the gut microbiota. It is hypothesized that PA mode and frequency may underlie differences in the gut microbiota in heavier adults.

**PURPOSE**: To examine the relationship between PA measures and gut microbial richness and evenness and composition in overweight and obese adults.

**METHODS**: Adults (n=38), 28-55 years old with BMI 27-36 kg·m-2 were asked about their frequency of aerobic, strength, and stretching exercise during one week. Participants were measured for their age-predicted VO2 max using a modified Bruce protocol on a treadmill. DNA was extracted from self-collected fecal samples for Illumina MiSeq amplicon sequencing of 16S rRNA V4. Sequencing reads were processed according to MOTHUR standard operating procedures, with operational taxonomic unit assignment at the 97% similarity threshold. General linear models were used to test effect of PA measures on alpha diversity indices. Distance-based redundancy analyses were used to evaluate community composition in relation to PA measures.

**RESULTS**: Shannon and Simpson indices did not differ by estimated VO2 max nor by PA frequency and mode (p > 0.05). Frequency and mode of PA explained more variability in the gut microbial community (11.6%) than estimated VO2 max (1.9%). Community patterns were not explained by estimated VO2 max (p = 0.81). However, PA frequency and mode did explain community patterns with the frequency of strength training during the week showing a greater impact (p < 0.01) than aerobic (p = 0.06) and stretching exercise (p = 0.72).

**CONCLUSIONS**: PA frequency and mode exhibit greater impacts on the gut microbial community structure than cardiorespiratory fitness in overweight and obese adults. In particular, the incorporation of strength exercise may have a larger impact on the gut microbial community than cardiorespiratory fitness in overweight and obese adults. In particular, the incorporation of strength exercise may have a larger impact on the gut microbial community structure than cardiorespiratory fitness in overweight and obese adults.
POURPOSE: Sleep and physical activity are altered in pregnancy and may affect pregnancy health; however, whether these behaviors influence each other is not well understood. In this study, we describe self-reported sleep parameters across pregnancy trimesters and examine associations with objectively measured moderate-to-vigorous physical activity (MVPA) and sedentary behavior (SB). METHODS: Women were recruited from Iowa City, IA and Pittsburgh, PA to assess sleep, MVPA, and SB in each trimester of pregnancy. Sleep was measured using the Pittsburgh Sleep Quality Index. MVPA and SB were estimated using a wrist-worn Actigraph GT3X and thigh-worn activPAL micro, respectively; data were considered valid with ≥2 days of ≥10 hours of wear. Mixed models effects were used to examine changes in sleep parameters (global sleep score, poor sleep quality, sleep efficiency, sleep duration) across trimesters. Associations of MVPA and SB trajectories with sleep parameters were also examined using mixed effects models. RESULTS: Women (n=120) averaged 31.1 ± 4.7 years of age with a pre-pregnancy BMI of 26.8 ± 6.7 kg/m². As seen in the Table, differences were found for sleep parameters across pregnancy trimesters, with adverse changes occurring in the third trimester compared to the first and second trimesters. MVPA trajectory was not associated with any of the sleep parameters. Women in the high SB trajectory had greater sleep efficiency (β=−0.78%, 95% CI: 0.07 to 0.94) and women in the moderate and high SB trajectories also had longer sleep duration (β=0.79 hours, 95% CI: 0.23, 1.35; β=0.80 hours, 95% CI: 0.26, 1.33, respectively), compared to those in the low SB trajectory. CONCLUSIONS: Few studies have examined self-reported sleep measures across pregnancy trimesters. Findings indicate that sleep quality, efficiency, and duration are adversely affected in the third trimester. Contrary to our hypotheses, high SB but not MVPA was favorably associated with sleep parameters.  

Table: Sleep across pregnancy trimesters and associations of moderate-to-vigorous intensity physical activity (MVPA) and sedentary behavior (SB) trajectories with sleep

<table>
<thead>
<tr>
<th>Trimester</th>
<th>PSQI Global Score Mean ± SD</th>
<th>Four Sleep Quality Items Mean ± SD</th>
<th>Sleep Efficiency Mean ± SD</th>
<th>Sleep Duration Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>First (n=25)</td>
<td>6.1 ± 3.9</td>
<td>38 (48.7)</td>
<td>65 (95.6)</td>
<td>85.0 ± 12.4</td>
</tr>
<tr>
<td>Second (n=36)</td>
<td>5.7 ± 3.3</td>
<td>46 (69.0)</td>
<td>85.0 ± 12.4</td>
<td>7.1 ± 1.5</td>
</tr>
<tr>
<td>Third (n=114)</td>
<td>7.3 ± 3.4</td>
<td>78 (60.4)</td>
<td>80.8 ± 12.6</td>
<td>6.5 ± 1.1</td>
</tr>
</tbody>
</table>

Intra- | 0.80 | 0.006 | 0.006 | 0.006 |

Trajectories* | β (95% CI) | β (95% CI) | β (95% CI) | β (95% CI) |
<table>
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<tr>
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<tbody>
<tr>
<td>Low (n=35)</td>
<td>0.65 (0.28, 1.02)</td>
<td>0.06 (0.15, 0.27)</td>
<td>0.06 (0.00, 0.12)</td>
<td>0.05 (0.14, 0.29)</td>
</tr>
<tr>
<td>Medium (n=59)</td>
<td>0.15 (0.06, 0.23)</td>
<td>0.15 (0.00, 0.31)</td>
<td>0.14 (0.03, 0.25)</td>
<td>0.10 (0.04, 0.16)</td>
</tr>
<tr>
<td>High (n=26)</td>
<td>0.10 (0.00, 0.20)</td>
<td>0.10 (0.00, 0.19)</td>
<td>0.10 (0.00, 0.18)</td>
<td>0.10 (0.00, 0.17)</td>
</tr>
</tbody>
</table>

MVPA and SB trajectories conducted using growth mixture modeling: models adapted for age, race, education, and pre-pregnancy BMI.

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Purpose: Disparities in health outcomes exist for members of the lesbian, gay, bisexual, transgender, and queer (LGBTQ) community across the lifespan. Regarding sleep quality (SQ) specifically, obtaining adequate restorative sleep is a challenge for many individuals, especially college students. Although it is well established that habitual physical activity (PA) is associated with improved SQ in many cohorts, the relationship between PA and SQ among LGBTQ college students remains unstudied. This study aimed to compare PA and SQ, and their associations, in LGBTQ and non-LGBTQ college students. METHODS: Self-identified LGBTQ (n = 84; 20.6 ± 2.2 yo) and non-LGBTQ college students (n = 456; 20.8 ± 2.0 yo) completed online surveys: a) Pittsburgh Sleep Quality Index (PSQI) and b) International Physical Activity Questionnaire (IPAQ) with subsequent MET-min/wk and days of resistance training (RT) being calculated. T-tests were used to compare SQ and PA levels of LGBTQ and non-LGBTQ students. Bivariate correlations explored relationships between SQ and PA within groups. RESULTS: LGBTQ students reported less aerobic PA (222.6 ± 147.8 vs. 264.9 ± 163.5 MET-min/wk) and less frequent RT (1.3 ± 1.9 days/wk) than non-LGBTQ students (all p ≤ 0.05). Global PSQI scores indicated poor SQ for both LGBTQ and non-LGBTQ students (6.85 and 5.79, respectively); however, LGBTQ students reported 16.7% higher scores indicating poorer SQ (p = 0.05) Among LGBTQ students, higher aerobic PA was associated with improved SQ (r = −0.24, p &lt 0.05) whereas no association was observed in non-LGBTQ students (r = −0.05, p = 0.25). No associations between RT and SQ were observed in either group (both p ≥ 0.05). CONCLUSIONS: Disparities exist between LGBTQ and non-LGBTQ college students regarding self-reported PA and SQ. Although causality cannot be determined, our findings suggest that increasing PA could improve SQ, particularly among LGBTQ college students. Future research should explore the utility of PA to enhance SQ using more robust methodologies toward the end of informing effective health promotion programming.

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Purpose: To examine the combined associations of PA and sleep with depressive symptoms in women with young children. METHODS: We analyzed data from the National Health and Nutrition Examination Survey (2007-2014). We included women with children < 5 years of age, not pregnant, with complete data on physical activity, sleep, and depressive symptoms (n=1,222). The primary exposures were self-reported physical activity (some vs. none) and sleep duration (>6 vs. ≤ 6 hours/night). The primary outcome was moderate-to-severe depression (referred to as “depression” going forward). Multivariable logistic regression was used to compare odds of depression by engagement in PA and sleep individually or in combination. No PA and short sleep duration (<6 hours/night) was the reference group. RESULTS: Participants had a mean age of 31.2 yrs and their youngest child had a mean age of 2.3 yrs. Approximately 48%, 82%, and 40% performed some PA, slept >6/night, and both respectively. Depression was prevalent in 10% of the sample. Engaging in some PA and sleeping >6/night were associated with an unadjusted 0.41 (95% CI 0.26 to 0.64) and 0.40 (95% CI 0.25 to 0.64) odds of depression. The combined associations of engaging in some PA and sleeping >6/night were strongly associated with depression (OR = 0.16, 95% CI 0.09 to 0.29) than either behavior alone. This relationship persisted after adjustment for race/ethnicity, marital status, disability, poverty status, and the child’s age (OR = 0.19, 95% CI 0.10 to 0.38) CONCLUSIONS: PA and sleep, considered separately and in combination, were associated with fewer depressive symptoms in women with young children. The combination of adequate PA and sleep may have greater mental health benefits than either behavior alone. Future studies should examine the effects of promoting PA and sleep on postpartum depression in women.
Quality sleep is essential for health and quality of life, and can impact academic performance. Prior research has shown a reduced sleep time in college students. A relationship has been shown between sleep quality and physical activity (PA), but has not been examined extensively in a college cohort, nor has sedentary behavior been factored in.

**PURPOSE:** To examine the effect of sleep quality on sedentary and PA behavior in college students. **METHODS:** Eighty-one female (n = 53) and male (n = 28) college students (age mean ± SD: 20.2 ± 1.5 yrs; BMI: 25.1 ± 4.7; % body fat: 31.8 ± 10.2) underwent 7-day objective PA and sleep assessment via Actigraph accelerometer. Poor sleep quality was defined as total sleep time (TST) < 6 hours or sleep efficiency (SE; TST / Total time in bed) < 85%. One-way ANOVA was utilized to assess mean differences in PA and sedentary behavior between poor sleep (PS) and normal sleep (NS). **RESULTS:** Based on weekly averages, 22 subjects had poor sleep quality by TST criteria, and 43 subjects had poor sleep quality by SE criteria. Based on TST, PS resulted in greater number of sedentary bouts per day (20.6 ± 2.8) vs. NS (18.5 ± 3.8, \( p = 0.02 \)), fewer minutes per sedentary break per day (45.2 ± 9.1 and 53.5 ± 14.5, for PS and NS, respectively, \( p = 0.02 \)), and greater average sedentary minutes per day (701.4 ± 79.4 and 645.1 ± 106.6 for PS and NS, respectively, \( p = 0.03 \)). Average moderate-to-vigorous PA minutes (MVPA) did not differ between PS (65.0 ± 30.0) and NS (57.6 ± 23.9, \( p = 0.25 \)), nor did any other PA variable. However, on SE, the PS (65.3 ± 27.2) had greater MVPA minutes compared to NS (53.2 ± 22.7, \( p = 0.04 \)). No other PA variable differed. There was no difference in body composition between groups when analyzing by TST or SE criteria. **CONCLUSION:** Poor sleep quality, defined as less than 6 hours of TST, appears to have a greater impact on sedentary behavior than PA behavior in a college student population. While sleep quality is poor, college students experience a greater amount of sedentary behavior, while PA variables did not change. This may be a result of the college lifestyle, where walking on campus to classes and other activities is a large part of the day.

The 24-hour movement guidelines recognize the collective influence of child physical activity (PA), sleep, and screen-time on development. An important part of child development is fundamental motor skills (FMS), as higher FMS competency in preschool is related to greater PA in adolescence. It is unknown whether meeting preschool movement guidelines is associated with FMS. **PURPOSE:** To examine the association among 24-hour movement guidelines and FMS in preschoolers. **METHODS:** Children ages 3-4 years of age were recruited from childcare centers. Parents reported child age, sex, race, and time spent viewing screens (hours/day). Child PA and sleep were measured using accelerometry. The 24-hour movement guidelines were examined (≤ 1 hour/day of screen-time, ≥ 3 hours/day total PA of which ≥ 1 hour/day is moderate-to-vigorous, and 10-13 hours/day of sleep). To measure FMS, trained researchers administered the Test of Gross Motor Development - Third Edition (TGMD-3). Raw score of the two subscales (Locomotor and Ball skills) and total TGMD-3 score were used for analysis. Linear regression was used to assess individual and number of guidelines met with total, locomotor, and ball skills scores. Crude models and models adjusting for age, sex, and race were conducted. **RESULTS:** Of the 112 participants, 86 provided complete measures (76%). Preschoolers were 3.4±0.5 years old, 53% were male, 52% were White, and the sample was below average in the age-and-sex adjusted total score percentile (41±21). Most children met the PA guideline (94%) and sleep guideline (87%), but few met the ST guideline (12%) or all three guidelines (10%). In crude models, those who met the PA guideline had a higher total (\( p=0.04 \)) and ball skills scores (\( p=0.01 \), and those who met the ST guideline had a lower ball skills score (\( p=0.04 \)). However, these associations were not significant in adjusted models (\( p=0.05 \)). No other relationships between individual number of guidelines and FMS scores were found. **CONCLUSIONS:** In this sample, there was no relationship between movement guidelines and FMS when adjusting for other factors. Promotion of adequate movement behaviors and FMS is still warranted for later child health.
MEDICINE & SCIENCE IN SPORTS & EXERCISE®

2472 Chair: Robert A. Huggins. University of Connecticut, Manchester, CT. (No relevant relationships reported)

2472 Board #2 May 29, 1993 AM - 11:30 AM
The Influence Of Match Congestion, Load And Wellness On Injury Risk In Collegiate Women's Soccer
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(No relevant relationships reported)

The impact of match congestion, training load (TL), perceived stress, fatigue and soreness on the odds of injury remains unclear. PURPOSE: To examine the influence of: 1) days rest between matches on injury rate (IR) and odds of injury and 2) TL on injury, perceived stress, fatigue and soreness. METHODS: A prospective multi-site study tracked daily exposures, TL (distance and duration), injury and perceptual data from six Division I NCAA women’s soccer teams in one season. Overall and non-contact (NC) IRs expressed per 1000 athlete exposures (AEs), and odds ratios (OR) were determined by days before and after matches. Associations between injury rates and changes in both TL and perception were analyzed using a multilevel logistic regression. RESULTS: 139 players experienced 94 injuries in 137 matches and 107 injuries in 363 practices. Overall match and practice IRs (per 1000AEs [95%CI]) were 39.0 [31.1, 46.9] and 17.1 [13.9, 20.3], respectively. While insignificant (p > 0.21), match IRs were highest 2 days between matches (IR= 50.9 [26.7, 75.1]). Patients were at increased odds of being injured in a match with 1 to 5 days since the last match vs. 6+ days (OR [95%CI] = 1.79 [1.02, 3.17]). Practice IRs were highest in the pre-season (IR = 28.8 [17.0, 40.5]). Players were at increased odds of sustaining an NC overuse injury with 1-5 days between matches vs. 6+ days (OR=7.85 [1.06, 57.94]; p=0.04). Similarly, 1-3 days' rest had 2.24 (1.03, 4.88) times higher rates on NC overuse IRs compared to more than 4+ days' rest (p=0.05). Acute NC IR was increased with 1 to 3 days rest vs. 4+ days rest (OR = 3.01 [1.11, 8.14]; p=0.03). Patients were at increased odds (p < 0.001) of feeling fatigue (>5) (OR = 4.71 [1.82, 12.17]) and soreness (>5) (OR = 7.68 [6.27, 22.10]) on match day with 2 days vs. 7+ days since the last match. For each additional 3000m covered on a day, odds of overall injury, soreness and fatigue increased (41%, 32% and 31% respectively). CONCLUSION: Days between matches and acute TL increases on a given day had a negative impact on odds of injury and perception. The odds of getting injured in a match were greater with 1 to 5 days vs. 6+ days between matches. This data may be used to inform and guide the NCAA in determining optimal scheduling and recovery.

2473 Board #1 May 29, 9:30 AM - 11:30 AM
Analyses Between Field-test Outcome And Match-related Physical Performance In Elite Youth Soccer Players
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(No relevant relationships reported)

BACKGROUND: How field-test results are associated with match-related physical performance is understudied, especially in elite youth soccer players. PURPOSE: To investigate relationship between field-test outcome and physical performance during official soccer matches in elite youth soccer players. METHODS: During pre-season, elite youth soccer players (n = 27; age = 17 ± 1.00; 9 years; height = 177.9 ± 7.4 cm; weight = 71.0 ± 5.5 kg) performed field tests including running acceleration on 5 m (AC5) and 10 m (AC10), maximal speed running (MSR), Agility 505 with turning on 2472

2474 Chair: Robert A. Huggins, University of Connecticut, Manchester, CT. (No relevant relationships reported)

2474 Board #2 May 29, 9:30 AM - 11:30 AM
Biomarkers Differ Between And Within Starters And Non-Starters Throughout A Collegiate Soccer Season
Cody R. Butler1, Robert A. Huggins1, Adam S. Lepley2, Ryan M. Curtis3, Courtney L. Benjamin1, Yasuki Sekiguchi1, Douglas J. Casa, FACSM. 1University of Connecticut, Mansfield, CT. 2San Antonio Spurs, San Antonio, TX. 3University of North Carolina at Chapel Hill, Chapel Hill, NC. (Sponsor: Douglas J. Casa, FACSM)
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PURPOSE: To observe differences in blood biomarkers (oxygen (O2) transport, immune, cardiovascular (CV) health and hematology) between starters (S) and non-starters (NS) over a full NCAA Division I collegiate men’s soccer season. METHODS: Biomarkers (n = 30) related to O2 transport (n = 9), immune function (n = 12), and CV and lipid profiles (n = 9) were collected at the start of pre-season (PS), in-season at weeks (W)1, 4, 8, and 12 in soccer players (n = 20, mean ± SD; age = 21 ± 1, height = 180 ± 6 cm, body mass = 78.19 ± 6.3 kg, body fat = 12.0 ± 2.6%, VO2max = 51.5 ± 5.1 ml kg⁻¹ min⁻¹). A 2 x 5 (group x time) repeated measures ANOVA was used to identify differences between S (n = 10) and NS (n = 10). In the presence of a significant interaction effect (p<0.05), post-hoc one-way ANOVA’s and paired tests were used to identify group and time differences with uncorrelated alpha level set at p<0.05.

RESULTS: A significant interaction effect (group x time) was found for 9 biomarkers (hematocrit [HCT], hemoglobin [HGB], red blood cells [RBC], total cholesterol [Total Chol], LDL cholesterol [LDL], Chol:HDl ratio, non-HDL cholesterol [non-HDL], direct LDL [dLDL] and apolipoprotein B [ApoB]). S demonstrated significant increases in RBC (W1) and Chol:HDl (W8), while NS demonstrated significant increases in HCT and HGB (W4); Chol:HDl (W4, 12). Within-group significant
Soccer is one of the most popular sports in the world that include small sided games (SSGs) as a match specific type of training. Much is unknown about the physiological demands of official match-play (OM), however less is known about which practice demands official match-play (OM) for soccer players. It is unknown if SSGs can be used as a match specific training that can improve OM related performance.

METHODS: Twenty female collegiate soccer players (age ± SD: 20 ± 2 yrs, height = 169 ± 6 cm, weight = 64 ± 6 kg) were recruited to participate in this study. A commercially available team monitoring system was used to measure HR and determine time spent in various zones based on %HRmax. Player touches (contacting the ball) were based on video analysis of each session. Field size (120m x 75m) for the SSGs were kept constant, but the intensity of the games were influenced by the number of players involved (6 vs 7, 7 vs 8, 8 vs 8, 9 vs 9 and 11 vs 11).

RESULTS: A one-way repeated measures ANOVA showed there was a significant main effect of average HR on SSGs, F (4, 64) = 11.248; p < 0.01. The average %HRmax responses increased in concert with the increased number of players in SSGs (6 vs 6 = 73 ± 6%, 7 vs 7 = 75 ± 10%, 8 vs 8 = 81 ± 7%, 9 vs 9 = 83 ± 5%, and 11 vs 11 = 83 ± 6%). A one-way repeated measures ANOVA showed there was a statistically significant main effect of group size on the number of touches, F (4, 64) = 12.67, p < 0.001. The number of touches were inversely related to the number of players (11 vs 11 = 46 ± 16, 9 vs 9 = 61 ± 15, 8 vs 8 = 66 ± 22, 7 vs 7 = 78 ± 22, and 6 vs 6 = 86 ± 28). A two-way Mixed Model ANOVA showed there was a significant main effect of position (DEF, MID, STK) on time spent in heart rate zones, F (2, 72) = 1.38, p > 0.05. Changes in SSGs game format affect the players using SSGs to allow coaches to more closely alter physiological and technical demands differently. The greater touches with fewer players may enhance technical ability. However, fewer players in SSGs are also associated with a lower %HRmax. The 9 vs 9 SSGs formats provide players with the opportunity to spend sufficient proportion of time spent in high intensity HR zones that are specific to OM.

CONCLUSION: Variability of Heart Rates During Small Sided Games in Female College Soccer Players

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interaction effect (time x group) could be determined for RT (F(1,32) = 4.85, p = .035, \( \eta^2 = .13 \)). **CONCLUSIONS:** The intervention showed a significant effect on right-sided peripheral reaction time of highly talented soccer players. The analysis of the left-sided reaction time showed no significant interaction effect. Based on demands for sports-specific transfer tasks, the shown training intervention represents a practical approach to improve perceptual-cognitive skills. In future analyses, neurophysiological parameters (e.g., changes in activity in the motor cortex) should be recorded in order to determine the importance of dual tasks for the development of perceptual-cognitive abilities of young highly talented soccer players and to understand underlying mechanisms.

**INTRODUCTION:** Ventilatory threshold (VT) is the point at which minute ventilation (VE) increases nonlinearly with increasing exercise intensity. Several previous studies have shown that subjects are able to recognize their VT by noticing changes in their breathing during exercise bouts. High importance can be placed on knowing VT, as positive training adaptations for sport occur when the intensity is at or above this threshold. There are no previous studies examining team sport athletes detecting VT. **PURPOSE:** Determine whether female collegiate soccer players can accurately perceive the changes in ventilation associated with their VT during maximal exercise testing. **METHODS:** Volunteers were recruited from a women’s collegiate soccer team (n=17, age= 19 ± 1.56 yrs.) to participate in the study. All subjects performed a modified maximal treadmill protocol with breath-by-breath gas analysis throughout the test. All subjects were given instructions from a script asking them to indicate when they noticed a significant change in their breathing, and this was recorded as their perceived ventilatory threshold (PVT). Actual VT was recorded and calculated from the maximal exercise test results. Pearson product correlation and independent samples t-tests were used to test the relationships and mean differences between oxygen consumption (VO2), ventilatory frequency (VF), minute ventilation (VE), and tidal volume (VT) at PVT and VT. Significance was set at p < 0.05. **RESULTS:** Data was collected for 13 subjects. Positive correlations were found between actual VT and PVT on physiological variables with TV having a very strong relationship (r= 0.932), VO2 a strong relationship (r= 0.714), and VF (r= 0.684) and VE (r= 0.49) with moderate relationships. On average, subjects perceived their VT after 72% ± 13% of VO2max, VF, VE, and VT at PVT versus VT.

**CONCLUSION:** In respect to the current study, female collegiate soccer players may be able to detect the changes in their breathing associated with VT, which could be useful in prescribing exercise for this population. Coaching professionals could use PVT as a reliable mark for players to train above their VT to produce desired training effects.

Sumo style deadlifting has recently become more prevalent. Barefoot-style lifting has also become increasingly popular with claims such as increased force production and improved “grounding” of the foot. However, the biomechanics of sumo deadlifting while barefoot have not been examined. **PURPOSE:** To examine the effects on the hip, knee, and ankle joint moments during a sumo deadlift when comparing shod and barefoot conditions. **METHODS:** Ten subjects (27.3±3.5 yrs, 1.74±0.13m, 77.97±17.34kg) with minimum six months of deadlift experience (7.6±4.6 yrs), who were free from lower extremity injury, performed 1 repetition maximum (IRM: 137.7±43.0 kg) testing on day 1. This testing was performed in self-selected footwear. On day 2, a minimum of 72 hours later, subjects lifted 70% of their IRM during a 3-dimensional analysis. Subjects performed one set of five continuous repetitions of a sumo deadlift in shod and barefoot conditions in randomized order. Five minutes of rest was given between sets. Marker data were collected using Qualisys Track Manager, sampling at 240Hz. Force data were collected using Bertec force plates, sampling at 1200Hz. Raw marker and force data were imported into Visual3D. Marker and force data were filtered using a fourth-order lowpass Butterworth filter at 8Hz. Peak internal sagittal and frontal plane joint moments of the hip, knee, and ankle were calculated during the concentric phase of each repetition. Peak vertical ground reaction force was measured during the concentric phase. **RESULTS:** No significant differences were detected in peak hip extension moment (p=0.855), hip abduction (p=0.288), knee extension (p=0.607), knee abduction (p=0.926), ankle plantarflexion (p=0.376), ankle eversion (p=0.739), or peak vertical ground reaction force (p=0.558). **CONCLUSIONS:** There is no evidence to suggest that the barefoot lifting style increases performance capabilities when lifting the same weight as in the shod condition. Additionally, there is no evidence to suggest that there is any increased risk in excess frontal plane joint moments during barefoot lifting. Future research should examine the IRM capabilities in both shod and barefoot conditions to determine if differences exist during maximal compared to submaximal efforts.
lower back/lower extremity injuries within the past six months. Day one consisted of 1RM testing based on NSCA guidelines. On day two subjects were fitted with two EMG sensors (biceps femoris, vastus medialis) and a maximal voluntary isometric contraction was performed. The subjects then completed two sets of five randomized repetitions (with shoes and barefoot) at 70% of their 1RM. Raw data were imported to Visual3D and processed using a moving RMS (window size of 25 frames). A paired-samples T-test was used to compare muscle activity of the biceps femoris and vastus medialis. RESULTS: The percentage of vastus medialis recruitment was significantly greater (p=0.005) in the condition with shoes (43.8±25.0%) compared to the barefoot condition (35.6±26.9%). Additionally, there was a significant difference in percentage of biceps femoris recruitment (p=0.037) between the conditions (45.2±33.1%) and barefoot condition (35.6±26.9%). Conclusion: Using a barefoot condition in the conventional deadlift appears to have an effect on percent peak muscle activation of the biceps femoris and vastus medialis muscles. Early evidence may suggest that barefoot lifting styles increase hamstring activation while decreasing quadriceps activation.

Repetitive lifting with submaximal loads has gained popularity as a mean for increasing strength and endurance. Given that repetitive lifting is a known occupational risk factor for low back injury, it is important to develop an objective criterion for determination of number of lifting repetitions that maximize the benefits of lifting while minimizing the potential risk for low back injuries. Purpose: To determine whether measures of lumbo-pelvic coordination (LPC) during repetitive low-handle deadlift (LHBD) get impaired before fatigue exhaustion. Methods: Eight weight-trained males performed repetitive-fatigue of LHBD with a load of 68 kg. Rotations of the thorax and pelvis in the sagittal plane, measured in using a motion capture system, were used to characterize LPC according to Needham, et al. 2015. Subsequently, the differences in LPC over the early portion of the lifting phase between the first and last 10% of total lifting repetitions were compared using paired t-tests. Results: Peak pelvic and trunk flexion angles and lumbar range of motion from respective values of 53.9° ± 4.8°, 64.9° ± 6.6°, and 28.4° ± 3.2° during the first 10% of lifting cycles increased to 57.2° ± 4.1° (p = 0.02) 69.4° ± 6.7° (p = 0.05), and 32.9° ± 5.2° (p = 0.04) during the last 10% of lifting cycles. Pelvic and trunk rotations over the early portion of the lifting phase were in-phase (anti-phase) 40.0% ± 8.8% (21.3% ± 2.8%) of the time during the first 10% of lifting cycles that increased, p=0.04, (decreased, p=0.01) to 47.9% ± 4.8% (21.3% ± 2.8%) during the last 10% of lifting cycles. Conclusion: Significant changes in neuromuscular control of LPC were observed before participants stop lifting due to fatigue. Such alterations in LPC changes mechanical loads experienced in the spinal tissues, hence, affecting risk of injury. However, more research is needed to understand the impact of such impairments in mechanical loads experienced in the spinal tissues, hence, affecting risk of injury.

Deadlifts are often an integral part of training programs to build posterior chain strength and power, but current research has not examined the performance outcomes when performed with and without shoes from a biomechanical perspective. PURPOSE: To examine the differences in lower extremity sagittal plane joint kinetics and peak vertical ground reaction force (vGRF) of a conventional barbell deadlift with and without shoes. METHODS: Ten subjects (males: n=7; females: n=3; age: 27.9 ± 3.8 years) who deadlifted twice a week for the past 6 months, were free from injury, and had no history of lower extremity surgery were recruited. Subjects first performed a one repetition max (1RM) test in self-selected footwear according to NSCA guidelines. At least 72 hours later subjects returned for a 3-dimensional analysis of their deadlift at 70% of their 1RM. Subjects performed 1 set of 5 continuous repetitions on a 1RM deadlift in using a shoe and barefoot conditions in a randomized order. A 5-minute rest was given between each condition. Visual3D was used to process raw marker and force data, calculate peak sagittal joint moments of the ankle, knee, and hip and to find peak vertical ground reaction force during the concentric phase. A one-way repeated measures MANOVA was performed to statistically test differences between shoe and no shoe conditions in the dependent variables. RESULTS: Average 1RM for males and females was 343.7 ± 83.4 lbs. and 224.2 ± 77.6 lbs., respectively. No significant differences were found in internal hip extension moments (p=0.444, S=2.99 Nm/kg, B=3.05 Nm/kg), knee extension moments (p=0.151, S=0.92 Nm/kg, B=0.81 Nm/kg), ankle planar flexion moments (p=0.113, S=1.07 Nm/kg, B=1.01 Nm/kg), and peak vGRF (p=0.295, S=1044.9 N, B=1035.2 N) between shoe and barefoot conditions. CONCLUSION: Anecdotal claims suggest performing a deadlift barefoot enhances stability and increases connection to the ground which would lead to improvement in deadlift performance. The lack of difference seen in sagittal plane kinetics and peak vGRF suggest that deadlift performance is unaffected by footware choice. Future research should investigate if similar results would be attained when subjects’ deadlift performance is tested at various percentages of the 1RM.

Abstract
Background/Objective: Currently, no gold standard electromyography (EMG) normalizing technique exists when conducting between-muscle comparisons of muscle activity during isometric resistance training exercises. The aim of this study was to assess if between-muscle activity during the back-squat differed among electromyography (EMG) normalizations techniques when normalizing to: (1) repetition maximum (IRM), (2) maximal voluntary isometric contraction (MVIC), and (3) the first of a set of three repetitions (Rep1%) in trained female lifters. Methods: Thirteen participants completed a back-squat 1RM, MVIC of the rectus-femoris (RF) and glutus-maximus (GM), and three repetitions of the back-squat at 80% 1RM. For the IRM and MVIC normalization techniques, the average of the peak RMS signal of both muscles during the three submaximal reps were normalized to the peak 1RM and MVIC signals. The Rep1% averaged the peak RMS signals of both muscles during the 2nd and 3rd submaximal repetitions normalized to the peak signal during the 1st repetition. Results: The RF-GM between-muscle EMG (AEMG) differed among normalization techniques (p < 0.001, η2 = 0.48). Post-hoc pairwise comparisons indicated MVIC normalization elicited different AEMG with large effects compared to both 1RM (p = 0.037; d = 1.2) and Rep1% (p = 0.004; d = 1.9) techniques, but the IRM and Rep1% did not produce different AEMG (p = 0.27; d = 0.8). Conclusion: Our findings suggest EMG normalization technique influences the magnitude and direction of between-muscle activity during common lifting exercises, and we recommend normalizing into movement dynamics to maximum normalization methods such as a 1RM or Rep1%.

Whole-body vibration (WBV) exposes the entire body to mechanical oscillations when one is standing on a vibrating platform. In recent years, researchers have studied the extent to which these oscillations effect the body. Previous studies have investigated muscle activity in the general population during static exercises with WBV, but there has been little research that has focused on the effects of WBV during dynamic movements in athletes. PURPOSE: The purpose of the study was to investigate the effects of WBV on rectus femoris muscle activity during a whole-body squat (WBS) exercise in NCAA Division 1 female track and field athletes. METHODS: Fifteen NCAA Division 1 track and field female athletes (Height = 165.20 ± 7.85 cm; Weight = 61.11 ± 9.46 kg; BP% = 18.80 ± 4.92%; Age = 19.80 ± 1.57 years) were assessed for adequate squat form using the FMS deep squat protocol. Subjects then completed a dynamic warm-up before a wired EMG sensor was placed over the rectus femoris muscle belly of the right leg. Subjects completed two trials consisting of 10 repetitions of WBV with and without WBV, in a counterbalanced order. Root mean squared (RMS) values of EMG sensor during WBS trials. RMS values for WBS each trial were analyzed using a Dependent t-Test with an alpha level of p < 0.05. RESULTS: Mean values for RMS were 74.92 ± 22.81 µV for WBV trials, and 53.11 ± 24.46 µV for ground squat trials. The values for RMS were significantly higher for WBV vs. ground squat trials.
There was less NJM in the injured limb and more in the non-injured limb when the injured limb was leading compared to controls (Figure 1). When in the trail position, the injured limb produced less NJM than the uninjured. The RJC from the lead hip was lower for the AKP, while their contribution from the knee was higher. **CONCLUSION:** The total NJM suggested an increased reliance of the non-injured leg during split-squats, which likely offloads the injured leg. The RJC from the lead hip was less in the injured group (C: 50%, AKP: 46-44%), while the knee was higher (C: 30%, AKP: 34-38%). This was unexpected and highlights demands for further research.

1. Graci V 2015. 2 Nakagawa TH 2012. 3 Cunningham TJ 2014. 4 Peterson TJ 2018
traumatic LLA, compared to active non-injured controls (CON). METHODS: Sixteen LLA (8 unilateral (UNI), 30±5yrs; 8 bilateral (BI), 29±3yrs), nearing the end of their clinical rehabilitation, were assigned to either a 4-week residential rehabilitation admission and one 6-week recovery block at home. Physically active, age-matched males (28±5yrs) represented CON. Estimated daily ambulatory PA energy expenditure (PAEE) was estimated from an accelerometer (Actigraph GT3X+), worn on the hip of the shortest residual limb in each environment, using validated population specific prediction algorithms. Six minute walk distance (6MWD) was recorded at baseline and 10 weeks (general population 6MWD norms is >459m). RESULTS: Whilst at home, mean PA counts.day-1 reduced by 17% (p=0.018) and 42% (p=0.001) in the UNI and BI group, respectively. UNI group demonstrated a similar capacity for PAEE to CON, both of which were greater (P<0.05) than BI (Table 1). No significant changes in 6MWD were demonstrated within groups (P>0.05), however, significant differences (P<0.05) were demonstrated between all groups at baseline (UNI, mean, 574±66m; BI, 337±85m, CON, 705±32m). CONCLUSION: UNI group demonstrate a similar capacity for PA and function to active non-injured CON. To support and manage the long-term health and well-being of more severely injured BI LLA, future research should investigate strategies that promote regular engagement in PAEE, particularly when they return home.

### Estimated daily physical activity in all groups. Data presented as mean±SD and Δ mean

<table>
<thead>
<tr>
<th>Unilateral Amputation (n=8)</th>
<th>Bilateral Amputation (n=8)</th>
<th>Control (n=13)</th>
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<tbody>
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<td><strong>Bilateral Amputation</strong></td>
<td><strong>Control</strong></td>
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<td><strong>Days (&lt;14 hours)</strong></td>
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<td>5 ± 1</td>
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<tr>
<td><strong>Work</strong></td>
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<tr>
<td>918 ± 41</td>
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<tr>
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</tr>
<tr>
<td>839 ± 88</td>
<td>733 ± 87</td>
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</table>

### Purpose

Aggrecan is a key proteoglycan found in the extracellular matrix of articular and cartilage and provides resistance to compression and deformity. Aggrecan deficiency is recently described autosomal dominantly inherited condition due to mutations in the ACAN gene. Individuals with aggrecan deficiency experience premature joint degeneration and altered skeletal growth development.

### RESULTS

Cross-sectional evaluation of musculoskeletal outcomes & physical activity levels in patients with aggrecan deficiency.  

#### METHODS

**Purpose:** The aim of the current investigation was to test the hypothesis that muscle sympathetic nerve activity (MSNA) responses to a cold pressor test (CPT) are reduced in individuals with MS compared to healthy controls.  

#### CONCLUSION

Individuals with MS appear to have an attenuated muscle sympathetic response to CPT. However, MAP appears to respond similarly to healthy controls potentially through other compensatory mechanisms.

### 2492

May 29 9:45 AM - 10:00 AM

Cross-sectional Evaluation Of Musculoskeletal Outcomes & Physical Activity Levels In Patients With Aggrecan Deficiency

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**Reported Relationships:** P.J. Gubanich: Industry contracted research; Novo Nordisk

### 2494

May 29 10:15 AM - 10:30 AM

The Adoption Of Spinal Cord Injury Policies In The Secondary School Setting

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**Reported Relationships**

Development of written policies and procedures (P&P) may enhance adequate preparation and management of spinal cord injuries (SCI). PURPOSE: To evaluate the current adoption of SCI P&P in the secondary school setting as reported by athletic trainers (ATs). METHODS: Using a cross-sectional design, ATs employed in a secondary school (n=3315) were emailed invitations to participate in an online questionnaire about sport safety best practices, which included three questions related to SCI P&P (Table 1). The questions were framed using the Precaution–Adoption Process Model (PAPM), which is a health behavior model aimed at identifying an individual’s readiness to act with answers including unaware, unengaged, undecided, decided not to act, decided to act, acting and to maintaining. Of the 389 ATs who responded (response rate = 8.5%) (males=52.1%, age=41±10 years), a majority reported “maintaining” for all questions (Q1 (Comprehensive SCI plan) = 82.8%, Q2 (Equipment Removal) = 79.1%, Q3 (Healthcare professional practice) = 64.8%, Table 1). The proportion of ATs reporting being “unaware” was higher in Q3 compared to Q1 (7.2% vs 4.8%, PR=1.78, 95% CI=1.11, 2.87). Further, the ATs reporting “acting” or “maintaining” in Q2 was higher than Q3 (86.0% vs 65.8%, PR=1.22, 95% CI=1.12, 1.33). Approximately half (56.6%) reported they coordinate SCI policy with emergency medical services (EMS). A majority reported they do not document practicing equipment removal (62.2%). CONCLUSION: Overall, the PAPM appears to be able to classify ATs readiness to act for the adoption of a SCI P&P, though there was a low proportion in many of the stages. Interventions may be needed to improve the practicing and documentation of equipment removal skills along with collaborative efforts between ATs and EMS.

### Abstracts Prepared by the Authors and Printed as Submitted.
women, 53.2±10.3 yrs) and 26 PMS (16 women, 60.3±8.7 yrs). Sensorimotor function measures included lower-extremity cutaneous vibration sensitivity, proprioception, and central motor drive. Mobility measures included the 25-Foot Walk Test at preferred and brisk speeds (25FWTpref, 25FWTbrisk), and the Timed-Up-And-Go (TUG). One-sample t-tests and pairwise comparisons were used to determine whether within- and between-group performance changed, respectively, relative to baseline. RESULTS: One-sample t-tests revealed that RRMS became less sensitive to vibration at the hallux (p=0.014, [-5.4, 4.3]), improved 25FWTbrisk performance (p=0.018, [-17.5, -1.8]), and tended to improve performance during the 25FWTpref (p=0.076, [-13.8, 0.7]) and TUG (p=0.053 [-14.8, 0.1]). Results for PMS demonstrated moderately decreased sensation to vibration at all but 1 site on the foot (Hallux: p=0.006, [-7.1, 49.8], Heel: p=0.084, [-2.9, 43.4]) and worsened performance for the 25FWTpref (p=0.090, [-1.4, 17.6]). Neither RRMS nor PMS demonstrated changes in lower-extremity proprioception or central motor drive measures for either one-sample t-tests or pairwise comparisons. Pairwise comparisons between the groups showed a larger % change (improved performance) from baseline to visit 2 in RRMS compared to PMS for all mobility tests (25FWTpref: p=0.015, [-26.2, 3.0], 25FWTbrisk: p=0.009, [-24.3, -3.7], TUG: p=0.048, [-26.5, -0.1]). CONCLUSION: Relative to RRMS, people with progressive forms of MS may increase the amount of time it takes to complete the 25FWT. Increased mobility impairment in PMS over a one year period may be explained by decreased sensation, especially related to cutaneous sensitivity at the plantar surface of the foot, which could impact perception of body orientation and foot-ground contact during the stance phase of gait, and thereby impair mobility performance by walking more cautiously at slower speeds.

2497 May 29 11:00 AM - 11:15 AM The Medical Demands On The Multidisciplinary Team Of Team UK At The 2018 Invictus Games

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73 military personnel competed at the 2018 Invictus Games in Sydney, Australia as part of Team UK. The medical support team consisted of two doctors, two nurses and two physiotherapists. PURPOSE: To describe the epidemiology of injury and illness of Team UK competitors at the 2018 Invictus Games and the medical demand on the multidisciplinary team (MDT) by role (doctor, nurse & physiotherapist). METHODS: Electronic medical notes of the 56 males and 27 females (mean age: 37.18 S.D. 7.67) Team UK athletes were recorded via PPS software platform (Rushcliff, UK 2018). All medical interactions were retrospectively analysed using Excel (Microsoft, USA 2019) by: presenting complaint, MDT role, time, venue, anatomical region, treatment and outcomes. RESULTS: Team UK comprised of 60 veterans and 13 serving military personnel. Self-declaration of baseline illness/impairment returned 67 (18.6%) athletes had suspected, 23 (6.6%) had definite, illness/impairment. 2018 Invictus Games medical team managed 1047 interactions on-site (34.4% medical, 22.9% physiotherapy, 42.7% nursing), 125 (12%) were classified as injuries, 17 (1.7%) hospitalisations, 1 (0.1%) inpatient admission and 1 (0.1%) death. CONCLUSION: These results can be used to inform injury prevention programming and the composition of future MDTs. The data presented will allow for comparative data to be collected at future Invictus Games.
Dementia has become a critical health problem with negative impacts on the quality of life. It is widely accepted that exercise has beneficial effects on both physical and mental performance of the elderly people.

PURPOSE: This study examined the effect of an exercise training program on physical and mental abilities of nursing home patients in early and middle stages of dementia.

METHODS: Thirty-eight patients with early to middle dementia (31 females and 7 males, age: 80.8±6.9 yrs, body mass: 67.8±6.3 kg, height: 164±7 cm) volunteered to participate in the study. They were randomly assigned to either the intervention group (IG), which received a 50-min structured exercise program 3 days/week, or the control group (CG), which followed the usual care, for an experimental period of 9 months. The study was conducted in an elderly care unit, and functional and cognitive parameters were evaluated in both groups before and after the completion of the intervention period.

RESULTS: Compared to pre exercise values, significant improvements \((p<0.05)\) were found in Time Up and Go test \((TUG: 16.8±4.5 \text{ sec} vs 15.1±4.4 \text{ sec})\), Berg Balance Scale score \((BBS: 42.9±3.8 \text{ vs} 43.6±3.2 \text{ sec})\), and Geriatric Depression Scale \((GDS: 5.8±2.9 \text{ vs} 3.8±3.2 \text{ sec})\) in IG, while no change \((TUG: 16.8±4.5 \text{ vs} 16.8±5.9 \text{ sec}; BBS: 49.1±5.4 \text{ vs} 49.7±11.1 \text{ sec}; GDS: 5.8±2.9 \text{ vs} 6.2±3.8 \text{ sec})\) occurred in the control group. Significant improvement \((p<0.05)\) was observed in IG at the end of the experimental period. Significant improvements \((p<0.05)\) were revealed in IG compared to CG regarding GDS \((2.9±1.4 \text{ vs} 9.2±3.3 \text{ sec})\). No significant changes \((p>0.05)\) were found between groups in Handgrip \((11.94±6 \text{ vs} 11.35±5.6 \text{ kg})\) and Mini-Mental State Exam \((21.8±4.7 \text{ vs} 23.1±9.1 \text{ m})\) (Functional Rating Scale for Symptoms of Dementia-FRSSD: 4.6±2.6 \text{ vs} 9.2±3.3; 6MWT: 312.6±100.9 \text{ vs} 231.9±131.5 m; Functional Rating Scale score (BBS: 42.9±3.8 \text{ vs} 46.3±5.2); Chair-Stand test (CST: 9.5±1.6 \text{ vs} 18.0±3.8 sec); Berg Balance Scale \((V̇\text{O}_{2\text{peak}}-(-3±7 \text{ b·min}^{-1}, p<0.05)\) in the CG, while peak stroke volume tended to be higher \((0.87±2.5 \text{ mL·b}^{-1}, p=0.12)\) in the TG compared to the CG. Conventional risk factors (body weight, waist circumference, blood pressure and lipids/glucose) were unaltered. One-year regular AIT rates were 15/25 (TG; different from CG: \(p<0.0001\)) and 0/23 (CG), respectively. CONCLUSIONS: AIT was successfully integrated in long-term collaborative care of outpatients with schizophrenia, advocating this model for aerobic capacity improvement and CVD risk reduction in future treatment.

PTSD is more likely to be accompanied by another psychological disorder (most commonly depression) than to occur alone, and those with this comorbidity exhibit more severe psychological outcomes compared to those with a single disorder. Exercise-based interventions that occur in the natural environment, such as surf therapy, have preliminarily been shown to improve psychological outcomes in service members/veterans with PTSD or major depressive disorder (MDD); however, previous research has not yet examined the effectiveness of these programs for those with both disorders. PURPOSE: This study compared changes in depression/anxiety and positive affect during surf therapy sessions between active-duty service members with comorbid PTSD and MDD and those with either disorder alone. METHODS: Probable PTSD and MDD diagnoses were determined using Diagnostic and Statistical Manual of Mental Disorders, 5th Edition criteria applied to baseline self-report measures. Study outcomes were assessed using validated self-reports (Patient Health Questionnaire-4 and Positive Affect Schedule) completed before and after each of 6 weekly surf therapy sessions. Longitudinal repeated measures data was analyzed using multilevel modeling. RESULTS: From pre-to-post session, both the comorbid and single disorder groups reported significant improvements in symptoms of depression/anxiety and positive affect \((p<.001\). However, those with comorbid PTSD and MDD experienced significantly greater reductions in depression/anxiety \((β = −1.22, p = .028)\) and significantly greater improvements in positive affect \((β = 3.94, p = .046)\) compared with the single disorder group. CONCLUSIONS: Surf therapy appears to have global effects on psychological symptom reduction, and may be a useful adjunctive intervention for the treatment of comorbid PTSD and MDD in both clinical and community health settings. Supported by the U.S. Navy Bureau of Medicine and Surgery under work unit no. N1600.

OBJECTIVE: High-intensity interval training (HIIT) has recently attracted considerable interest as a time-efficient approach to improving physical and psychological health. The aim of this study was to compare the physical and psychological effect of substance abusers by HIIT or body-mind exercise.

METHODS: 120 Methamphetamine (Meth) dependent individuals from a compulsory rehabilitation center in Shanghai were randomly assigned to HIIT group (experimental group) and body-mind exercise group (control group). The subjects in the experimental group received HIIT training including rope jumping, running, weight lifting and basketball game, 1 hour a day, 3 times a week. The control group received Tai Chi practice, the duration of each session and the repetitions per week were the same as those of the experimental group. Subjects in both groups took part in 6 months intervention. The outcomes of Amphetamine Withdrawal Symptom Questionnaire (AWS), blood pressure (BP), vital capacity (VC) and fitness test were measured at the beginning and after the intervention period.

Although aerobic interval training (AIT) is recognised to attenuate the risk of cardiovascular disease (CVD) and premature mortality, it appears that it rarely arrives at patients’ doorsteps. PURPOSE: This study investigated 1-year outcomes when AIT was integrated with municipal and specialised health service in collaborative care of outpatients with schizophrenia. METHODS: Forty-eight outpatients (28 men, 35±12 years; 20 women, 35±12 years) with schizophrenia spectrum disorders (ICD-10) were randomised to either a collaborative care group provided transportation and substance abuse counseling or a control group (CG) given 2 introductory AIT sessions and advised to continue training. RESULTS: Directly assessed peak oxygen uptake \((\text{VO}_{2\text{peak}})\) increased in the TG (3-months: 2.7±3.1 mL·kg\(^{-1}\)·min\(^{-1}\); 6-months: 3.2±3.0 mL·kg\(^{-1}\)·min\(^{-1}\); 1-year: 3.3±3.1 mL·kg\(^{-1}\)·min\(^{-1}\); all \(p<0.001\); different from CG: \(p<0.05-0.001\)). In contrast, \(\text{VO}_{2\text{peak}}\) remained unchanged (3/6-months) and decreased (1-year: \(-1.8±3.8 \text{ mL·kg}^{-1}·\text{min}^{-1}, p<0.05\)) in the CG. One-year cardiac effects revealed increased \(HR_{\text{peak}}\) \((3.7±0.5; \text{min}^{-1}, p<0.05\); different from CG: \(p<0.01\)) in the TG and decreased \(HR_{\text{peak}}\) \((3.7±0.5; \text{min}^{-1}, p<0.05\)) in the CG, while peak stroke volume tended to be higher \((0.87±2.5 \text{ mL·b}^{-1}, p=0.12)\) in the TG compared to the CG. Conventional risk factors (body weight, waist circumference, blood pressure and lipids/glucose) were unaltered. One-year regular AIT rates were 15/25 (TG; different from CG: \(p<0.0001\)) and 0/23 (CG), respectively. CONCLUSIONS: AIT was successfully integrated in long-term collaborative care of outpatients with schizophrenia, advocating this model for aerobic capacity improvement and CVD risk reduction in future treatment.
baseline, 3 months, 6 months. Data analysis was applied with SPSS 22.0, a two-way repeated measures analysis of variance (ANOVA) was applied to test whether the treatments were different after 6 months.

**Results:** At the baseline, there were no significant differences between the two groups regarding to age, years of drug use, scores of AWQ, BP, VC and fitness. The significant changes were found after 6 months. The score of AWQ in experimental group was 8.84 ± 0.78 and in control group was 12.04 ± 0.76, p = 0.004. The blood pressure, vital capacity, heart rate, and eyes close, reaction time were found significantly improved after 6 months intervention in both groups. However, there was no significant differences between the two groups.

**Conclusion:** HIIT and body-mind exercise have similar effect for Meth dependent individuals except the score of AWQ, the result suggests that the body-mind exercise might be a safer and optional choice for whom don’t want to engage in vigorous exercise.

### 2503 May 29 10:30 AM - 10:45 AM

**Aerobic Exercise Acutely Reverses Negative Mood Occurring In The Mid-luteal Phase Of The Menstrual Cycle**

Jessica A. Freemas, Marissa N. Baranauskas, Joel T. Greenshields, John S. Raglin, FACSM, Timothy D. Mickleborough, Zachary J. Schlader, FACSM. Indiana University, Bloomington, IN. (Sponsor: Zachary Schlader, FACSM)

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(No relevant relationships reported)

**Purpose:** Over 80% of women report a more negative mood state during the luteal phase compared to the follicular phase of their menstrual cycle. Mood is acutely improved following aerobic exercise. Thus, aerobic exercise may be capable of normalizing mood during the luteal phase of the menstrual cycle. We tested the hypothesis that prior aerobic exercise would eliminate differences in mood state between the mid-luteal and mid-follicular phases of the menstrual cycle.

**Methods:** 12 recreationally active eumenorrheic women (25 ± 6 y) completed ~30 min of aerobic exercise, which consisted of 10 min of steady state aerobic exercise and an 8 km cycle time trial, during the mid-follicular and mid-luteal phases of the menstrual cycle. Participants completed a Profile of Mood State Questionnaire (POMS) pre-exercise and 20 min post-exercise. The POMS provided indices of confusion, tension, depression, vigor, fatigue and anger, from which total mood disturbance (TMD) was calculated (higher scores = more negative mood). Data are presented as T-scores (a.u.).

**Results:** Pre-exercise tension (42 ± 10 vs. 39 ± 7, P<0.01) and anger (41 ± 4 vs. 39 ± 4, P<0.04) were elevated and vigor (35 ± 11 vs. 42 ± 11, P<0.01) and TMD (174 ± 26 vs. 162 ± 31, P<0.01) were lower in the mid-luteal vs. the mid-follicular phase. Confusion and depression did not differ between phases pre-exercise (P≥0.56). Fatigue did not differ between phases at any time (P≥0.57) nor change from pre- to post-exercise (P≥0.15). Confusion, tension, depression, and vigor decreased from pre- to post-exercise in the mid-luteal and mid-follicular phases (P<0.01), but there were no differences between phases at post-exercise (P≥0.06). Anger decreased from pre- to post-exercise in the mid-luteal (38 ± 1, P<0.01) but not the mid-follicular phase (37 ± 1, P=0.08), which eliminated differences between phases post-exercise (P=0.57). TMD decreased from pre- to post-exercise in both phases (P<0.01) and there were no differences between the mid-luteal (142 ± 17) and mid-follicular (136 ± 16) phases post-exercise (P=0.16).

**Conclusion:** Women experience a more negative mood state during the mid-luteal compared to the mid-follicular phase. Aerobic exercise acutely normalizes these differences in mood state by eliminating menstrual cycle dependent differences in vigor, anger, and tension.

### 2504 May 29 10:45 AM - 11:00 AM

**The Effects Of Ecologically-Valid Resistance Exercise Training Among Young Adults With Analogue Generalized Anxiety Disorder**

Brett R. Gordon,1 Cillian P. McDowell2, Mark Lyons3, Matthew P. Herring, FACSM. 1University of Limerick, Limerick, Ireland. 2Trinity College Dublin, Dublin, Ireland. 3University College Dublin, Dublin, Ireland. (Sponsor: Matthew P. Herring, FACSM)

Email: brett.gordon@ul.ie

(No relevant relationships reported)

**Purpose:** This randomized controlled trial examined the effects of eight weeks of ecologically-valid resistance exercise training (RET) compared to wait-list control among 27 young adults (26:6y: 18 female) with analogue Generalized Anxiety Disorder (AGAD; Psychiatric Diagnostic Screening Questionnaire GAD subscale ≥6 and Penn State Worry Questionnaire ≥45).

**Methods:** Fully supervised, ecologically-valid, one-on-one RET sessions designed according to World Health Organization (WHO) and American College of Sports Medicine (ACSM) guidelines, consisting of 2 sets of 8-12 repetitions of eight exercises, were delivered twice weekly, after a 3 week familiarization. Ratings of perceived exertion (RPE) and muscle soreness (1-10) were assessed after each exercise. The primary outcome was remission based on change in AGAD status, was assessed post-intervention, and quantified with number needed to treat (NNT). Worry and anxiety symptoms were assessed at baseline, week 1, week 4, and post-intervention. Independent samples t-tests examined baseline differences between conditions. Paired sample t-tests examined changes in SMR strength. RM-ANOVAs examined differences between conditions and wait-list across time. Significant interactions were decomposed with simple effects analysis. Hodges’ d effect sizes (95%CI) quantified the magnitude of the difference in change between groups across time.

**Results:** There were no baseline differences between conditions. Attendance was 81%, and compliance was 77% (average RPE=14±4±1±1.58, muscle soreness=4.01±1.70). Participants significantly increased strength (r=0.66, p<0.001, d=1.24), RET improved AGAD status (NNT=3, 95%CI: 2 - 17). A significant condition-time interaction was found for (F(3,25)=3.12, p=0.043, d=0.93 [0.13 - 1.73]), and anxiety symptoms (F(3,25)=2.91, p=0.046, d=0.71 [0.08 - 1.49]). RET significantly reduced worry (mean difference=-6.49, p=0.045) and anxiety symptoms (mean difference=−10.50, p=0.001).

**Conclusions:** Ecologically-valid RET, designed according to WHO and ACSM guidelines, improved AGAD status, and elicited large magnitude reductions in worry and anxiety symptoms among young adults with AGAD. This is the first ecologically-valid RET intervention among young adults with clinically relevant anxiety pathology.

### 2505 May 29 11:00 AM - 11:15 AM

**Neural Responsiveness To Reward And Cognitive Control Following An Eight-week Aerobic Exercise Trial For Depression**

Christophet J. Brush1,2, Greg Hajcak1, Brandon L. Alderman. 3Florida State University, Tallahassee. 4University of Maryland, Baltimore, MD. (Sponsor: Matthew P. Herring, FACSM)

Email: brett.gordon@ul.ie

(No relevant relationships reported)

**Purpose:** The primary aim was to examine the effects of an 8-week aerobic exercise (AE) program on event-related potential (ERP) indices of reward processing (RewP) and cognitive control (ERN), and symptoms of depression among individuals with MDD. Secondary aims were to determine whether changes in reward (RewP) or cognitive control (ERN) were related to changes in depressive symptoms and whether baseline RewP or ERN could predict the likelihood of an antidepressant response. **Methods:** Individuals with MDD (N=51; 75% female) were stratified by depressive intensity and randomized to either moderate-intensity AE or light-intensity stretching (n=26) that was completed 3 times per week for 45 min. Depressive symptoms, aerobic fitness, and ERPs were assessed pre and post intervention. **Results:** Compared to stretching, the AE condition resulted in pre-to-post reductions in depressive symptoms (p<0.01; n²p=0.17), while both conditions experienced pre-to-post increases in aerobic fitness (p<0.01; n²p=0.14). Although no mean-level treatment changes in RewP or ERN were observed, there was a relationship between pre-to-post change in ERN and change in depressive symptoms (r=-0.41, p<0.01), indicating a decrease in ERN was related to larger pre-to-post reductions in depressive symptoms. At baseline, a larger ERN was predictive of greater pre-to-post change in depressive symptoms, (p<0.05, OR = 1.27), while there was a trend for baseline RewP as a predictor of treatment response (p=0.07, OR = 1.24). **Conclusion:** These findings provide support for the antidepressant effects of AE and highlight ERN as a potential neurobiological marker that predicts and tracks the antidepressant response. Future research incorporating predictors of response and examining neurobiological mechanisms may help advance understanding of the effects of exercise as a treatment for depression.
E-13 Clinical Case Slide - Knee II

Friday, May 29, 2020, 9:30 AM - 11:10 AM
Room: CC-2020

Chair: Mark R. Hutchinson, FACS, University of Illinois, Elmhurst, IL.
(No relevant relationships reported)

Discussant: Jason Pothast, University of Florida, Gainesville, FL.
(No relevant relationships reported)

Discussant: Emily A. Sweeney, Children's Hospital Colorado, Aurora, CO.
(No relevant relationships reported)

Left Knee, Leg Pain After A Hand Cycling Accident
Cameron Fausett, Alexander Sheng. Shirley Ryan Ability Lab, Chicago, IL. (Sponsor: Dr. Joseph Ihm, FACS)
Email: cfausett@sralab.org
(No relevant relationships reported)

HISTORY: A 56 year old female with past medical history of Ehlers-Danlos Syndrome and stroke was seen in clinic with left hemiparesis sustained a left knee and leg injury while hand cycling. Patient was on a ride when she collided with another cyclist, causing her to fall onto her left leg and thigh. She reported immediate pain, swelling and bruising of her left leg. She reported a previous dislocation of the patella during rugby matches at school. There was no pop or swelling of the knee nor pain or discomfort. Previously, she sustained multiple knee injuries, including patella dislocation, patella-femoral tendon and medial collateral ligament injury which resulted in surgery complicated by post-operative intra-articular sepsis and septicemia. He reported a previous dislocation of the patella during rugby matches at school.

PHYSICAL EXAMINATION: Examination revealed a young, healthy male with his right knee in full flexion. Active and passive extension were impossible. There was no obvious swelling or joint line tenderness yet, comprehensive examination of the knee revealed that the mass consisted of pigmented villonodular synovitis. Loosening of the knee and patella-femoral joint were performed with free floating internal derangement. A soft tissue mass was discovered in the intercondylar notch causing patellofemoral pain (PFP) which began at the end of a marathon. Symptoms resolved with rest. However, 1 year later, patient was training for another marathon. Speed work was added to this training and the patient alternated between running in cushioned and highly cushioned shoes. PFP developed quickly stopping the patient within 3 miles of running. Knee pain increased up to 8/10 with running, prolonged sitting, stairs and hiking. Patient was referred to orthopedic surgeon for consultation. Initial arthroscopic examination and surgery revealed a large intra-articular effusion. The medial condyle and patella showed cartilage degeneration. A soft tissue mass was discovered in the intercondylar notch causing patellofemoral pain. It was excised and sent for histology. One patient had previously undergone a left knee arthroscopy for patellofemoral pain (PFP) which began at the end of a marathon. Symptoms resolved with rest. However, 1 year later, patient was training for another marathon. Speed work was added to this training and the patient alternated between running in cushioned and highly cushioned shoes. PFP developed quickly stopping the patient within 3 miles of running. Knee pain increased up to 8/10 with running, prolonged sitting, stairs and hiking. Patient was referred to orthopedic surgeon for consultation. Initial arthroscopic examination and surgery revealed a large intra-articular effusion. The medial condyle and patella showed cartilage degeneration. A soft tissue mass was discovered in the intercondylar notch causing patellofemoral pain. It was excised and sent for histology.

DIFFERENTIAL DIAGNOSIS: Femoral/tibial fracture, bone contusion, medial/lateral collateral ligament sprain, meniscus injury

TREATMENT AND OUTCOMES: Patient returned to plastic surgery who recommended percutaneous drainage. She underwent ultrasound guided drainage of 25 ml of serosanguinous fluid. At follow up no further fluid collection seen on ultrasound. Pain was resolving. Patient advised to wear compression garment to assist with swelling. Cleared to return to activity as tolerated. Patient seen one year later with resolved symptoms and physical examination findings.

2511 May 29 9:50 AM - 10:10 AM
Mechanical Locking Of The Knee: A Retired Rugby Union Player-What Is The Catch?
Pierre L. Vivier, FACS, Elton Wayne Derman, FACS, Stellenbosch University, Stellenbosch, South Africa.
Email: plvivier@sun.ac.za
(No relevant relationships reported)

HISTORY: A 29 year-old male retired rugby player presented to the sports medicine clinic during an emergency appointment with his right knee acutely locked in full flexion. He was bending into a squat position when he felt something “giving way”. He was subsequently unable to stand or straighten his knee. There was no acute trauma reported in relation to his present complaint. There was no pop or swelling of the knee nor pain or discomfort. Previously, he sustained multiple knee injuries, including patella dislocation, patella-femoral tendon and medial collateral ligament injury which resulted in surgery complicated by post-operative intra-articular sepsis and septicemia. He reported a previous dislocation of the patella during rugby matches at school.

PHYSICAL EXAMINATION: Examination revealed a young, healthy male with his right knee in full flexion. Active and passive extension were impossible. There was no obvious swelling or joint line tenderness yet, comprehensive examination of the knee revealed that the mass consisted of pigmented villonodular synovitis. Loosening of the knee and patella-femoral joint were performed with free floating internal derangement. A soft tissue mass was discovered in the intercondylar notch causing patellofemoral pain (PFP) which began at the end of a marathon. Symptoms resolved with rest. However, 1 year later, patient was training for another marathon. Speed work was added to this training and the patient alternated between running in cushioned and highly cushioned shoes. PFP developed quickly stopping the patient within 3 miles of running. Knee pain increased up to 8/10 with running, prolonged sitting, stairs and hiking. Patient was referred to orthopedic surgeon for consultation. Initial arthroscopic examination and surgery revealed a large intra-articular effusion. The medial condyle and patella showed cartilage degeneration. A soft tissue mass was discovered in the intercondylar notch causing patellofemoral pain. It was excised and sent for histology.

DIFFERENTIAL DIAGNOSIS: Displaced meniscus tear, Loose bodies, Osteochondral fragment, Soft tissue mass.

TEST AND RESULTS: 1) Referral to orthopedic surgeon for urgent consultation. Initial arthroscopic examination and surgery revealed a large intra-articular effusion. The medial condyle and patella showed cartilage degeneration. A soft tissue mass was discovered in the intercondylar notch causing patellofemoral pain. It was excised and sent for histology. 2) Histological analysis revealed that the mass consisted of pigmented villonodular synovitis.

WORKING DIAGNOSIS: Pigmented villonodular synovitis TREATMENT AND OUTCOMES: Started with physiotherapy rehabilitation immediately post-operative and continued for 6 weeks. Immobilized partial weight bearing on crutches (2 weeks) Functional return - swimming (2 weeks), jogging (6 weeks). The patient returned to jogging and completed several 10 km events without any discomfort. Yet he experienced marked pain and discomfort in events more than 10Km. He does not partake in any sport with a collision nature. Long term follow-up needed to monitor for growth recurrence.

2512 May 29 10:10 AM - 10:30 AM
Inclusion Of Wearable Sensors In The Treatment Of Patellofemoral Pain
Lindsay Wasserman, Spaulding National Running Center, Cambridge, MA. (Sponsor: Irene Davis, FACS)
Email: lwasserman@partners.org
(No relevant relationships reported)

TEXT:

HISTORY: 32 yr. old male with 2 yr history of bilateral (BIL) patellofemoral pain (PFP) which began at the end of a marathon. Symptoms resolved with rest. However, 1 year later, patient was training for another marathon. Speed work was added to this training and the patient alternated between running in cushioned and highly cushioned shoes. PFP developed quickly stopping the patient within 3 miles of running. Knee pain increased up to 8/10 with running, prolonged sitting, stairs and hiking. PHYSICAL EXAM:
1. Weakness of the hip extensors, abductors and external rotators BIL and core muscles
2. (+) Obese & Thomas test
3. (+) Patella compression test with medial patella tenderness BIL
4. Weakness of the calves, and foot intrinsicus BIL
5. Running Gait Analysis
Excessive and prolonged foot pronation through stance BIL

Abstacts were prepared by the authors and printed as submitted.
Decreased knee flexion at footstrike BIL. Increased hip ADD BIL. R CPD and L ipsilateral trunk lean. Significantly high vertical rates of loading.

**WORKING DIAGNOSIS**
PPF due to increased impact loads during landing, as well as excessive hip ADD, CPD and trunk lean due to poor dynamic control of the foot and hip associated with weakness. These issues of loading and alignment have both been shown to contribute to patellofemoral pain.

**TREATMENT:**

- **Pre Gait Retraining**
  1. Transition to minimal shoes for walking to promote foot/ankle strength
  2. Improve foot/ankle function and control with heel raises, balance exercises and plyometrics
  3. Increase hip/core strength to improve dynamic alignment

- **Gait retraining**
  1. Wearable sensor feedback: an accelerometer was attached to the ankle and set to sound an alarm when impact exceeded a set threshold. Initially the threshold was set to 6 gs, but reduced to 5 gs as the patient’s ability to control his landings improved
  2. Mirror feedback: patient was instructed to activate his arch muscles and his gluteals as he ran and was provided mirror feedback to reinforce this. Feedback was gradually faded.

**OUTCOME:** Patient had 9 pre-gait visits and 12 visits of gait retraining with focus on soft landings and improved alignment. Pt’s rates of loading reduced and was able to exhibit reduced hip ADD, CPD, trunk lean, and pronation. The patient is able to run 30 minutes pain free. This case demonstrates the value of wearable sensor devices to assist in gait retraining.

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**E-14 Clinical Case Slide - Thigh and Leg I**

**Friday, May 29, 2020, 9:30 AM - 10:50 AM**

**Room: CC-2022**

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**2513 May 29 10:50 AM - 10:50 AM**

**Rare Knee Injury In A Hurler**

Ravi M. Shah¹, Marc Breslow¹, Kaleigh Ann Suhls¹. 'Advocate Lutheran General Hospital, Park Ridge, IL. 'Illinois Bone and Joint, Niles, IL.

(No relevant relationships reported)

**History:** 18-year-old female with history of asthma presented to the ED with injury to knee. About 20 minutes prior to arrival she tripped over a hurdle and landed awkwardly. Immediately felt pain to the left knee and hip and had an obvious left knee deformity. The high school trainer was able to palpate patellar tenderness. EMS was called and patient was placed in an air splint and transferred to the ED.

**Physical Exam:** In the ED patient had stable vital signs. She had notable deformity to the left knee, left lower limb notably shorter than right and externally rotated with dimpling at the medial knee. Unable to flex at the left knee joint. Tenderness at the left knee joint, no erythema, no swelling. Able to wiggle toes, dorsiflex and plantarflex. L5-S1 Sensation intact. Dorsalis pedis and posterior tibialis pulses 1+ on the left, weaker than the right. Brisk cap refill. **Differential Diagnoses:**

1. Anterior Knee Dislocation with multiple ligamentous damage with vascular complication.
2. Anterior Knee Dislocation with multiple ligamentous damage without vascular complication.
3. Anterior Knee Dislocation with minimal ligamentous injury.
4. Hip Fracture/Dislocation

**Tests and Results:**

1. **XR KNEE LT 2V IMPRESSION:** Complete dislocation at the left knee joint. Distal femur displaced posteriorly with respect to proximal tibia. No fractures noted. No radiopaque foreign body.
2. **XR PELVIS IV IMRESSION:** Normal Xray, no fracture, dislocations or deformities noted.
3. **XR KNEE LT 2V Post Reduction IMPRESSION:** Relocation of previously seen dislocation. Normal alignment noted. No fractures.

**Final Working Diagnosis:** Anterior Knee Dislocation with multiple ligamentous damage and vascular compromise.

**Treatment and Outcome:** Pt underwent a closed reduction in the ED with sedation by ortho and ED physicians. 2. Distal pulses improved and patient was placed in an immobilizer. Vascular surgery was consulted, and a CTA of the lower extremity was done which showed no vascular injury. Pt had external fixation procedure with fluoroscopy for knee stabilization.

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**2515 May 29 9:30 AM - 9:50 AM**

**Leg Injury—ATV Accident**

Hunter D. Haley, Jason L. Zaremski, FACSM.

(No relevant relationships reported)

**History:** A 16-year-old female presented with a 2 week history of right knee and lower leg pain following an ATV accident. Outside radiographs of the right tibia-fibula, femur, and right foot were reported as normal. She had noted worsening knee pain as well as tingling in her 2nd-5th toes. She was using crutches and non-weight bearing (WBI) at presentation.

**Physical Examination:** Exam revealed 3/5 muscle strength with great toe flexion/extension, 3/5 strength with ankle dorsiflexion, and 4/5 strength with plantar flexion, inversion, and eversion. Decreased sensation noted in the right 1st web space as well as the lateral, medial, and posterior lower leg. Tinel’s sign positive at fibular head. Lateral proximal tibia and lateral knee joint line tend to palpation. 4/5 strength with painful flexion/extension of knee, but range of motion (ROM) intact. She had 2+ posterior tibialis and dorsalis pedis pulses.

**Differential Diagnosis:**

1. Proximal Lateral Tibia bony stress injury
2. Peroneal Neuropathy
3. Intra-articular knee derangement.
TEST AND RESULTS: Due to examination, a knee MRI was obtained as was an EMG/Nerve Conduction Study (NCS) to assess the peroneal nerve. MR Knee revealed a non-displaced subchondral fractures of anterior lateral talib plateau and femoral condyle. Semimembranosus tendon partial tear near tibial insertion. Grade 1 MCL injury. The EMG/NCS revealed a mild, acute-subacute, peroneal neuropathy.

FINAL WORKING DIAGNOSIS: Non-displaced fractures of lateral talib plateau and lateral femoral condyle with peroneal neuropaxia.

TREATMENT AND OUTCOMES:

1. Initial visit: Ankle Foot Orthosis (AFO) and hinge knee brace provided while MRI and EMG/NCS pending. Remained non-WB with crutches. 2) After MRI and EMG/NCS 1 week later- began home passive and active assisted ROM exercises at home. Returned AFO and crutches when not at home. 3) 4 weeks after first evaluation- began toe-touch WB with progression to partial WB as tolerated and also began PT with right knee/ankle stretching and strengthening. Continued to wear AFO to allow for peroneal nerve healing as she progressed to WB as tolerated. 4) 3 months post injury- AFO removed for activities of daily living but advised against exertional impact activity while completing PT.

2519 May 29 9:50 AM - 10:10 AM
Posterior Thigh Injury-Tennis
Dayna Yorks, Monica Rho. Shirley Ryan AbilityLab/ Northwestern University Feinberg School of Medicine, Chicago, IL. (Sponsor: Joseph Ilum, MD, FACSM)
Email: dyorks@srarlabs.org

HISTORY: A 76-year-old male was sprinting for the ball one hour into playing singles tennis with a score of 6-6 when he developed acute onset right posterior mid-thigh pain. He denied an audible “pop.” He stopped playing, took ibuprofen, and applied ice upon returning home. He continued to rest and apply ice. Eight days later, he presented to the outpatient sports medicine clinic with improved pain rated 1-2/10, but with worsened swelling and bruising of the right distal posterior thigh. He denied back pain, hip pain, low extremity numbness, tingling, or weakness. He denied a history of prior hamstring injury. He typically plays doubles tennis three times/week for two hours at a time. This was his second time playing singles this year.

PHYSICAL EXAMINATION: Examination revealed bruising along the popliteal fossa and distal hamstring on the right. There was palpable swelling and mild tenderness along the medial aspect of the posterior mid-thigh on the right. There was no tenderness to palpation of the ischial tuberosity. Knee flexion strength was 4/5 on the right, 5/5 on the left. Gait was non-antalgic. There was pain with resisted right knee flexion at 135 degrees, with lesser discomfort at 90 and 45 degrees. Bilateral lower extremities were warm with intact sensation and 2+ patellar and achilles reflexes.

DIFFERENTIAL DIAGNOSIS:
1. Hamstring muscle strain or tear
2. Hamstring tendon avulsion injury
3. Femoral stress fracture
4. Aductor magnus strain
5. Referred pain from the lumbarosacral spine, hip joint, or sacroiliac joint
6. Ischial bursitis

TESTS AND RESULTS:
- Right Hamstring Ultrasound: Hypoechochogenicity of the right semimembranosus muscle consistent with partial tear
- Intramuscular calcification in the area of the tear
- MRI Pelvis Without Contrast: Suggestion of grade 2 hamstring muscle strain centered near the central myotendinous complex of one of the hamstring tendons, likely the semimembranosus

FINAL WORKING DIAGNOSIS:
Partial tear of the semimembranosus muscle with calcification

TREATMENT AND OUTCOMES:
1. Rest for 2 weeks post-injury.
2. Walk and cycle if tolerated 3-4 weeks post-injury. No tennis.
3. Started physical therapy 4 weeks post-injury for progressive hamstring strengthening and return to tennis and exercise.

2520 May 29 10:10 AM - 10:30 AM
Knee Pain And Swelling - Volleyball Player
Sarah Weinstein, Karin VanBaak. University of Colorado, Aurora, CO. (Sponsor: Morteza Khodaei, FACSM)
Email: sarah.weinstein@cuanschutz.edu

HISTORY: An 18 year old volleyball player presented with acute swelling and pain of her right knee with associated nausea, vomiting, and subjective fevers. Aside from an abrasion beneath her knee sustained during practice 2 weeks prior, she denied inciting injury or trauma. She complained of knee tightness, but denied feelings of instability or mechanical symptoms. She denied history of skin or soft tissue infections.

Physical exam:
On initial examination, she was febrile to 102°F (38.9°C). She had notably increased warmth and erythema along the lateral aspect of her right knee with tenderness to palpation. She had evidence of a healed abrasion inferior to her right knee without an associated joint effusion. There did appear to be swelling localized to the lateral aspect of her knee. She had full range of motion of her right knee without any indication of ligamentous injury. Her gait was non-antalgic.

Differential diagnosis:
1. Septic prepatellar bursitis
2. Necrotizing infection (cellulitis, myositis, fasciitis)
3. Septic arthritis
4. Morel-Lavallée lesion
5. Reactive arthritis (gonococcal, chlamydial)

Tests and results:
- Pertinent labs: White blood cell count 27,000 X 10^9/L, sodium 127 mEq/L, potassium 3.2 mEq/L
- Blood cultures negative times 2
- Lower extremity MRI: Extensive cellulitis and probable phlegmon in subcutaneous fat throughout the distal thigh and knee; myositis in the distal vastus lateralis muscle and biceps femoris
- Gram stain from L&D right thigh: Positive strep pyogenes (group A)
- Surgical findings consistent with necrotizing fasciitis.

Final working diagnosis: Subacute necrotizing fasciitis

Treatments and outcomes:
1. She was initially treated with broad spectrum antibiotics, subsequently tailored to culture and sensitivities.
2. She underwent three surgical explorations to assess underlying muscle and fascia, including L&D of necrotic tissue along illiotibial tract.
3. With both subjective and objective improvement, she was discharged from the hospital to complete one week of IV Ceftriaxone.
4. She was cleared to start her rehabilitation and progressed to walk/jog/jump for four weeks focusing on quadriceps strengthening.
5. After one week of non contact play and sport specific drills, she returned to full contact practice six weeks after hospital discharge.

2521 May 29 10:30 AM - 10:50 AM
Anterolateral Thigh Pain - Soccer And Ice Hockey
Marissia L. Dombovy-Johnson, Karen L. Newcomer, FACSM. Mayo Clinic, Rochester, MN. Email: dombovoy-johnson.marissia@mayo.edu

HISTORY: A 13-year-old male presented with left anterolateral thigh pain that initially occurred during a soccer game. He felt as if he “pulled a muscle” and finished playing the game, but 2 weeks later the pain returned during ice hockey practice. The pain was so severe that he couldn’t finish practice. Over the next two weeks until his clinic visit, the pain kept him out of gym class and ice hockey. His pain worsened as the day went on, while improving with Ibuprofen use.

PHYSICAL EXAMINATION: Antalgic gait, with exacerbation of pain on toe-walking. Tenderness to palpation along the distal aspect of the left greater trochanter. Left hip range of motion limited by pain in flexion and internal rotation. FABER and Stinchfield tests reproduced left lateral thigh pain.

DIFFERENTIAL DIAGNOSIS:
- Iliotibial band syndrome
- Greater trochanteric bursitis
- Slipped Capital Femoral Epiphysis
- Femoroacetabular impingement
- Avulsion fracture

TEST AND RESULTS:
- Left Thigh and Hip Radiographs - Normal
- Left Thigh and Hip MRI - Patchy edema with associated confluent marrow replacing T1 signal within the medial and posterior column of the left acetabulum
- Pelvis CT - 1.8 cm osteolytic lesion within or adjacent to the physs of the left posterior medial acetabulum
- Whole Body Bone Scan - Normal
- ESR and CRP - Normal
- CT Guided Bone Biopsy - Chronic inflammation; Gram stains of tissue and fluid were negative for infection

FINAL WORKING DIAGNOSIS:
- Chronic Nonbacterial Osteomyelitis

TREATMENT AND OUTCOMES:
- Referred to Pediatric Infectious Disease who recommend IV antibiotic treatment due to concern over potential bone destruction from bacterial osteomyelitis and scheduled follow-up.
- Patient relapsed after stopping Ibuprofen
- Pediatric Rheumatology evaluated and recommended treatment with Naproxen BID for 2 months, with complete symptom resolution at end of course
2522  May 29 10:50 AM - 11:10 AM  
**Progressive Post-traumatic Leg Pain In An Ncaa Division 1 Basketball Player**  
Avinash Sridhar. University of Virginia, Charlottesville, VA.  
(Sponsor: John M. MacKnight, MD, FACSM)  
(No relevant relationships reported)

**HISTORY:**
A 19-year-old male NCAA Division 1 college basketball player sustained two blunt force injuries to the anterior portion of his right thigh during practice. This area was struck by an opponent’s knee in both events. He had a similar injury to this area the week prior but otherwise had no previous issues with his right lower extremity. After the second collision, he continued to participate in drills until his pain progressed to the point when he became unable to bear weight on his right leg over the course of 1.5 hours. He was then taken to the emergency department for further evaluation.

**PHYSICAL EXAMINATION: Height: 6’11”**
Examination of the right lower extremity in the emergency department was remarkable for significant swelling of the anterior portion of the right thigh. The anterior compartment was exquisitely tender and firm with minimal compression. The medial and posterior compartments were non-tender and easily compressible. The right foot was warm and well-perfused with 2+ dorsalis pedis and posterior tibial pulses. Sensation was intact to light touch in the L4-S1 nerve distribution. He was able to dorsiflex and plantarflex his right foot but was unable to extend his knee. He was not able to ambulate and his pain worsened over the next hour.

**DIFFERENTIAL DIAGNOSIS:**
1. Right anterior thigh hematoma
2. Anterior thigh compartment syndrome
3. Quadriceps femoris muscle tear

**TESTS AND RESULTS:**
- CBC: Hb 12.6, Hct 36.8
- CMP: CO2 19, BUN 27, PT 12.1, PTT 29.6
- Ultrasound right thigh: Large heterogeneous subcutaneous anterior thigh hematoma measuring 27 × 6 cm. No flow is visualized within. Visualized vasculature is patent on color Doppler imaging. Patent middle right femoral vein and artery.

**FINAL/WORKING DIAGNOSIS:** Right anterior thigh hematoma with developing anterior compartment syndrome, query underlying bleeding diathesis

**TREATMENT AND OUTCOMES:**
1. Urgent surgical treatment in the operating room for right anterior thigh compartment release with irrigation and evacuation of hematoma
2. Post-operative care and knee immobilizer
3. Touch-down weight bearing of right lower extremity
4. Indomethacin 25 mg PO TID for heterotopic ossification prophylaxis
5. Gradual return to sport after medical and surgical clearance

**TREATMENT AND OUTCOMES:**
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5. Gradual return to sport after medical and surgical clearance

**RUN OUT BLOOD PRESSURE: The Correlation Between Physical Activity And Blood Pressure And Sit Time**
Megan L. Conner, Constance Haynes, Jonathan Williams, Larissa Boyd, Melissa Powers. University of Central Oklahoma, Edmond, OK.  
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(No relevant relationships reported)

The implementation of the new American College of Cardiology (ACC) and American Heart Association (AHA) blood pressure guidelines has added to the increase in the number of individuals classified as hypertensive. Increasing physical activity and reducing sit-time is recommended to combat hypertension. PURPOSE: The purpose of this study was to evaluate the correlation between physical activity (PA) and sit-time (ST) and blood pressure (BP) in university employees. It was hypothesized that there would be a significant inverse relationship between PA and BP and a direct relationship between ST and BP. METHODS: In this study the participants were faculty and staff members of a regional university in the Midwest, that were included in a larger workplace intervention (N=51). Baseline data was used for this study. The participants completed a self-reported physical activity questionnaire (The International Physical Activity Questionnaire [IPAQ]) to determine their amount of PA engagement (met- min/wk) and ST. Both systolic and diastolic resting BP (mmHg) were assessed using a stethoscope and sphygmomanometer following at least five minutes of sitting. RESULTS: There was a non-significant relationship between PA and BP (p=0.05) and ST and BP (p<0.05) when analyzed with a Pearson’s Product Moment Correlation. To further analyze these results, the participants were classified based on BP as normal (<120/<80; n = 23), pre-hypertensive (120-129/<80; n = 6), or hypertensive (>130/<80; n = 22). However, due to a low amount of participants classified as prehypertensive, only participants classified as normal and hypertensive were analyzed. Differences in PA and ST between the groups based on BP classification were also non-significant (p>0.05) when analyzed with an independent t-test. CONCLUSION: Self-reported PA and ST were not related to BP in this study; however, other research reports significant correlations. The participants in this study were a part of a larger study including a workplace intervention to decrease sedentary time. This could explain the difference between the results from this study and those from previous studies. Future studies should focus on the relationship between PA and ST and BP in a variety of groups with diverse backgrounds.
CONCLUSIONS: Our next step will be to develop student teaching modules so that students working in small groups can practice experimental design and hypothesis testing to learn more about modeling their own energy budgets.

2542  
May 29 9:30 AM - 11:00 AM  
Health And Lifestyle Behaviors Of International Masters World Cup Field Hockey Athletes  
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The number of Masters Athletes competing worldwide has increased, yet little research on the health and lifestyle behaviors of Masters Athletes participating in team sports has been undertaken. PURPOSE: The purpose of this study was to examine the health and lifestyle behaviors of international Masters Field Hockey Athletes competing in the Masters Field Hockey World Cup in Barcelona, Spain in 2018. METHODS: Participants were 488 athletes (301 women, 186 men) from 26 countries, 35 to 76 years of age (51.4±7.9 years). Participants completed the 42-item Health and Wellness of Master’s Field Hockey Athletes Survey, which asked about demographics, health status, and lifestyle behaviors. RESULTS: Mean body mass index was 24.2±2.9 kg/m² (range = 15.2 to 35.3 kg/m²). Participants rated their health as “very good” or “excellent” (86.9%), had no major health condition (64.8%), medication use (84.2%), or injuries (51.0%). Perceived stress was rated as “rare” or “not at all” by 57.9% of participants. Participants consumed ≥2 alcoholic beverages per day (43.0%) per day, and ≥2 vegetables per day (78.3%), daily breakfast (68%), and ≥2 fruits (65.3%) and ≥2 vegetables per day (78.3%), daily breakfast (68%), ≥2 cups of water (43.0%) per day, and ≥2 alcoholic beverages per week (54.9%). Only 5.3% of participants reported using tobacco products. Participants reported ≥7 hours of sleep per night (68.4%), with no or little restless sleep (48.0%). Just under half of participants reported sitting ≥2 hours per day (45.3%). Exercise frequency at ≥3 days per week and ≥30 minutes per session was cited by 92.9% and 93.5% of the sample, respectively. Aside from field hockey, predominant activities included: jogging (62%), walking (56%), high intensity training (41.4%), and cycling (29.7%). CONCLUSION: While there are Masters Field Hockey Athletes generally practice lifestyle behaviors conducive to positive health.

2543  
May 29 9:30 AM - 11:00 AM  
Perceived Daily Wellness Responses Following Games During A Professional American Football Season  
Email: eric.freese@pepsico.com  
Reported Relationships: E.C. Freese: Salary; Gatorade Sports Science Institute, PepsiCo Inc. The views in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo Inc., etc.

Purpose: The purpose of this study was to investigate the perceptual wellness responses and time course of recovery following an American football game and if those responses vary across a professional American football season. METHODS: Twenty-four male, American football players (25.9 ± 2.7 y) were recruited to complete a standardized daily wellness survey the day before each game (GD-1), game day (GD) and each day following game day (GD-1, GD-2, GD-3, GD-4, and GD-5) during the seven week season. The surveys were obtained each morning via automated text messages to assess perceptions of energy, motivation, stress, and soreness utilizing 10-point Likert scales. A composite daily wellness score (DWS) was created where higher scores indicated better overall wellness. Eight players met the minimum index was 24.2±2.9 kg/m² (range = 15.2 to 35.3 kg/m²). Participants rated their health as “very good” or “excellent” (86.9%), had no major health condition (64.8%), medication use (84.2%), or injuries (51.0%). Perceived stress was rated as “rare” or “not at all” by 57.9% of participants. Participants consumed ≥2 alcoholic beverages per day (43.0%) per day, and ≥2 vegetables per day (78.3%), daily breakfast (68%), and ≥2 fruits (65.3%) and ≥2 vegetables per day (78.3%), daily breakfast (68%), ≥2 cups of water (43.0%) per day, and ≥2 alcoholic beverages per week (54.9%). Only 5.3% of participants reported using tobacco products. Participants reported ≥7 hours of sleep per night (68.4%), with no or little restless sleep (48.0%). Just under half of participants reported sitting ≥2 hours per day (45.3%). Exercise frequency at ≥3 days per week and ≥30 minutes per session was cited by 92.9% and 93.5% of the sample, respectively. Aside from field hockey, predominant activities included: jogging (62%), walking (56%), high intensity training (41.4%), and cycling (29.7%). CONCLUSION: While there are Masters Field Hockey Athletes generally practice lifestyle behaviors conducive to positive health.

2544  
May 29 9:30 AM - 11:00 AM  
Algorithms, Filters And Corrections Compound Differences Between Multiple Lifestyle Physical Activity Estimates  
Marissa Hope Mueller1, Ruth Chimenti1, Shannon Merkle2, Alexandra Haugen1, Laura Frey-Law1, 1University of Iowa, Iowa City, IA. 2United States Army Research Institute of Environmental Medicine, Natick, MA.  
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Physical activity (PA) can be objectively and conveniently measured using accelerometers. The use of wrist-worn devices has grown dramatically over the past decade, becoming the preferred choice in many recreational, clinical and research applications. ActiGraph is a leading company in this field, wherein data from accelerometers can be analyzed in their ActiLife software. However, the effects of multiple algorithms, filters and corrections on PA outcomes are not always clear. PURPOSE: To examine how lifestyle PA estimates are impacted by multiple scoring methods in a commercial software platform. METHODS: We collected lifestyle wrist-worn accelerometer data (ActiGraph GT3X+) from 132 adults with a range of activity levels with and without chronic pain (low back pain, fibromyalgia, pain-free). We analyzed accelerations in ActiLife using multiple algorithms, with and without the wrist correction and proprietary low-frequency extension (LFE) across four PA domains: total EE (METs), active EE (kCal), MVPA time, and steps. Accelerometer and self-reported (International Physical Activity Questionnaire) PA outcomes were compared. RESULTS: PA estimates differed notably across most algorithms with highly variable, but typically large effect sizes (p < 0.05, median % change = 33.5% [6.9% – 62.6%], d = 1.04 [0.60 – 1.45]). The wrist correction reduced PA estimates across all outcomes (p < 0.05, % change ~ 15.0% [3.9% – 31.8%], d = 0.56 [0.31 – 0.93]) with one exception and one daily EE algorithm (no change). The LFE increased steps considerably (p < 0.05, % change = 72.3%, d = 1.44) yet had little effect across all other outcomes (p < 0.05, % change = 4.7% [2.9% – 4.9%], d = 0.13 [0.11 – 0.14]). Differences were always greater when multiple factors were considered (% change = 89.2% [80.7% – 201.3%]). Correlations between objective and self-reported PA were typically moderate (ρ = 0.55 [0.36 – 0.83]). Further reduced by the wrist correction, and affected minimally by the LFE. CONCLUSIONS: Previously-validated scoring methods are not necessarily interchangeable. The wrist correction and LFE inconsistently inflate PA estimates, with variability increasing when multiple factors are considered. Researchers should consistently report detailed methodology to optimize comparisons across studies and to normative guidelines.

2545  
May 29 9:30 AM - 11:00 AM  
Fitness Levels In College-aged Females: A 20-year Follow-up  
Ruth N. Henry, Megan D. Jones, Grace A. Zimmerman.  
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(No relevant relationships reported)

Purpose: A decline in fitness levels of both children and young adults has been reported over the last two decades. The purpose of this study was to determine to what extent the claim is true, and which components of fitness may be involved in this decline. METHODS: Researchers examined several components of fitness, including estimated cardiorespiratory fitness, muscular fitness, percent body fat, and body mass index (BMI) during 1999. Subjects for the original study were 72 college females enrolled in general education fitness classes. The assessment was repeated at the same university in 2019 with 69 college females, also enrolled in general education fitness classes. During both time periods, students were assessed at the beginning of the course using the Queens College Step Test to estimate cardiorespiratory fitness, the YMCA bench press test to assess muscular fitness, and 3-site skinfolds to estimate percent body fat. Height and weight were measured to calculate BMI. Data were analyzed using independent measures t-tests to evaluate differences between the 1999 and 2019 groups. Participants were also categorized as normal weight/overweight and obese/nonobese, and Pearson chi-square evaluated significant differences in those categories from 1999 to 2019. RESULTS: Participants were significantly higher in percent fat (25.45 ± 0.72%) in 1999 than in 2019 (22.97 ± 0.71%; p=0.0149). Performance on the YMCA bench press test decreased in 2019 (11.78 ± 0.98 reps) compared with the same test in 1999 (23.7 ± 9.37 reps; p<0.001). BMI was statistically the same from 1999 to 2019 (22.79 ± 1.6; p < 0.05). There was no daily effect on perceived stress (p > 0.05). Conclusions: Perceptual wellness markers are negatively impacted immediately after and days following a football game, and the effects remained consistent across the season. The DWS and individual markers of perceptual wellness may take up to 5 days to return to pregame levels and should be considered when planning player training.
Since physical fitness (PF) is based on past lifestyle that include physical activity (PA), current PF could reflect health status. Although previous studies have identified a positive relationship between health status and PA and among university students, the relationship with PF is unclear. **Purpose:** The present study aimed to determine whether the PF level of university students is related to health status independently of PA, by cross-sectional and one-year follow-up designs. **Methods:** The study surveyed 245 freshman university students in April 2018 (immediately after university admission) and February 2019 (end of second semester). We examine PF by having the students complete physical fitness test were standardized by the Japanese Ministry of Education. Sleep sufficiency, happiness, and subjective health status were assessed using numeric rating scales from 0 to 10. Sleep duration and the CES-D were also assessed. We examined cross-sectional correlations by assessing partial correlations with adjustments for gender, PA (IPAQ-short), living arrangements, and economic status. Longitudinal data were assessed using two-way repeated ANCOVA with the above adjustments. Students were considered to have high, medium, and low (n = 61, 94, and 72, respectively) PF levels based on standardized scores derived from the physical performance tests. **Results:** PF correlated with sleep sufficiency (partial r = 0.129), happiness (partial r = 0.180), and subjective health status (partial r = 0.247), independently of PA. Health indexes did not interact in the longitudinal design. However, a significant group effect was identified in sleep sufficiency, happiness, and subjective health status; students with higher PF were more likely to have better health status than others during the follow-up period. The adjusted mean baseline and followup values for subjective health status remained significantly lower in the group with low PF than in the groups with medium and high PF (baseline: 5.9 vs. 6.7 and 7.3, respectively; followup: 5.1 vs. 6.2 and 6.9, respectively). **Conclusions:** University students with higher PF had better health status than others during a followup period. Maintaining higher PF could have positive health benefits for university students independently of PA. Supported by JSPS KAKENHI Grant Number 18K10931.

**It is well-known that long-term participation in sports is beneficial for physical fitness, especially for older adults. However, little is known about potential differences in fitness effects with long-term participation in different common sports.**

**Purpose:** This study investigated the fitness effects of long-term participation in four popular sports (Aerobics, Tai-chi, Diabolo, and Track and Field) in middle-aged females.

**Methods:** One hundred and fifteen female subjects (aged 45-54 years old), who were selected to be National Sports Instructors (NSI) in China (2016 and 2017), participated in this study. All of them had been performing their specific sports specialty for at least nine years, which was also the basic requirement to become a NSI. Sports included Aerobics (N=30), Tai-chi (N=28), Diabolo (N=29), and Track and Field (N=28). Measures included height, weight, body composition, waist-hip ratio, resting heart rate, blood pressure, vital capacity, grip strength, flexibility (sit and reach), reaction time, and balance (time on one-leg standing with eyes closed). Data were analyzed using one-way analysis of variance (ANOVA), and Fisher’s LSD test was used for post hoc comparisons of significant differences.

**Results:** As shown in Table 1, vital capacity and flexibility were greater (P<0.05) in the Aerobics group versus other groups. Lean body mass was greater in the Tai-chi group versus other groups (P<0.05). No significant differences between groups existed for the other variables.

**Conclusions:** Several different fitness outcomes differed by sports participation in female participants. Those participating in aerobics had the greatest vital capacity and flexibility, while those participating in Tai-chi had the greatest lean body mass. Future research should continue to explore fitness outcomes in these sports. This is especially true for diabolo, in which there is limited research compared to the other sports.
Purpose: To examine student athletes’ motivation toward sport participation, and to compare male and female student athletes’ motivation.

Methods: The sample consisted of 290 athletes (167 males, 123 females), university students of sport and physical education. In order to assess student athletes’ motivation, the Sport Motivation Scale (SMS) was used (Pellitier et al., 1995, 2012). The scale consists of 28 items assigned to seven subscales: achievement, intrinsic motivation (to know, to accomplish and to experience stimulation), extrinsic motivation (external regulation, introduced regulation, identified regulation), and intrinsic motivation (to know, to accomplish and to experience stimulation). Descriptive statistics (means and standard deviations) were calculated. Cronbach’s alpha was used to estimate reliability and internal consistency of the scales. In order to compare the mean values of the subscales (males and females), ANOVA with repeated measures was applied. The assumed significance level was set at α = .05.

Results: The Cronbach alpha values were high for all the subscales (SMS .87; AMS .90). Significant differences between males and females motiviation toward sport participation were found for intrinsic motivation to accomplish (males M=5.71, SD=1.20; females M=6.24, SD= .82). There were no statically significant differences in amotivation (males M=2.32, SD=1.22; females M=2.08, SD=1.17), external regulation (males M=3.67, SD=1.50; females M=3.42, SD=1.48), introduced regulation (males M=5.48, SD=1.20; females M= 5.29, SD=1.23), identified regulation (males M=4.90, SD=1.17; females M=5.13, SD=1.09), intrinsic motivation to know (males M=5.38, SD= 1.29; females M=5.80, SD=1.00), intrinsic motivation to experience stimulation (males M=5.94, SD=1.02; females M= 6.21, SD=7.5).

Conclusions: Results revealed that female student athletes’ motivation toward sport participation showed higher levels of intrinsic motivation to accomplish than males. The mean values for amotivation subscale were significantly lower than for other subscales.

Purpose: Although the Diabetes Prevention Program (DPP) established diet, exercise and weight loss as the ‘gold standard’ in preventive therapy for diabetes, the contribution of an exercise-only interventions on quality of life is not known. The purpose of this study, part of the Studies Targeting Risk Reduction Interventions through Defined Exercise - Prediabetes (STRIIDE), was to compare the effects of different exercise groups vs DPP like intervention on change in the Physical and Mental Component scores from the SF-36 Health Survey.

Methods. Subjects were healthy 45-75 y, sedentary, overweight/obese, with impaired fasting glucose, randomized as follows: 1) Low Amount/Moderate Intensity (L/M) - equivalent to exercising at 50% of VO2 peak to expend 10 kcal per Kg of body wt per wk; 2) High Amount/Moderate Intensity (HM) (16 kcal/kg/wk @ 50%); 3) High Amount/Vigorous Intensity (HV) (16 kcal/kg/wk at 75% of VO2 peak) and 4) Low Amount/Moderate Intensity + Diet/weight loss (L/M+D). The SF-366 Health Survey was administered pre and post intervention. This survey measures 8 domains of health, 4 combine to provide a Physical Component score and the other 4 combine for a Mental Component score.

Results. The figures below show the effects of each group on change in the Physical and Mental Component scores. The p-values inside each bar indicate significant within group changes. The lines with p-values above and connecting two groups show a significant difference between groups.

Summary. All intervention groups experienced highly significant improvements in the Physical Component score. However, only the Low/Mod/Diet group had a significant improvement in the Mental Component score. While these data need to be replicated, the clinical significance of these results suggest that many amounts/intensities of aerobic exercise training can improve self-rated physical function scores, and that exercise plus a weight loss diet improves mental and physical scores.

Purpose: To evaluate functional movements and subjective well-being of NCAA Division I, female athletes when measured before and after a 7-week indoor season to identify the benefits and deterrents of competing during an indoor season (January to March).

Methods: Participants completed pre- and post-season measures: the Functional Movement Screen (FMS; Cook, 2010), the Y-Balance Test (YBT; Plisky et al., 2009), Physical Activity Enjoyment Scale-Trait (PACES-T; Kendzierski & DeCarlo, 1991), and the Satisfaction with Life Scale (SWLS; Diener et al., 1985). Athletes (N=21 completed all testing; 3 dropped out due to injury; Mean age ± S.D., 20.0 ± 1.4 yrs) were grouped by event: throwers (shot put, weight throw), distance runners, and other competitors (sprinters, hurdlers, and jumpers). For all dependent variables, 3 (Group) by 2 (Time) ANOVAs and Pearson correlations were calculated.

Results: Although there were no group differences, athletes’ total FMS scores improved significantly pre- to post-season (14.8 ± 2.5) to post-season (15.6 ± 2.2; p = .03). Scores from each pre- to post-season FMS test were analyzed using Wilcoxon signed-rank tests. Scores for the Deep Squat (p = .025) and Right Shoulder Mobility (p = .007) improved significantly. However, scores for the Left Hurdle Step (hip flexion and extension; p = .034) decreased over the indoor season. The YBT posteromedial reach distance was significantly greater when pushing with the left leg (p < .05) perhaps reflecting the right-leg dominance for most athletes (83% were right leg dominant). The relatively high scores on PACES-T and SWLS did not change after the season (post-season: 102.5 ± 17.4; 27.1 ± 5.1, respectively). PACES-T was related to SWLS both at pre-season (r = .50) and post-season (r = .66; p < .01). In support of the physiological and psychological benefits of college TF participation, these Division I athletes improved their total FMS scores pre- to post-season. They also reported high exercise enjoyment and satisfaction with life scores despite participating in a demanding indoor, competitive season.

Purpose: To evaluate functional movements and subjective well-being of NCAA Division I, female athletes when measured before and after a 7-week indoor season to identify the benefits and deterrents of competing during an indoor season (January to March).

Methods: Participants completed pre- and post-season measures: the Functional Movement Screen (FMS; Cook, 2010), the Y-Balance Test (YBT; Plisky et al., 2009), Physical Activity Enjoyment Scale-Trait (PACES-T; Kendzierski & DeCarlo, 1991), and the Satisfaction with Life Scale (SWLS; Diener et al., 1985). Athletes (N=21 completed all testing; 3 dropped out due to injury; Mean age ± S.D., 20.0 ± 1.4 yrs) were grouped by event: throwers (shot put, weight throw), distance runners, and other competitors (sprinters, hurdlers, and jumpers). For all dependent variables, 3 (Group) by 2 (Time) ANOVAs and Pearson correlations were calculated.

Results: Although there were no group differences, athletes’ total FMS scores improved significantly pre- to post-season (14.8 ± 2.5) to post-season (15.6 ± 2.2; p = .03). Scores from each pre- to post-season FMS test were analyzed using Wilcoxon signed-rank tests. Scores for the Deep Squat (p = .025) and Right Shoulder Mobility (p = .007) improved significantly. However, scores for the Left Hurdle Step (hip flexion and extension; p = .034) decreased over the indoor season. The YBT posteromedial reach distance was significantly greater when pushing with the left leg (p < .05) perhaps reflecting the right-leg dominance for most athletes (83% were right leg dominant). The relatively high scores on PACES-T and SWLS did not change after the season (post-season: 102.5 ± 17.4; 27.1 ± 5.1, respectively). PACES-T was related to SWLS both at pre-season (r = .50) and post-season (r = .66; p < .01). In support of the physiological and psychological benefits of college TF participation, these Division I athletes improved their total FMS scores pre- to post-season. They also reported high exercise enjoyment and satisfaction with life scores despite participating in a demanding indoor, competitive season.

Purpose: To examine student athletes’ motivation toward sport participation, and to compare male and female student athletes’ motivation.

Methods: The sample consisted of 290 athletes (167 males, 123 females), university students of sport and physical education. In order to assess student athletes’ motivation, the Sport Motivation Scale (SMS) was used (Pellitier et al., 1995, 2012). The scale consists of 28 items assigned to seven subscales: achievement, intrinsic motivation (to know, to accomplish and to experience stimulation), extrinsic motivation (external regulation, introduced regulation, identified regulation), and intrinsic motivation (to know, to accomplish and to experience stimulation). Descriptive statistics (means and standard deviations) were calculated. Cronbach’s alpha was used to estimate reliability and internal consistency of the scales. In order to compare the mean values of the subscales (males and females), ANOVA with repeated measures was applied. The assumed significance level was set at α = .05.

Results: The Cronbach alpha values were high for all the subscales (SMS .87; AMS .90). Significant differences between males and females motiviation toward sport participation were found for intrinsic motivation to accomplish (males M=5.71, SD=1.20; females M=6.24, SD= .82). There were no statically significant differences in amotivation (males M=2.32, SD=1.22; females M=2.08, SD=1.17), external regulation (males M=3.67, SD=1.50; females M=3.42, SD=1.48), introduced regulation (males M=5.48, SD=1.20; females M= 5.29, SD=1.23), identified regulation (males M=4.90, SD=1.17; females M=5.13, SD=1.09), intrinsic motivation to know (males M=5.38, SD= 1.29; females M=5.80, SD=1.00), intrinsic motivation to experience stimulation (males M=5.94, SD=1.02; females M= 6.21, SD=7.5).

Conclusions: Results revealed that female student athletes’ motivation toward sport participation showed higher levels of intrinsic motivation to accomplish than males. The mean values for amotivation subscale were significantly lower than for other subscales.
Osteoporosis has become a global health problem. Mechanical loading during physical activity (PA) and exercise increases and maintains bone mass and strength. This study aimed to examine the relationship between PA intensity and total bone mineral density (BMD) at the femur and spine in premenopausal women.

**METHODS**

The data from 2005–2006 National Health and Nutrition Examination Survey (NHANES) were used for this study. PA was assessed using ActiGraph accelerometers, and bone health metrics were measured through dual-energy X-ray absorptiometry. Across all participants, no differences were found in BMD between genders.

**RESULTS**

The means and standard deviations of Light intensity = 537.79 ± 85.59 (cnts/min) using the thresholds in previous calibration studies. Correlations between different PA intensities and BMD are summarized below:

<table>
<thead>
<tr>
<th>Bone Mineral Density</th>
<th>Light Intensity</th>
<th>Moderate–vigorous Intensity</th>
<th>Vigorous Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Femur neck</td>
<td>0.06</td>
<td>-0.07</td>
<td>0.02</td>
</tr>
<tr>
<td>Trochanter</td>
<td>0.10</td>
<td>-0.01</td>
<td>0.03</td>
</tr>
<tr>
<td>Total femur</td>
<td>0.09</td>
<td>-0.03</td>
<td>0.01</td>
</tr>
<tr>
<td>Total spine</td>
<td>0.03</td>
<td>-0.02</td>
<td>-0.09</td>
</tr>
</tbody>
</table>

**CONCLUSION**

Although low correlation was found between PA intensity and BMD, only no or low correlation was found between BMD and a specific PA intensity. Lack of variability within a specific PA intensity may be the reason. More studies are needed to understand the relationship between PA intensity and bone health.

**PURPOSE**

ACSM is an affiliate of and contributor to “Athletes and the Arts” (A&A). A&A recognizes the demands and needs of performing artists and acknowledges their limited access to prevention and treatment services. Dance is one of the most grueling of the performing arts, particularly in terms of musculoskeletal injuries. This study’s purpose was to assess undergraduate dance students at a regional university in terms of their overall health and fitness profile to identify potential weaknesses that could be addressed through prevention focused efforts.

**METHODS**

College dancers (N=22, M age = 19.1 ± 1.8, 18 female, 4 male) underwent a battery of 69 anthropometric, clinical, health, and fitness assessments. Clinical assessments were administered by licensed physical therapists, while all other data were collected and/or supervised by an “ACSM Certified Exercise Physiologist.” The analysis consisted of identifying primary weaknesses (i.e., those affecting >50% of the dancers) within the amalgamated areas. Due to space constraints, areas affecting <50% of the dancers are minimally reported.

**RESULTS**

Flexibility limitations were identified in the ankles (100%), hips (100%), and knees (86.4%), more than the shoulders (45.3%), and trunk (45.3%). Weaknesses in strength were observed in the abdominals (90.9%), hips (77.3%), shoulders (77.3%), knees (63.6%), and ankles (54.5%), more than the feet (9.1%), r2 (1) = 11.96, p<0.001. Postural misalignments were noticeable in the pelvis (100%), spine (95.5%), feet (73.7%), and shoulders (73.7%), more than the head/neck (50%) and knees (13.6%), r2 (2) = 15.3, p<0.001. Significant concerns included weight distribution (100%), balance (90.9%), pelvic tilt (86.4%), shoulder height (86.4%), hamstring ROM (81.8%), thoracic curve (81.8%), trapezius strength (72.7%), hip abductor strength (68.2%), scapula/shoulder placement (68.2%), knee flexor strength (63.6%), and external hip rotator ROM (59.1%), ankle-foot alignment (59.1%), and lumbar curve (54.5%). CONCLUSION: Dance technique classes are insufficient for addressing these problems and may even contribute to them. Dancer screens and individualized, supplemental conditioning and referral to medical professionals is needed. ACSM/A&A can support these efforts through advocacy.

**PURPOSE**

The purpose of this study was to determine how sedentary and physical activity behaviors correlate with academic performance among undergraduate college students, implementing two objective measures and a subjective measure of physical activity.

**METHODS**

Fifty-one (22 males, 29 females) participants (age 20.2 ± 0.1 years) were instructed to simultaneously wear ActiGraph and ActiPalm monitors continuously.

**Board #14 May 29 9:30 AM - 11:00 AM**

**Relationship Between Physical Activity Intensity And Bone Mineral Density In Premenopausal Women**

Sicong Ren, Weizho Zhu, FACSM, University of Illinois Urbana-Champaign, Champaign, IL. (Sponsor: Prof. Weizho Zhu, FACSM)

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No relevant relationships reported

Music is integral to sport, and is commonly heard during intervals between play, such as a timeout in basketball or as a baseball batter approaches the plate. When

**Board #15 May 29 9:30 AM - 11:00 AM**

**Pre-performance Motivational Music Enhances Force Output Parameters In Healthy Adults**

Alexander Lesser, Eric Waldon, Feihe Hsiao, Courtney Jensen. University of the Pacific, Stockton, CA.

Email: alexserr@bellsouth.net

No relevant relationships reported

Ergonomic effect of music during physical performance is well established; the effect of listening prior to activity is not. PURPOSE: To test the effect of pre-participation music on forces. METHODS: 23 recreationally active adults (7 men, 16 women) between the ages of 18–50 with no history of lower leg injury completed dominant leg flexion and extension using a Cybex HUMAC NORM dynamometer. After a standardized familiarization protocol, subjects completed 3 trials separated by 3 minutes. The experimental conditions were: 1) no preparticipation music, 2) researcher-selected music, and 3) participant-selected music. The conditions were randomized and listening conditions were constant: headphones were worn during the silent trial, and the volume and duration were identical during music trials. Peak torque (PT) and time to achieve peak torque (TPT) were recorded. Mixed ANOVA with repeated measures tested the difference between preparational music conditions. RESULTS: Subjects were 26.7 ± 4.8 years old. Across all trials, PT was 86.0 ± 36.6 lb-ft for extension and 50.5 ± 21.7 lb-ft for flexion. TPT was 1.2 ± 0.7 sec for extension and 0.9 ± 0.6 sec for flexion. Repeated measures ANOVA with a Greenhouse-Geisser correction found a PT difference in the trials for flexion (F=5.077; p=0.016) and extension (F=4.020; p=0.036). In both movements, the highest PT was achieved with participant-selected music and the lowest during the non-music trial. For flexion, post hoc tests using the Bonferroni correction revealed participant-selected music to have significantly higher PT than the non-music trial (p=0.043) and a weak trend for higher PT than the administrator-collected trial (p=0.099). These relationships were less significant in extension. Although the same patterns were reflected in TPT, the differences failed to reach significance for flexion (p=0.125) and extension (p=0.420). CONCLUSIONS: These findings support the ergonomic effect of pre-participation music on post-listening performance, and the importance of administrator selection.

**Board #16 May 29 9:30 AM - 11:00 AM**

**Assessment Of Undergraduate Dancers’ Health And Fitness Profiles At A Liberal Arts Public University**

Marita K. Cardinal1, Bradley J. Cardinal, FACSM1, Western Oregon University, Monmouth, OR. 2Oregon State University, Corvallis, OR. (Sponsor: Bradley J. Cardinal, FACSM)

No relevant relationships reported

**Board #17 May 29 9:30 AM - 11:00 AM**

**The Association Between Physical Activity Behaviors And Academic Performance In College Students**

Mackenzie Rae O’Connell, Jennifer M. McKay, Lesley M. Scibora. University of St. Thomas, SAINT PAUL, MN.

Email: ocon3943@stthomast.edu

No relevant relationships reported

Ergonomic effect of music during physical performance is well established; the effect of listening prior to activity is not. PURPOSE: To test the effect of pre-participation music on forces. METHODS: 23 recreationally active adults (7 men, 16 women) between the ages of 18–50 with no history of lower leg injury completed dominant leg flexion and extension using a Cybex HUMAC NORM dynamometer. After a standardized familiarization protocol, subjects completed 3 trials separated by 3 minutes. The experimental conditions were: 1) no preparticipation music, 2) researcher-selected music, and 3) participant-selected music. The conditions were randomized and listening conditions were constant: headphones were worn during the silent trial, and the volume and duration were identical during music trials. Peak torque (PT) and time to achieve peak torque (TPT) were recorded. Mixed ANOVA with repeated measures tested the difference between preparational music conditions. RESULTS: Subjects were 26.7 ± 4.8 years old. Across all trials, PT was 86.0 ± 36.6 lb-ft for extension and 50.5 ± 21.7 lb-ft for flexion. TPT was 1.2 ± 0.7 sec for extension and 0.9 ± 0.6 sec for flexion. Repeated measures ANOVA with a Greenhouse-Geisser correction found a PT difference in the trials for flexion (F=5.077; p=0.016) and extension (F=4.020; p=0.036). In both movements, the highest PT was achieved with participant-selected music and the lowest during the non-music trial. For flexion, post hoc tests using the Bonferroni correction revealed participant-selected music to have significantly higher PT than the non-music trial (p=0.043) and a weak trend for higher PT than the administrator-collected trial (p=0.099). These relationships were less significant in extension. Although the same patterns were reflected in TPT, the differences failed to reach significance for flexion (p=0.125) and extension (p=0.420). CONCLUSIONS: These findings support the ergonomic effect of pre-participation music on post-listening performance, and the importance of administrator selection.
24h each day for seven days. Sleep/non-wear time was excluded from analysis. Demographics data, including self-reported grade point average (GPA), and mean daily minutes of sedentary (sitting time), light, moderate, and vigorous intensity physical activity (PA) were collected. Participants also kept a 7-day self-reported physical activity log and completed the International Physical Activity Questionnaire (IPAQ) at the end of the seven days.

RESULTS: Females engaged in significantly higher mean daily minutes of moderate intensity activity than males (60.1 ± 25.4 vs. 47.3 ± 13.2; p = 0.047). Self-reported GPA for females was significantly greater than males (3.7 ± 0.3 vs. 3.4 ± 0.3; p = 0.019). For males, mean minutes of light intensity PA measured by ActiVital and Actigraph was negatively correlated with GPA (r = -0.448 and r = -0.491, respectively; both p < 0.05). When considering self-reported PA by males, mean sitting time was positively correlated with GPA (r = 0.762; p < 0.001), but there was not association with GPA for females. For females, ActiVital-measured light intensity PA was positively correlated with GPA (r = 0.504; p < 0.05).

CONCLUSIONS: Results of this study showed that female college students spent more time in moderate intensity PA than males. Further, for both objectively and subjectively measured PA behavior, more daily sitting was associated with a higher self—reported GPA in males, but the opposite was true for females. Interestingly, the more time male college students spent in light intensity the lower their GPA, but the opposite was true for females. These results suggest that physical activity behaviors have different relationships with academic performance in college males and females.

**E-25 Free Communication/Poster - Muscle and Mechanics**

**Board #18 May 29 9:30 AM - 11:00 AM Detecting Swimming Strokes Using Pattern Recognition Analysis**

Xiong Qin1, Yadong Song2, Guanqun Zhang2, Fan Guo3, Weimo Zhu, FACSM1. University of Illinois at Urbana and Champaign, Urbana, IL. 2. Lifesense, Shanghai, China. 3. Southeast University, Nanjing, China. (Sponsor: Weimo Zhu, FACSM)

Email: xiongq2@illinois.edu

(No relevant relationships reported)

**PURPOSE:** While exercises such as walking, running or cycling can be distinguished well by accelerometer, little was reported for swimming. Purpose of this study was to detect four common swimming strokes using a pattern recognition analysis and determine the swimming time of each stroke.

**METHODS:** A total of 17 swimming athletes (9 females, 53%) from the Southeast University, China were recruited and their age (Mean(±SD), male: 20.0±8, female: 19.4±1.0, total: 19.7±0.9 yr.), height (184±5.1 cm, 172±1.5, 187±3.7 cm), body weight (82.9±6.0, 61.3±5.3, 72.2±1.2 kg), years of training on swimming (12.5±1.8, 12.9±1.9, 12.7±1.8 yr.) were collected. Each participant performed breaststroke, front crawl, backstroke and butterfly in their own preferred orders for four laps in a 50-meter pool, with an Actigraph GT9X inertia measurement unit on right or left wrist with their hand in the water. In each lap, the order of the strokes was random. The movement was recorded using a 3D motion capture system. The raw data was processed to calculate the vector magnitude of each stroke. The sensitivity and specificity of the classification model were calculated using the following equation:

\[
\text{Sensitivity} = \frac{TP}{TP + FN} \\
\text{Specificity} = \frac{TN}{TN + FP} \\
\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN} 
\]

where TP, TN, FP, and FN are true positive, true negative, false positive, and false negative, respectively.

**RESULTS:** The accuracy of the classification model was 0.995±0.012 by SVM and 0.984±0.021 by SVM while corresponding cross-validation accuracy are 0.971±0.085 and 0.964±0.046, respectively, with no statistical significant difference between the two models.

**CONCLUSIONS:** With a wearable device and SVM like pattern recognition algorithm, swimming strokes can be accurately detected, which provides a great convenience to track the participation time of swimming activities.

**2557 Board #19 May 29 9:30 AM - 11:00 AM Reactive Strength Index Scores Are Associated With Injury Risk And Game Performance In Female Collegiate Volleyball Players**

Jason Brumitt, Robin Dorociak, Tyler Cuddeford. George Fox University, Newberg, OR.

Email: jbrumitt@georgefox.edu

(No relevant relationships reported)

**PURPOSE:** The reactive strength index (RSI) is a measure used by coaches to quantify an athlete’s explosiveness. The RSI score is calculated based on one’s drop vertical jump (DVJ) performance (RSI = jump height [m] / contact time [sec]). The purpose of this study was twofold. The first purpose of this study was to evaluate the ability of preseason RSI scores to discriminate injury risk in female collegiate volleyball (VB) players. The second purpose was to evaluate correlations between preseason RSI scores and game statistics.

**METHODS:** 117 female collegiate VB players representing 3 levels of competition participated. Reflective markers were applied to the pelvis and the lower extremities. Athletes performed 3 DVJ from a 30.48 cm box. Subjects were instructed to drop off the box, land with one foot on each force plate (BP 600600 force plate, AMTI, Watertown, MA), and then immediately upon landing jump as high as possible. Reflective marker and force data was collected simultaneously with an 11 camera Qualisys motion system (Gothenburg, Sweden) at 100 Hz for the 3D marker data and 100 Hz for the force plates. Visual3D (C-Motion, Germantown, Maryland) was used to create the kinematics and kinetics. A receiver operator characteristic curve was constructed to identify a cutoff score for subsequent risk analysis. Relative risk was calculated to determine the difference in injury risk between two groups based on cutoff score dichotomization. The Pearson product-moment correlation coefficient was calculated to determine the relationship between preseason RSI scores and game statistics.

**RESULTS:** Mean preseason RSI scores were 0.88 m/s (± 0.31). Athletes with a lower preseason RSI score (0.25 m/s or less) were 4 times more likely (relative risk = 4.4 [95% CI: 1.0, 18.4]; p-value = 0.022) to experience a noncontact time-loss injury to the low back or lower extremities during the season. There was a significant correlation between preseason RSI score and kills/set (r = 0.369; p-value = 0.031). Athletes with a lower preseason RSI score (0.25 m/s or less) were 4 times more likely (relative risk = 4.4 [95% CI: 1.0, 18.4]; p-value = 0.022) to experience a noncontact time-loss injury to the low back or lower extremities during the season. There was a significant correlation between preseason RSI score and kills/set (r = 0.369; p-value = 0.031). Athletes with a lower preseason RSI score (0.25 m/s or less) were 4 times more likely (relative risk = 4.4 [95% CI: 1.0, 18.4]; p-value = 0.022) to experience a noncontact time-loss injury to the low back or lower extremities during the season.

**CONCLUSIONS:** The RSI measure should be collected as part of a preseason screening clinic to identify female collegiate VB players at risk for a noncontact time-loss injury to the low back or lower extremities. The RSI score could also be used by VB coaches when evaluating current and future athletes.
The functional movement screen (FMS) is used to identify asymmetries and imbalances in the body. It contains seven movement patterns rated on a 0 to 3 scale: deep squat (DS), hurdle step (HS), in-line lunge (ILL), shoulder mobility (SM), active straight leg raise (ASLR), trunk stability push up (TSPU), and rotary stability (RS) (Cook, 2006). In professional football players, FMS composite scores below 14 are associated with increased injury risk (Kiesel, 2007). In junior Australian players, the presence of two tests with asymmetries was indicative of injury risk (Chalmers, 2017). There are no established normative scores for NCAA Division III football players; furthermore, it is not known how many athletes display risk factors for injury.

PURPOSE: To describe FMS scores and potential injury risk in NCAA Division III football players.

METHODS: Fourteen current football players from an urban Midwestern University were recruited and consented to participate in this pilot study. Participants were assessed in the FMS by one certified level 1 tester, according to the procedures described by Cook et al. (2006). Scores below 14 and players with more than two asymmetrical scores were totaled.

RESULTS: The mean FMS composite score was 14.57 (SD = 2.2). Three (21%) athletes had composite scores below 14. Two athletes (14%) had two or more asymmetries.

DISCUSSION: FMS composite scores were similar to the mean score of 14.1 described for healthy Division I athletes by Warren (2015), but below the mean of 16.9 for professional football players (Kiesel, 2007). Two of the athletes with scores below 14 had sustained previous knee injuries, but were fully rehabilitated at the time of the testing. One of these athletes also had a composite score below 14, suggesting that a history of previous injury places athletes at greater risk for re-injury. Athletic training and coaching staff should consider these factors when assessing return to play readiness in DI football players.

CONCLUSIONS: FMS composite scores for DIII were similar to DI football players, but lower than professionals. Previous history of injury may impact the number of asymmetries displayed in the FMS, potentially resulting in higher re-injury risk.

Screening tools for the individual risk of injury in athletes have gained high popularity lately. Not only professional athletes, but also college students are in need for cost efficient and quick screening tools to allow targeted injury prevention. The Functional Movement Screen (FMS) and frontal plane knee alignment during a single leg squat (SLS) are used to identify persons at high risk for injury. The Deep Squat (DS) and active straight leg raise (ASLR) scores and to determine the relationship between frontal plane knee biomechanics in the SLS and ASLR and DS scores in healthy NCAA Division III football players and athletes with previous knee injuries.

METHODS: Fourteen football players (mean age = 21.4) were recruited and consented to participate in this study. They completed the FMS and were rated by a certified level 1 FMS tester, changed into black compression clothing. Markers were placed on the tibial tuberosity and distal tibia to define absolute valgus and varus angles at the deepest point of the SLS, where the supporting heel was still in contact with the ground. Trials were recorded using a digital camera facing the frontal plane and angles were measured using DARTfish Software.

RESULTS: For the previously injured group (n=7), mean right SLS angle was 0.5º (valgus) and mean left SLS angle was 0.38º (varus), mean DS was 1.86, mean ASLR was 2.43, and mean composite score was 14.14. DS was negatively correlated with right (r = -0.13) and left (r = 0.12) SLS angles, right ASLR was negatively associated with right SLS (r = -0.12), left SLS was negatively correlated to left SLS (r = 0.15). For the non-injured group (n=7), right SLS mean angle was 3.55º (valgus) and left mean SLS was 2.27º (valgus), mean DS was 2, mean ASLR was 2.43, and mean composite score was 15. DS was positively correlated with right (r = 0.59) and left (r = 0.86) SLS angles, right ASLR was negatively associated with right SLS (r = -0.13), left ASLR was negatively correlated to left SLS (r = 0.66). There was no significant difference in SLS angles, DS, or ASLR scores between groups (p>0.05).

CONCLUSION: Knee angles in the SLS, DS, and ASLR scores did not differ between groups. For the healthy group, DS had strong positive relationships with SLS angles and left ASLR had a moderate negative relationship to left SLS angles.

One of the most well established risk factors for future injury in athletes is having sustained a previous injury. Currently there is a lack of research regarding baseline performance of athletes on the common return to sport tests. Research evaluating baseline performance can expose the need of implementing an anticipatory rehabilitation program to avoid the risk of future injury.

PURPOSE: To investigate the differences in performance on a battery of tests amongst incoming collegiate athletes who have sustained a lower extremity injury in the past 6 months and those who have not.

METHODS: 40 (Males: 19 Females: 21) incoming collegiate athletes from an NCAA Division I University completed a battery of baseline tests that assessed their strength, flexibility, dynamic balance, power and speed. Individuals were categorized as injured and uninjured, with injury defined as having a lower extremity injury in the past 6 months (Injured: 16 Uninjured: 24).

RESULTS: The left knee flexion strength for injured (.32T-12.2BW) was significantly greater than that of uninjured (.25T-1.1BW; p = .041). The right hip internal rotation strength for injured (.20F-0.7BW) was significantly greater than that of uninjured (.15F-0.6BW; p = .014). The SLS strength was also significantly greater in injured (.20F-0.5BW) compared to uninjured (.15F-0.6BW; p = .004). For balance, the postrotoralach reach from the Y-Balance test indicated a significant difference with uninjured (7.58±6.38 cm) having a greater lumbar asymmetry compared to injured (3.49 ± 3.26 cm; p = .03). The flexibility, power and speed tests did not identify any differences.

CONCLUSIONS: The results indicated that athletes who were injured performed better on isometric strength tests and Y- Balance than those with no recent injuries. One potential hypothesis to account for these differences is that the injured athletes could have participated in an individualized rehabilitation program after injury.

Football has the highest rate of knee injuries when compared to other contact sports (Rothenberg, 2016). It is important to investigate whether the risk for such injuries in NCAA Division III football players can be assessed by the Functional Movement Screen (FMS) and frontal plane knee alignment during a single leg squat (SLS), as suggested by Kiesel et al. (2007) and Ugalde (2015), respectively.

PURPOSE: To compare FMS deep squat (DS) and active straight leg raise (ASLR) scores and to determine the relationship between frontal plane knee biomechanics in the SLS and ASLR and DS scores in healthy NCAA Division III football players and athletes with previous knee injuries.

METHODS: Fourteen football players (mean age = 21.4) were recruited and consented to participate in this study. They completed the FMS and were rated by a certified level 1 FMS tester, changed into black compression clothing. Markers were placed on the tibial tuberosity and distal tibia to define absolute valgus and varus angles at the deepest point of the SLS, where the supporting heel was still in contact with the ground. Trials were recorded using a digital camera facing the frontal plane and angles were measured using DARTfish Software.

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CONCLUSION: Knee angles in the SLS, DS, and ASLR scores did not differ between groups. For the healthy group, DS had strong positive relationships with SLS angles and left ASLR had a moderate negative relationship to left SLS angles.
address their functional deficits, which improved performance. Therefore, this study shows that it could be critical to screen all athletes, whether injured or uninjured, prior to participation in the athletic season.

**RESULTS:** Table 1. Root mean square (mean ± SE) measured in µV between traditional and non-traditional A, Y, and pushup plus.

<table>
<thead>
<tr>
<th></th>
<th>Mid-Deltoid</th>
<th>Mid-Latissimus Dorsi</th>
<th>Pectoralis Major</th>
<th>Upper Trapezius</th>
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<tr>
<td>T A</td>
<td>246.9±31.6</td>
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<td>109.6±27.2</td>
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<td>T PU+</td>
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<td>133.4±56.6</td>
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<td>185.8±36.6</td>
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<td>73.1±15.0</td>
<td>159.5±28.7</td>
<td>585.5±66.8*</td>
</tr>
</tbody>
</table>

* p ≤ 0.05

**CONCLUSIONS:** Neuromuscular activity between traditional and non-traditional A and Y exercises were relatively similar and were not found to be significantly different. Traditional shoulder-related pre-/rehabilitative exercises is a comparable method to supplement shoulder-related issues. Traditional pushup plus, however, evoked greater neuromuscular activity amongst two of the four targeted muscle groups, which may be explained due to the angular differences from the pivot point. From an applied perspective, therefore, practitioners and clinicians may utilize the non-traditional A and Y as another pre-/rehabilitative modality for shoulder-girdle augmentation.

**RESULTS:** Table 1. Root mean square (mean ± SE) measured in µV between traditional and non-traditional A, Y, and pushup plus.
Prevention and rehabilitation methods for ankle and Anterior Cruciate Ligament (ACL) injuries now include proprioception and Range of Motion (ROM) exercises as they are proven to be successful techniques. The purpose of this study is to determine if a relationship between lower extremity proprioceptive scores and ankle ROM in uninjured female collegiate soccer athletes exist. PURPOSE: To investigate a comparison between proprioception scores and Range of Motion (ROM) scores of the ankle in female collegiate soccer athletes to determine if a relationship exists.

METHODS: A one shot case study design was used to determine if a relationship exists between proprioception scores and range of motion in female collegiate soccer athletes. Proprioception was tested using the Bertec Balance Posturography Plate measuring Center of Pressure (COP) on a normal surface (NS) and perturbed surface (PS) with eyes open (EO) and eyes closed (EC) as well as measuring Limit of Stability (LOS) with eyes open. The Goniometer was used to measure Inversion and Eversion in both the left ankle (LA) and right ankle (RA) joint. RESULTS: There were no significant relationships between proprioception and ROM in the ankle documented either in Inversion or Eversion. Statistical analysis indicated inversion of the left ankle resulted in diminished proprioception scores in both a normal surface with eyes open and perturbed surface eyes open compared to both surfaces with eyes closed, (LA NS-EO p<.105, LA NS-EC p=.084, LA PS-EO p=.225, LA PS-EC p=.094). There were no relationships between the variables due to the correlation coefficient resulting close to zero (NS-EO: LA inversion r=0.011, LA eversion r=0.030, RA eversion r=0.006) (NS-EC: LA inversion r=0.175, LA eversion r=0.019, RA inversion r=0.003, RA eversion r=0.131) (PS-EO: LA inversion r=0.091, LA eversion r=0.017, RA inversion r=0.315, RA eversion r=0.040) (PS-EC: LA inversion r=0.165, LA eversion r=0.033, RA inversion r=1.556, RA eversion r=0.026). CONCLUSION: These results suggest that no significant relationship exists between ankle joint ROM and proprioception scores. Further studies examining healthy uninjured ankle ROM in athletes should be conducted in order to identify relationships that could prevent ankle injuries from occurring.

It has been well established that several minerals such as calcium, potassium, and iron play an important role in muscle metabolism, muscle function, and physical performance. Although the importance of calcium has been well studied in bone healing, little is known about the relationship between calcium intake and muscle performance, especially in young adults. PURPOSE: The purpose of this study is to investigate the relationship between dietary calcium intake and muscle performance in college-aged students. METHODS: A randomized cross-sectional study participated by 70 college-aged students. The dietary and muscle performance in college-aged students. CONCLUSIONS: Although the result suggests calcium intake was related to lower muscle performance, in future experimental study should explore and control confounding variables to understand role of calcium intake on muscle performance in larger samples and in different sports.
versus traditional core stabilization exercises at strengthening the TrA and LM in healthy participants. METHODS: University students (41 females, 13 males), ages 18-25 years with no recent history of back injury and no history of back surgery were recruited. Participants were tested on the maximum voluntary contraction (MVC) of the TrA and LM at lumbar vertebrae levels L4 and L5 using wireless electromyography (EMG). Participants were split into two groups. The control group performed traditional core stabilization exercises, the experimental group used an augmented biofeedback device. Participants performed the exercises 3 times a week for 20 minutes. Participants returned after 8 weeks to retest the MVC. RESULTS: Paired-sample t-tests revealed significant improvements for Left L4 (t(52) = 2.08, p < .05), Left L5 (t(52) = 2.14, p < .05), Right L4 (t(52) = 2.34, p < .05), and Right L5 (t(52) = 2.41, p < .05) over the course of the 8-week exercise period. To determine if improvements differed across exercise conditions, a series of analyses of covariance (ANCOVAs) were used. In all analyses, change scores were entered as the dependent variable with pre-test MVC entered as covariates. Exercise condition was entered as the independent variable. Results of the analyses revealed no significant effect of exercise condition on change score for Left L4 (F(1, 51) = .47, p = .50), Left L5 (F(1, 51) = 1.72, p = .20), Right L4 (F(1, 51) = .01, p = .95), Right L5 (F(1, 51) = .18, p = .68), Left TrA (F(1, 51) = .03, p = .86), or Right TrA (F(1, 51) = .00, p = .95). CONCLUSION: Results of the study found that MVC of the LM significantly improved in both groups. MVC of the TrA improved in both groups as well, however changes did not reach statistical significance. An augmented biofeedback device could be used as an alternative to traditional core stabilization exercises to strengthen the TrA and LM.

2572 Board #33 May 29 9:30 AM - 11:00 AM COMPARISON OF MUSCLE ACTIVATION BETWEEN THE CONVENTIONAL, SUMO AND STIFF-LEG DEADLIFT
Dominique Vitanza, California State University, Long Beach, Long Beach, CA

Purpose
The purpose of this study was to compare differences in muscle activation of the primary agonist muscles during three variations of deadlift - sumo (SDL), stiff-leg (SLDL), and conventional (DL) - in both men and women.

Methods
Twelve recreationally trained subjects (six males, six females; age: 23 ± 0.5 years, height: 182 ± 3.2 cm, body mass: 74 ± 6.1 kg, SDL SLDL: 128 ± 53.6 kg, SDL DL: 127 ± 56.8 kg, SDLL: 117 ± 49.6 kg) participated in this within-subject crossover design. Electromyographic (EMG), activity of the DL, SDL, and SLDL for the vastus lateralis (VL), vastus medialis (VM), biceps femoris (BF), medial hamstring group (MH), and erector spinae (ES) was measured. Gender differences were evaluated, comparing the difference in the HQ ratio between male and female. For the second session, participants completed three repetitions at 80% of their 1RM for each lift as EMG data was collected. Raw EMG data was smoothed and rectified with NORAXON software (150 Hz) and mean peak activation was expressed as the root mean square (RMS). EMG values obtained during the 3 repetition experimental session were averaged then normalized to the EMG values achieved in the 1RM. RESULTS
Results showed no significant differences (p>0.05) in normalized EMG values between the five measured muscles during the DL, SDL, and SDLL. No significant differences were found in EMG ratios because of the large variance in the EMG data between the five muscles and the lack of statistical power due to the small sample size. No significant difference was found in EMG ratios between males and females; however, there was a statistical trend in the SDL that indicated sex differences in the EMG ratio, with males having the higher HQ ratio (p=0.063).

Conclusions
This study revealed that no variation is superior in activating the quadriceps, hamstrings, or low back, indicating all three variations are acceptable methods to train the aforementioned musculature. Moreover, the lack of significant disparity between men and females suggests women are not quadriceps-dominant and display similar activation patterns to males.

2573 Board #34 May 29 9:30 AM - 11:00 AM The Effect Of Concentric Prime Movers Vs. Synergist Muscle Contraction On Coactivation Ratios
Bulent Sokmen, Ryann De Sousa, German Reyes, Jose Limas, Nicholas Nygaard, Yazmin Moreno, Jireh Pejana, Emily Campbell, Sonoma State University, Santa Rosa, CA
Email: sokmen@sonoma.edu

(Purpose: The purpose of this study was to examine the coactivation ratio of agonist to antagonist muscle groups with varying pre-exhaustion protocols, and to see if postactivation potentiation is influenced by pre-exhaustion. METHODS: Eight college age males and females were recruited for the study. Each participant visited the Human Performance Laboratory four times over the duration of the study. Subjects were monitored via EMG and randomly performed 1 set of 50 repetitions maximal voluntary knee extension, knee flexion, and knee extension/flexion at 60°•s-1 using an isokinetic machine on the dominant leg. They performed 1 set of 10 repetitions of modified Peterson step-up testing at pre-exercise, immediately post-exercise, and during the period of recovery. Given the small number of subjects in this study, additional research using larger subject groups and different fatiguing and post-activation protocols is warranted to support or refute the use of pre-exhaustion techniques to improve activity/recovery of atrophied muscle in physical therapy settings.

Alternative training modalities (ATM) have recently gained popularity as a form of resistance exercise through non-traditional methods and equipment. ATM share a common characteristic, the incorporation of non-traditional exercise movements and equipment in efforts to develop strength in a multi-planar fashion. Forms of common ATM include kettlebells, battle ropes, tires, and the steel mace. The steel mace, like a sledgehammer, consists of a long-levered club attached with a heavy sphere (i.e. mace head) fixed at one end. What remains relatively unknown are the neuromuscular demands of specific muscles or muscle groups among steel mace exercises. PURPOSE: To examine the electromyographic profile of four common steel mace exercises: the overhead squat, 360° overhead rotation, reverse lunge offset, and lap offset squat. METHODS: Twenty-nine resistance-trained males (n=15) and females (n=14) were recruited to participate in this cross-over experimental design investigation. All participants completed each of the four exercises with the mace head (i.e. heavy sphere) fixed at both dominant and non-dominant sides of the body. Normalized surface electromyography (EMG) of the dominant-side upper trapezius, anterior deltoid, pectoralis major, triceps brachii, biceps brachii, external oblique, rectus femoris, and biceps femoris were analyzed. A one-way ANOVA was used to compare normalized EMG among muscles within each exercise and among exercises for each muscle. RESULTS: No significant difference was found, indicating the incorporation of non-traditional exercise movements and muscle group, EMG activity was significantly altered when positioning the mace head ipsilateral vs. contralateral to the dominant side (p<0.05). Additionally, each exercise demonstrated differential EMG activities among muscles for each muscle (p<0.05). Overall, the upper trapezius and rectus femoris exhibited the greatest EMG activity (p<0.05). All muscle groups except for the bicep brachii and external oblique showed differential EMG activity among exercises (p<0.05). CONCLUSIONS: The present findings provide practically significant information regarding the muscle-specific demands of popular steel mace exercises which may provide valuable insight for athletes, fitness enthusiasts, and exercise practitioners who implement steel mace training programs.

Numerous variables influence performance in resistance training. The duration between sets has been explored both for its acute effect on the subsequent set as well as its effect on the physiological responses to exercise. However, the duration of rest between repetitions is relatively unexplored. PURPOSE: To evaluate the effect of inter-repetition rest interval (IRRI) duration on power parameters within a single set. METHODS: We tested 206 healthy men and women between the ages of 15 and 70 using Proteus technology (Proteus Motion, USA). Subjects performed
36,728 repetitions across 4,566 sets of 25 exercises at various loads (1lb to 25lb) of three-dimensional isometric resistance. Protein software calculated the IRRI duration (milliseconds) and recorded the peak power (watts) and peak force development rate (watts/sec). Linear regression models tested the effect of IRRI duration on the peak power and peak force development rate of the subsequent repetition when controlling for other significant predictors. RESULTS: In upper body motions, holding constant exercise performed (p<0.001), repetition (p<0.001), and repetition number (p<0.05), each additional second of IRRI predicted a 2.23-watt increase of peak power in the next repetition (p=0.001; 95%CI: 1.81-2.65). The overall model was significant (R²=0.613; p<0.001). Lower limb motions displayed a similar pattern (R²=0.620; p<0.001) but the magnitude of effect by IRRI duration was smaller (p=0.001; β=1.13; 95% CI:0.67-1.59). Lower limb peak force development rate was unaffected by IRRI (p=0.714); in upper body motions, there was a weak negative trend (p=0.001; β=1.13; 95% CI:0.67-1.59). Lower limb peak force development rate was unaffected by IRRI (p=0.714); in upper body motions, there was a weak negative trend (p=0.001; β=1.13; 95% CI:0.67-1.59). Lower limb peak force development rate was unaffected by IRRI (p=0.714); in upper body motions, there was a weak negative trend (p=0.001; β=1.13; 95% CI:0.67-1.59). Lower limb peak force development rate was unaffected by IRRI (p=0.714); in upper body motions, there was a weak negative trend (p=0.001; β=1.13; 95% CI:0.67-1.59).

RESULTS: Performance in resistance training is affected by innumerable factors. Our findings add one more for

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quadriceps endurance between healthy males and females, and compare quadriceps endurance to quadriceps strength. METHODS: 19 healthy subjects (10 M, 26.8 ± 7.6 y; 77.6 ± 12.2 kg; 9 F, 23.8 ± 7.3 y; 60.4 ± 6.2 kg; Teqger 7.9 ± 0.9) participated in this study. Leg dominance was self-reported. Maximal voluntary isometric contraction (MVIC) and endurance were assessed at 90° of flexion on a Biodex dynamometer. Endurance was assessed via 5-second contractions followed by 3-second rests at a 70% of MVIC. Once the subject’s torque output fell below 50% of the target for 3 repetitions, the test was completed. Endurance was calculated through the torque curve summed across repetitions. Independent t-tests compared differences between males and females. Pearson product moment correlation coefficients assessed the relationship between quadriceps strength and endurance. RESULTS: There were no significant differences in peak isometric strength normalized to body weight (M: 2.6 ± 0.6 Nm/kg; F: 2.6 ± 0.5 Nm/kg), nor was there a relationship between cumulative work and peak strength (p = 0.85, r = -0.05), age (p = 0.22, r = 0.30) or bodyweight (p = 0.31, r = 0.2). Male subjects displayed greater cumulative work than female subjects (M: 242.9 ± 127.3 Nm*s/kg; F: 142.9 ± 71.6 Nm*s/kg. p = 0.05). Both males and females showed significantly greater endurance in the dominant limb (Dominant: 194.9 ± 114.3; Non-dominant: 122.2 ± 55.3; p = 0.003). CONCLUSIONS: The muscle endurance test was not influenced by strength, age, or bodyweight. However, we did find significant differences in limb dominance which could be due to greater use of the dominant limb. In contrast to prior studies, males had greater endurance. We speculate that this could be due to differences in how the muscle repurposes during rest periods. Future work should assess if these differences carry over after injury and evaluate the physiological determinants for the observed differences.

2580 Board #41 May 29 9:30 AM - 11:00 AM

Water Vs. Land-based Squat Exercise In Postmenopausal Women: Effects On Neuromuscular Activity And Metabolic Equivalents

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Overweight and obesity are osteoarthritis (OA) risk factors. The prevalence of OA in women is higher than that of men. The squat exercise is a simple and effective strength training mode for lower extremities. The buoyancy and warm temperature of the water can reduce joint discomfort during the squat exercise. However, it is unclear the responses of neuromuscular activity (MA) and metabolic equivalents (METs) when squat exercise at different speeds was performed. PURPOSE: This study was to compare the responses of MA, rating of perceived exertion (RPE), and METs following squat exercise at slow (20 bpm), medium (60 bpm), and the fast as possible speed between in water and on-land in postmenopausal women. We recruited 23 postmenopausal women over the age of 50 with a BMI ≤ 24 or body fat ≥ 50%. Subjects performed 15 repetitions squat exercise at medium speed, slow speed and fast speed in water and on land by random order. We measured the maximum voluntary contractions of quadriceps and hamstring muscle and standing posture oxygen consumption before exercise testing and collected RPE, METs, and MA in the exercise period. Paired-samples t tests were performed to test all parameters in water and on land. RESULTS: MA of quadriceps in water was significantly lower than that on land at three-speed squat exercise (slow: 11.95 ± 3.93 vs 31.21 ± 10.70, medium 17.02 ± 5.31 vs 42.79 ± 16.46, the fastest: 30.48 ± 7.74 vs 72.12 ± 25.86 rns %, p<0.05). MA of hamstring was no difference between in water and on land following medium and fast-speed squat exercise. The METs in water were lower than that of on land at slow and medium speed squat exercise (slow: 1.73 ± 0.37 vs 2.40 ± 0.60, medium: 1.91 ± 0.35 vs 2.34 ± 0.42, the fastest: 2.21 ± 0.79 vs 2.50 ± 0.63, p<0.05). MA of hamstring and METs following the fast-speed squat exercise were similar to those of on land, whereas it had a lower RPE.

2581 Board #42 May 29 9:30 AM - 11:00 AM

Different Methods Of Post Activation Potential On Swimming

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PURPOSE: The purpose of this study was to compare the effect of post-activation potential (PAP) on countermovement jump (CMJ) using different set configurations and loads on conditioning activity (CA) in highly trained swimmers.

METHODS: Sixteen national level swimmers participated in this study and performed a total of six visits to the laboratory. The first session was used for familiarization, the second session was utilized to determine a five repetitions maximum (RM) in the half squat (HS), and the following four visits consisted of four CA protocols performed in a counterbalanced order. Two CA was performed as traditional sets (TS) with sequential repetition, with different load, that involved one set of five repetitions at 100% (TS50) or 65% of 5 RM load (TS45). Additionally, two CA included one set of five repetitions within 30 s of superset interrepetition rest (IRR), with both relative loads (IRR50 and IRR45). Countermovement jump height was measured at baseline, immediately after the CA, and every 2 min until 12-min.

RESULTS: Significantly faster peak and mean barbell velocity was observed for the CA with lower relative loads (p < 0.05). When evaluating the peak CMJ height, considered the best result after the CA, TS50 improved CMJ performance (effect size = 0.39; p = 0.027; Δ% = 4.8 ± 7.3) and TS45 did not improve CMJ performance (effect size = 0.21; p = 0.05; Δ% = 2.4 ± 5.3). CONCLUSIONS: Thus, set configuration using IRR does not promote PAP and TS with a high-load should be adopted for an acute improvement in CMJ for highly trained swimmers.

2582 Board #43 May 29 9:30 AM - 11:00 AM

The Effect Of Reflexive Performance Reset And Gluteal Activation Exercises On Muscular Excitation During Sprints

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(No relevant relationships reported)

 Reflexive performance reset (RPR) has been reported to mitigate compensation patterns to reduce pain, increase flexibility, and enhance performance during sport and exercise. Furthermore, gluteal activation exercises (GA) have been postulated to enhance gluteal recruitment during exercise. However, it is currently unknown whether RPR or GA alter muscular excitation during exercise. PURPOSE: To test the hypothesis that RPR improves hamstring excitation and GA improves glutei maximis excitation when compared to a dynamic warm-up.

METHODS: Ten male subjects (age: 21 ± 1 y, BMI: 25.2 ± 2.4 kg/m²) randomly completed a control visit (Control), a RPR visit (RPR), and a GA (GA) visit. Whole-body feeling was assessed using the feeling scale (< 5 = very bad, 0 = neutral, 5 = very good) and sprint time was assessed using slow motion video capture. The total contribution of muscular work was assessed for the quadriceps, the glutei maximis, and the hamstrings using surface electromyography (Atlos Training System). Subjects performed a standardized dynamic warm-up (Control), had RPR performed on them by a trained technician (RPR), or completed a series gluteal activation exercises (GA). Maximal voluntary isometric contractions for the quadriceps, the glutei maximis, and the hamstrings were assessed, after which the subject ran three all-out 9.14 m sprints. The feeling scale and sprint time were analyzed via a one-way ANOVA and the total contribution of muscular work was analyzed via a two-way ANOVA. Data are presented as mean ± SD.

RESULTS: There were no statistical differences between Control (2.91 ± 1.4 a.u.), RPR (2.91 ± 1.6 a.u.), and GA (3.21 ± 1.7 a.u.) for the feeling scale (p = 0.80). There were no statistical differences between Control (2.01 ± 0.03 s), RPR (2.02 ± 0.07 s), or GA (1.93 ± 0.31 s) for sprint time (p = 0.48). Total muscular contribution was not statistically different (condition main effect: p = 0.90) during Control (quadriceps: 70 ± 12%, glutei maximis: 161 ± 88%, hamstrings: 149 ± 9%). RPR (quadriceps: 61 ± 11%, glutei maximis: 175 ± 5%, hamstrings: 22 ± 8%), or GA (quadriceps: 65 ± 11%, glutei maximis: 171 ± 5%, hamstrings: 186 ± 8%). CONCLUSION: These data indicate no alterations in muscular excitation following RPR or GA during short sprints in healthy males. Furthermore, RPR or GA did not enhance whole-body feeling or performance.

2583 Board #44 May 29 9:30 AM - 11:00 AM

Case Study: Shoulder Muscle Activity While Swimming With Different Wetsuit Conditions And Swimming Paces.

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(No relevant relationships reported)

During swimming, the wetsuit is an important piece of equipment can benefit swim performance. Triathletes can select different types of wetsuit based on personal preference, body type, and swimming technique. It is not clear if wetsuit design or swim pace influences shoulder muscle activity. PURPOSE: To determine how swimming with different types of wetsuit (HUR Designs Inc., Aquas II 3.5, Sebago) using different swimming paces influence shoulder muscle activity. METHODS: One male subject (height: 181.6 cm, body mass: 81.1 kg) completed total four swim conditions in a 25 m pool: 1) No wetsuit (NWS), 2) Sleeveless wetsuit (SLW), 3) Full-sleeve
wetsuit (FSW), 4) Buoyancy shorts (BS) x 3 swimming paces: slow, medium, fast. A wireless waterproof EMG system (Cometa, Italy) was used to measure shoulder electromyography (EMG). Anterior Deltoid (AD) & Posterior Deltoid (PD) and swimming pace was measured by stopwatch. EMG data were averaged across 5 consecutive stroke cycles with stroke rate calculated. EMG data were normalized to NWS slow speed. Results: Stroke rate (slow: 1.92 ± 0.05 Hz, medium: 1.75 ± 0.05 Hz, fast: 1.46 ± 0.06 Hz) decreased as swimming velocity (m/s) increased (NWS - Slow: 1.12 ± 0.04, Medium: 1.21 ± 0.02, Fast: 1.32 ± 0.01; FSW - Slow: 1.27 ± 0.02, Medium: 1.34 ± 0.01, Fast: 1.52 ± 0.01 / FSW - Slow: 1.25 ± 0.02, Medium: 1.38 ± 0.02, Fast: 1.48 ± 0.04 / BS - Slow: 1.21 ± 0.02, Medium: 1.30 ± 0.01, Fast: 1.40 ± 0.02). Inspecting EMG trends, AD EMG was greatest during BS vs. other conditions and increased with swim velocity during FSW and BS conditions. PD muscle activity did not exhibit any clear pattern between conditions or across swimming velocities. Table 1. Anterior and posterior deltoid muscle activities (%NWS slow) across the wetsuit conditions.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Slow</th>
<th>Medium</th>
<th>Fast</th>
<th>Slow</th>
<th>Medium</th>
<th>Fast</th>
</tr>
</thead>
<tbody>
<tr>
<td>NWS</td>
<td>75.9 ± 19.4</td>
<td>72.6 ± 11.1</td>
<td>80.0 ± 4.8</td>
<td>93.8 ± 7.4</td>
<td>75.9 ± 19.4</td>
<td>83.7 ± 7.4</td>
</tr>
<tr>
<td>SLW</td>
<td>92.2 ± 13.2</td>
<td>79.4 ± 18.1</td>
<td>102.7 ± 22.2</td>
<td>187.7 ± 22.2</td>
<td>157.3 ± 8.9</td>
<td></td>
</tr>
<tr>
<td>FSW</td>
<td>65.2 ± 3.6</td>
<td>76.8 ± 4.3</td>
<td>103.5 ± 14.9</td>
<td>162.5 ± 26.5</td>
<td>121.1 ± 3.7</td>
<td>149.3 ± 14.5</td>
</tr>
<tr>
<td>BS</td>
<td>111.7 ± 1.6</td>
<td>122.8 ± 5.7</td>
<td>149.4 ± 9.8</td>
<td>83.4 ± 4.8</td>
<td>83.4 ± 4.8</td>
<td>83.4 ± 4.8</td>
</tr>
</tbody>
</table>

Note: Anterior Deltoid and Posterior Deltoid as percent of Slow-No Wetsuit (NWS) condition during sleeveless wetsuit (SLW), full sleeve wetsuit (FSW), and neoprene shorts (BS).

Conclusion: It is important to establish techniques to measure muscle activity during swimming in different wetsuit conditions since muscle activity is influenced by a complex interaction of wetsuit condition, pace, and swim technique.

Biofeedback provides a unique stimulus enhancement to the maximal voluntary isometric contractions (MVIC) ability in several muscle groups. However, limited research has investigated the use of biofeedback in the upper extremities specifically, the forearm flexors (FF).

PURPOSE: The purpose of this study was to examine the following conditions whilst performing the FF MVIC test: 1) VIVE feedback only (VIVE); 2) visual feedback only (VF); 3) no feedback at all (NOVIVE). Real-time force output was displayed to the following conditions whilst performing the FF MVIC test. These included, 1) VIVE, 2) VF, 3) VIVE + VF (VIVE+VF), 4) VF + NOVIVE (VF+NOVIVE), 5) VIVE + NOVIVE (VIVE+NOVIVE) conditions. Peak power was 96.3±13.7 w in IR and 99.3±15.7 w in ER; peak force development rate in watts/second, range of motion in meters (ROM), consistency (the ability to replicate ROM in three-dimensional space), and endurance (replication of active movement extent discrimination apparatus (AMEDA)). Repeated measures analysis of variance (ANOVA) was performed to analyze the data. RESULTS: There was a significant Side (R=0.411, p=0.057), Muscle or Time effect (F=0.826, p=0.445), and NOVIVE condition (p=0.046) effect. However, when BF were divided into superior (SG, n=11) and inferior (IG, n=11) groups, according to the median of bilateral ankle proprioception, we found: 1) the dominant right ankle proprioception worsened significantly after both BF (p=0.022) and VF (p=0.02) in the SG, but not in the IG (F=1.748, p=0.2); 2) the non-dominant left ankle proprioception improved significantly after both BF (p=0.046) and VF (p=0.03) in the IG, but not in the SG (F=1.461, p=0.256). These findings suggest that VFRE can impair the dominant right ankle proprioceptive performance in those who initially have superior proprioception, and conversely improve the non-dominant left ankle proprioceptive performance in those who initially have inferior proprioception. CONCLUSIONS: This study has revealed a novel proprioceptive specialization in bilateral ankle proprioceptive information processing associated with VFRE. Specifically, VFRE affects proprioception of the dominant and non-dominant hemispheric systems differently suggesting that the clinical application of VFRE should be considered regarding each individual’s initial ankle proprioception and footedness.
The simulated dynamic warm-up using three-dimensional resistance elicited the best subsequent function, follow up studies should examine mechanisms that produce this difference.

**2587** Board #48  
**The Relationship Between Mountain Bike Seat Angle, Knee-pedal Alignment, And Knee Range Of Motion**  
Kyle E. Petersen, Andrew Creer, Shane Draper, Anthony Ciccone. Utah Valley University, Orem, UT.  
(No relevant relationships reported)

**PURPOSE:** Newer bicycles have increasingly steep seat angles. Seat tube angle (STA) is consistent within each bike model, but changes with seat height and post positioning. Traditionally, a bike fit will vertically align the knee with the pedal at the midpoint of the downstroke. This positioning has an effect on a rider’s knee range-of-motion (ROM) potentially affecting fatigue rates. Additionally, the ROM may affect the knee-pedal spindle alignment position thereby affecting power capacity. Therefore, the purpose of this study was to determine if effective seat tube angle affects knee-pedal alignment and knee ROM.

**METHOD:** Participants included 17 male and female (176.9 ±9.3 cm, 66.6 ±12.5 kg), amateur and elite, cross-country mountain bike racers. Reflective markers were placed by the same researcher at locations on the participants dominant side: greater trochanter of femur, lateral condyle of femur, and lateral malleolus of fibula. Photographs were taken of the bike alone and with the participant in their typical riding position, with leg at full extension, full flexion, and halfway through the downstroke. Photographs were analyzed to determine knee-spindle horizontal distance (KTS), peak knee flexion angle (KFA), and STA using digital measurement software (Dartfish USA, Alpharetta, GA). Linear regression was used to statistically analyze the data (alpha=0.05).

**RESULTS:** For every 1 degree increase in STA, knee position moved forward 1.42 cm closer to the handlebars (p=0.050, $R^2=0.23$). After accounting for STA, KFA explained an additional 44% of the variance in KTS (p<0.001) where every 1 degree increase in KFA resulted in knee position moving 0.58 cm further away from the handlebars. When combined, STA and KFA explain 67% of the variance in KTS.

**CONCLUSIONS:** It is generally accepted that KTS should be 0 to have optimal power transfer to the pedals and limit sagittal forces on the knee joint. Changing STA in order to decrease KTS may be effective to increase performance. Further research should examine how individualized STA could affect rider positioning and performance during endurance efforts.

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**E-26** Free Communication/Poster - Acute Exercise  
Friday, May 29, 2020, 9:30 AM - 12:00 PM  
Room: CC-Exhibit Hall

**2588** Board #49  
**Energy Resource Of Four Styles Of 30s All-out Rope Skipping**  
Changjian Du, Li Guo. Shanghai University of Sport, Shanghai, China.  
Email: 494943064@qq.com  
(No relevant relationships reported)

Rope skipping has been popular and a major tool for training and entertainment. When skipping rate per jump increments from single under to quad under, flight time prolonged and increased swinging frequency, the proportion of aerobic and anaerobic energy supply may be different.

**Purpose:** To compare 30s all-out rope skipping energy resource between four styles.  
**Method:** Ten skilled rope jumpers (height=169.3±4.7cm, body mass=65.5±9.2kg; age=23.2±2.1yrs, years of training=3.81±1.3yrs)voltunteer for this study. Participants conducted 30-second rope skipping test at 1 skip per jump (single under, SU), 2 skip per jump (double under, DU), 3 skip per jump (triple under, TU) and 4 skip per jump (quad under, QU), and completed as many repetitions as possible with 24 hours between trials. VO2 were monitored at rest, during test and up to 1 hour after test. Blood lactate was measured immediately, minute by minute after test. Lactic (Wlac) and alactic anaerobic (Wana) energy outputs were calculated from net lactate production and the fast component of EPOC. Aerobic metabolism (Wao) was determined from VO2 during exercise.

**Result:** During the simulated dynamic warm-up using three-dimensional resistance elicited the best subsequent function, follow up studies should examine mechanisms that produce this difference.

**Conclusion:** When skipping rate per jump increments from single under to quad under, flight time prolonged and increased swinging frequency, the proportion of aerobic and anaerobic energy supply may be different. When combined, STA and KFA explain 67% of the variance in KTS. The simulated dynamic warm-up using three-dimensional resistance elicited the best subsequent function, follow up studies should examine mechanisms that produce this difference.

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**2589** Board #50  
**Physiological Responses And Energetic Of Two Sprint Interval Exercise Protocols Based On Rope-skipping And Cycling**  
Ting Zhao, Li Guo. Shanghai University of Sport, Shanghai, China.  
Email: 1158552475@qq.com  
(No relevant relationships reported)

High-intensity interval training could improve performance effectively. However, the acute physiological response and energy expenditure of a low-volume, high-intensity rope-skipping based protocol have not been determined.

**PURPOSE:** To compare the physiological response and energy resource in repeated bouts of sprint interval cycling (SIC) and high-intensity intermittent double-under rope skipping (HIT-RS).

**METHOD:** Fifteen college students (age=20.2±0.8yrs, body mass=66.7±4.8kg, BMI=22.4±1kg.m-2, VO2peak=51.9±7.83ml.kg-1.min-1) volunteered for this study. Participants completed two protocols (30s with 4min active recovery) on separate days with 1 week between trials. VO2 and heart rate were monitored at rest, during test and continue to 1 hour after test. Blood lactate was measured 3 minutes after each bout, and minute by minute after the last bout. Lactate (Wlac), alactic anaerobic (Wana) energy outputs were calculated from net lactate production and the fast component of EPOC. Aerobic metabolism (Wao) was determined from VO2 during exercise.

**RESULT:** Mean values for %Vo2max and %HRmax for SIC (78.79±15.35% and 85.33±4.69%) and HIT-RS (74.93±16.21% and 83.17±3.77%) were not significantly different (p>0.05). The overall energy cost for SIC (102.75±13.15 kJ) was significantly higher (p<0.001) compared to HIT-RS (70.86±10.25 kJ). Wana and Wao for SIC (17.39±3.08, 59.50±8.10 and 25.86±5.40 kJ) and HIT-RS (13.05±2.01, 27.97±6.77 and 29.84±6.28 kJ) were significantly different (p<0.01). Fractions of Wana and Wao for SIC (16.92±1.77%, 57.99±4.70% and 25.09±3.65%) and HIT-RS (18.80±3.33, 38.84±6.99% and 42.36±5.98%) were significantly different (p<0.001). Both protocols were anaerobic-dominated with similar fraction (SIC:83.08±3.01% vs HIT-RS:81.20±4.52%). Compared to SIC, HIT-RS was more PCr dominant (42.16±5.98% vs 25.09±3.65%, p<0.01) with lower anaerobic lactate contribution (38.84±6.09% vs 57.99±4.70%, p<0.001).

**Conclusion:** High-intensity interval protocol of rope skipping elicits vigorous cardiorespiratory responses and may confer physiological adaptations and performance improvements resembling as SIC.

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**2590** Board #51  
**Determinants Of Metabolic Cost During Four Styles Of 30-second Sprint Rope Skipping**  
Li Guo, Yaogang Han. Shanghai Sport University, Shanghai, China.  
Email: guoli@sus.edu.cn  
(No relevant relationships reported)

Rope skipping has been a major training tool for many sports. However, no study has been conducted as yet to determine energy expenditure with incremental skipping rate per jump (difficulty) from single under to quad under.

**Purpose:** To determine and compare 30-seconds all-out effort energy expenditure between four incremental rope skipping difficulties.

**Method:** Ten skilled rope jumpers (height=169.3±4.7cm, body mass=65.5±9.2kg; age=23.2±2.1yrs, years of training=3.81±1.3yrs) volunteered to participate this study. Participants conducted rope skipping as many repetitions as possible at 1 skip jump (single under, SU), 2 skips jump (double under, DU), 3 skips jump (triple under, TU) and 4 skips jump (quad under, QU) during 30-second test with 24 hours between trials. Kinematic and kinetic data were collected to calculate flight time (FT) and vertical center of mass displacement (vCOM). Each style was assessed in three trials and then averaged. Net energy expenditure (Wnet) was calculated from VO2 during exercise, the fast component of the EPOC above resting and net blood lactate production.

**Result:** SU exhibited significantly lower Wnet value (49.9±12.70 kJ) than in DU (69.2±11.05), TU (72.0±13.59) and QU (81.0±16.25) (p<0.01). Wlac (kJ) was significantly different between SU (23.4±6.9), TU (33.7±12.8) and QU (40.0±10.5) (p<0.05), and DU (29.1±8.0) and QU (p<0.05). Wana (kJ) in SU and QU were significantly different (16.5±8.6 vs 27.2±12.4, p<0.05). SU (10.0±2.2) had significantly lower Wana (kJ) value than the other styles (DU 12.3±3.1, TU 14.8±2.4, QU 17.3±3.7, p<0.05). WPCr and Wao accounted for 45.6%–50.2% and 32.2%–35.3% of total energy in four styles with no difference between styles (p>0.05). Aerobic provided 16.8–22.1% of total energy in all styles, with significant difference between SU and QU (20.6±4.8% vs 16.8±2.5%, p<0.05), TU (22.1±1.68%) and QU (p<0.05).

**Conclusion:** Four styles of 30s all-out rope skipping are all anaerobic-dominated with similar fractions, PCr and anaerobic lactate account for 45.6%–50.2% and 32.2%–35.3% of total energy.

**Keywords:** rope skipping, metabolism, energy resource

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Abstracts were prepared by the authors and printed as submitted.
and 1.95±0.66, DU: 276.6±36.1 and 9.3±3.2, 22, TU: 473.6±32.1 and 27.6±4.7, QU: 544.4±60.3 and 36.7±8.15, P<0.01). 30s skip repetitions in QU (46.0±19.34) was significantly lower than the other styles (SU 105.2±12.08, DU 128.2±15.12, TU 126.9±20.39, P<0.01). Standard Wmax (J/kg^1 jump^-1) was exponentially related to skipping difficulty from 1 skip jump to 4 skips jumps (R=0.89, p<0.001).

**Conclusion:** Skipping difficulty (skip per jump) is one of the main determinants of metabolic cost, whereas skip repetition does not significantly contribute to metabolic cost during 30 seconds all-out rope skipping.

Recent studies in elite runners suggest that cardiorespiratory synchronization, when step rate and heart rate naturally occur with a 1:1 ratio, can lead to hemodynamic advantages of counterpulsation when the foot strikes occur during the diastolic phase of the cardiac cycle. **PURPOSE:** Healthy non-elite runners were studied to investigate the hemodynamic and metabolic responses to prolonged counterpulsation by prompting individuals to step during the diastolic phase of their cardiac cycles during endurance running. We hypothesized that an auditory prompt that elicited counterpulsation would result in a lower heart rate, pulse pressure, respiratory exchange ratio (RER), ventilations and blood lactate, and higher oxygen consumption and blood glucose compared to an auditory prompt that did not elicit counterpulsation.

**METHODS:** Fifteen healthy subjects (8 male, 7 female) completed two single-blinded sessions of 20-minutes of continuous treadmill running at an intensity of 60-80% of VO2max in randomized order: 1) with an auditory prompt adaptive to the subject’s real-time heart rate and stepping phase to guide diastolic stepping, and 2) with a non-adaptive, constant frequency auditory prompt set at each subject’s natural step rate. Heart rate and indirect calorimetry were measured continuously throughout exercise followed by 10 minutes of sedentary recovery. Finger pricks for blood lactate and glucose were done every five minutes during exercise and every two minutes during recovery. Blood pressure was measured pre- and post-exercise and post-recovery.

**RESULTS:** The adaptive auditory prompt successfully guided runners to step in diastole >75% of the steps and resulted in a significantly lower pulse pressure following the post-exercise recovery compared to the non-adaptive prompt (31 ± 2 vs. 36 ± 3 mmHg, p<0.05). We also observed trends in lower heart rate (2-6 beats/min) and higher blood glucose (0.1-0.3 mM) during exercise guided by the adaptive auditory prompt compared to the non-adaptive prompt. No differences were observed in the other variables.

**CONCLUSION:** Counterpulsation, through prompted cardiorespiratory synchronization, may have hemodynamic advantages during and after endurance running in a healthy recreationally active population.

**Hydrostatic pressurization (H2P) training is an example of one of the “Proven Nonpharmacological Interventions for Prevention and Treatment of Hypertension” by the American Heart Association/American College of Cardiology in their current guidelines. Barriers to participation in H2P training are largely related to the equipment required to implement the protocol. Isometric handgrip (IHG) training is endorsed as one of the “Best Proven Nonpharmacological Interventions for Prevention and Treatment of Hypertension” by the American Heart Association/American College of Cardiology in their current guidelines. Barriers to participation in IHG training are largely related to the equipment required to implement the protocol.**
inverse relationship with age (R²=0.65-0.78, P<0.001) with the rate of decline of CS steepening after ~55 years. Age was weakly related to D' (R²=0.06, P=0.035-0.055), with an average of a 1.06±1.46 meter decline in D' per year.

CONCLUSIONS: Even in subjects representing some of the fittest individuals in the world for a given age, the speed-distance relationship and CS are impacted in a non-linear manner by age, with steeper declines in CS being observed after age ~55 years.

2595 Board #56 May 29 10:30 AM - 12:00 PM Hemodynamic Changes Between Post-exercise Hypotension Responders And Non-responders After Maximal Exercise
Yu-Ching Wang1, Lin-Sheng Lin1, Hao-Min Cheng2, Hsin-Fu Lin1. 1National Taiwan University, Taipei, Taiwan. 2Taipei Veterans General Hospital, Taipei, Taiwan.

Emerging evidence showed hemodynamic indices derived from arterial waveform predict cardiovascular events and target organ damage. Whether these biomechanical markers change correspondingly with post-exercise hypotension (PEH) remain unknown.

PURPOSE: To test the hypothesis that arterial hemodynamic indices following a maximal exercise test in PEH responders would differ from those in non-responders.

METHODS: A total of 71 recreational active young people (age=23.1±3.8yrs; BMI=23.1±3.1kg/m2) were recruited and underwent an acute bout of graded maximal anaerobic exercise test on cycle ergometer, and 5 (P5-1st), 15 (P15-1st), and 30 minutes (P30-1st) following a maximal anaerobic exercise test. Brachial systolic (SBP), diastolic (DBP) blood pressures, central aortic SBP, DBP and mean arterial blood pressure (aortic MAP) were measured. Carotid arterial stiffness (beta-stiffness index) were obtained using ultrasonography.

RESULTS: Data were presented in Table 1 as mean ± standard error. Resting DBP and aortic DBP were significantly different between AA and CA (§ p<0.05). There was a significant rate by time interaction for aortic MAP (+ p=0.05). And there was a trend towards significance in race by time interaction for beta stiffness index (p=0.06).

CONCLUSION: Acute bouts of anaerobic exercise increase aortic MAP in young AA but not in CA, and it may be related to increases in arterial stiffness in AA. The heightened BP and vascular responses to exercise stimulus may play a role in the pathogenesis of hypertension in AA.

Table 1. Hemodynamic responses to two acute bouts of maximal anaerobic exercise.

<table>
<thead>
<tr>
<th>Variables Race</th>
<th>Rest</th>
<th>P5-1st</th>
<th>P15-1st</th>
<th>P30-1st</th>
<th>P15-2nd</th>
<th>P30-2nd</th>
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<td>SBP (mmHg) AA</td>
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<td>131 ± 3</td>
<td>120 ± 3</td>
<td>116 ± 2</td>
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<td>CA</td>
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<td>129 ± 3</td>
<td>114 ± 2</td>
<td>114 ± 2</td>
<td>134 ± 3</td>
<td>118 ± 4</td>
</tr>
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<td>DBP (mmHg) § AA</td>
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<td>68 ± 2</td>
<td>68 ± 2</td>
<td>71 ± 2</td>
<td>68 ± 2</td>
<td>69 ± 2</td>
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<td>CA</td>
<td>68 ± 2</td>
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<td>aortic SBP (mmHg) AA</td>
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<td>110 ± 2</td>
<td>104 ± 2</td>
<td>102 ± 2</td>
<td>109 ± 3</td>
<td>100 ± 3</td>
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<tr>
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<td>97 ± 2</td>
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<tr>
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<td>70 ± 2</td>
<td>71 ± 2</td>
<td>73 ± 2</td>
<td>70 ± 2</td>
<td>72 ± 2</td>
</tr>
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<td>66 ± 2</td>
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<td>aortic MAP (mmHg) * AA</td>
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<td>87 ± 2</td>
<td>85 ± 2</td>
<td>85 ± 2</td>
<td>86 ± 2</td>
<td>82 ± 2</td>
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<td>81 ± 2</td>
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<td>80 ± 2</td>
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<tr>
<td>beta stiffness index AA</td>
<td>4.9 ± 0.5</td>
<td>6.3 ± 0.5</td>
<td>6.6 ± 0.5</td>
<td>5.8 ± 0.6</td>
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<tr>
<td>CA</td>
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<td>6.3 ± 0.5</td>
<td>5.8 ± 0.6</td>
</tr>
</tbody>
</table>

2597 Board #58 May 29 10:30 AM - 12:00 PM Muscle Damage And Acute Kidney Injury In Endurance Mountain Running
Daniel Rojas-Valverde1, Braulio Sanchez-Ureña1, Guillermo Olicina1, Jose Pino-Ortega1, Randall Gutierrez-Vargas1, Rafael Timón1, Jeffrey M. Mjaanes, FACSM. 1National University, Heredia, Costa Rica. 2University of Extremadura, Cáceres, Spain. 3University of Murcia, Murcia, Spain. 4University of Extremadura, Cáceres, Spain. Northwestern University, Evanston, IL. (Sponsor: Jeffrey M. Mjaanes, FACSM)

During mountain running events, athletes can experience muscular impairment as well as adverse health conditions of cardiovascular, immunological, renal and hepatic nature. Specifically, regarding the renal system, it has been shown that physical stress is a factor that contributes to the transitory decrease of renal function known as acute kidney injury (AKI) and muscle disintegration called exertional rhabdomyolysis (ER). The aim of this study was to assess hydration status, kidney function and muscle damage during an endurance mountain running (35.3km trail run, total positive ascend 1815m). A total of 26 experienced and trained mountain runners (age 39.5 ± 9.23 years, weight 71.26 ± 11.17 kg, height 171.65 ± 8.69 cm) took part of the study. Assessments included urine specific gravity (USG), body weight (BW), creatinine (Cr), blood ureic nitrogen (BUN), albumin (ALB), glomerular filtration rate (eGFR) and creatine kinase

(No relevant relationships reported)
Heavy rope battle exercise (HI-HRE) is used to increase power, muscle hypertrophy and maximal strength. The data regarding autonomic modulation in response to heavy battle rope exercise between the sexes are non-existent. PURPOSE: To assess sex differences in autonomic modulation in response to heavy battle rope exercise.

METHODS: Twenty-six girls (Mean±SD: Age, 22±2 yrs) and 14 women volunteered for the study. The heavy rope battle exercise involves massaging the right and then left leg, starting and ending seated, with 10 seconds of leg extension at every 15 seconds. The duration of the exercise was 10 minutes. The participants were divided into two groups: Rest (R) and passive recovery (PR). The HRV was measured using a respiratory belt (Polar, Finland) and a data logger (Polar, Finland) at Rest, 15 (R15), 30 (R30), 45 (R45), and 60 (R60) minutes after the exercise. The HRV was assessed using logarithmically (ln) transformed low frequency/high frequency ratio (lnLF/lnHF). Hemodynamics and pulse wave reflection (PWR) were assessed at Rest, and 10 (R10), 25 (R25), 40 (R40), and 60 (R60) minutes after the exercise. The hemodynamics and pulse wave reflection were assessed using a non-invasive arterial tonometry device (SphygmoCor, AtCor Medical, Australia). The PWR was assessed using logarithmically (ln) transformed high-frequency power (lnHF), and the ratio of left and right PWR (PWR-L/R).

RESULTS: There were no significant differences between the sexes for any variable. However, HR demonstrated a significant main effect of time (p≤0.001) in all groups. The HR was significantly higher in women than in men at all-time points. There were significant sex by time interactions for heart rate (HR), augmentation index (AIx), and AIx normalized to 75bpm (AIx@75) such that women had higher HR at Rest (Women: 76±5bpm, Men: 54±2bpm, p<0.001). AIx@75 was significantly higher in women (Women: 7.3±3.0%, Men: 0.2±1.2%, p<0.001) at Rest compared to men at R10. CONCLUSION: These data suggest that sex difference existed for HR and PWR at rest, and men had greater responses to URE with and without BFR compared to women. Although both sexes had attenuated recovery for PWR in response to URE without BFR, PWR returned to resting levels in both sexes 40 minutes after URE with or without BFR.

PULSE WAVE REFLECTION AFTER UPPER-BODY RESISTANCE EXERCISE WITH AND WITHOUT BLOOD FLOW RESTRICTION BETWEEN SEXES

Acute upper-body resistance exercise (URE) with blood flow restriction (BFR) on pulse wave reflection (PWR) between sexes is unclear. PURPOSE: To evaluate the effects of URE, with and without BFR, on PWR between sexes. METHODS: Nine women and 14 men volunteered for the study (Mean±SD: Age, 22±2 yrs). Hemodynamics and PWR were assessed at Rest (R), and at 10 (R10), 25 (R25), 40 (R40), and 55 (R55) minutes after each URE (lat pulldown and chest press) with or without BFR. The BFR condition consisted of 30, 15, 15 and 15 repetitions at 30% 1-repetition maximum (1RM), while the without BFR (high-load, HL) condition consisted of 4 sets of 8 repetitions at 70% 1RM. A 2x2x5 repeated measures ANOVA was used to evaluate the effect of sex across conditions and time. RESULTS: There were no significant main effects of sex or time for any variable. However, there were significant sex by time interactions for heart rate (HR), augmentation index (AIx), and AIx normalized to 75bpm (AIx@75) such that women had higher HR at Rest (Women: 65±3bpm, Men: 54±2bpm, p<0.001). AIx@75 was significantly higher in women (Women: 7.3±3.0%, Men: 0.2±1.2%, p<0.001) at Rest compared to men at R10. CONCLUSION: These data suggest that sex difference existed for HR and PWR at rest, and men had greater responses to URE with and without BFR compared to women. Although both sexes had attenuated recovery for PWR in response to URE without BFR, PWR returned to resting levels in both sexes 40 minutes after URE with or without BFR.

PULSE WAVE REFLECTION AFTER UPPER-BODY RESISTANCE EXERCISE WITH AND WITHOUT BLOOD FLOW RESTRICTION BETWEEN SEXES

Yu Lun Tai1, Erica M. Marshall2, Jason C. Parks2, J. Derek Kingsley, FACSM. Kent State University, Kent, OH. (No relevant relationships reported)

PULSE WAVE REFLECTION AFTER UPPER-BODY RESISTANCE EXERCISE WITH AND WITHOUT BLOOD FLOW RESTRICTION BETWEEN SEXES

Yu Lun Tai1, Erica M. Marshall2, Jason C. Parks2, J. Derek Kingsley, FACSM. Kent State University, Kent, OH. (No relevant relationships reported)
During resistance exercise there is an increase in blood pressure, with systolic pressure rising up to 400 mmHg. This transient elevation in pressure has been shown to result in acute stiffer vessels in young males, however, this has not been well studied in young females. It is possible that the sex hormones of young females may be protective against this pressure load, resulting in differential responses following resistance exercise. PURPOSE: The purpose of this study was to determine if there are sex differences in arterial stiffness following an acute resistance exercise bout in young, healthy males and females who are not currently resistance training.

METHODS: Carotid beta stiffness (β), arterial compliance (AC), and elastic modulus (Ep) measurements were taken in 23 young participants (10 males, 13 females, 26 ± 1 years) before, immediately after, and 30 minutes following full body resistance exercise. Exercise consisted of 2 sets of 10-12 repetitions performed on 8 resistance machines completed at 40% 1RM for the upper body and 60% 1RM for the lower body. Females were tested during the early follicular phase of their menstrual cycle to control for sex hormones. Exercise values (pre, post, postBL) were compared between males using a repeated measures ANOVA, with significance set at p < 0.05. When the interaction was significant, the responses were evaluated with paired samples t-tests within each sex and independent t-tests between sexes. RESULTS: There were no sex differences in stiffness values prior to exercise, but males displayed significantly higher β and Ep and lower AC post and postBL compared to females. Males demonstrated significantly increases in β (4.2 ± 0.4 to 6.6 ± 0.5 to 5.8 ± 0.5 AU) and Ep (48 ± 5 to 73 ± 6 to 65 ± 6 kPa) and decreases in AC (1.5 ± 0.2 to 0.9 ± 0.1 to 1.1 ± 0.1 mmH2O/mmHg) both immediately and 30 minutes post resistance exercise compared to baseline values, while females had no change in AC (1.4 ± 0.1 to 1.2 ± 0.1 to 1.5 ± 0.1 mmH2O/mmHg) or Ep (46 ± 4 to 52 ± 5 to 44 ± 5 kPa) with exercise and an immediate increase in β that returned to baseline at 30 min post (4.2 ± 0.3 to 5.1 ± 0.5 to 4.3 ± 0.4 AU). CONCLUSION: Acute resistance exercise in females does not result in the elevation of stiffness as seen in males. It appears females may be protected from this increased pressure load, which may be due to the vasodilatory effects of estrogen.

Acute exercise provides a stimulus for improving the function and health of the endothelium by initiating release of circulating angiogenic cells (CAs). However, this may also result in endothelial stress through the shedding of endothelial cells into circulation (CECs). The ratio of CACs/CECs may serve as a unique indicator of vascular health but sex differences in the ratio of CACs/CECs in response to acute exercise are unknown. PURPOSE: To determine if there are sex differences in the CAC and CEC response to a single bout of submaximal treadmill exercise. METHODS: Subjects were healthy physically active men (n=15) and women (n=10) between the ages of 18-29 years. Maximal oxygen consumption (VO2max) was measured and 48 hours later, participants performed 30 minutes of treadmill running at 70% VO2max. Fasted blood was obtained before and 30 minutes following full body resistance exercise. Peripheral blood mononuclear cells were isolated, FcR blocked and immunostained with antibodies specific to CD34-FITC, CD31-FITC, CD3-APC, CD146-PECy7 and CD45-PerCP, and fixed in paraformaldehyde. The forward-side scatter plot was used to identify the lymphocyte and monocyte gates from a total of 5,000 events/sample using a flow cytometer. CAs (CD34+/KDR+), CD3, CD13, and CD13/CD31+ and CECs (CD146+/CD4+) were quantified. RESULTS: There was no main effect for exercise or sex, or a sex*exercise interaction in the number of CD34+/KDR+ and CD31+cells (p>0.05 for both). There was no main effect of exercise in CD31+CD3+ cells but there was a significant main effect of sex (p=0.038) and a sex*exercise interaction (p=0.069) in men exhibiting 8% and 3% fewer CD13+CD3+ cells vs. women before and after exercise, respectively. Regardless of sex, CECs increased from 45.2 ± 9.7 events to 63.3 ± 13% (p<0.001) increased at 10 and 30 minutes compared to Rest following BL. Following UL, AIX was increased at 10 minutes compared to Rest and recovered by 10 minutes. AIX@75 also increased at 10 minutes but did not recover at 30 minutes for UL. For both conditions, SEVR decreased at 10 and 30 minutes compared to Rest. PWV increased at 10 minutes compared to Rest and returned to Rest by 30 minutes for both conditions. CONCLUSIONS: Our data suggest that unilateral RE may produce a quicker recovery in terms of central diastolic BP and AIX, thereby returning measures of pulse wave reflection to rest at a faster pace than bilateral RE.

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Short sleep (SS) disrupts the normal functioning of the autonomic nervous system (ANS). Heart rate variability (HRV) is a reproducible measure of ANS function. Reduction in HRV represents a disruption of the ANS. High-intensity interval exercise (HIIE) reduces HRV. The immediate HRV response and its short-term recovery after HIIE is unexplored. SS prior to HIIE may disrupt further the ANS and reduce HRV.

**PURPOSE:** To characterize the influence of SS on HRV after a single bout of HIIE in the hours post-exercise (PE).

**METHODS:** Fifteen physically active males (age 31.1±5.3 yr) with good sleep quality as determined by the Pittsburgh Sleep Quality Index (PSQI) participated in this study. Participants completed a non-exercise control trial after 9 to 9.5 hours of reference sleep (RS), a HIIE treadmill running (90% and 40% of VO2 reserve in 3:2 min ratio) to expand 500 kcal after reference sleep (RSX) and after 3 to 3.5 hrs of SS (SSX) in a randomized crossover design. After being in a supine position for 10 minutes in a quiet and temperature-controlled environment heart rate (HR) was recorded for 5 minutes the night before, the morning of the next day, 1-, 2-, 4- and 6-hours PE using an elastic electrode belt (Polar Wearlink®). Sleep was performed at their own residence. Supine resting HRV indices (frequency domain: LF/HF) were obtained from HR derived and measured by CardioMood®. Data were analyzed using a 3 (condition) by 6 (time) repeated measures ANOVA. Examined variables included normality and thus were transformed into natural logarithm (ln). Bonferroni was used for post hoc comparisons. Significance was set at p < 0.05. All analyses were performed using SPSS®.

**RESULTS:** For In LF there was a main effect for condition by time interaction (F(10,140)=3.06, p=0.007, ηp²=0.24). For In LF/HF by condition by time interaction (F(10,140)=1.84, p=0.060, ηp²=0.16). In LF was both decreased in RSX at 1hr PE (3.2±6, p=0.001) and 1hr PE (3.1±2.0, p=0.007) and in SSX 1hr PE (6.1±2.2, p=0.000) and 2hr PE (7.4±2.6, p=0.000) compared to RS. During post hoc analysis frequency domain ln LF/HF was increased in SSX at Day 2 baseline (29±17, p=0.040) and at 1hr PE (1.1±2.9, p=0.041). At 10,000=1.84, F(10,140)=3.60, p=0.007). FMD increased only in the SHAM trial (p=0.008). SDNN decreased from baseline more so in the SM trial (SM:51.5±24.5ms to 23.6±15.7ms to 36.3±18.9ms) compared to the SHAM trial (SHAM:56.8±28.1ms to 43.1±17.2ms to 50.8±22.8ms)(p=0.041 for interaction). CONCLUSION: Cigarette smoking immediately after exercise deteriorated autonomic and hemodynamic recovery in smokers, suggesting that smoking immediately after leisure-time physical activity or exercise should be avoided to reduce in the susceptibility of sudden cardiovascular events.

**CONCLUSIONS:** Our results suggest that SS prior to HIIE deteriorates autonomic function at the immediate (day 2 baseline) and short-term recovery after HIIE and that sleep restriction has an impact on autonomic function. This study is novel in that it investigated the immediate effect of sleep restriction on autonomic function and in that sleep restriction was investigated with HIIE.

**REFERENCES:**


HRV spectra were significantly increased compared to those at baseline, but these indices did not return to baseline level up to 96 h. Besides, there were no statistical differences between EC and control in LF/HF ratio respectively. CONCLUSIONS: From these results we suggested EC itself showed the sympathetic imbalance of HRV index in men. Moreover, unlike the changes in conventional markers of EIMD following EC, the cardiac autonomic regulation was not adapted to the second bouts of EC, suggesting unique pattern of cardiac autonomic regulation in following repeated EC. [Supported by the National Research Foundation of Korea Grant (NRF-2017R1C1B1001696)]

Cardiolocomotor synchronization, when step rate and heart rate naturally occur with a 1:1 ratio, has been well-described in studies of running and walking. A proposed explanation for this phenomenon is that the frequency match enables cardiac counterpulsation via diastolic stepping, a potentially adaptive physiological behavior that may improve hemodynamic efficiency during ambulation. PURPOSE: Highly trained runners were studied to assess the prevalence of cardiolocomotor synchronization and whether the step-to-heart phase timing preferentially occurred during diastole, facilitating natural counterpulsation. We hypothesized that unprompted heart rate and step rate entrainment would be present in our cohort of elite runners and the synchronization would occur during the diastolic phase of their cardiac cycles.

METHODS: Eleven elite male endurance athletes completed three stages of over-ground running separated by ample recovery. The stages consisted of 12 min at 17.06 km/h (5:40 min/mi), 11 min at 18.67 km/h (5:10 min/mi), and 5 min at 21.08 km/h (4.35 min/mi), for a total running time of 28 minutes. A chest strap-based sensor transmitted and recorded real-time ECG and three-axis accelerometer data. Proprietary software was then used to analyze data for timing comparison of step rate, heart rate and the step-to-heart cycle phase relationship. RESULTS: When the frequencies of step and heart rates were matched, six of the eleven athletes displayed episodes of prolonged (>30 sec) diastolic stepping during at least one of the three speeds. Three runners exhibited prolonged diastolic stepping for 18 ± 6% of the first stage. All six runners exhibited prolonged diastolic stepping for 26 ± 15% of the second stage. Three runners exhibited prolonged diastolic stepping for 28 ± 15% of the third stage. Five of the eleven athletes did not experience any episode of cardiolocomotor synchronization, due to heart rate being consistently lower than step rate. Only one episode of prololysisystolic stepping was observed. CONCLUSIONS: Unprompted cardiolocomotor synchronization occurs with highly trained runners and is associated with diastolic stepping and natural counterpulsation, suggesting that the entrainment for hemodynamic advantages may be a driving force behind the coupling of heart rate and step rate.

PURPOSE: To investigate the effects of caffeine ingestion in conjunction with acute resistance exercise in resistance-trained women on resistance exercise performance, cardiovascular hemodynamics, and pulse wave reflection measure in resistance-trained women.

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Resistance Exercise And Caffeine On Performance, Hemodynamics, And Pulse Wave Reflection Measure In Resistance-trained Women

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(NO relevant relationships reported)

Due to lower cardiovascular demand despite of high-force generation, eccentric contraction (EC) have recently been preferred in sports and clinical practice. However, EC is not well adapted to the cardiovascular response. The effects of repeated bouts of EC on cardiovascular autonomic regulation and adaptation along with exercise-induced muscle damage (EIMD) are unknown. PURPOSE: The present study was performed to examine changes in indices of heart rate variability (HRV) as well as the signs of EIMD after the maximal EC exercise and to determine whether the cardiac autonomic regulation would be adapted by the so-called “repeated bout effect”. METHODS: Repeated bouts of the 22-sec voluntary fast eccentric exercise on isokinetic dynamometer were performed in twelve young men. To evaluate signs of EIMD, muscle strength, range of motion (ROM), muscle pain and swelling, creatine kinase activity, and echo intensity of rectus femoris were measured. HRV from RR intervals was analyzed to identify cardiac autonomic balance during 5-min. All parameters were measured before and post-EC (24, 48, 72, and 96 h). The second bout of EC was measured 3-week later using the same leg. RESULTS: There were significant changes in ROM, muscle pain and swelling, and echo intensity as EIMD markers following ECC exercise, respectively. After EC exercise, resting normalized low frequency (LF nu) and low to high frequency ratio (LF/HF) ratio of
We observed between ABPACUTE and ABPCHRONIC under ambulatory conditions appear to be lower -5.9±5.7 mmHg /-2.9±4.1 mmHg than inactive adults with hypertension (136.3±10.7 / 85.2±8.9 mmHg). Following the responses to aerobic exercise training (ABPCHRONIC).

Aerobic exercise acutely reduces blood pressure (BP) 5-7 mmHg among adults with hypertension, termed PEH. PEH has been shown to be highly correlated to the BP response to exercise training in the laboratory. However, this relationship has yet to be explored under ambulatory conditions and compared to a control sham session (CONTROL) which is necessary to account for the circadian variation in ambulatory BP (ABP).

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Rec1: 28.9±19.8%, Rec2: 23.6±17%, Rest1: 32.3±10.8%, Rest2: 24.2±12%, Caffeine: Rest1: 1.2±11.5%, Rest2: -0.8±11.2%, Rec1: 28.9±19.8%, Rec2: 23.6±17%. CONCLUSIONS: These data suggest that the ingestion of 4mg/kg of caffeine provides no ergogenic effect in resistance-trained women. Additionally, caffeine consumption, in addition to performing resistance exercise, does not demonstrate alter hemodynamics or pulse wave reflection in resistance-trained women.

Purpose: To verify if athletes submitted to volume overload display differences in the cardiac autonomic function throughout the post-exercise recovery phase comparatively to athletes submitted to resistance overload.

METHODS: 30 men were divided into three equal groups (p=0.05): non-athlete group (n=10 30.6±5.0 year, BMI: 24.6±2.7 kg/m²), high-intensity functional training athletes (n=10, 31.4±2.9 year, BMI: 31.4±2.2 kg/m²), and triathlon athletes (n=10, 31.2±2.8 year, BMI: 23.1±1.8 kg/m²). Participants underwent a maximal graded treadmill exercise test followed by a five-minute of active recovery protocol (2,4km-h 2,5%). During the post-exercise recovery phase, a valid R-R intervals series were recorded (5min) using a valid and reliable heart rate meter. The data were processed off-line using the Kubios HRV - Heart Rate Variability Software. A Kruskal-Wallis test was used to determine differences in SD1 and SD2 indices between all groups. The SD1 and SD2 indices were used to assess the degree of parasympathetic reactivation and global cardiac modulation, respectively over the recovery phase. Heart rate variability was measured by means, SD1 and SD2 indexes of Poincaré Plot were recorded during the 30s: 1st min; 3rd min and 5th min of recovery to evaluate the cardiac autonomic function (CAF).

RESULTS: No significant differences were found in parasympathetic and global cardiac modulation between groups, There were no difference between 3 groups in SD1-30s (2.66-3.15; p = 0.29), SD1-1st min (2.52-4.14; p = 0.21), SD1-2nd min (2.57-2.92; p = 0.39), SD2-3rd min (4.36-5.78; p = 0.58), SD2-4th min (5.34-6.79; p = 0.53). Possibly, the magnitude of differences is small, which warrants a larger sample size than used in our study to detect statistical differences.

CONCLUSIONS: In our study, no significant differences in parasympathetic and global cardiac modulation were found between groups. These initials results show that individuals submitted to resistance and volume overload training have similar abilities of the autonomic branches (sympathetic and parasympathetic) on the modulation of the heart throughout the post-exercise recovery.

Purpose: Ultra-endurance running, classified as any distance greater than a marathon (42.2km), is strenuous on the body. These extreme distances may include difficult weather conditions or terrain (e.g., heat, cold, altitude, trails, etc.) and could lead to changes in urine biomarkers resulting from damage to essential organs (e.g., kidney, liver, and heart). The purpose of this study was to determine the effects of running a grueling 161.3km trail race on general characteristics, presence of blood, and other molecules in the urine of an elite ultra-endurance runner (EUR).

METHODS: Urine specimens were collected from a 32y male EUR (170cm, 64.5kg, age-ranked 98.7%[ultrasignup.com]), before and after completing the Western States Endurance Run (WSER). Samples were analyzed using 11-parameter urinalysis strips (Med Lab Diagnostics, Laguna Beach, CA) one day pre-race and –2h post-race. RESULTS: EUR finished the WSER in less than 16 hours. Main findings showed red blood cell (RBC) count increased from 0 to ≥200 cells/µL (indicated hemolysis), bilirubin increased from 0 to 17 mmol/L (biproduct of hemoglobin), and urobilinogen increased from 0 to 3.2 mmol/L (indicated RBC destruction) post-race. Urine proteins and ketone abundance increased while ascorbate decreased post-race. CONCLUSIONS: Elevated urinary levels of red blood cell derivatives post-WSER highlight the formidable hematologic implications of ultramarathon running. Modalities to mitigate this phenomenon as well as an improved understanding of the systemic consequences of and time to recover from this exercise-induced hemolysis are of interest.
Exercise training has been demonstrated to cause beneficial cardiac adaptations in different patient groups. However, comparative studies on different exercise training modes are needed in sedentary women with arterial hypertension.

**PURPOSE:** To examine effects of 15 weeks of soccer training versus low volume high intensity interval training on cardiac structure and function in middle-aged, sedentary, hypertensive women.

**METHODS:** Seducentary, premenopausal women with mild-moderate arterial hypertension (n = 73) with average (± SD) age, height, weight and body fat of 45.6 ±16.8, 165.6 ± cm, 80.0 ±14.1 kg and 42.6 ±5.7% were randomized into a soccer training group (SOC; n=19), moderate intensity interval training (MOS; n=18), high intensity interval training group, (HIS; n=19) and control group (CON; n=19). SOC completed a total of 45 ±3 training sessions over the 15-week intervention period. MOS completed 3 ±1 sessions consisting of small-sided soccer games (4v4 to 6v6). HIS completed 1 ±1 sessions of continuous front-crawl swimming, with the participants encouraged to swim as far as possible during each session, while HIS performed 6-10×30-s all-out front-crawl swimming intervals interspersed with 2 min of passive recovery; thus, 3-5 min of effective swimming time. Cardiac measures were evaluated by echocardiography. RESULTS: Left ventricular mass increased (p=0.05) by 11 ±14.1 and 8.7 ±16.5 g in SOC and HIS with no change in MOS and CON. Right ventricular diastolic properties (as the ratio of early to late mitral inflow velocities, E/A ratio) improved (p=0.05) by 38.5 ±46.9, 24.6 ±25.4 and 26.6 ±48.2% in SOC, MOS and HIS, respectively, with no change in CON. Right ventricular function determined by tricuspid annular plane systolic excursion was improved by 8.9 ±13.7% in SOC only. When data from the three training groups were pooled together left ventricular mass rose by 8.0 ±11.3%, with greater change-scores compared to CON (2.2 ±11.0%). CONCLUSION: Exercise training improves cardiac structure and diastolic function in hypertensive women with superior effects of a hybrid training mode like soccer compared both to endurance training and high intensity interval training alone.

### RESULTS

- **Out of 161 participants, 144 (89%) completed the 2 year follow-up. VO2peak (ml/kg/min) was not significantly different between groups (p=0.777) at T1 (33.1 ±7.7, 33.6 ±8.5, 34.0 ±7.2), T2 (33.1 ±7.9, 33.1 ±8.4, 33.9 ±7.4) or T3 (30.9 ±7.5, 32.2 ±8.6 and 32.0 ±7.3) for ExCR, HCR and CG, respectively. The decrease in VO2peak over time was significant from T2 to T3 (p=0.024). Daily average of minutes in MPA and VPA were not significantly different between groups (p=0.441 and p=0.557 respectively) at any time. There was a significant reduction from T1 to T2 in both MPA (107 ±61 min to 100 ±59 min, p=0.043) and VPA (14 ±19 min to 11 ± (18 min, p=0.007).**

**CONCLUSIONS:** Exercised cardiac rehabilitation did not enhance exercise adherence compared to usual care after a HIT-based CR program. Despite a decrease in VO2peak over two years, the amount of physical activity met the current guidelines.

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**Exercise adherence is in general poor after cardiac rehabilitation (CR). In Norway, standard exercise-based CR typically offers 12 weeks of hospital-based supervised exercise at moderate or high intensity. The use of high-intensity interval training (HIT) in CR expands; however, it is still unclear how HIT affects exercise adherence. The purpose of this study was to assess the effect of an extended community-based or home-based CR program on long-term exercise adherence.**

**METHODS:** Between August 2014 and June 2017, 161 persons (27 women, age 62.3 ±73) with average (± SD) age, height, weight and body fat of 45.6 ±16.8, 165.6 ± cm, 80.0 ±14.1 kg and 42.6 ±5.7% were recruited. All had completed an HIT-Based CR at St. Olav’s Hospital in Trondheim, Norway. They were randomized in a 1:1:1 ratio to an extended supervised community-based CR (ExCR), a home-based CR (HCR) or a control group (CG). The extended CRs (ExCR and HCR) consisted of one HIT session and two additional sessions a week for eight weeks. The ExCR got a follow-up session every third month until one year after inclusion. The CG received usual care (standard advice for exercise and life style). Measurements were performed at baseline (T1), at 1 year (T2) and 2 years (T3) after inclusion. Primary outcome was peak oxygen uptake (VO2peak) at 2 years. Secondary outcome was achievement of new guidelines in regard of physical activity (PA) at moderate (MPA) and vigorous (VPA) intensity, measured with accelerometer. Data are analyzed with mixed linear model.

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**CONCLUSIONS:** Extended cardiac rehabilitation did not enhance exercise adherence compared to usual care after a HIT-based CR program. Despite a decrease in VO2peak over two years, the amount of physical activity met the current guidelines.
Between 2016-2019, 42 women aged 18-62 years (mean=35 ± 13.02) were referred to CR with 68% exhibiting below average age-predicted fitness in Metabolic Equivalents (METS) ml/min/kg. (9.7 ± 10.42). 62% of participants attended onsite CR while 33% of patients opted for a home program. A multidisciplinary team developed content and selected outcome measures better suited to evaluate this population. Based on the literature, recumbent aerobic exercise, resistance training and counter pressure maneuvers are important components to physical activity participation. Strategies to manage postural intolerance such as pacing, hydration, salt intake and compression garments are included to promote first line non-pharmacological approaches to POTS management. Based on feedback from past participants in the traditional CR model, peer-support and stress/anxiety management are highly valued and therapeutic.

CONCLUSIONS: The self-management and peer support model for POTS was developed with up-to-date recommendations and non-pharmacologic interventions. Effectiveness and feasibility of this new model of care will be evaluated. Future developments in virtual care will be explored to enhance access to the program.

Studies conducted both in Norway and Europe have found low achievement of current guidelines regarding cardiovascular risk factors. Physical activity (PA) positively affects several risk factors of coronary heart disease (CHD). Extended cardiac rehabilitation (CR) increases maintenance of PA-level. PURPOSE: To explore whether extended CR had an additional effect on the lipid profile in patients with CHD, and further to investigate the achievement of current guidelines in regards of PA. METHODS: A randomised controlled study. Participants (112 men/22 women) who had completed standard CR were randomly assigned to either extended CR run by municipality (MBG), home-based extended CR (HBG) or a control group (CG). The extended CR groups (MBG and HBG) completed 1 session of interval training (4 times 4 minutes) for 8 weeks and were encouraged to two optional additional exercises per week. After 8 weeks the MBG got a follow-up session every third month until 1 year after inclusion. The CG received standard lifestyle advice at baseline and had no follow-up throughout the year. RESULTS: Results are presented in Table I. At 1-year follow up 50% of all participants and 56% of participants on high-intensive PA.

CONCLUSIONS: The self-management and peer support model for POTS was developed with up-to-date recommendations and non-pharmacological interventions. Effectiveness and feasibility of this new model of care will be evaluated. Future developments in virtual care will be explored to enhance access to the program.

Exercise-based cardiac rehabilitation is associated with reduced secondary events in coronary artery disease (CAD) patients. Despite this evidence, the rate of participation in cardiac rehabilitation exercise is low. There is a lack of information evaluating how both traditional and time-reduced higher intensity protocols affect muscle metabolism in this population, even though CAD exacerbates skeletal muscle defects that contribute to the poor metabolic phenotype.

PURPOSE: To determine the effect of a traditional cardiac rehabilitation exercise program and an alternative stair climbing-based high-intensity interval training program on the skeletal muscle phenotype in CAD patients. METHODS: 16 participants (15M, 1F) were randomly assigned to either a standard low-intensity exercise (7M, TRAD) or brief but higher-intensity interval stair climbing exercise (8M, 1F, STAIR). Both programs were 12 weeks (3d/w) in duration, each TRAD exercise session consisted of 45 minutes of moderate-intensity aerobic exercise, and each STAIR session consisted of 3 bouts x 6 flights of high-intensity stair climbing. Muscle biopsies were collected from the vastus lateralis at baseline and after 12 weeks of training. Immunofluorescent staining of muscle cross sections was completed to determine fiber size, capillarization, satellite cell (SC) and myonuclear content.

RESULTS: There were no differences in the cross-sectional area and myonuclear domain of type I or II fibers following 12 weeks of either TRAD or STAIR training (p>0.05). Following 12 weeks, both exercise programs resulted in increases in muscle biopsies were collected from the vastus lateralis at baseline and after 12 weeks of training. Immunofluorescent staining of muscle cross sections was completed to determine fiber size, capillarization, satellite cell (SC) and myonuclear content.

CONCLUSIONS: The self-management and peer support model for POTS was developed with up-to-date recommendations and non-pharmacological interventions. Effectiveness and feasibility of this new model of care will be evaluated. Future developments in virtual care will be explored to enhance access to the program.

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RESULTS: There were no differences in the cross-sectional area and myonuclear domain of type I or II fibers following 12 weeks of either TRAD or STAIR training (p>0.05). Following 12 weeks, both exercise programs resulted in increases in muscle biopsies were collected from the vastus lateralis at baseline and after 12 weeks of training. Immunofluorescent staining of muscle cross sections was completed to determine fiber size, capillarization, satellite cell (SC) and myonuclear content.

CONCLUSIONS: The self-management and peer support model for POTS was developed with up-to-date recommendations and non-pharmacological interventions. Effectiveness and feasibility of this new model of care will be evaluated. Future developments in virtual care will be explored to enhance access to the program.

Studies conducted both in Norway and Europe have found low achievement of current guidelines regarding cardiovascular risk factors. Physical activity (PA) positively affects several risk factors of coronary heart disease (CHD). Extended cardiac rehabilitation (CR) increases maintenance of PA-level. PURPOSE: To explore whether extended CR had an additional effect on the lipid profile in patients with CHD, and further to investigate the achievement of current guidelines in regards of PA. METHODS: A randomised controlled study. Participants (112 men/22 women) who had completed standard CR were randomly assigned to either extended CR run by municipality (MBG), home-based extended CR (HBG) or a control group (CG). The extended CR groups (MBG and HBG) completed 1 session of interval training (4 times 4 minutes) for 8 weeks and were encouraged to two optional additional exercises per week. After 8 weeks the MBG got a follow-up session every third month until 1 year after inclusion. The CG received standard lifestyle advice at baseline and had no follow-up throughout the year. RESULTS: Results are presented in Table I. At 1-year follow up 50% of all participants and 56% of participants on high-intensive PA.

CONCLUSIONS: The self-management and peer support model for POTS was developed with up-to-date recommendations and non-pharmacological interventions. Effectiveness and feasibility of this new model of care will be evaluated. Future developments in virtual care will be explored to enhance access to the program.

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PURPOSE: To determine the effect of a traditional cardiac rehabilitation exercise program and an alternative stair climbing-based high-intensity interval training program on the skeletal muscle phenotype in CAD patients. METHODS: 16 participants (15M, 1F) were randomly assigned to either a standard low-intensity exercise (7M, TRAD) or brief but higher-intensity interval stair climbing exercise (8M, 1F, STAIR). Both programs were 12 weeks (3d/w) in duration, each TRAD exercise session consisted of 45 minutes of moderate-intensity aerobic exercise, and each STAIR session consisted of 3 bouts x 6 flights of high-intensity stair climbing. Muscle biopsies were collected from the vastus lateralis at baseline and after 12 weeks of training. Immunofluorescent staining of muscle cross sections was completed to determine fiber size, capillarization, satellite cell (SC) and myonuclear content.

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CONCLUSIONS: The self-management and peer support model for POTS was developed with up-to-date recommendations and non-pharmacological interventions. Effectiveness and feasibility of this new model of care will be evaluated. Future developments in virtual care will be explored to enhance access to the program.
Increased quadriceps muscle strength has shown to decrease the risk of cardiovascular mortality by 34% in patients with coronary heart disease. Muscle mass and strength declines progressively in the elderly and training effects have been generally reported after 12 weeks. Adherence to cardiac rehabilitation programs is usually low, with less than 50% of patients completing 36 sessions in 12 weeks. There is still no consistent evidence that muscle strength in elderly patients can be improved after just 12 sessions of cardiac rehabilitation.

**PURPOSE:** To evaluate the effect of 12 sessions of combined training on lower limb strength, in elderly patients attending a cardiac rehabilitation program 2-3 times per week. **METHODS:** Participants included eighty-four elderly (60-80 yrs) (21 women, age 67 ± 6 yrs; 63 male, age 70 ± 7 yrs) attending a cardiac rehabilitation program in a university hospital in Bogotá city, Colombia. They were evaluated from January to September 2019 before and after 12 training sessions 2-3 times per week, which included 30 minutes of cardiovascular aerobic and 15 minutes of multistep strength training. Aerobic training was performed at 60 - 85% of the estimated maximal heart rate. Progressive resistance strength training included 3 sets of 10-15 repetitions of major muscle groups with 50 - 70% estimated 1-repetition maximum (1-RM) including elastic bands, cuff weights, free weights and gym machines. Baseline and follow up evaluation at the 12th session were performed by a horizontal leg press machine with 1-RM estimation according to Bryczk formula: (1-RM: 100* load repetition / [102.78 - 2.78* %]). Pre/post training changes were assessed by paired t tests.

**RESULTS:** After 12 training sessions a significant maximum strength increase was found, both for men (189.6 ± 42.6 vs 203.0 ± 47.4; p = 0.000), and women (116.1 ± 50.2 vs 123.8 ± 51.9; p = 0.000). CONCLUSIONS: This study showed that twelve sessions of combined training in elderly patients attending a cardiac rehabilitation program, improved lower limb strength in less time than usually reported. This finding supports the importance and feasibility of including strength in addition to aerobic training to reduce cardiovascular risk in this growing population.
Inconsistent associations have been reported for ground reaction force (GRF) variables and running injuries when grouping all injuries together. However, previous work has shown more consistent associations when focusing on specific injuries. PURPOSE: To establish general and injury-specific associations between GRFs and five common running injuries when grouping all injuries together. However, previous work has shown more consistent associations when focusing on specific injuries. METHODS: 126 runners presenting with patellofemoral pain (PFP), tibial bone stress injury (TBSI), plantar fasciitis (PF), Achilles tendinitis, or iliotibial band syndrome and 70 healthy controls (CON) completed an instrumented treadmill assessment at a self-selected speed. All were rearfoot strikers. Injured/control groups were matched for gender and running speed. Vertical average and instantaneous load rates (VALR, VILR) and specific injuries and CON. Further, optimal cutoff values were established for V ALR, VILR and mGRF variables using ROC curves. Area under the curve (AUC) and odds ratios (ORs) were shown more consistent associations when focusing on specific injuries. Diagnostic value of variables was driven by PFP, PF and TBSI. Diagnostic value of variables was shown more consistent associations when focusing on specific injuries. CONCLUSIONS: VALR, VILR and mGRF variables showed significant differences between groups (p<0.05). Cutoffs for V ALR had shown superior diagnostic value for PFP and PF (OR=5.8-10.6, AUC=0.70-0.73) compared to INJ (OR=3.8, AUC=0.65). This trend held for VILR (PPF: OR=5.1, AUC=0.72; INJ: OR=3.5, AUC=0.64) and mGRF (TBSI: OR=8.8, AUC=0.74; INJ: OR=3.0, AUC=0.60). CONCLUSION: VALR, VILR and mGRF variables showed significant associations with running injury, even when grouped across injuries. However, associations were driven by PFP, PF and TBSI. Diagnostic value of variables was greatly improved when separating specific from general injuries.

<table>
<thead>
<tr>
<th>HR (bpm)</th>
<th>Control (n=17)</th>
<th>Injured (n=21)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>157 ± 23</td>
<td>188 ± 15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Absolute VO_2 (L/min) Peak</th>
<th>Control (n=17)</th>
<th>Injured (n=21)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.68 ± 0.5</td>
<td>2.71 ± 0.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relative VO_2 (mL/kg/min) Peak*</th>
<th>Control (n=17)</th>
<th>Injured (n=21)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.3 ± 9.0</td>
<td>38.6 ± 7.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>O_2 Pulse (mL/kg/bpm) *</th>
<th>Control (n=17)</th>
<th>Injured (n=21)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.0 ± 0.5</td>
<td>21.0 ± 0.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data presented as mean ± standard deviation. BMI: Body Mass Index, RER: Respiratory Exchange Ratio, HR: Heart Rate, VO_2: Oxygen Uptake

* p < 0.05

Medicine & Science in Sports & Exercise®

E-29 Free Communication/Poster - Running

Friday, May 29, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

2629 Board #90 May 29 9:30 AM - 11:00 AM
Abstract Withdrawn

2630 Board #91 May 29 9:30 AM - 11:00 AM
The Association Of Ground Reaction Forces With The Five Most Common Running Injuries
Caleb D. Johnson, Adam S. Tenforde, Jereme Outerleys, Irene S. Davis, FACSM. Harvard Medical School, Cambridge, MA. (Sponsor: Irene Davis, FACSM)

No relevant relationships reported

Patellofemoral Pain (PFP) is a common injury among amateur runners. The mechanisms of sex differences associated with lower extremity biomechanics in PFP are still unclear. PURPOSE: To determine the differences in knee biomechanics between male and female amateur runners with PFP and without PFP in running task. Further, to determine the sex-specific biomechanical factors associated with the development of PFP.

METHODS: 15 male and 10 female amateur runners aged 18 to 40 years with PFP were screened and enrolled in PFP group, 25 healthy amateur runners matched with the PFP group in sex, age, and running experience were recruited as control group. PFP group was tested running with and without knee pain (PFP with pain and PFP without pain groups), while control group performed one running test (running speed = 4.0 ± 0.3 m/s). Knee pain in PFP group was eliminated by decreasing the volume of running. Knee kinematics and kinetics during landing phase of running were reduced from reflective marker coordinates and ground reaction force data, as well as compared among groups and between sexes.

RESULTS: Peak knee valgus angle of running in PFP group with pain (male: 3.2 ± 4.2º, female: 4.8 ± 4.9º, P = 0.001) and control group (male: 1.9 ± 2.7º, female: 3.8 ± 3.0º, P = 0.001) were significantly lower compared to PFP group without pain (male: 5.0 ± 4.8º, female: 5.6 ± 4.2º, P = 0.019) and control group (male: 0.020 ± 0.006 BW × BH, female: 0.017 ± 0.006 BW × BH, P = 0.001) were significantly lower compared to control group (male: 0.024 ± 0.009 BW × BH, female: 0.022 ± 0.008 BW × BH). Peak knee flexion angle of running in PFP group without pain (48.8 ± 5.6º) was significantly greater compared to control group for male participants (46.3 ± 3.6º, P = 0.008).

CONCLUSIONS: Decreased knee valgus angle and external rotation moment in running appeared to be compensations to avoid pain when amateur runners with PFP were running with pain, and increased knee valgus angle and external rotation moment might be biomechanical factors associated with the development of PFP. Increased knee flexion angle in running may be another critical biomechanical factor associated with the development of PFP for male amateur runners.

2631 Board #92 May 29 9:30 AM - 11:00 AM
Sex-specific Knee Biomechanics Associated With Patellofemoral Pain In Amateur Runners During Running
Chen Yang¹, Bing Yu², Hui Liu³, Feng Qu¹. ¹Nanjing Sport Institute, Nanjing, China. ²The University of North Carolina at Chapel Hill, Chapel Hill, NC. ³Beijing Sport University, Beijing, China.

Email: obayoung@foxmail.com

(No relevant relationships reported)
Table 1. Results for demographics and time to contact (TtC) for runners with and without increased potential for loss of balance.

<table>
<thead>
<tr>
<th>Group</th>
<th>Age (years)</th>
<th>Height (m)</th>
<th>Mass (kg)</th>
<th>TtC Medial Early Stance (s)</th>
<th>TtC Medial Mid-Stance (s)</th>
<th>TtC Medial Late Stance (s)</th>
<th>TtC Anterior Early Stance (s)</th>
<th>TtC Anterior Mid-Stance (s)</th>
<th>TtC Anterior Late Stance (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy</td>
<td>42.90 (10.76)</td>
<td>1.660 (0.090)</td>
<td>67.73 (12.89)</td>
<td>0.021 (0.018)</td>
<td>0.099 (0.076)</td>
<td>0.041 (0.034)</td>
<td>0.074 (0.034)</td>
<td>0.172 (0.157)</td>
<td>0.086 (0.091)</td>
</tr>
<tr>
<td>PF</td>
<td>38.20 (10.94)</td>
<td>1.660 (0.080)</td>
<td>64.99 (10.52)</td>
<td>0.026 (0.024)</td>
<td>0.183 (0.098)</td>
<td>0.064 (0.037)</td>
<td>0.104 (0.032)</td>
<td>0.392 (0.228)</td>
<td>0.141 (0.097)</td>
</tr>
</tbody>
</table>

p<0.05 indicates significant differences in TtC between legs.

### Dynamic Stabilization In Runners With Plantar Fasciitis

#### Purpose
To determine differences in dynamic stability during the stance phase of running in individuals with PF.

#### Methods
Twenty runners were separated into two groups based on injury status: PF (n=16) and healthy (n=16). Kinematic and kinetic data were collected at 200 and 1000 Hz, respectively, as participants ran at 3.5 m/s ±5%. TtC of each group were determined using one-way ANOVA with alpha level set at 0.05.

#### Results

<table>
<thead>
<tr>
<th>Group</th>
<th>Knee-Shank</th>
<th>Shank-Ante</th>
<th>30% Stance</th>
<th>50% Stance</th>
<th>80% Stance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy</td>
<td>45.0°</td>
<td>55.0°</td>
<td>55.0°</td>
<td>55.0°</td>
<td>55.0°</td>
</tr>
<tr>
<td>PF</td>
<td>50.0°</td>
<td>60.0°</td>
<td>60.0°</td>
<td>60.0°</td>
<td>60.0°</td>
</tr>
</tbody>
</table>

p<0.05 indicates significant differences in CA V between legs.

### Whipping Or Tearing? Mechanisms For The Development Of Achilles Tendinopathy In Runners

#### Purpose
To determine if peak rearfoot eversion, duration of rearfoot eversion, peak sagittal plane ankle power absorption, and peak dorsiflexion moment are different between runners with and without a history of Achilles tendinopathy.

#### Methods
10 male, rearfoot strike runners (34±10 years; 1.79 ± 0.07 m; 81.3 ± 12.6 kg) participated. Participants had no history of Achilles tendinopathy and had no markers placed on the trunk, pelvis, legs, and feet. Motion capture system recorded five good trials for each participant running at 3.7 m/s. Variables of interest and effect sizes (r) were calculated to compare groups.

#### Results
There was a small effect for peak rearfoot eversion, with previously injured runners exhibiting higher peak rearfoot eversion angles.
There was also a small effect for the duration of rearfoot eversion, with injured runners remaining in an everted position for longer than the control group. There were no differences between groups in peak power absorption or peak dorsiflexion moment.

**CONCLUSION:** In this preliminary study runners with and without Achilles tendinopathy exhibited gait characteristics that provide partial support for the whipping mechanism of injury proposed for Achilles tendinopathy in runners. However, these findings were not consistent with the proposed tearing mechanism of injury.

**Table 1.** Ankle biomechanics in men with and without previous Achilles tendinopathy during running.

<table>
<thead>
<tr>
<th></th>
<th>Controls Median (IQR)</th>
<th>Previous Injury Median (IQR)</th>
<th>Effect Size (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Eversion (°)</td>
<td>8.6 (13)</td>
<td>11.4 (11)</td>
<td>0.30</td>
</tr>
<tr>
<td>Duration of eversion (% stance)</td>
<td>71 (45)</td>
<td>87 (61)</td>
<td>0.26</td>
</tr>
<tr>
<td>Peak dorsiflexion moment (Nm/kg)</td>
<td>2.2 (0.5)</td>
<td>1.9 (0.8)</td>
<td>0.03</td>
</tr>
<tr>
<td>Peak power absorption (watts/kg)</td>
<td>3.8 (1.7)</td>
<td>4.0 (1.0)</td>
<td>0.12</td>
</tr>
</tbody>
</table>

**CONCLUSIONS:** This preliminary study

Stabilization of the head in space is important during running, but less is known about how individuals accomplish the head-in-space equilibrium through segmental and joint coordinative adaptations. **PURPOSE:** To identify changes in segment/joint coordination and its variability in running with increasing head stability requirements. **METHODS:** Fifteen strides from twelve recreational runners (29.67 ± 4.4 years; 1.73 ± 8.5 miles) ran a 10-mile hilly run which matched the elevation profile of a popular local trail run. 3D kinematics and ground reaction forces were collected during five-minute level ground running sections prior to and following the run. Changes in spatial temporal parameters, ground reaction forces, and leg stiffness variables from pre to post run were computed for each participant’s left leg using Visual3D. Pre-run 24-hour dietary recalls were analyzed for total caloric intake (Tkcal) and percent calories from carbohydrate (%CHO), protein (%PRO), and fat (%FAT). Pearson’s correlations were used to assess associations between each nutritional variable and changes in biomechanical variables. **RESULTS:** There were significant associations between %PRO and changes in peak ground reaction force and changes in contact time such that runners with higher %PRO displayed smaller changes in biomechanics (Figure 1). Similar associations were observed between Tkcal and %FAT and changes in vertical center of mass displacement. **CONCLUSIONS:** This preliminary study suggests nutritional status prior to a long run may affect the changes in biomechanics a runner experiences during the run. These biomechanical effects have implications for both performance and injury, and highlight the importance of protein for long distance runners. Additional research is required to evaluate whether manipulating nutrition can be used to manage biomechanical changes associated with long duration running.
Running participation has increased since the 1970’s, concomitant with the rise in popularity has been the rise in running related injuries. Epidemiological studies have reported 2.5 to 3.30 injuries for every 1000 hours of running, with most common injuries being overuse injuries. There is a common consensus that altered hip and knee kinematics are risk factors for developing overuse injuries. Previously we demonstrated altered gait kinematics as result of fatigue following a high intensity interval training run (HIIT). These fatigue induced alterations in kinematics could place runners at greater risk of developing an overuse injury. To date, the time course of kinematic changes immediately after and 24hr post HIIT.

RESULTS: Hip frontal angles were significantly increased with time for both maximum angles (P < 0.001) and RoM (P = 0.001). Post hoc analysis revealed a significant increase in maximum hip adduction angle immediately post (P < 0.001, d = 0.91) and at 24hr post (P < 0.001, d = 0.86) compared to pre. Hip frontal RoM was also increased significantly at post (P < 0.001, d = 0.85) and at 24hr (P < 0.001, d = 0.74). Knee kinematics were affected with time for maximum angle of knee frontal plane (P = 0.046) and sagittal plane knee RoM (P = 0.015). However, there was no presence of altered knee kinematics at 24hr.

CONCLUSIONS: The HIIT session induced kinematic alterations to the hip frontal angles. In some runners these alterations were still present 24 hours after HIIT. For these runners, this could increase the risk of developing overuse injuries.

CONCLUSION: The HIIT session induced kinematic alterations to the hip frontal angles were 1.0 ± 2.4 and 1.0 ± 2.3 degrees, respectively. The regression model did not suggest this simplistic model may be insufficient to describe muscular and skeletal loading. These findings proportional to muscular contributions to load attenuation. JRFs had weak associations between kSkel and ankle (p = 0.25; r = -0.10), knee (p = 0.17; r = 0.14) and hip joint variables of muscular (kMusc) and skeletal (kSkel) components of leg stiffness have been previously related to injury patterns in runners [1]. Though these components mirror proposed injury mechanisms in runners, their relationship to underlying biomechanical variables remains unclear. PURPOSE: to evaluate the association between components of leg stiffness (kMusc & kSkel) with common biomechanical variables of muscular (joint work) and skeletal loading (joint reaction forces) during a running task. METHODS: Thirteen recreational runners (8 male, 5 female) performed ten over ground running trials at 3.35 m/s (±5%) in each of four conditions with varying shoe and strike patterns. Kinematics and ground reaction forces (GRFs) were recorded using an 8-camera motion capture system (240 Hz, Qualisys) and force platform (1200 Hz, OR-7, AMTI). Visual3D (C-Motion) was used to calculate joint powers and compressive joint reaction forces (JRFs). MATLAB was used to calculate negative joint work values and stiffness variables. kMusc and kSkel were calculated as previously reported [1]. Prism 8.0 (GraphPad) was used to perform correlation analyses between muscular and skeletal contributions to load attenuation. RESULTS: kMusc had moderate and weak relationships with lower extremity work (p < 0.01; r = 0.55) and knee joint work (p < 0.01; r = 0.32). Weak correlations existed between kSkel and ankle (p = 0.17; r = 0.14) and hip joint reaction forces (p = 0.46; r = 0.01). CONCLUSIONS: These data revealed moderate associations between kMusc and negative work values suggesting that kMusc is proportional to muscular contributions to load attenuation. JRFs had weak associations with kSkel, suggesting kSkel may not represent skeletal loading. These findings suggest this simplistic model be insufficient to describe muscular and skeletal contributions to load attenuation.

Exercise modality and age-related declines observed during running. Brianne Borgia and Julia Freedman Silvernail. University of Nevada, Las Vegas, Las Vegas, NV. (Sponsor: Janet Dufek, FACSM)
Email: borgia@unlv.nevada.edu
(No relevant relationships reported)

Exercise modality and age-related declines observed during running, while participants in the resistance training and cycling/swimming group ran at least 3 miles/week. Running kinematics were captured using a 10-camera motion capture system while participants ran at a controlled pace of 3.5 m/s (± 5%) over a 10-m runway with force platforms collecting kinetic data. Five successful trials were chosen for analysis. A one-way ANOVA assessed differences in mean kinematic and kinetic variables of interest between physical activity groups (n=0.05). RESULTS: Mean values for gait variables during the stance phase are shown in Table 2. CONCLUSION: Preliminary data shows no differences between activity groups, suggesting that participation in physical activity helps maintain healthy movement patterns in older adults. As the study continues we will be able to ascertain whether this lack of difference is a result of our small current sample size or reflective of the participants’ primary form of physical activity.

### Table 1: Participant demographics.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Running</th>
<th>Resistance Training</th>
<th>Cycling/Swimming</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>54.20 ± 5.81</td>
<td>48.40 ± 3.91</td>
<td>56.40 ± 6.69</td>
</tr>
<tr>
<td>Height (m)</td>
<td>1.76 ± 0.11</td>
<td>1.69 ± 0.11</td>
<td>1.69 ± 0.15</td>
</tr>
<tr>
<td>Mass (kg)</td>
<td>71.69 ± 12.88</td>
<td>67.97 ± 11.01</td>
<td>74.69 ± 17.54</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>22.84 ± 1.76</td>
<td>23.80 ± 2.33</td>
<td>26.24 ± 5.10</td>
</tr>
<tr>
<td>PBF (%)</td>
<td>21.40 ± 5.80</td>
<td>20.10 ± 4.54</td>
<td>27.86 ± 16.46</td>
</tr>
<tr>
<td>Days/week</td>
<td>5.00 ± 1.22</td>
<td>4.80 ± 1.10</td>
<td>4.60 ± 0.89</td>
</tr>
<tr>
<td>Miles/week</td>
<td>41.00 ± 14.32</td>
<td>6.20 ± 4.49</td>
<td>9.20 ± 4.09</td>
</tr>
</tbody>
</table>

Mean ± standard deviation; m: meters, kg: kilogram; BMI: body mass index; PBF: percent body fat; days/week: number of days participating in respective primary activity.

### Table 2: Kinematics and kinetics during the stance phase of gait.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Running</th>
<th>Resistance Training</th>
<th>Cycling/Swimming</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ankle ROM (°)</td>
<td>20.66 ± 2.31</td>
<td>17.18 ± 4.85</td>
<td>20.02 ± 5.63</td>
</tr>
<tr>
<td>Knee ROM (°)</td>
<td>20.99 ± 1.11</td>
<td>24.29 ± 4.15</td>
<td>27.25 ± 7.29</td>
</tr>
<tr>
<td>Hip ROM (°)</td>
<td>39.41 ± 6.27</td>
<td>43.91 ± 3.71</td>
<td>39.25 ± 6.74</td>
</tr>
<tr>
<td>Ankle angle at IC (°)</td>
<td>0.480 ± 2.21</td>
<td>4.17 ± 7.03</td>
<td>6.960 ± 3.66</td>
</tr>
<tr>
<td>Knee angle at IC (°)</td>
<td>18.61 ± 5.07</td>
<td>16.65 ± 2.79</td>
<td>15.11 ± 1.35</td>
</tr>
<tr>
<td>Hip angle at IC (°)</td>
<td>38.27 ± 11.89</td>
<td>42.14 ± 5.71</td>
<td>38.83 ± 4.47</td>
</tr>
<tr>
<td>Peak vGRF (N)</td>
<td>1731.11 ± 464.75</td>
<td>1707.46 ± 221.99</td>
<td>1731.27 ± 326.91</td>
</tr>
<tr>
<td>Peak PF moment (Nm)</td>
<td>-185.11 ± 56.69</td>
<td>-174.42 ± 21.71</td>
<td>-190.64 ± 50.38</td>
</tr>
<tr>
<td>Peak KE moment (Nm)</td>
<td>160.41 ± 32.21</td>
<td>162.94 ± 27.49</td>
<td>180.46 ± 43.87</td>
</tr>
<tr>
<td>Peak HE moment (Nm)</td>
<td>-230.48 ± 53.42</td>
<td>-189.35 ± 16.24</td>
<td>-198.53 ± 42.09</td>
</tr>
</tbody>
</table>

Mean ± standard deviation for kinematic and kinetics during the stance phase of gait. N: newtons; ROM: range of motion; IC: initial contact; °: degrees; vGRF: vertical ground reaction force; PF: plantarflexion; KE: knee extension; HE: hip extension; Nm: newton meter.

Running pace is one of the primary measures of running intensity, however, variations in grade limit quantifying intensity solely based on pace. Cross sectional area (CSA) of the vastus lateralis is a key determinant in running pace. With the advent of wearable running power meters, runners can assess the metabolic demand inclusive of pace and grade. The research of CSA on metabolic demand in running with wearables is currently limited.

### Table 3: Normalizing running power by muscle CSA increases variance explained compared to metabolic power.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Running</th>
<th>Resistance Training</th>
<th>Cycling/Swimming</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>54.20 ± 5.81</td>
<td>48.40 ± 3.91</td>
<td>56.40 ± 6.69</td>
</tr>
<tr>
<td>Height (m)</td>
<td>1.76 ± 0.11</td>
<td>1.69 ± 0.11</td>
<td>1.69 ± 0.15</td>
</tr>
<tr>
<td>Mass (kg)</td>
<td>71.69 ± 12.88</td>
<td>67.97 ± 11.01</td>
<td>74.69 ± 17.54</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>22.84 ± 1.76</td>
<td>23.80 ± 2.33</td>
<td>26.24 ± 5.10</td>
</tr>
<tr>
<td>PBF (%)</td>
<td>21.40 ± 5.80</td>
<td>20.10 ± 4.54</td>
<td>27.86 ± 16.46</td>
</tr>
<tr>
<td>Days/week</td>
<td>5.00 ± 1.22</td>
<td>4.80 ± 1.10</td>
<td>4.60 ± 0.89</td>
</tr>
<tr>
<td>Miles/week</td>
<td>41.00 ± 14.32</td>
<td>6.20 ± 4.49</td>
<td>9.20 ± 4.09</td>
</tr>
</tbody>
</table>

Mean ± standard deviation; m: meters, kg: kilogram; BMI: body mass index; PBF: percent body fat; days/week: number of days participating in respective primary activity.
All runners experience physiological fatigue during a run. Research shows physiological stress induced by fatigue influences changes in running biomechanics. However, past studies have focused on a limited number of kinematic variables during fatigue. To understand the interrelationship between a plurality of kinematic variables, a study was conducted to observe changes in stride length (SL), ground contact time (GCT), foot strike angle (FSA), and cadence (CAD). It was hypothesized fatigue would yield a decreased CAD, increased GCT and SL, and shift subjects to a more rear-foot FSA. PURPOSE: To examine the influence of physiological fatigue on running biomechanics during a short bout of high-intensity running. METHODS: Male and female athletes of all levels (n=36; 15 female; 33 ± 9 years; 70.11 ± 13.66 kg; 171.37 ± 9.75 cm) participated in 10 trials of steady-state, submaximal running at different speeds and inclinations. The CSA of the body's vastus lateralis and rectus femoris was measured by use of ultra sound (GE LOGIQ e Series). Ventilatory measures and heart rate (HR) were measured with a portable breath by breath analyzer (COSMED K5). Running speed was paced by a cyclist using a speedometer. Pearson Correlation Coefficients between metabolic and running power (normalized by total CSA) were calculated for all subjects, individually as well as combined.

RESULTS: There were statistically significant, strong positive correlations between metabolic power and running power (normalized and non-normalized) for the collegiate cross country runners, both individual (Table 1) and as a group, (r corr = .910 P<0.001, r = .602 P<0.001).

CONCLUSIONS: The results support that predicted running power is positively related to metabolic power, which indicates a strong relationship with running intensity. Additionally, normalizing running power to CSA improves correlation and increases the explanation of variability (r^2) from 36% to 83%.

<table>
<thead>
<tr>
<th>Correlations of Running Power and Metabolic Power</th>
<th>Subject</th>
<th>Correlation Coefficient (r)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined</td>
<td>0.60</td>
<td>P&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Combined, CSA-normalized</td>
<td>0.91</td>
<td>P&lt;0.001</td>
<td></td>
</tr>
</tbody>
</table>

2644

Board #105
May 29 9:30 AM - 11:00 AM
Characterization Of Fatigue In A Short Bout Of Running
Yunae Lee, Erin Butler, Jeff Knight, Luke Montzingo. Under Armour, Austin, TX. (Sponsor: Brian McFarlin, FACSM)

(No relevant relationships reported)

Over the last 10 years, ultra-marathon running events have become increasingly popular. For these longer distances, it is common for runners to carry hydration devices with them. How different water carrying devices impact cost of transport (CoT) during running is unknown.

PURPOSE: To examine differences in CoT in trained ultrarunners utilizing two popular hydration devices filled with various amounts of water.

METHODS: Six ultra-marathon trained runners (5 males, 1 female) participated in this study after obtaining informed consent. Each subject completed six 10 min running trials at 15% below their lactate threshold over two days: one baseline trial (no water), two trials with a hand bottle (0.25 and 0.5 kg of water) and three trials with a hydration pack (0.5, 1.0 and 1.5 kg of water) on their back. Each subject’s running trials were randomized utilizing a Latin Square design. For each trial, we analyzed VO2 (ml/kg/min) and RER to obtain 2 minutes of steady state data to calculate CoT (J/kg/m). We used a linear mixed model to analyze the effects of water mass and hydration device on CoT.

RESULTS: We found a statistically significant effect of water mass on CoT: every 1 kg of additional water mass increases CoT by 1.92% (p<0.001), but hydration device had no significant effect on CoT (p=0.31) (see Figure 1).

CONCLUSIONS: Our preliminary findings indicate that CoT increases by 1.92% for every additional 1 kg of water mass carried. This increase in CoT could have significant negative effects on ultramarathon running performance.

2645

Board #106
May 29 9:30 AM - 11:00 AM
Anthropometric And Kinematic Predictors Of Base Of Gait During Running
Mikel R. Stiffler-Joachim, Seraphina G. Provenzano, Jennifer L. Sanfilippo, Bryan C. Heiderscheid. UW-Madison, Madison, WI.

(No relevant relationships reported)

A narrow base of gait (BOG) during running, such that the foot crosses contralateral to the body’s line of gravity, has been implicated as a cause of iliotibial band syndrome and patellofemoral pain. BOG has been shown to vary by sex and running speed, but it is unknown if body anthropometric and running kinematic measures predict BOG. Determining predictors of BOG will clarify if BOG is a result of non-modifiable anthropometric factors or biomechanical factors, which could be modified using targeted interventions. PURPOSE: To determine if BOG at midstance during running can be predicted by anthropometric or kinematic measures. METHODS: Whole body kinematics were obtained for 71 Division I cross country runners (30 males) during treadmill running at preferred speed. Athletes were healthy with no history of stress fracture 3 months before testing or any history of lower extremity surgery. Anthropometric measures from each athlete were obtained from whole body dual-energy X-ray absorptiometry scans: greater trochanteric (GTR) and hip joint center width; leg and femur length. Kinematic measures during stance phase included: peak lateral pelvic drop, hip adduction (HADD), knee flexion (KADD), vertical excursion of center of mass (vCOM); anterior-posterior distance from heel to COM at initial contact. Correlations between predictors and BOG were calculated, with variables moderately correlated or better (r ≥ 0.3) included in subsequent analyses. Data from both limbs were included in a forward, stepwise regression to determine predictors of BOG, controlling for sex and speed. RESULTS: Stride length, vCOM, peak KADD and HADD, GTR width, and leg and femur length (r ≥ 0.32 - 0.51) were entered into the model with the best overall fit included all predictors except leg length (R^2 = 0.383, BIC: -32.1). The strongest predictors were GTR width (β = -0.27), vCOM, (β = -0.18), and peak HADD (β = -0.17). CONCLUSIONS: biomechanical and anthropometric measures explain less than 40% of the variance in BOG. Given that GTR width is the strongest predictor of BOG and is non-modifiable, BOG appears to be largely influenced by an individual’s anthropometrics. Conversely, vCOM and peak HADD are modifiable through gait retraining strategies such as step rate modification and may be targeted in those where narrow BOG is a concern.
Evidence between leg stiffness and varying sprint speed remains inconclusive. Some studies indicate that stiffness decreases from low to medium, and that vertical stiffness and leg stiffness increase which may lead to improved push-off force during a sprint. Others have shown that leg stiffness remains relatively unchanged with the increment of speed. Some recent evidence suggests that muscular strategies of high-speed sprinting may be different.

**PURPOSE** The purposes of this study are to: (a) determine differences in leg stiffness during acceleration and constant speed phases in sprinting, (b) examine the association between leg stiffness and kinematic and kinetic characteristics during each phase of sprinting.

**METHODS** 11 sprinters (Height: 1.77±0.05cm; Weight: 69.0±5.5kg; Personal Best: 11.17±0.25s) from Shanghai University of Sport participated in the study. 12 cameras were used to capture the kinematic data (200Hz) and three force plates were placed in the runway to ascertain kinetic data (1000Hz). The starting line of sprinting was set 12 and 40 meters ahead force plates allowing sufficient leadway for acceleration and constant speed phases when they reached the force plates. Paired t-tests and correlation analyses were used to analyze leg stiffness and kinematic and kinetic data ascertained under each running phase.

**RESULTS** There was a significant difference in leg stiffness between constant speed phase and acceleration phase of sprinting (15.11±2.00 kN/m versus 12.54±1.98 kN/m, p=0.001). No difference was observed in vertical stiffness between the two phases. Leg stiffness during the constant speed phase was significantly correlated with vertical ground reaction force (normalized by body weight) and contact time (r=-0.754; r=0.751). Similar results on leg stiffness were observed during the acceleration phase (r=-0.849; r=0.686).

**CONCLUSION** During the acceleration phase of sprinting, leg stiffness was more pronounced than constant speed phase. Leg stiffness in the two speed phases were correlated with contact time and vertical ground reaction force.

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**REFERENCES**

[1] Armstrong, Savannah, GA.

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**MEDICINE & SCIENCE IN SPORTS & EXERCISE®**

**2647 Board #108 May 29 9:30 AM - 11:00 AM Influence Of Leg Stiffness And Its Effect On Performance During Acceleration And Constant Speed Phases Of Sprinting**

Wen Zhuang, Keyi Yin, Yu Liu. school of kinesiology, Shanghai, China.
Email: zhuangweisu@outlook.com

(No relevant relationships reported)

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**Results**

Running barefoot, in minimal shoes, or traditional shoes alters certain injury-related biomechanical variables and these footwear effects can be influenced by foot strike pattern. It is unclear however how highly cushioned shoes might alter this interaction.

**PURPOSE** Given the increasing popularity in highly cushioned footwear in runners, this study assessed the influence of foot strike and foot strike pattern on injury-related biomechanical variables in experienced runners. METHODS: Six rear (RFS) and seven non-rearfoot strike (NRFS) experienced runners completed five running trials at 3.5m/s (±5%) in minimal (MSH), standard (SH) and high cushioned (HC) shoes. A mixed-design repeated measures ANOVA was used to test interaction effects for all injury-related variables. Pair t-tests were used to decipher any interaction effect and Cohen’s d effect sizes were computed to assess mean difference magnitudes. Given the preliminary nature of this work and the small sample size, alpha level was set to 0.1. RESULTS: Strike index confirmed the different strike patterns while running in SH between RFS (15.2±3.1%) and NRFS (102.8±11.8%) groups (p<0.001). Interaction effects were not observed for any of the variables except for peak eversion velocity (p=0.1) and instantaneous vertical loading rate (IVLR; p=0.1) (Figure 1). Main footwear effects were observed for IVLR (p=0.004) and peak eversion velocity (p=0.01). Main foot strike effects were observed for step length (p=0.041), strike index (p=0.00), and IVLR (p=0.00). CONCLUSION: Similar to prior research, these current preliminary findings suggest there might be an interaction between foot strike and footwear in experienced runners for peak eversion velocity and IVLR. Thus, if these biomechanical variables are of interest to scientists or clinicians, these findings suggest that footwear type and strike pattern should both be considered in research or return to running programs.

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**2648 Board #109 May 29 9:30 AM - 11:00 AM The Influence Of Hamstring Muscle-tendon Stiffness On Isolated And Dynamic Velocity Based Parameters**

Sean P. Langan, Jadeon D. Carreker, Thomas Murphy, George J. Davies, Bryan L. Riemann. Georgia Southern University (Armstrong), Savannah, GA.

(No relevant relationships reported)

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Previous research has demonstrated sex differences in active hamstrings muscle-tendon stiffness as well as associations between stiffness and landing biomechanics and architectural tissue properties. Little is known whether active stiffness relates to other measures of muscle function (i.e., maximum voluntary isometric contraction [MVIC], isotonic dynamometry) and performance (i.e., sprinting).

**PURPOSE** To conduct a pilot study examining the relationship between active hamstring muscle-tendon stiffness and isotonic torque production, isotonic velocity development, and sprint velocity. A secondary research interest was to examine the relationship between the isotonic velocity parameters and sprint performance.

**METHODS:** Nine recreationally active and healthy subjects (7 males, 2 females) (24 ± 3 years) completed an MVIC for the hamstrings (30° knee flexion) followed by three 40m sprint trials using an infrared timing gate system (Brower, Draper, UT). At least 48 hours later, subjects completed a measure of hamstring muscle-tendon stiffness (damped oscillatory technique) and an isotonic knee flexion test on a fixed dynamometer (Biodex, Shirley, NY). The isotonic test began at 90° of knee flexion and was eccentric/concentric through a 90° arc of motion with subjects lying prone. Eccentric velocity was set at 180°/s and concentric torque was set at 25% of MVIC. Bivariate correlations were conducted between stiffness, MVIC (normalized to body mass), sprint times, time to peak velocity, rate of velocity development (RVD, 0-100ms), and rebound time (0-50% to 50%).

**RESULTS:** Stiffness (24.3 ± 11.7 Nm/kg) was only significantly related (r= -0.681, P=0.043) to MVIC (1.48 ± 0.23 Nm/kg). Stiffness was not significantly related to rebound time (r=0.067 ± 0.026s) (r=-0.354, P=0.350), time to peak velocity (r=0.214 ± 0.034s) (r=-0.285, P=0.457), RVD<sub>100</sub> (1114.64 ± 222.30°/s) (r=-0.336, P=0.377), or sprint velocities (5.90 ± 0.56 m/s) (r=0.248, P=0.521). Rebound time (r=-0.535, P=0.138) and RVD<sub>100</sub> (r=-0.436, P=0.241) were not significantly related to sprint times.

**CONCLUSIONS:** Although only the association between stiffness and normalized MVIC reached statistical significance, the magnitude of the other observed relationships provides impetus for further study with a larger sample size.

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**2649 Board #110 May 29 9:30 AM - 11:00 AM Effects Of Minimal, Traditional, And Highly Cushioned Shoes On Injury-related Biomechanics In Rear And Non-rearfoot Strike Runners**

Richard T. Beltran¹, Jake A. Melaro¹, Megan R. Ryan¹, Isabel Moore², Max R. Paquette³, ¹University of Memphis, Memphis, TN, ²Cardiff Metropolitan University, Cardiff, United Kingdom. (Sponsor: Douglas W. Powell, FACSM)
Email: rbtiran@memphis.edu

(No relevant relationships reported)

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Running barefoot, in minimal shoes, or traditional shoes alters certain injury-related biomechanical variables and these footwear effects can be influenced by foot strike pattern. It is unclear however how highly cushioned shoes might alter this interaction.

**PURPOSE:** Given the increasing popularity in highly cushioned footwear in runners, this study assessed the influence of foot strike and foot strike pattern on injury-related biomechanical variables in experienced runners. METHODS: Six rear (RFS) and seven non-rearfoot strike (NRFS) experienced runners completed five running trials at 3.5m/s (±5%) in minimal (MSh), standard (SH) and high cushioned (HC) shoes. A mixed-design repeated measures ANOVA was used to test interaction effects for all injury-related variables. Pair t-tests were used to decipher any interaction effect and Cohen’s d effect sizes were computed to assess mean difference magnitudes. Given the preliminary nature of this work and the small sample size, alpha level was set to 0.1. RESULTS: Strike index confirmed the different strike patterns while running in SH between RFS (15.2±3.1%) and NRFS (102.8±11.8%) groups (p<0.001). Interaction effects were not observed for any of the variables except for peak eversion velocity (p=0.1) and instantaneous vertical loading rate (IVLR; p=0.1) (Figure 1). Main footwear effects were observed for IVLR (p=0.004) and peak eversion velocity (p=0.01). Main foot strike effects were observed for step length (p=0.041), strike index (p=0.00), and IVLR (p=0.00). CONCLUSION: Similar to prior research, these current preliminary findings suggest there might be an interaction between foot strike and footwear in experienced runners for peak eversion velocity and IVLR. Thus, if these biomechanical variables are of interest to scientists or clinicians, these findings suggest that footwear type and strike pattern should both be considered in research or return to running programs.

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**2650 Board #111 May 29 9:30 AM - 11:00 AM How Does Footwear Impact Stride Characteristics In Younger And Older Runners?**

Kelsey M. Klug, Brianne Borgia, Julia Freedman Silvernail. University of Nevada Las Vegas, Las Vegas, NV. (Sponsor: John Mercer, FACSM)
Email: klugk1@unlv.nevada.edu

(No relevant relationships reported)

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How does footwear impact stride characteristics in younger and older runners? Kelsey Klug, Brianne Borgia, Julia Freedman Silvernail. University of Nevada Las Vegas, Las Vegas, NV Running is an increasingly popular form of exercise among adults due to the positive influence exercise has on health. Currently, little is known about how different types of footwear effect gait mechanics in experienced runners. PURPOSE: The purpose of this study was to examine how different types of running footwear impacted stride characteristics in younger and older experienced runners. METHODS: Five older adults (Age: 56 ± 7.28, Mass: 77.96 ± 10.92, Height: 1.75 ± 0.09, PBF: 21.78 ± 5.13; Miles/week: 25.2 ± 5.77) and four younger adults (Age: 30.80 ± 3.32, PBF: 24.02 ± 3.31; Miles/week: 23.3 ± 6.08) participated in this investigation. Participants were provided with a neutral shoe and a maximal cushioning shoe in their self-reported size. The participants own running shoes served as a third footwear condition. Participants
run at a controlled pace of 4.0 m/s (± 5%) over a 10-m runway with force platforms collecting kinetic data. Initial contact and toe off were determined from the vertical GRF using a 30% threshold from which stance time, swing time, step width and stride length were calculated. Differences in mean stride characteristics were analyzed using a 2x3 (group x shoe) mixed analysis of variance (α<0.05). RESULTS: Mean values for variables of interest are shown in Table 1. No comparisons were significant, with all p-values greater than 0.05. CONCLUSION: There were no differences observed between groups or footwear condition suggesting participants maintained their preferred movement in all three shoes.

<table>
<thead>
<tr>
<th>Table 1. Stride Characteristics</th>
<th>Neutral Shoe</th>
<th>Maximal Shoe</th>
<th>Own Shoe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stance time (s)</td>
<td>0.19(0.01)</td>
<td>0.19(0.02)</td>
<td>0.21(0.02)</td>
</tr>
<tr>
<td>Swing time (s)</td>
<td>0.43(0.03)</td>
<td>0.42(0.01)</td>
<td>0.43(0.04)</td>
</tr>
<tr>
<td>Step width (m)</td>
<td>0.07(0.02)</td>
<td>0.06(0.02)</td>
<td>0.16(0.19)</td>
</tr>
<tr>
<td>Stride length (m)</td>
<td>2.92(0.14)</td>
<td>2.89(0.20)</td>
<td>2.83(0.14)</td>
</tr>
<tr>
<td>Mean (standard deviation) of stride characteristics during gait: s; seconds; m: meters.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Older individuals frequently walk as a means for exercise and often wear running shoes during this activity. Recently there has been increased popularity in older individuals wearing maximal running shoes during walking. Maximal running shoes are unique because they are comprised of a highly cushioned midsole in both the rearfoot and forefoot that is supposed to improve shock attenuation. Minimal running shoes with little cushioning are also used in this population to improve proprioception and balance. Loading in the frontal plane is of particular interest for older individuals since it has been associated with increased risk of knee osteoarthritis. Little is currently known about how maximal and minimal shoes influence walking biomechanics in any age group.

PURPOSE: To examine the influence of maximal and minimal running shoes on walking biomechanics in older individuals. METHODS: Walking biomechanics were collected on 16 female participants (age range: 51 – 64 years) using an 8-camera Vicon motion capture system and two embedded force plates. 3D kinematics and kinetics were collected while subjects walked along a 10-meter runway in three different footwear conditions (MAX, MIN, TRAD). Variables of interest included the 1st and 2nd peak of the vertical ground reaction force (Fz1, Fz2), the instantaneous vertical loading rate (IVLR), peak ankle eversion and knee varus angles, and the peak external ankle eversion and knee varus moments. Differences were determined using a repeated measures ANOVA. RESULTS: The external knee varus moment was significantly higher in the maximal shoe compared to the traditional shoe (MAX: 0.55 ± 0.16 Nm/ kg, TRAD: 0.49 ± 0.14 Nm/kg, p = .005). The IVLR was significantly higher in the minimal shoe compared to the traditional shoe (MIN: 30.4 ± 3.4 BW/s; TRAD: 21.8 ± 1.8 BW/s, p < .001). No other significant differences were found for the variables of interest. CONCLUSION: The maximal shoe was found to increase the external knee varus moment, which has been linked to increased pain and disease progression in knee osteoarthritis. The IVLR was significantly higher in the minimal shoe, which has also been linked to injury. Based on these findings, there are no clear advantages to wearing a maximal or minimal shoe during walking, and doing so may be detrimental to injury risk. No grant support was provided.

Prolonged physical inactivity or immobilization after sports injuries and/or surgery can lead to severe cognitive and motor disorders that prevent rapid recovery and lead to future falls. Previous studies have shown that gait control provides the demand for cognitive centers of the brain and that dual-task assessments may indicate an increased risk of falling or a protection strategy to prevent falls. PURPOSE: To determine to which extent walking and walking while text messaging (single-task) and walking and walking while typing on the smartphone (dual-task) can be used for the future development of effective rehabilitation countermeasures. Supported by ASI, MARS-Pre Project, n. DC-VUM-2017-006.
About 50% of emerging adults do not meet the national physical activity recommendations. Risk of injury, like patellofemoral pain (PFP) during walking, may be a barrier to meeting the physical activity recommendations for sedentary emerging adults. PURPOSE: To determine if sedentary emerging adult women had walking biomechanics related to PFP compared to active emerging adult women.

METHODS: As part of a larger study, 26 (12 sedentary, 14 active) emerging adult women (age=22.3 years; height: 1.580 (0.08) m; mass: 58.4 (8.7) kg) participated in the study. Anatomical and tracking retro-reflective markers were placed on body segments to record movement. Participants completed 5 good walking trials at 1.4 m/s (± 5%). Three-dimensional gait analysis was performed using motion capture sampling at 200 Hz and force platforms sampling at 1000 Hz. Joint angles were determined using the joint coordinate system and moment was determined using inverse dynamics. The variables of interest were peak knee flexion angle, peak internal knee extensor moment (PKEM), knee abduction and external rotation angles at PKEM, and hip abduction and internal rotation angles at PKEM. Independent t-tests compared variables between sedentary and active emerging adult women. Effect sizes (d) were calculated for each variable.

RESULTS: A larger knee external rotation angle at PKEM was significantly larger in sedentary compared to active emerging adult women (Table 1). There were no other significant differences between the sedentary and active groups for the remaining variables of interest. CONCLUSION: A larger knee external rotation angle at PKEM suggests higher pressure on the lateral patella in the sedentary versus active group. According to the pathomechanical model for PFP, high lateral pressure and associated high cartilage stress is a mechanism for the develop of PFP. Therefore, sedentary women may be at more risk for developing PFP during walking for exercise compared to active women.

Table 1: hip and knee biomechanics during walking in sedentary and active emerging adult women

<table>
<thead>
<tr>
<th>Variable and Angle</th>
<th>Sedentary Mean (SD)</th>
<th>Active Mean (SD)</th>
<th>t</th>
<th>p-value</th>
<th>Effect size (d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak knee flexion angle (°)</td>
<td>15.6 (4.8)</td>
<td>16.1 (5.1)</td>
<td>-0.3</td>
<td>0.78</td>
<td>0.1</td>
</tr>
<tr>
<td>Peak internal knee extensor moment (Nm/kg)</td>
<td>0.45 (0.20)</td>
<td>0.60 (0.21)</td>
<td>1.9</td>
<td>0.08</td>
<td>0.8</td>
</tr>
<tr>
<td>Knee abduction angle at peak internal knee extensor moment (°)</td>
<td>0.2 (2.4)</td>
<td>-0.2 (3.4)</td>
<td>-0.4</td>
<td>0.71</td>
<td>0.2</td>
</tr>
<tr>
<td>Knee external rotation angle at peak internal knee extensor moment (°)</td>
<td>9.1 (3.3)</td>
<td>3.7 (4.5)</td>
<td>3.5</td>
<td>&lt;0.01*</td>
<td>1.4</td>
</tr>
<tr>
<td>Hip adduction angle at peak internal knee extensor moment (°)</td>
<td>9.6 (2.5)</td>
<td>8.6 (2.7)</td>
<td>-1.1</td>
<td>0.29</td>
<td>0.4</td>
</tr>
<tr>
<td>Hip internal rotation angle at peak internal knee extensor moment (°)</td>
<td>6.7 (4.3)</td>
<td>5.7 (4.6)</td>
<td>-0.6</td>
<td>0.58</td>
<td>0.2</td>
</tr>
</tbody>
</table>

* indicates significant difference: p<0.05

Older adults with lower balance confidence demonstrate a reduced willingness to experience instability as the task of walking becomes more challenging. The specific reason why is not known. PURPOSE: To investigate the extent to which performance of a challenging walking task relates to the attentional requirements of walking. METHODS: Fourteen older participants were asked to walk on a treadmill at a range of speeds from 0.4 m/s, increasing 0.2 m/s, up to either 2.0 m/s or a speed they chose to stop. All walking trials included 60 steps. Kinematic data was collected and a measure of margin of stability in the anterior direction at heel strike (MOSAP) was quantified. The timed up and go (TUG) and timed up and go dual task (TUGdual) were performed. An automaticity index (TUG/TUGdual *100) was calculated to evaluate the attentional resources. Individuals were grouped (n=7 in each group) based on whether they could (complete, 70±2.44 years) or could not (incomplete, 67±2.43 years) complete all walking trials. Comparisons between groups were made with Independent T-test and Mann-Whitney U test. Correlations were detected with Spearman rank correlation. RESULTS: Significant differences were detected in the maximum speeds achieved between groups as well as the range of gait stability (p<0.05). Those that could not complete all speeds had a lower automaticity score compared to other group (p=0.019). The fastest speed attempted was correlated with an average of MOSAP (rho=-0.93, p<0.001) and the automaticity index (rho=-0.61, p=0.022). The average of MOSAP and the automatic gait index were significantly correlated (rho=-0.71, p=0.004, Fig 1). CONCLUSION: Older adults with lower automaticity of gait appeared to choose stop limit walking trials before they became dynamically unstable, which may relate with the increased attentional demand required to maintain dynamic stability at higher walking speeds. This should be considered for an assessment to identify stability problems.
Gait complexity decreases with aging. Gait rehabilitation commonly uses step synchronization with external cues; yet, cues do not present variability in its structure. It has been recently suggested that cues should be presented in a fractal-like pattern (i.e., complexity). Yet, the effects of fractal-cueing on physiological outcomes remains poorly understood.

**Purpose:** To investigate the effect of synchronization of visual stimuli with different temporal structures on cardiorespiratory function.

**Methods:** 14 male participants (23 ± 4 yrs, 1.8 ± 0.1 m, 70 ± 9 kg) completed four 10-min treadmill walking trials at their preferred walking speed. First, self-paced walking (SPW) condition (no stimuli). Stride time from SPW was used to design individualized stimuli for 3 randomized cued conditions: periodic (PER), fractal (FRAC), and random (RND). Detrended fluctuation analysis (DFA) was used to validate the temporal structure of the FRAC and RND stimuli. The stimulation was provided via a moving horizontal bar projected on a screen. Heart rate (HR) and oxygen uptake (VO2) were collected. An accelerometer, placed at the ankle, was used to determine gait events. DFA was used to determine the fractal-scaling exponent from inter-stripe intervals (ISIs). ANOVAs were conducted to assess differences between conditions for all dependent variables (p < 0.05).

**Results:** Descriptive statistics are shown in Table 1. ISIs was significantly different between conditions (F13,133.76, p < 0.0001). FRAC and SPW had greater ISIs than PER and RND.

**Conclusion:** FRAC and SPW displayed higher complexity (ISIs) compared to PER and RND. Compared to SPW, only FRAC maintained the complexity of the system. Participants maintained the structure of the stimuli. Notably, FRAC appears a viable approach for gait training without altering the cardiorespiratory system, and likely improve gait complexity compared to the PER.

<table>
<thead>
<tr>
<th>Metric</th>
<th>PER</th>
<th>RND</th>
<th>SPW</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISIs</td>
<td>0.82 ± 0.13</td>
<td>0.48 ± 0.12</td>
<td>0.60 ± 0.12</td>
</tr>
<tr>
<td>VO2 (ml.kg^-1.min^-1)</td>
<td>13.3 ± 1.7</td>
<td>13.3 ± 1.7</td>
<td>13.3 ± 1.7</td>
</tr>
<tr>
<td>HR (bpm)</td>
<td>90 ± 11</td>
<td>91 ± 11</td>
<td>94 ± 12</td>
</tr>
</tbody>
</table>

Falls have detrimental effects to older adults’ physical and mental wellbeing and can even result in death. The medical system spends billions of dollars on treatment for falls every year. Measuring different aspects of gait, such as gait velocity, can help predict the risk for falling. **Purpose:** This study investigated how walking with no device, walking poles, or the gait trainer impacted gait metrics in older adults. **Methods:** Fourteen participants (3 men, 11 women, aged 77.3 ± 7.28 years) were randomized to one of three walking groups: Control (C) (n = 4), Walking Poles (WP) (n = 5), or Gait Trainer (GT) (n = 5). The gait trainer is a new device aimed at preventing age-related gait decline. Assessments were performed at three separate times: prior to the intervention (Pre-test), immediately after the intervention (Post1), and six weeks after Post1 (Post2). Assessments included measures of gait velocity, cadence, and left and right step lengths for the subjects’ normal and fast gait speeds. For the six-week intervention, all participants walked three times per week for 30 minutes in their assigned walking group. **Results:** ANOVA showed there were no statistically significant differences between the groups at Pre-test for all metrics (p > 0.05). Between group measurements across time were analyzed using linear regression models for all metrics, with an alpha set at p < 0.05. The only statistically significant difference was found for left step length (L SL) for fast gait velocity between the C and WP groups from Pre-test to Post1 (p = 0.03). From Pre-test to Post1, L SL increased in C from 68.4 cm to 73.7 cm and decreased in WP from 73.0 cm to 70.6 cm. There were no statistically significant differences for all other metrics analyzed. **Conclusion:** The results from this study found that walking group did not impact gait velocity over time. Gait velocity is determined by step length and cadence, and can be used as a predictor of falls; therefore, walking group did not impact fall risk with the six-week walking intervention, despite the increase in L SL for the C group. The current sample size was relatively high-functioning and did not show improvement; however, trends indicated a subset of lower functioning participants who have experienced notable age-related gait decline may benefit from the gait trainer.

**Purpose:** To determine how reduced body weight affects lower extremity muscle activity in obese women. **Methods:** Eight obese females (Age: 37.5 ± 8.5y; BMI 36.3 ± 4.0 kg/m²) walked at a self-selected speed (2.3 ± 0.4 mph) on a lower body positive-pressure treadmill (LBPP) during four conditions: control (CON), 10% incline (INC), 25% body weight support (BWS), and BWS+ INC. Surface EMG of the vastus lateralis (VL), vastus medialis (VM), semitendinosus (ST), and medial gastrocnemius (MG) were recorded at 1000Hz during the final 30s of each stage. Integrated EMG activity (iEMG), total spectral power (TSP), peak frequency (PF), and median frequency (MF) were calculated over 20 consecutive gait cycles for each subject. **Results:** Compared to CON, INC increased VL iEMG by 38% (p = 0.010) while decreased VL iEMG by 29% (p = 0.037). VL iEMG was lower in BWS+ INC compared to INC by 33% (p = 0.002), but was not significantly different from BWS alone (p = 0.133). A significant interaction (p = 0.029) between INC and BWS alone was noted for VM iEMG, but post-test revealed no significant differences among conditions. ST iEMG was not significantly different among conditions. Compared to CON, INC increased MG iEMG (35%, p = 0.015). BWS did not significantly affect MG iEMG compared to CON. MG iEMG was significantly lower in BWS+ INC (23%, p < 0.001) compared to INC, but was not significantly different from BWS alone (p = 0.232). Compared to CON, TSP was higher in INC for the VL (232%, p < 0.001) and MG (47%, p < 0.001). BWS significantly decreased TPS compared to CON in MG (35%, p = 0.009), but not VL. TSP was not significantly different between BWS+ INC compared to INC or BWS alone. There was a main effect for incline to increase PF of the VL (p = 0.035), but post-tests revealed no significant differences among conditions. MF was not significantly different among conditions in any muscle group. **Conclusion:** Reduced body weight lowers muscle activity of the VL and MG during level and incline walking without significantly affecting motor unit recruitment pools. Reduced VL and MG activity may explain reduced metabolic cost of transport following weight loss interventions.

**Purpose:** To determine how reduced body weight, independent of changes in body segment volume, affects lower extremity joint kinematics and muscle recruitment during walking. **Methods:** Eight apparently healthy, obese women (Age: 37.3 ± 8.5y; BMI: 36.3 ± 4.1 kg/m²) walked at a self-selected pace on a lower body positive-pressure treadmill (LBPP) under four conditions: 1) control (CON), 2) 10% incline (INC), 3) 25% body weight support (BWS), and 4) BWS + INC. Joint kinematics were measured through bi-axial wireless electrogoniometers and time-synchronized with surface electromyography (EMG) of the vastus lateralis (VL), vastus medialis (VM), semitendinosus (ST), and medial gastrocnemius (MG). The gait cycle was defined by swing, weight acceptance (WA), midstance (MS), and pushoff (PO) according to plantarflexion (PF) and dorsiflexion (DF). Statistical comparisons were made by two-way repeated measures ANOVA. **Results:** Joint kinematics and EMG activity were unchanged throughout swing. At the knee joint, INC increased mean knee flexion during WA (23.8 ± 12.9 v 21.8 ± 14.2°, p < 0.001) and MS (9.3 ± 19.4 v 12.0°, p = 0.044) compared to CON. BWS + INC reduced mean knee flexion during WA (23.8 ± 13.3, p < 0.001) and MS (21.1 ± 12.4°, p = 0.020) compared to INC. Similarly, mean PF was reduced during INC during WA (10.1 ± 1.7 v 13.6 ± 2.2°, p < 0.001) and MS (4.4 ± 5.3 v 8.0 ± 4.9°, p = 0.008) compared to CON. BWS + INC increased mean PF compared to INC during WA (12.3 ± 1.7°, p = 0.009) and MS (7.0 ± 5.5°, p = 0.006). During PO, both BWS (10.8 ± 4.8°) and BWS + INC (9.8 ± 5.4°) increased mean PF compared to CON (8.1 ± 4.6°) and INC (6.5 ± 6.1°). Compared to CON, INC increased mean VL EMG activity during WA (31.3 ± 10.1 v 17.8 ± 6.0 %MVIC) and MS (19.2 ± 5.2 v 11.3 ± 3.8 %MVIC) for both conditions. Reduced body weight lowers muscle activity of the VL and MG during level and incline walking without significantly affecting motor unit recruitment pools. Reduced VL and MG activity may explain reduced metabolic cost of transport following weight loss interventions.
The link between walking speed, rectus femoris (RF) muscle quality [echo intensity (EI)], and maximal and rapid strength in older adults is not well understood. PURPOSE: To examine the relationships between walking speed, RF EI, and maximal and rapid isometric torque characteristics of the leg extensors in elderly females. METHODS: Twenty elderly (67 ± 4 yrs) females underwent one diagnostic ultrasound assessment followed by three isometric voluntary maximum contractions (MVC) of the leg extensors and a 6-min walk test. RF EI was measured on the right leg using a portable B-mode ultrasound imaging device and linear-array probe.

Results: Peak rate of torque development (RTD) was calculated during each MVC as the highest slope value for any 50 ms epoch that occurred over the entire 3-4 s MVC plateau. Peak rate of torque development (RTD) was calculated during each MVC as the highest slope value for any 50 ms epoch that occurred over the entire 200 ms period of the torque-time curve. Pearson correlation coefficients (r) were used to examine the relationships between walking speed, EI, PT, and RTD. A partial correlation was used to examine the relationship between walking speed and RTD when controlling for EI.

RESULTS: There were significant relationships between walking speed and RTD (r = 0.451; P = 0.046) and EI (r = 0.497; P = 0.026). There was a significant negative relationship between EI and RTD (r = -0.469; P = 0.037). No relationships were observed between PT and walking speed (r = 0.394; P = 0.085) or EI (r = 0.413; P = 0.071). With EI as a control variable, there was no significant relationship between walking speed and RTD (r = 0.285; P = 0.238).

CONCLUSIONS: We found a significant positive relationship between walking speed and RTD of the leg extensors in elderly females. Although the reason for this is uncertain, partial correlation analysis suggested that this relationship may be explained by the variance shared (collinearity) between walking speed and RF EI. From a functional standpoint, an age-related decrease in RTD due to its apparent collinearity with RF EI, may significantly impact the quality of life among older adults by impairing their walking speed performance abilities.

**Introduction:** Below-knee-ampuettees (BKA) are at a higher risk of falling compared to non-ampuette controls. Gait patterns have been reported to be an important risk factor of falls: in particular, great disparity in asymmetry of kinematic parameters between lower limbs are observed in BKA. PURPOSE: To investigate differences between spatiotemporal symmetry gait patterns, functional mobility and balance confidence among unilateral BKA fallers and non-fallers. METHODS: Twenty-six unilateral BKA (14 fallers: 45.7 ± 8.6 yrs; 29.5 ± 4.5 kg/m² and 12 non-fallers: 47.5 ± 8.6 yrs; 31.1 ± 5.5 kg/m²) completed 5 walking trials, at a self-selected pace, on a 4.3 m GaitRite system. Step length, swing time, and stance time for each limb was collected. Symmetry ratios between limbs were calculated. Self-reported falls within the past 12 months, Timed Up and Go (TUG) Test and the Activity-Specific Balance Confidence (ABC) questionnaire were also collected. Independent t-tests were performed to compare the fallers with the non-fallers. RESULTS: The fallers had significantly lower functional mobility (12.1 ± 2.7 v. 8 ± 1.1 sec) and reported lower balance confidence (77.4 ± 10.9 v. 87.5 ± 13.7) than the non-fallers (P < 0.05). The fallers also had significantly larger step length (1.12 ± 0.05 v. 1.01 ± 0.05), stance time (10.6 ± 0.03 v. 10.2 ± 0.02) and swing time (1.11 ± 0.05 v. 1.04 ± 0.05) asymmetries (p < 0.05). Discussion: These results suggest that spatiotemporal asymmetry could be useful in distinguishing prospective fallers from non-fallers among BKA. BKA fallers had increased gait asymmetry compared to the non-fallers, which may be attributed to prothetic alignment, as well as acquired gait changes because of pain, and diminished strength and range of motion. These findings should be used by clinicians to identify BKA at a greater risk of falling, and specific functional and psychological interventions should be considered for these individuals to improve gait asymmetry, functional mobility, and balance confidence.
Gait modifications (GM) have successfully reduced knee adduction moment (KAM) which is linked with medial compartment knee osteoarthritis (KOA). Prior studies have largely relied on single-session designs with healthy participants. Experimental designs with KOA patients are necessary to confirm these findings. PURPOSE: Measure the effect of an GM intervention compared to normal walking on KAM in a randomized sample of KOA patients. METHODS: Seven participants with KOA completed the intervention (61 ± 13 yrs, 1.7 ± 0.1 m, 80 ± 23 kg). After baseline, participants were randomized into GM or control (CTRL) group. The GM group performed trunk lean (TL) - leaning the trunk over the affected limb. During training, the TL group was provided with real-time haptic feedback. No feedback provided for the CTRL group. 8-week training sessions were performed with KAM measured baseline, week 5 (PT1), 8 (PT2), and 1-week post-training (PT3). During posttests, participants performed 5 unprompted trial, and then were prompted to perform TL gait for 5 more (TL group). Two-sample randomization tests were performed to determine if mean change in PKAM and TL angle from baseline to posttests were significantly different between groups (p<0.05). RESULTS: TL angle increased and KAM decreased from baseline to posttest when prompted in the GM group compared to CTRL; however, not all differences reached statistical significance (Table 1). CONCLUSIONS: Preliminary data suggests that an 8-week intervention is sufficient to reduce pain and increase trunk support in adult degenerative scoliosis (ADS) patients. However, only anecdotal evidence of their efficacy is available in improving gait and posture control mechanisms. PURPOSE: Investigate the impact of scoliosis bracing on lower extremity kinematics and effectiveness in gait rehabilitation. METHODS: 15 patients with ADS ( Cobb angle >25°; age:73.9±29.7yr; weight:66.6±16.2kg) were recruited using the adult deformity SRS-Schwab system. Oswestry Disability Index (ODI) scores were recorded and patients performed 3m timed up & go, 6 minute walk tests and over-ground 10m walk trials at a self-selected speed at initial evaluation (pre), 45min post fitting (post45) with Peak™ scoliosis brace and after 8 weeks of bracing (post8w). Gait variables were calculated for 5 walking trials and compared between the 3 time points (pre, post45 and post8w) using RM-MANOVA (p< .05). RESULTS: Patients walked faster on 3m timed test (pre: 12.5s; post8w: 10.0s) and covered greater distances in the 6 min walk test (p< .01; 61.2m). For kinematic variables, significant differences were observed for swing time of left leg (p<.013; pre:9.40s; post45:4.42s; post8w:3.93s), step length on right (p< .019; pre:0.52m; post45:0.57m; post8w:0.56m), right ankle peak dorsiflexion (p< .049; pre:8.7°; post45:7.9°; post8w:11.7°), both knee peak flexion and extension angles (p< .001- .048), and right hip (p< .002; pre:37.2°; post45:39.2°; post8w:31.6°) and knee ROM (p< .018; pre:29.8°; post45:31.6°; post8w:37.7°). ODI pain scores (p<.06) showed tendency for statistical significance. CONCLUSIONS: Patients with scoliosis demonstrated few immediate and long-term benefits for improving pain and altered gait mechanics. Faster walking speeds, greater walking distances, longer step lengths and greater ROM as observed are indicators of improved gait and dynamic balance. Bracing has immediate effects on improving ambulation and for any neuromuscular adaptation, brace might need to be worn for at least 8 weeks.
Age, obesity and altered knee biomechanics are known risk factors for developing knee osteoarthritis (OA) in the elderly. Recently racial differences in gait biomechanics have been associated with progression of knee OA in the elderly. It is unknown if these racial differences in gait biomechanics exists in healthy young adults. Purpose: The purpose of this study was to determine if there are biomechanical gait differences between young African-American (AA) and Caucasian (C) adults. Methods: 20 young adults between the ages 18-30 volunteered for this study. Participants completed a self-report version of the Knee Injury and Osteoarthritis Outcome Score (KOOS). A 10-camera motion capture system and 2 force plates embedded in a walkway were used to collect kinematic and kinetic data while participants completed 5 walking trials at a self-selected pace. 3D knee torques were calculated using inverse dynamic analyses. Gait velocity was collected as participants walked across a 14 foot GaitRite® instrumented carpet at both a self-selected (SS) and fast (F) pace. Outcome variables were internal knee adductor (KAD) and knee abductor (KAB) torque and gait velocity (SS, F). Data analysis was conducted using independent sample (AA vs C) t-test for all outcome measures with the alpha level set at p < .05. RESULTS: Nine AA (5 males; 4 male) and eleven C (4 females; 7 males) young adults participated in this study. No significant differences were found between the groups for BMI (AA = 28.6 ± 6.6; C = 25.5 ± 4.9), age (AA = 25.76 ± 1.5 years; C = 26.1 ± 2.5), or KOOS Global scores (AA = 90.1 ± 15.24; C = 94.5 ± 6.2). There were no significant differences found in any of the studied outcome variables.

# Table: Outcome Variables

<table>
<thead>
<tr>
<th>Outcome Variable</th>
<th>African American</th>
<th>Caucasian</th>
</tr>
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<tbody>
<tr>
<td>Left KAD (%BW*Ht)</td>
<td>0.65 ± 0.4</td>
<td>0.64 ± 0.5</td>
</tr>
<tr>
<td>Right KAD (%BW*Ht)</td>
<td>0.63 ± 0.5</td>
<td>0.55 ± 3</td>
</tr>
<tr>
<td>Left KAB (%BW*Ht)</td>
<td>2.57 ± 0.5</td>
<td>2.33 ± 0.8</td>
</tr>
<tr>
<td>Right KAB (%BW*Ht)</td>
<td>2.74 ± 0.2</td>
<td>2.9 ± 0.8</td>
</tr>
<tr>
<td>SS gait velocity (m/sec)</td>
<td>1.20 ± 0.07</td>
<td>1.28 ± 0.07</td>
</tr>
<tr>
<td>F gait velocity (m/sec)</td>
<td>1.87 ± 0.07</td>
<td>2.0 ± 0.25</td>
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All torques listed are internal torques. CONCLUSION: These findings do not support the hypothesis that there are racial differences in gait velocity or knee torques during gait between African American and Caucasian healthy young adults. The generalizability of this study is limited by the small sample size.

Prior research suggests the relation between gravitational and inertial forces plays an important role in the determination of the preferred transition speed (PTS) for both walk to run transitions (WRT) and run to walk transitions (RWT), and that humans prefer to transition gait when the ratio of inertial force (IF) to gravitational force (GF) (i.e. Froude #) is ~0.5. Purpose: In this study, we investigated the effect of gravitational and inertial forces on PTS and Froude # for both WRT and RWT. We hypothesized that decreasing gravitational force (GF) would decrease PTS and increase the Froude # at PTS, but that increases in inertial force (IF) or increases in both gravitational force and inertial forces (+GF+IF) would not affect PTS. Methods: Twelve healthy adults (9 M, 3 F) performed WRT and RWT trials on a motorized treadmill across seven combinations of altered body weight (BW) and body mass (BM). Subjects performed the PTS at 1.0BM/1.0BM, 0.70 and 0.85 BW/1.0 BM (+GF, 1.15 and 1.30 BM / 1.0 BW +IF), and 1.15 and 1.30 of both BW and BM (+GF+IF). For each condition, we determined PTS (m/sec) by increasing BM (-GF), 1.15 and 1.30 BM / 1.0 BW (+IF), and 1.15 and 1.30 of both BW and BM (+GF+IF). For each condition, we determined PTS by increasing speed (WRT) or decreasing speed (RWT) 0.09 m/s every 30 seconds through two speeds beyond the PTS. Results: -GF decreased the PTS of WRT (p<0.02). At 0.70 BW, the PTS was 93% (1.83 m/s) that of the control (1.97 m/s). Neither IF (+p=0.156) nor IF+GF (+p=0.149) affected the PTS of WRT. -GF increased the Froude # at WRT (p<0.01). At 0.70 BW, PTS Froude # was 120% (Fr=5.3) of the control (Fr=4.4). +IF also increased the WRT Froude # (p<0.001). At 1.30 BM, the Froude # was 132% (Fr=5.8) of the control. +GF+IF did not affect the Froude # at WRT (p=0.135). There was no change in PTS for RWT due to -GF (p=0.263), +IF (p=0.658) or +GF+IF (p=0.202). Yet, -GF increased the Froude # of RWT (p=0.001). At 0.70 BW, RWT Froude # was 131% (Fr=2.55) of the control (Fr=2.42). Moreover, +IF increased RWT Froude # (p<0.001). At 1.30 BM, RWT Froude # was 140% (Fr=5.99) of the control. +GF+IF did not affect the Froude # of RWT (p=0.426).

Conclusion: This study suggests WRT speed and Froude # are influenced by changes in gravitational forces but are unaffected by changes in inertial forces or proportional changes in both gravitational and inertial forces. In contrast, the relation between gravitational and inertial forces did not appear to influence RWT speed but did affect the RWT Froude #.

Most studies of gait analysis in hip osteoarthritis (OA) have involved patients with end-stage hip osteoarthritis or after total hip replacement. However, there have been few studies of patients with early stage hip OA is few. Purpose: The purpose of this study was to analyze of gait pattern in the hip joint during stance phase, in patients with early stage of hip OA. METHODS: Data of gait analysis was obtained from medical records of patients. Patients with early stages of hip OA (without acetabular dysplasia [sharp angle 41.9 ± 4.59 deg], n=22, female: age 55.4 ± 7.962 [44–70] yrs, height: 156.7 ± 5.134 cm, weight: 51.5 ± 6.75 kg [Hip OA]) and patients with traumatic temporomandibular disorder after a road traffic accident without lower extremity and lower back disorder (n=20, female: age 51.9 ± 7.94 [47–66] yrs, height: 160.0 ± 5.86 cm, weight: 54.0 ± 8.76 kg [C]) between 2014 and 2019. Two-way ANOVA was used for statistical analysis between group [Hip OA vs C] and within subject [side]. RESULTS: Results (mean ± SD) of range (degree) of hip extension to flexion during gait cycle were C 48.0 ± 6.63 and Hip OA 45.3 ± 8.29 (p < .05). Range of hip adduction of Hip OA was significantly smaller than C (F = 4.72, p < .05, ES = 0.438). Results of range of hip adduction during early stance phase were C 9.1 ± 3.44 and Hip OA 7.2 ± 2.44. Range of hip adduction of Hip OA was significantly smaller than C (F = 4.72, p < .05, ES = 0.438). Results of range of hip internal rotation during early stance phase were small side C 9.7 ± 3.75, large side C 11.63 ± 7.31, affected side Hip OA 7.50 ± 3.84 and unaffected side Hip OA 11.2 ± 3.62. Results of range of hip internal rotation were observed interaction (F=8.90, p<0.01, ES=0.472). Unaffected side Hip OA was significantly smaller than unaffected side (F = 30.39, p<0.001, ES = 1.418) and small side of C (F = 3.26, adjusted p < .15, ES = 0.285). CONCLUSIONS: In patients with early stage of hip OA, hip extension during gait wasn’t restricted, but hip adduction and hip internal rotation during early stance phase of gait were restricted. This hip joint restriction may be influenced by degeneration of ligamentum teres femoris which carries blood supply of femur head. Rotation restriction during stance phase by weight-bearing in early phase of hip OA occurs before hip joint extension restriction.

Exercise interventions that approximate the stepping motion are thought to be useful in gait recovery after stroke. However, it remains unknown if hemiparetic asymmetry remains consistent between common exercise modes. PURPOSE: Therefore, our primary purpose was to examine contralateral mEMG (i.e., affected leg vs. non-affected leg) of chronic stroke survivors (SC) (10 ± 5 years post) and age plus sex-matched control (HC) on the NuStep Cross Trainer (NS) and Treadmill (TM).
METHODS: In order to determine self-selected (SS) cadence, each participant performed a 10 minute (min) protest on the NS and TM at an RPE between 12 and 16. After returning to resting heart rate and blood pressure, participants performed a 5-minute exercise bout on the NS and TM at the SS. The exercise order was randomized. mEMG values were recorded from the rectus femoris (RF), vastus medialis oblique (VMO), semitendinosus (ST), biceps anterior (TA), medial gastrocnemius (MG) and soleus (SOL) bilaterally. mEMG amplitudes (μV) were converted to a percentage of isometric maximum voluntary contraction (%MVC). Five separate 2 x 2 repeated measures ANOVA were used to examine the effect of limb (i.e., affected vs. non-affected) and exercise mode (i.e., TM vs. SS) on mEMG. Post-hoc data are presented as mean and 95% confidence interval. Summary of RESULTS: SC (n = 15) and HC (n = 19) did not differ in age or BMI; p > 0.05. The repeated measures ANOVA found no interaction or main effects for the proximal musculature (i.e., RF, VMO, ST); p > 0.05. However, main effects for limb were detected for the distal musculature (i.e., MG, SOL, and TA; p < 0.05). The non-affected MG produced higher mEMG (M = 105.08% MVC; CI = 39.52% - 170.64%) than the affected side (M = 48.92% MVC; CI = 33.58% - 64.26%); p < 0.04. The non-affected SOL produced higher mEMG (M = 121.65% MVC; CI = 20.68% - 222.61%) than the affected side (M = 47.96% MVC; CI = 15.49% - 80.43%); p < 0.04. Post-hoc analysis revealed the non-affected TA produced higher mEMG (M = 33.29% MVC; CI = 21.76% - 44.81%) than the affected side (M = 18.79% MVC; CI = 14.30% - 23.29%); p < 0.01. CONCLUSION: Distal muscular activity demonstrated higher mEMG in the non-affected limb despite exercise mode. This gives preliminary evidence supporting the use of the NS to elicit mEMG values similar to the TM in the proximal leg musculature.

PURPOSE: To examine the change in dual-tasking ability during gait in response to a golf exercise program in healthy, older adults. BACKGROUND: The ability of older adults to perform dual-tasking during gait has been studied as a predictor of fall risk. Therefore, it is important to investigate exercise programs that not only improve fitness and balance in older adults, but also enhance the ability to dual-task. METHODS: Fifteen healthy, older adults without previous golf experience were enrolled in a golf program with fitness testing before and after the intervention. One participant had to drop out of the study due to a work-related injury at week 8. Dual-task performance was measured using a fast-gait task while counting backwards by threes on a ProtokineticsTM walking mat. Cognitive cost was determined by normalizing the dual-task responses to a seated counting task. Paired t tests were run to determine significance. Results are presented as means±SD. Cohen’s d effect sizes were calculated and reported as small=0.2, medium=0.5, and large=0.8. RESULTS: Gait speed during the dual-task was significantly increased following the golf program with a large effect size (1.75±0.19m/s to 1.91±0.22m/s; p=0.007; d=0.85). This increase in gait speed coincided with increases in both average stride length (2.2%; p=0.061; d=0.55) and average cadence (5.8%; p=0.059; d=0.55). Cognitive dual cost did not change between pre and post testing but trended towards improving (40.94%; p=0.207; d=0.35). CONCLUSION: Golf is a unique, multimodal activity that has a beneficial impact on fitness in healthy, older adults. This study demonstrated that a golf program can improve the ability to perform dual tasking. Participants were able to increase their gait speed without compromising the amount of numbers they could recite correctly. The participants trended towards an improved correct response rate following the program as shown by the improvement in cognitive dual cost. Golf should be encouraged as a physical activity program for older adults. Supported by R&A Grant GHA0012017.

2673 Board #134  May 29 10:30 AM - 12:00 PM Feasibility And Adherence Of A Novel Golf Training Intervention For Healthy Older Adults Guanrong Cai1, Jared Moore1, Kiran Kanwar2, Karen Lee3, Roger Hawkes2, George Salem, FACSM. 1University of Southern California, Los Angeles, CA. 2University College London, London, United Kingdom. (Sponsor: George Salem, FACSM) Email: guanrong@usc.edu (No relevant relationships reported)

Golf is a multimodal physical activity that can potentially be utilized as a health intervention for diverse populations. Golf includes aerobic, power, balance, and cognitive training, yet is overlooked as a therapeutic program due to notions of cost and feasibility. Adherence rate is also a key measure of success in intervention studies. No previous evidence has demonstrated the adherence and feasibility of a golf-based training program in older adults whom did not play golf. PURPOSE: This study will report on the adherence and feasibility of a novel 10-week golf training program for healthy older adults. METHODS: Fifteen healthy, older adults enrolled and fourteen completed a 10-week golf training program with physical and cognitive testing before and after the program. The golf program consisted of warm up exercises, driving range practice, and golf play twice per week for 90 minutes, under the supervision of a PGA instructor. Functional, fitness, and cognitive measurements were taken in pre- and post-testing. The attendance rate, program-related adverse events, and cost related to the program were collected to determine the adherence and feasibility of the program. RESULTS: Participants completed 283/300 (94%) scheduled training sessions. There were no adverse events or drop-outs related to the intervention. Fourteen of fifteen participants completed pre- and post-testing, with one participant leaving the study at week 8 due to a work-related injury. Improvements were found in strength, functional, balance, and cognitive measures. The individual subject cost for the 10-week golf program was $1,100, which included clubs, hand-cart, range and green fees, lessons, and necessary accessories. The average cost of playing 9 holes on 7 Los Angeles city golf courses is $8.88 (±1.28) for older adults. There are 29 courses with green fees for 18 holes under $20 (booked on golfnow.com and open access to public) within a 30-mile radius of downtown Los Angeles. CONCLUSION: The nature of golf allows it to be incorporated as a multimodal training intervention that is beneficial for older adults. The cost data demonstrate that golf can be financially feasible for older adults living in the Los Angeles region to participate regularly. Golf should be utilized when designing health and fitness interventions for older adults.

2674 Board #135  May 29 10:30 AM - 12:00 PM Short-term Multicomponent Exercise: Effective For Addressing Major Variables That Influence Fall Risk In Older Adults Brett D. Bruinink, Derick Hansen, Lauren Wikstrom, J. Adam Korak. University of St. Thomas, St. Paul, MN. Email: bruin8983@stthomas.edu (No relevant relationships reported)

Falls are commonly linked to gait and balance inconsistencies, influenced by a combination of variables including muscle strength and power. For years, short-term higher intensity multi-component dynamic training methods have been used to improve athletic performance in younger populations by significantly affecting variables including muscular strength and force, gait, and balance. Currently, there are a number of fall prevention programs. However, questions specifically surrounding mode and duration of these fall prevention programs still exist. PURPOSE: To determine if a short-term, 8-week multi-component dynamic resistance-training program is effective in eliciting positive changes in factors that directly influence fall risk in older adults. METHODS: Forty men and women (ages 55-90 yrs.; mean = 69.5) performed 8-weeks of multi-component dynamic training (3x/week; 45 minutes per session) consisting of skill appropriate agility and change of direction training, specific lower body strength exercises, and both stationary and dynamic balance training. Muscle performance was measured pre/post using a 10RM bilateral leg extension and a standardized sit-to-stand test. Repetition-by-repetition force (N) was assessed using a calibrated force plate during the sit-to-stand test. Balance, gait, and speed were measured using standardized balance and walking tests. Changes in lean and fat masses were observed via dual energy X-ray absorptiometry (DXA). Pre/post mean differences were analyzed using a Paired T-tests. RESULTS: Training elicited positive outcomes in all muscle performance variables. Sit-to-stand efficiency increased (+53.9%; p<0.001) and repetition-by-repetition mean force improved (+6.0%; p=0.05) during the same test. Significant increases in mean 10RM bilateral leg extension (+6.6kg; +28.0%; p<0.001), and positive balance changes were also observed (11.5%; p<0.01). While participants (+17.0%; p<0.001). CONCLUSION: Shorter, higher intensity dynamic exercise can be a safe and effective way to improve muscle performance, gait speed, and balance in older adults at risk for falling.
Purpose: To examine the associations of handgrip strength (HGS) with prevalence of digestive system disorders (DSD) in older adults.

Methods: This cross-sectional study included 511 older adults (57% women; mean age 72 years old) who were without heart attack, stroke, or cancer in the past 5 years. HGS was calculated as the sum of two maximal contractions from both hands. Participants were categorized into sex-specific tertiles (thirds) of HGS. DSD cases were identified via self-administered medical history questionnaire. The DSD were further categorized into disorders of the upper tracts (gastroesophageal reflux disease, ulcers, intestines, irritable bowel syndrome, inflammatory bowel disease, diverticulitis), or accessory organs (gallbladder, liver, pancreas). Logistic regression was used to calculate the odds ratios (ORs) and 95% confidence intervals (CI) of DSD among HGS thirds while adjusting for sex, age, smoking, heavy alcohol consumption, diet quality, cardiorespiratory fitness, and body mass index (BMI). Results: There were 192 DSD cases. Compared with the lower third of HGS (least strong), the ORs (95% CIs) of having DSD were 0.60 (0.28-1.27), 0.27 (0.11-0.65), 0.43 (0.21-0.88), 0.41 (0.20-0.83) among those in the middle and upper (strongest) thirds, respectively, after adjusting for the possible confounders. Similar trends were observed in the DSD of the upper tracts, intestines, and accessory organs. In a joint analysis of HGS and BMI (another strong risk factor for DSD), participants were dichotomized into weak (lower third) or strong (middle and upper thirds) based on BMI. Compared with the weak-obese group, ORs (95% CIs) were 0.60 (0.28-1.27), 0.27 (0.11-0.65), 0.43 (0.21-0.88), 0.41 (0.20-0.83) or obese (≥30.0 kg/m2) based on BMI. Compared with the weak-obese group, ORs (95% CIs) of having DSD were 0.58 (0.37-0.92) and 0.50 (0.31-0.81) among those in the middle and upper (strongest) thirds, respectively, after adjusting for the possible confounders. Conclusions: HGS was inversely associated with DSD in older adults. In addition, higher HGS appears to attenuate the increased prevalence of DSD in obese and obese participants. Prospective studies are warranted.

Purpose: To examine the associations of handgrip strength (HGS) with the risk of digestive system disorders (DSD) in older adults.

Methods: This cross-sectional study included 511 older adults (57% women; mean age 72 years old). CRF and MS were assessed with the 400-meter walking test (minutes) and handgrip strength (kg), respectively. Poor cognitive function was defined as the slowest 20% of congruent (CRT) and incongruent (IRT) reaction times from the Stroop Color-Word Task. Logistic regression was used to calculate odds ratios (ORs) and 95% confidence intervals (CIs) for CRT and IRT among sex-specific tertiles (thirds) of CRF and MS. Participants were further categorized as fit (middle/upper CRF) or unfit (lower CRF) and strong (middle/upper MS) or weak (lower MS) for a joint analysis. Covariates included sex, age, body mass index, smoking, heavy alcohol intake, depression, daily steps, diabetes, hypertension, hypercholesterolemia, and CRF or MS in respective analyses.

Results: Compared with the lower third of CRF, the middle and upper thirds had 0.47 (0.26-0.86) and 0.42 (0.21-0.84) reduced odds of poor CRT, respectively, and 0.44 (0.24-0.80) and 0.48 (0.24-0.97) reduced odds of poor IRT, respectively, after adjusting for all covariates including MS. Compared with the lower third of MS, the middle and upper thirds had 0.54 (0.31-0.94) and 0.51 (0.28-0.94) reduced odds of poor CRT, respectively, after adjusting for all covariates including CRF. No associations were found between MS and poor IRT. In a joint analysis, compared with the Weak & Unfit group, the odds of poor CRT were 0.48 (0.23-1.00), 0.37 (0.17-0.79), and 0.25 (0.13-0.49) for the Strong & Unfit, Weak & Fit, and Strong & Fit groups, respectively. Compared with the Weak & Unfit group, the odds of poor IRT were 0.75 (0.37-1.55), 0.31 (0.13-0.71), and 0.39 (0.20-0.75) for the Strong & Unfit, Weak & Fit, and Strong & Fit groups, respectively.

Conclusion: These results indicate that both CRF and MS are independently associated with faster processing speed (i.e., CRTs), but that CRF may be more strongly associated with tasks requiring executive function (i.e., selective attention in the IRTs) than MS.

Purpose: To determine if exercise-induced decreases in FM are evident in older adults and to examine the relationship between CRF and MS with changes in body composition.

Methods: A total of 732 older adults (Males 45.9%, age: 73.51±6.20yrs, BMI: 24.07) participated in Korea Survey of National Physical Fitness (KSNPF). All participants performed the senior physical fitness test (SPFT) including body composition (TUG) and HG were relatively important to predict the fall risk for the healthy elderly in Korea. Coordination and strength exercise are critical for fall prevention in older adults. *Corresponding author (mylee@kookmin.ac.kr)
PURPOSE: The purpose of this present study was to examine the effect of Tai Chi sward (TS) on physical function in Chinese older adults.

METHODS: 160 Chinese older adults were randomly assigned into either an experimental group experiencing four 90-minute TS sessions weekly for seven consecutive weeks or a control group. At baseline and 7 weeks later, all participants were asked to perform physical functional tests for both lower and upper limbs. The test included leg strength, dynamic balance, the Back Scratch Test, One leg Stand Test, the Arm Curl Test, the maximum isometric strength of the hand and forearm muscles, the Spiral Drawing Test, and Moberg Pick-Up Test.

RESULTS: The finding showed that TS group experienced positive changes on Handgrip Strength Test (17.40 to 22.45), Arm Curl-Up Test (19.25 to 24.28), Back Scratch Test (15.36 to 19.56), Timed Up and Go Test (13.51 to 12.24), and One leg Stand Test (15.65 to 23.37).

CONCLUSIONS: The findings indicated that a short-term and intensive TS training program does not only improve limb-related physical function such as dynamic balance and leg strength, but also strengthen upper limb-related physical function (e.g., arm and forearm strength, shoulder mobility, fine motor control, handgrip strength, and fine motor function). Health professionals could take into account TS exercise as an alternative method to help maintain or alleviate the inevitable age-related physical function degeneration in healthy older adults.

2680 Board #141 May 29 10:30 AM - 12:00 PM

Comparison Of Handgrip Strength Test Values From International Cohorts Of Normal And Active Older Adults

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(No relevant relationships reported)

The hand-grip strength test (HST) is one of the most utilized tests to measure muscle strength in older adults. It has been used to assess sarcopenia and fragility in older adults’ populations. PURPOSE: The aim of this study is to compare HST data from active older adults engaged in a physical activity promotion program in Spain with normative values of the general population in the same age ranges in Colombia (Ramírez-Vélez et al., 2019) and South Korea (Yoo et al., 2017).

METHODS: 1,862 older adults aged ≥60 years old who participated in a physical activity promotion program were evaluated with the HST measured with a dynamo-meter. The comparison with the other international cohorts [Colombian N=5327 (60) and South Korean N=935 and 147 (≥65 and ≥80, respectively)], we divided the study by gender (W = women and M = men) and by age ranges (≥60 to ≥80). From our 1,862 sample, we included all of them in 1 (W=1632 and M=230), 1840 in 2 (W=1608, M=232) and 807 in 3 (W=695, M=112).

RESULTS: Sample (n) and population (NSK) averages HST values (kg) were obtained in the three age groups (1, 2, and 3).

The means were 1 = n (W:20.3; M:34.2) and N (W:16.7; M:26.7); 2 = n (W:19.8; M:33.1) and N (W:20.5; M:33.6); and 3 = n (W:18.9; M:31.1) and N (W:16.7; M:26.9).

The Cohen’s d effect size as the standardized mean difference between n and N using the standard deviation of N due to the large sample size was calculated. The results were as follows: 1 = (W:0.63; M:0.88); 2 = (W:-0.14; M:-0.07); and 3 = (W:0.48; M:0.70).

CONCLUSION: The comparison shows that our sample data obtained higher values in HST by gender as well as by age, with moderate (0.63) to high (0.88) effect sizes when compared to Colombian data over 60 years old. The comparison with South Korean age groups shows that there are no differences when comparing our sample data with over 65 years data however the effect sizes are moderate when comparing older age groups (≥80). These findings suggest that physical activity could be an optimal therapeutic treatment against the muscle lost assessed with the HST even in older adults aged ≥80 years old.

2682 Board #143 May 29 10:30 AM - 12:00 PM

Association Of Muscle Quality And Prevalence Of Diabetes In Older Adults

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PURPOSE: Diabetes is often related to the skeletal muscle; however, studies investigating individual muscle characteristics like strength or mass on diabetes have produced mixed findings. The purpose of this study was to evaluate the association of muscle quality (MQ), a metric that reflects both muscle strength and mass, with diabetes in older adults.

METHODS: This cross-sectional study included 468 older adults aged ≥65 years (mean age 72 years; 55% women) enrolled in the Physical Activity and Aging Study (PAAS). Participants were excluded if they had heart attack, stroke, or cancer in the past 5 years. MQ was defined as the ratio of the combined left and right handgrip strength to the combined lean mass of the left and right arms (measured by DEXA). Diabetes was defined by self-report, fasting glucose ≥126 mg/dl, or taking insulin, or other diabetes medications. Logistic regression was used to calculate the odds ratios (ORs) and 95% confidence intervals (CIs) of diabetes among sex-specific tertiles ( thirds) of MQ. Covariates included sex, age, smoking, heavy alcohol consumption, body fat percentage, hypertension, hypercholesterolemia, and physical activity (daily steps).

RESULTS: Forty-five (9.6%) participants had diabetes. Compared to the lower third of MQ, the middle and upper thirds had 0.53 (0.26-1.07) and 0.25 (0.11-0.61) times lower odds of diabetes after adjusting for age and sex (model 1); 0.58 (0.28-1.21) and 0.26 (0.11-0.66) times lower odds of diabetes after adjusting for body fat percentage, smoking, heavy alcohol consumption, and physical activity (model 2); and 0.60 (0.28-1.25) and 0.24 (0.11-0.71) times lower odds of diabetes after adjusting for all confounders including hypertension and hypercholesterolemia (model 3). There was an inverse linear trend between MQ tertiles and diabetes (p=0.02).

STUDY DESIGN/INTERVENTION: The finding indicated that a short-term and intensive TS training program does not only improve limb-related physical function such as dynamic balance and leg strength, but also strengthen upper limb-related physical function (e.g., arm and forearm strength, shoulder mobility, fine motor control, handgrip strength, and fine motor function). Health professionals could take into account TS exercise as an alternative method to help maintain or alleviate the inevitable age-related physical function degeneration in healthy older adults.
CONCLUSIONS: Higher MQ was associated with a reduced likelihood of diabetes in older adults. MQ could be an indicator of diabetes, but future prospective studies are needed.

2683 Board #144 May 29 10:30 AM - 12:00 PM Sedentary Behavior, Physical Activity, And Baroreflex Sensitivity In Middle-aged And Older Adults Shoya Mori1, Krisei Kosaki1, Masahiro Matsui2, Kanako Takahashi1, Masaki Yoshioka1, Takashi Tarumi3, Jun Sugawara4, Ai Shiibata5, Koichiro Oka6, Makoto Kuro-o7, Chie Saito8, Kunihito Yamagata9, Seiji Maeda10. 1University of Tsukuba, Ibaraki, Japan. 2National Institute of Advanced Industrial Science and Technology, Ibaraki, Japan. 3Waseda University, Saitama, Japan. 4Jichi Medical University, Tochigi, Japan. Email: shemori@gmail.com (No relevant relationships reported)

Cardiovagal baroreflex sensitivity (BRS), a risk factors for cardiovascular disease, declines with advancing age. Previous studies reported that the higher amount of moderate- to vigorous-intensity physical activity is associated with the better BRS. However, the associations of BRS with sedentary behavior (SB) and light-intensity physical activity (LPA), which occupies most of the waking time, are not fully understood. PURPOSE: The purpose of this study was to examine the associations of BRS with SB and LPA in the middle-aged and older adults. METHODS: A total of 162 midadults (48 49 years) participated in this study. Spontaneous BRS was evaluated by transfer function analysis of a 5-minute continuous data (blood pressure and cardiac period) in the supine position. The SB and LPA time were assessed using triaxial accelerometers. The oxygen consumption at ventilation threshold (VO2VT) was measured as the cardiopulmonary fitness parameter. RESULTS: A series of multiple linear regression analysis revealed that SB and LPA time were significantly associated with BRS after adjusting for potential covariates such as age, sex, body mass index, heart rate, systolic blood pressure, smoking, menopause, and medication status (P<0.05, β=0.200, P=0.022). These associations remained significant after adjusting for the VO2VT (P<0.189, P=0.030, β=0.200, P=0.022). CONCLUSIONS: This cross-sectional study found that the time spent in SB and LPA are independently associated with BRS and suggests that lower SB and higher LPA contribute to maintaining BRS in middle-aged and older adults.

2684 Board #145 May 29 10:30 AM - 12:00 PM Perceptions Regarding Physical Function Limitations Among Midlife And Older Adults In A Health Ministry Program Brittny S. Lange-Maia1, Sheila A. Dugan2, Daniel R. Lindich3, Samantha Marinello2, Catherine Banks1, Elizabeth B. Lynch4. 1Rush University Medical Center, Chicago, IL. 2University of Illinois at Chicago, Chicago, IL. 3Greater Galilee Baptist Church, Chicago, IL. Email: brittny_lange-maia@rush.edu (No relevant relationships reported)

Limitations in physical function lead to decreased quality of life and are predictive of disability, hospitalizations, and mortality. We previously assessed physical function as part of a health-screening program with African American churches in Chicago’s West Side. Screenings revealed high rates of functional limitations among midlife and older adults. PURPOSE: To inform the development of a church-based intervention that aims to improve physical function. METHODS: We conducted 6 focus groups with a total of 40 participants age 40+ from our partner churches and communities who reported difficulty with physical function. Focus groups were audio recorded and transcribed. Qualitative data analysis software was used to analyze the data and generate themes and sub-themes. RESULTS: Participants (mean age 64.4 ± 11.0 years, range 42-92 years, 88% female) described that physical function limitations negatively impacted their ability to live a full life and play an active role in their family, church, and community. Faith and prayer helped participants cope with limitations and pain. Participants expressed that it is important to keep moving, both from an emotional (not giving up) and physical (moving to prevent more limitations) standpoint. Some participants shared positive experiences making home modifications to adapt to limitations (like installing grab bars), however, a prevailing opinion was that using mobility aids—especially canes or walkers—leads to further functional decline. An additional emerging theme was the desire to learn to move better; for example, how to safely navigate stairs or strengthen muscles to facilitate daily activities. Participants expressed frustration that their communities were not conducive to physical activity (particularly in regards to safety and lack of facilities for physical activity), but generally welcomed programs in the church focused on physical function and activity. CONCLUSIONS: Community-based programs focusing on reducing physical function limitations are needed, and delivering programs through the church is a potentially acceptable strategy. Along with using physical activity to promote physical function, integrating concepts from physical and occupational therapy could also be beneficial.

2685 Board #146 May 29 10:30 AM - 12:00 PM Three Months Of Aerobic Exercise Training Improves Vascular Endothelial Function In Overweight/obese Older Adults Kevin D. Ballard, FACSM, Gabrielle Volk, Alexandra Hopun, Olivia Henderson, Kyle L. Timmerman, FACSM. Miami University, Oxford, OH. Email: ballardk@miamioh.edu (No relevant relationships reported)

Aging and overweight/obesity (OW/O) are associated with insulin resistance (IR) and impaired vascular endothelial function (VEF), potentially increasing cardiovascular disease (CVD) risk. Aerobic exercise training is an effective intervention to improve IR and VEF. PURPOSE: To determine changes in IR and VEF following aerobic exercise training in older OW/O adults. We hypothesized that 3 months of aerobic exercise training would improve IR and VEF, independent of weight loss. METHODS: Preliminary data are from 11 (8 women) older OW/O adults participating in a randomized clinical trial: 4 control (CON) (64±18 y; BMI=32.7±3.3 kg/m², body fat=41.5±8.0%) and 7 exercisers (EX) (62±4 y; 32.2±5.5 kg/m², 40.2±10.2%). Supervised aerobic exercise training consisted of moderate-intensity (40-60% heart rate reserve) cycling performed 3 wk for 3 months. Body mass and composition were measured by bioelectrical impedance analysis following an overnight fast. Brachial artery flow-mediated dilation (FMD), a non-invasive measure of VEF that predicts incident CVD events, was assessed by a trained technician using high-resolution ultrasoundography. HOME-IR was calculated from fasting glucose and insulin. RESULTS: No between group differences were found at baseline. Compared to baseline, no changes were found in CON at 3 months (all P>0.19). However, percent body fat (40.2±10.2% vs. 38.9±10.4% for baseline vs. 3 months, respectively (P<0.05)) and brachial artery FMD (3.2±3.0 vs. 5.1±2.8% (P<0.05)) improved at 3 months in EX. No other time effects were found in EX. CONCLUSIONS: Preliminary data from our ongoing clinical study show that 3 months of moderate-intensity aerobic exercise training improves body composition and VEF in OW/O older adults. Continued recruitment of participants completing a longer exercise training program (i.e., 6 months) will more definitively determine the beneficial impact of aerobic exercise training on VEF and related cardiometabolic risk factors.

2686 Board #147 May 29 10:30 AM - 12:00 PM IMPROVEMENT THROUGH MOVEMENT: INVESTIGATING FITNESS, FUNCTIONAL CONNECTIVITY, AND COGNITION IN OLDER ADULTS Katherine Mary McDonald1, Sheeba Anterapur2, Michelle Voss3, Susan Whitfield-Gabrielli1, Kirk Erickson4, Charles Hillman1, Edward McAuley5, Arthur Kramer6 (Northeastern University, Boston, MA. 1University of Iowa, Iowa City, IA. 2University of Pittsburgh, Pittsburgh, PA. 3University of Illinois, Champaign, IL. (No relevant relationships reported)

As the U.S. population has grown older, it has become increasingly crucial to understand age-related brain alterations in an effort to ameliorate and protect against normal, and especially abnormal, decline. Prior research suggests that physical activity acts on and benefits similar cognitive constructs most commonly affected by cognitive aging. PURPOSE: The purpose of this investigation was to advance understanding of functional connectivity as a possible mechanism by which fitness protects and restores brain function. METHODS: Data were collected as a part of the “Fit and Active Seniors Trial” between 2015-2018. We evaluated functional brain changes in participants before and after they took part in an exercise intervention. Seventy-seven older adults that had pre- and post-intervention MRI scans, fitness data, and behavioral data were included. All participants (age range: 60 - 80 years, 69% female) were randomized into either an aerobic walking group (n=34) or active control stretching and toning group (n=43) that met three times a week for six months. RESULTS: Cardiorespiratory fitness (measured by VO2 peak) significantly improved within-groups pre/post (P<0.01), but not between-groups (P>0.37). Multi-voxel pattern analysis (MVPA) was performed on the resting-state functional MRI scans to detect variability in whole-brain patterns of connectivity. There were no significant between-group differences in functional connectivity at pre-test. However, several significant clusters in the Default Mode Network were identified between groups at the 6-month post-intervention, including regions of the hippocampus (height threshold p<0.001, cluster threshold p=0.05 corrected for false discovery rate). These MVPA-derived hippocampal voxels were then used for whole-brain seed-to-voxel analyses for post-hoc characterization, and results indicated that increases in between-group functional connectivity were driven by the walking group (p<0.01). CONCLUSION:
This research adds to the understanding of the mechanism by which physical activity protects and restores brain function, which ultimately could lead to efforts preventing, minimizing, and improving age-related cognitive decline.

2687  Board #148  May 29 10:30 AM - 12:00 PM  Muscle Capacity, Adiposity And Change In Dynamic Function After Weight Loss In Older Women
Isaura M. Castillo-Hernández, Ewan R. Williams, Chad R. Straight, Alison C. Berg, Rachelle A. Reed, Ellen M. Evans, FACSM. University of Georgia, Athens, GA. Email: isaura.castilloh27@uga.edu
(No relevant relationships reported)

PURPOSE: Improving muscle capacity (strength or power) can improve lower-extremity physical function (LEPF), however, it is unclear how concomitant weight loss impacts this relationship. Exercise training during weight loss may have complicated implications for changes in LEPF due to changes in both muscle capacity and adiposity. This study aimed to determine if adiposity influences the relationship between change in muscle capacity and LEPF in inactive overweight older women following a weight loss and exercise program.

METHODS: Inactive overweight/obese older women (n = 38; BMI = 30.0 ± 4.4 kg/m²; 69.3 ± 4.1 y) completed a 6-month weight loss and supervised exercise intervention. Maximal leg strength (STR) was measured via isokinetic dynamometry and leg power (POW) via leg extension power rig. Body composition was assessed via DXA. LEPF was assessed using the 6-minute walk (6MW) and 9-foot Up-and-Go (UPGO), which are both dynamic physical functional tests.

RESULTS: Body weight (9.6 ± 3.5%), fat mass (-6.8 ± 2.4 kg) and leg lean mass (-0.3 ± 0.5 kg) decreased (all p < 0.01). Muscle STR (19.7 ± 35.4 N·m) and POW (23.3 ± 39.1 watts) improved (both p < 0.01); 6MW (58.9 ± 33.7 m) and UPGO (1.84 ± 0.74 s) also improved (both p < 0.01). There was a strong trend for the addition of change in fat mass to the predictive model to improve the explained variance in LEPF outcomes by 7-10% (p = 0.053-0.06).

CONCLUSIONS: Increases in muscle capacity improve dynamic measures of LEPF in response to a weight loss and exercise program in older women, even in the presence of leg lean mass loss. The influence of reductions in fat mass on measures of LEPF appears to be of lesser importance compared to improvements in muscle capacity given the relative amount of variance explained. More research is needed to inform best practice for exercise prescription to enhance LEPF in older adults, especially under weight loss conditions.

2688  Board #149  May 29 10:30 AM - 12:00 PM  Validity Of Combined Heart Rate And Accelerometry To Predict Activity Energy Expenditure In Older Adults
Alina Rieckmann1, Bas Jordan2, Frederike Burzick2, Jacqueline Meixner1, Christian Thiel1. 1University of Applied Sciences Bochum, Bochum, Germany; 2Zuyd University of Applied Sciences, Heerlen, Netherlands. Email: alina.rieckmann@hs-gesundheit.de
(No relevant relationships reported)

Purpose The present study compared physical activity related energy expenditure (PAEE) as predicted by group calibrated algorithm combining accelerometry and heart rate.

Methods N=45 older adults with and without cardiac risk performed a protocol consisting of simulated daily living activities (resting period, light, moderate and vigorous physical activity including walking in different speeds and stair climbing) and a cycle ergometer test (25W + 25W every 2 minutes). PAEE was concurrently assessed by indirect calorimetry (IC) and by combined heart rate (HR) plus uniaxial accelerometry (ACC). Raw HR and ACC data were transformed to PAEE using a published branched equation model. Estimated and measured PAEE were compared using Bland-Altman plots.

Summary of results Preliminary results of n=12 healthy older adults without cardiac risk (8 male and 4 female, 71.9 ± 5.2 years) showed lower ACC+HR-estimated PAEE for clustered activities (including cycle ergometer test) and resting period (clustered activities 2.17 ± 1.17 Kcal/min; resting period 0.19 ± 0.17 Kcal/min) than PAEE measured by IC (clustered activities 2.93 ± 1.27 Kcal/min; resting period 0.61 ± 0.40 Kcal/min). The Bland & Altman plots’ limits of agreement were between -2.28 and +0.94 Kcal/min. Visual inspection showed that the dispersion of the absolute differences between ACC+HR and IC seemed to increase with higher measured values. The correlation between combined ACC+HR-PAEE and IC-PAEE was r=0.86.

Conclusion First results indicate that branched equation models based on combined ACC+HR registrations may underestimate PAEE in older people but appear sufficiently valid for the assessment of mean PAEE in groups. If the relatively large limits of agreement were to persist throughout this ongoing study, they would indicate a limited validity of existing ACC+HR branched equations for the individual assessment of PAEE in older adults. More research is needed to determine whether combined ACC+HR assessments are superior to simple ACC to measure physical activity in older adults.

2689  Board #150  May 29 10:30 AM - 12:00 PM  The Impact Of Sedentary Behavior On Mental Health For Older Adults: A Longitudinal Study Of University Retirees In Beijing China
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Email: fengxiaolu@vip.163.com
(No relevant relationships reported)

PURPOSE: This study was to estimate the impact of physical activity on mental health for older adult from a 5-year follow-up Chinese university retirees study during 2011-2016 in Beijing.

METHODS: We conducted follow-up health surveys on 5503 (2808 males & 3423 females; aged 67.6 ± 8.2, Height = 162.2 ± 7.5 cm, Weight = 63.3 ± 9.8 kg, BMI = 24.1 ± 43.2) older adults enrolled at Beijing from 2011 to 2016. Sedentary behavior (SB) were measured by the translated “Physical Activity Scale for the Elderly” (PASE) questionnaire (Washburn et al., 1993). Mental health were assessed by self-reported self-rated mental health scores (MHSs) in the participants. The data were analyzed using linear individual fixed-effect regressions.

RESULTS: The average time spent in sedentary behavior for men was 12.9 ± 3.3 hours/day. The mean mental health was 2.4 ± 0.7 scores. SB were negatively associated with mental health for older adults. A one hour increase in SB was associated with a decrease in mental health score by 0.25 [95% CI] = 0.19, 0.32. A one hour increase in SB was associated with a decrease in mental among females and males by 0.25 [95% CI] = 0.16, 0.33) and 0.27 [95% CI] = 0.16, 0.37), respectively.

CONCLUSIONS: SB may decrease mental health among older adults in Chinese follow-up study. Increasing SB in male’s older adults tended to decrease their mental health more than females.

2690  Board #151  May 29 10:30 AM - 12:00 PM  Processing Accelerometer Data For Older Adults With COPD
Katelyn Webster, Ronald Dechert, Janet L. Larson. University of Michigan, Ann Arbor, MI.
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(No relevant relationships reported)

Sedentary behavior (SB) is often measured with ActiGraph (AG) accelerometers, but the ActiPAL (AP) is the gold standard device. AG processing methods, including cut-points for SB, filters, and non-wear time algorithms, influence sedentary time estimates. The optimal protocol for processing AG sedentary time in a sample of 45 older adults with chronic obstructive pulmonary disease (COPD). METHODS: Participants were AG and AP monitors simultaneously for 7 days. AG data was processed using all possible combinations of two SB cut-points (<50 counts per minute [cpm] and <100 cpm), two filters (normal and low frequency extension [LFE]), and non-wear algorithms with three different lengths (60, 90, and 120 minutes) for a total of twelve protocols. Concordance correlations between AP-measured SB time and each of the twelve AG SB estimates were calculated using the Bland-Altman method. RESULTS: Concordance correlation coefficients range from 0.579 to 0.772 (see table). The AG cut-point of <50 cpm and the LFE filter resulted in the highest concordance correlations. Correlations were similar between the three non-wear algorithms lengths. CONCLUSIONS: Although the AP is the gold standard for measuring SB, the AG may be an acceptable substitute when optimal processing methods are used. This analysis provides evidence supporting the use of the AG cut-point of <50 cpm for SB and the LFE filter for older adults with COPD. The optimal non-wear algorithm length is less clear.
Older adults represent the fastest growing segment of the population, and spend approximately 60-70% of their waking hours engaging in sedentary behaviors, which increases their risk for functional decline and negative health outcomes. Therefore, interventions aimed at breaking up sedentary time by standing up and moving more throughout the day may have important health benefits for older adults, although well-designed randomized controlled trials (RCT) are limited. PURPOSE: To examine the effectiveness of a four week sedentary behavior intervention to reduce sedentary time and improve physical function in 56 community dwelling older adults (M age = 74 ± 7). METHODS: The intervention consisted of 4 weekly workshop sessions plus a refresher session, and was delivered by community partners from 3 different State Aging Units. A RCT design was implemented assessing sedentary behavior and physical function prior to, immediately following, and at follow-up (8-weeks after intervention). Sedentary time (mins/day) was obtained via accelerometers/inclinometers, and physical function (balance, gait speed, chair stands) was assessed with the Short Physical Performance Battery. Outcomes were analyzed between and within groups using mixed-design repeated measures ANOVAs. RESULTS: There were significant (p<.05) reductions in sedentary time for the intervention group (M = 152 ± 94 mins/day, p<.05) compared to a mean increase of 17 min/day in the control group. However, there was a significant (p<.05) increase in sedentary time from post-intervention to follow-up for the intervention group, with only a 17 min/day decrease from baseline. CONCLUSION: Results indicate that our sedentary behavior intervention reduced sedentary time and improved physical function in older adults, although it appears that additional research is needed in order to ensure this positive behavior change is maintained over time.

Supported by the National Institute on Aging Grant R21AG054916.

### Table: Processing Method

<table>
<thead>
<tr>
<th>Processing Method (Filter &amp; Non-Wear Algorithm Length)</th>
<th>Concordance Correlation (SE)</th>
<th>Mean Difference AG-AP (SD)</th>
<th>95% Limits of Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;50 cpm cut-point</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Normal &amp; 60 min.</td>
<td>0.654 (0.031)</td>
<td>40.0 (107.8)</td>
<td>-171.2, 251.2</td>
</tr>
<tr>
<td>Normal &amp; 90 min.</td>
<td>0.659 (0.030)</td>
<td>59.3 (102.7)</td>
<td>-142.1, 260.6</td>
</tr>
<tr>
<td>Normal &amp; 120 min.</td>
<td>0.666 (0.029)</td>
<td>69.0 (98.5)</td>
<td>-124.1, 262.2</td>
</tr>
<tr>
<td>LFE &amp; 60 min.</td>
<td>0.762 (0.024)</td>
<td>18.2 (94.8)</td>
<td>-167.6, 204.0</td>
</tr>
<tr>
<td>LFE &amp; 90 min.</td>
<td>0.762 (0.024)</td>
<td>28.0 (94.1)</td>
<td>-156.5, 212.5</td>
</tr>
<tr>
<td>LFE &amp; 120 min.</td>
<td>0.772 (0.023)</td>
<td>33.6 (90.5)</td>
<td>-143.8, 211.0</td>
</tr>
</tbody>
</table>

### Table: University, College, and Address

1. University of Wisconsin - Madison, Madison, WI. (Sponsor: Kelli Koltyn, FACSM)

This work was supported by a T32 predoctoral fellowship NIH/NINR NR016914-01, Complexity: Innovations in Promoting Health & Safety and NR016093, Active for Life with COPD.
PURPOSE: To explore the effects of Baduanjin on the blood lipids and serum IL-6,APN in the olders.

METHODS: The healthy old people without regular exercise behaviour were selected from China Rennnin University community , and were divided into the control group(C group,n=9) and the exercise group(E group,n=6) after the physical examination. The subjects took part in the study and gave formal consent. E group carried out Baduanjin for 4 months, while C group kept their routine life especially the daily exercise habits. Body composition and blood were tested at the beginning of the study and four months later, and the blood examination including the blood lipids and serum IL-6,APN.

RESULTS: 1.Body composition Compared with the baseline examination, the lean body mass of 4 months later in E group increased significantly(P<0.05),while the C group showed little different. E group’s body fat percentage and visceral fat mass decreased (P<0.01);and in C group, fat free mass,visceral fat mass hardly changed except the body fat percentage decline(P>0.05).2.Blood Lipids The total cholesterol(TC) of E group were higher than the C’s, and after the 4-month intervention , the E’s TC went down (5.13±1.07vs.4.92±0.74(P<0.05)),but the C’s elevated(P<0.05).3.Great difference were found between the two groups according to the baseline test of serum APN, but after 4-month E’s APN elevated and higher than C’s(P<0.01),while the C’s went down(P<0.05).

CONCLUSIONS: Regular exercise of Baduanjin could improve the body composition, change the blood lipids. Furthermore, Baduanjin exercise had good effect on the regulation of IL-6,APN, which in turn maybe alleviate the chronic gradual low inflammation inside the olders. Acknowledgements: This study was supported by Qigong Administration Center of General Administration of Sport of China.No. QG2016028

Aging promotes a decline in overall physical activity (PA) status and is associated with an increase in risk for numerous adverse health conditions, including poor sleep. Poor sleep quality is a commonly reported complaint in older adults that may accelerate many prevalent health conditions and limit daily functional capacity. Habitual PA for older adults has been shown to increase physical fitness with corresponding reductions in adverse health risks, to include sleep quality. However, a barrier for older adult habitual PA are the commonly reported barriers such as time, cost, transportation and poor education on exercise prescription. A possible approach to minimize barriers to habitual PA may be a home-based self-managed exercise program.

PURPOSE: The purpose of this ongoing pilot study is to describe the effects of a home-based self-managed exercise program on physical activity status and sleep quality.

METHODS: 7 older adults (68±4.7 years) were recruited from area community centers and participate in 6-weeks of the home-based self-managed University of Lynchburg Active Aging Program (ULAAP). Endurance, strength, and balance exercises were prescribed using the National Institute of Aging’s Exercise & Physical Activity Questionnaire (IPAQ).

RESULTS: There was a significant increase in MET-minutes at the end of 6-weeks of PA (pre 2729±2507, post 5626±2850 MET-minutes of light to vigorous exercise; P<0.048) with no change in sleep efficiency (SE pre 73.9±13%, post 84.7±6.6%, P=0.09).

CONCLUSION: Home-based self-managed older-adult exercise program increased overall physical activity status and reduced sedentary time with improved sleep quality. Our result suggests an older-adult self-managed low-impact multimodal exercise program may positively improve sleep quality.

Falls are the leading cause of fatal and non-fatal injuries for older Americans. Modifying exercise programs to address balance and lower body strength would vastly improve balance and functional movement. Past literature has shown balance and strength are important in preventing falls, but few studies have focused on developing strength in a lateral plane compared to an anterior/posterior plane. PURPOSE: To determine if a lateral pedal recumbent training device that allows lower limb movement in a horizontal plane can improve balance scores among older adults in 4 weeks. METHODS: A two group experimental-control multivariate design was selected for the study. All subjects (n = 56) were between the ages of 59-80 years and without any physical limitations or medical issues. All participants were divided into 2 equal groups, pre-tested and post-tested on a 10 -step gait platform (Bertec, Inc. Columbus, OH) to determine Center of Pressure scores with eyes opened (EOSS), Center of Pressure scores with eyes closed (ECSS), Center of Pressure scores with eyes open perturbed surface (EOPS), and Center of Pressure scores with eyes closed perturbed surface (ECPS). The experimental group used the lateral trainer for 15 minutes, 3 times per week, for 4 consecutive weeks while the control group maintained a sedentary lifestyle. A repeated measures MANOVA was used to determine significance between the two groups within the 4 balance assessments.

RESULTS: There were no significant main treatment effects for either group (p = .221). There were statistically significant differences over time for EOPS (p = .047) and ECPS (p = .047). Likewise, there were statistically significant differences for each univariate outcome with EOSS (p = .045) ECSS (p = .033), EOPS (p = .010), and ECPS (p = .026). Statistical power was achieved (> .98) for both univariate and multivariate measures. The multivariate outcome for group x time interaction accounted for 15.2% more variance than time alone (28.1%) for the experimental group alone. CONCLUSION: A recumbent lateral stability device can improve balance scores among older adults within 4 weeks of training, 3 x week for 15 minutes.

Most older adults fail to adhere to the multicomponent (aerobic, muscle strengthening, balance training), 2018 Physical Activity (PA) Guidelines. Thus, effective and sustainable multicomponent PA programs that promote adherence in older adults remains a public health priority, especially for females given their higher rates of physical inactivity and risk for physical disability compared to males. PURPOSE: To examine if sex/gender influences the effects of a multicomponent 10-week PA intervention grounded in Social Cognitive Theory and augmented with social media (Facebook) on program attendance and engagement, PA behaviors, muscle capacity, and lower extremity physical function (LEPF) in older adults. METHODS: Physically inactive older adults (71.3 ± 4.3 yr; n=28, 64% females) completed a 10-week multicomponent PA program that included 1) a twice weekly supervised exercise class (muscle strength and balance training) with PA behavior education, 2) Facebook engagement, and 3) an unsupervised walking prescription. PA behaviors were assessed via accelerometer, questionnaires and pedometer step count logs. Conventional measures of leg strength and power along with a battery of LEPF were assessed (3 repetition maximum and 60 second squats (60% of 1RM) for males and 40 second squats for females). RESULTS: There was a trend for higher class attendance in females compared to males (96.7±3.8% vs. 92.0±6.7%, p=0.06). Females also had a 2.3-fold greater engagement in Facebook compared to males (p=0.01). Males and females improved PA behaviors similarly (T p<0.05; GxT and G p>0.05). Muscle capacity improved similarly (T p<0.05) with males, as expected, having higher leg strength and power (G p>0.05; GxT p=0.05). Regarding LEPF, improvements occurred in 6MW, UPGO and TRANSFER (T p<0.05; GxT p<0.05)
with males also having higher functional capacity, as anticipated, in 6M, UPGO, and CHAIR (G p<0.05). CONCLUSION: A 10-week PA/EX program improves PA behavior, male capacity, and LEFF similarly in older males and females. Implementation science research is needed to develop effective and sustainable multicomponent PA programs for older adults which may differ by social factors in older females compared to males.

2698 Board #159 May 29 10:30 AM - 12:00 PM
Estimated Cardiorespiratory Fitness, Comorbidity, And Health-related Quality Of Life In Korean Older Adults With Diabetes
Inhwan Lee, Youngyun Jin, Jeonghyeom Kim, Minjung Kang, Yujin Lee, Hyunsik Kang. Sungkyunkwan University, Suwon, Korea, Republic of.

Purpose: Health-related quality of life (HRQoL) is a multidimensional subcomponent of quality of life that can be affected by health or health-related interventions. This study examined whether or not non-exercise-based estimation of cardiorespiratory fitness (eCRF) mediates the relationship of comorbidity with HRQoL in Korean older adults with diabetes.

Methods: Data from a subgroup (n=1371) of Korean older adults with diabetes and age of ≥60 years (55% women) who participated in the 2008-2011 Korean National Health and Nutritional Examination Survey were used in this analysis. HRQoL was assessed with the EuroQol-5 dimensions index and EuroQol visual analogue scale. Comorbidity was defined as physician-diagnosed chronic conditions. eCRF was assessed with a non-exercise regression equation derived from sex, age, body mass index, and self-reported physical activity. The SPSS macro provided by Preacher and Hayes was used to test whether CRF mediated the relationship between comorbidity and HRQoL at p<0.05.

Results: The total effect of the presence of comorbidities on HRQoL was significant (path cβ=-2.670, 95% CI=-3.686 ~ -1.472, p<0.001). The presence of comorbidities was negatively related to eCRF in HRQoL model (path β=-0.592, 95% CI=-0.652 ~ -0.404, p<0.001). The effect of eCRF as a mediator on HRQoL was also significant (path bβ=-1.434, 95% CI=-0.928 ~ -1.940, p<0.001). The mediation analysis using the bootstrapping method (5,000 resamples) showed that eCRF mediated the relationship between the presence of comorbidities and HRQoL in Korean older adults (path abβ=-0.757, 95% CI=-1.104 ~ -0.453, Sobel test Z=-2.753, p<0.001). In addition, a direct effect of the presence of comorbidities on HRQoL was also significant (path cβ=-1.913, 95% CI=-3.128 ~ -0.698, p<0.05).

Conclusions: The current findings suggest that cardiorespiratory fitness (CRF) can contribute to explain the relationship between comorbidity and HRQoL in Korean older adults with diabetes, implying the clinical relevance that promotion of CRF may have an impact beyond physical health in the patients. This study was supported by the National Research Foundation funded by the Korean Government (NRF-2019R1I1A1A01043771).

2699 Board #160 May 29 10:30 AM - 12:00 PM
Stand Up Now: A Sedentary Behavior Intervention In Older Adults Of Moderate-to-low Physical Function
Katie J. Thrall1, Susan S. Levy2. 1Seattle Pacific University, Seattle, WA. 2San Diego State University, San Diego, CA.

Email: kthrall@spsu.edu

No relevant relationships reported

BACKGROUND: Sedentary behavior (SB) is associated with impaired physical function, falls, and higher mortality in older adults, which in turn leads to loss of physical independence. PURPOSE: The purpose of this feasibility study was to examine the efficacy of a 12-week intervention, Stand Up Now (SUN), to reduce SB and improve physical function and mobility in older adults of moderate-to-low function residing in assisted living facilities. METHODS: SUN included two intervention groups: one group focused on reducing total sedentary time (SUN1); one group focused on increasing sit-to-stand (STS) transitions (SUNSTS). All participants (N=71; M=78.7±7.5yrs) received weekly coached health walking over 12 weeks. SB, physical function, and mobility were measured at baseline, 6, and 12 weeks via the activPAL™, Short Physical Function Battery (SPPB), and the 8-foot up-and-go (88 UG), respectively. Linear Mixed Models were used to examine the efficacy of SUN on outcome variables over time RESULTS: Both groups significantly decreased sedentary time (13.0±3.0hrs, p<0.001) and increased standing time (0.5±0.2hrs, p<0.02) at 6 weeks that was maintained at 12 weeks, compared to their baseline. SUNSTS significantly increased STS transitions at 6 weeks (5.4±1.4, p<0.001) while SUN1 had no changes (0.5±3.1, p=0.9). No changes were noted in stepping time (0.04±0.08hrs, p=0.15) or steps (261±234, p=0.14) per day in either group. Both groups improved physical function from baseline to 6 weeks (1.5±0.4 points, p=0.01) that was maintained at 12 weeks. No significant changes were seen in mobility for either group (0.5±1.5sec, p=0.05). CONCLUSIONS: SUN demonstrates the efficacy to improve SB and physical function and may be a promising strategy to maintain function for activities of daily living to prevent loss of independence in older adults.

2700 Board #161 May 29 10:30 AM - 12:00 PM
Association Between Air Pollution And Daytime Sleep Duration: A Follow-up Study Of Chinese Older Adults In Beijing
Miao Yu1, Hongjun Yu1, Weimo Zhu, FACSMM. 1Renmin University of China Libraries, Beijing, China. 2Tsinghua University, Beijing, China. 3University of Illinois at Urbana-Champaign, Urbana, IL. (Sponsor: weimo zhu, FACSMM)

Email: ymialuo@ruc.edu.cn

No relevant relationships reported

PURPOSE: This study was to estimate the association between air pollution and daytime sleep duration for older adults from the 5-year follow-up survey of Chinese older adults surveys during 2011-2016 in Beijing, China.

METHODS: We conducted follow-up health surveys on 5503 (2080 males & 3423 females; Age 67.6 ± 8.2 yr., Height = 162.2 ± 7.5 cm, Weight = 63.9±9.8 kg, BMI = 24.1 ± 4.3 2011) older adults enrolled at Beijing from 2011 to 2016, once per year. Sleep duration was measured using the Pittsburgh Sleep Quality Index (PSQI), which has been validated in China to measure sleep duration. Corresponding levels of average hourly PM2.5 (µg/m³) on the survey days were gathered from data provided by the mission China air quality monitoring program run by the US Department of State in Beijing. The data were analyzed using the linear individual fixed-effect regression.

RESULTS: The average time spent in daytime sleep for older adults was 0.6 ± 0.5 hours/day. The mean PM2.5 was 123.9 ± 52.5 (µg/m³). Daytime sleep was positively associated with air pollution for older adults. Overall, an one standard deviation (SD) increase in air pollution concentration in PM2.5 (56.6µg/m³ ) was associated with an increase in daytime sleep hours by 1.49 (95% confidence interval [CI] = 1.17, 1.81), with the corresponding increases in females and males were 0.91 (95% CI = 0.33, 1.49) and 1.82 (95% CI = 1.34, 2.30) hours, respectively.

CONCLUSIONS: Increased air pollution seems led more daytime sleep among older Chinese adults and the impact on males was more significant than females.

2701 Board #162 May 29 10:30 AM - 12:00 PM
Concurrent Training Reduces Depressive Symptoms In Mexican Female Older Adults
Ermilo Canto Martínez1, Iván Rentería1, José Moncada Jiménez2, Patricia Concepción García Suárez1, Luis Mario Gómez Miranda1, José Antonio De Paz Fernández2, Alberto Jiménez Maldonado1. 1Universidad Autónoma de Baja California, Ensenada, Baja California, Mexico. 2Universidad de Costa Rica, San José, Costa Rica. 3Universidad Autónoma de Baja California, Tijuana, Baja California, Mexico. 4Universidad de León, León, Spain.

Email: ecanton@uabc.edu.mx

No relevant relationships reported

Nearly 35% of Mexican older adults (OA) are diagnosed with mild depression. Exercise has shown positive effects on reducing depression symptoms in OA. The correlation between physical function, body composition and mild depression risk in healthy OA has been neglected in Mexico. PURPOSE: To determine the effect of a concurrent-training exercise program (CTEP) on mild depression in Mexican female OA. A secondary aim was to determine the correlation between physical function, body composition and depressive symptoms in OA following a CTEP. METHODS: Twenty-one females (age= 64.0 ± 5.3 yr., weight= 72.0 ± 12.6 kg, BMI= 29.0 ± 4.7 kg/m²) participated in the study. Before (Pre) and after (Post) the CTEP, participants were measured on depression by the Hamilton Depression Rating Scale (HAM-D: 0= no body fat, muscle mass [MM]), physical function by the Senior Fitness Test, and aerobic capacity by the 6-min walking test (6MWT). The CTEP consisted in two days of aerobic exercise and one day of resistance training performed for 50-min at moderate intensity (12 to 14 on Borg’s RPE scale) for 12-weeks. Paired t-tests were computed to compare pre- to post-CTEP effects, and Spearman correlation tested the association between body composition, physical function and depression scores using the GraphPad PRISM 5.0 software.

RESULTS: The CTEP reduced HAM-D scores (Pre= 15.7 ± 4.5 vs. Post= 10.3 ± 5.3 pts., p<0.001), improved upper-body strength (Pre= 15.1 ± 2.6 vs. Post= 18.9 ± 3.0 reps, p<0.001), lower-body strength (Pre= 12.0 ± 2.4 vs. Post= 14.5 ± 2.9 reps, p<0.001), agility (Pre= 6.5 ± 0.9 vs. Post= 6.6 ± 0.9 s, p<0.001), and MM (Pre= 21.8 ± 2.9 vs. Post= 22.2 ± 3.1 kg, p<0.002). No significant changes were found in aerobic capacity (Pre= 587.9 ± 164.4 vs. Post= 619.6±144.9 min, p=0.06) and body fat (Pre= 31.0 ± 8.8 vs. Post= 30.8 ± 9.1%, p< 0.05). The HAM-D scores were inversely correlated with upper-body strength (r= -0.53, p<0.002) and lower-body strength (r= -0.64, p=0.002), and directly correlated to agility (r= 0.50, p= 0.004).

CONCLUSIONS: A CTEP reduced depressive symptoms in Mexican female OA in
spite of lack in changes by body composition. The increased physical function relates to a reduction in depressive symptoms; thus, highlighting the importance of improving functionality in OA.

Limited data are available for the examination of the associations of physical activity (PA) and sedentary behavior (SB) with the onset of long-term care need (OLCN) in older adults.

**PURPOSE:** The purpose of this study was to investigate the independent and joint associations of moderate PA (MPA) and SB and on the OLCN among Japanese elderly in the local municipality.

**METHODS:** A cohort of 3937 Japanese elderly men [median (IQR) age 74 (65−99) years] and 2048 women [median (IQR) age 74 (65−99) years] without certification of long-term care need have reported on PA and SB in 2016. The participants were divided into three groups: 0-99 min/week; MPA-M1, 100-299 min/week; MPA-M2 and 300 min/week; MPA-M3. The associations between PA and SB and the outcome were examined using Cox proportional hazards regression models with backward elimination. To test the joint association of MPA and SB, the effect of MPA were analyzed along with that of SB with the MPA-none & SB-M as reference, HRs and 95% CIs for MPA-M1 and MPA-M2 were 0.67 (0.51−0.86) and 0.48 (0.35−0.66), respectively (P for trend < 0.001) and using lower SB (SB-M) as reference, HR and 95% CI for higher SB (SB-M2) was 0.74 (0.58−0.94). With the joint effects of MPA and SB, using MPA-none & SB-M as reference, HRs and 95% CIs for MPA-M1 & SB-M1, MPA-M2 & SB-M2, MPA-M3 & SB-M3, and MPA-M & SB-M were 0.62 (0.44−0.87), 0.58 (0.42−0.82), 0.50 (0.34−0.74), 0.39 (0.26−0.60), and 0.39 (0.25−0.62), respectively. CONCLUSIONS: These results suggest that MPA and SB might be independent factors for the onset of long-term care need and that these factors might have a strong joint effect on the onset.

**PURPOSE:** Analyze the effect of 16-weeks of eccentric and concentric training on physical function and body composition of older adults.

**METHODS:** Sixteen-weeks of strength training with an emphasis on concentric/eccentric contractions in six groups: Eccentric Training N=12 (ET); Concentric Training N=12 (CT) and Control Group N=12 (CG). Functional training was analyzed through the use of 30-second walking test (6MWT), and estimated VO2 and the VO2 max were recorded before and after completion of the program. Each training session was performed for 50-min at moderate intensity (12 to 14 on Borg’s RPE scale), with three-days of aerobic exercise and two-days of resistance training, accumulating five sessions per week for 12 weeks. Paired Student’s t-tests with Cohen’s effect sizes were computed on JASP v0.9.2 software.

**RESULTS:** No significant changes were observed on BMI (Pre= 28.3 ± 3.9 vs Post= 28.6 ± 4.2 kg/m², p= 0.067, d= 0.35), body fat (Pre= 39.8 ± 7.1 vs Post= 40.1 ± 7.4%, p= 0.63, d= 0.09), MM (Pre= 27.7 ± 4.1 vs Post= 22.8 ± 4.1 kg, p= 0.15, d= 0.27), Mmax (Pre= 9.1 ± 0.9 vs Post= 8.0 ± 3.1 kg/m², p= 0.059, d= 0.34), TC (Pre= 183.2 ± 68.9 vs Post= 175.8 ± 115 mg/dL, p= 0.07, d= 0.05), 6MWT distance (Pre= 400.7 ± 105.7 vs Post= 475.8 ± 107.2, p= 0.009, d= 0.02) and VO2 max (Pre= 29.4 ± 6.9 vs Post= 27 ± 7.1 ml•kg⁻¹•min⁻¹, p= 0.46, d= 0.13). Significant reductions were found on GLU (Pre= 98.0 ± 54.4 vs Post= 77.5 ± 43.5, p= 0.011, d= 0.45), TC (Pre= 122.2 ± 82.0 vs Post= 99.5 ± 65.6 mg/dL, p= 0.05, d= 0.34), TP (Pre= 6.5 ± 2.6 vs Post= 4.3 ± 1.5 mg/dL, p= 0.001, d= 0.90), and ALB (Pre= 3.7 ± 1 vs Post= 2.9 ± 0.9 mg/dL, p= 0.001, d= 0.80). CONCLUSION: A moderate-length 12-week exercise program improved GLU and TG levels in older adults. The lowered TP and ALB with a concomitant decrease of the Mmax reduction suggest a metabolic overreaching tendency to undernutrition after the program.

**PURPOSE:** To examine the effect of location of a PA intervention on physical function, PA and sedentary behavior in older adults.

**RESULTS:** TUG was significantly lower in ET and CT compared to CG after 16 weeks of strength training (13.6 ± 0.7 to 17.0 ± 0.2 and 13.8 ± 0.6 to 17.0 ± 0.7 with p=0.001) without significant difference between intervention groups. The 30-second chair test was significantly higher in ET and CT compared to CG (11.9 ± 0.7 to 6.1 ± 0.7 with p<0.001 and 10.9 ± 0.6 to 6.1 ± 0.7 with p=0.01 respectively). Hand Grip was statistically better in ET and CT compared to CG (21.5 ± 0.5 to 17.2 ± 0.5 with p= 0.021 and 21.4 ± 0.6 to 17.2 ± 0.5 with p=0.002). The 3M4 reductions were 6% higher in ET compared to CT and 19% higher compared to CG. BTH was significantly higher in ET compared to CG (0.46 ± 0.143 cm to 0.08 ± 0.137 with p=0.001) without differences between ET and CT. FRTH was significantly higher at the end of 16 weeks in ET and CT compared to the pretest (2.40 ± 0.2 to 2.67 ± 0.19 cm with p=0.01 respectively). Hand Grip was statistically better in ET compared to CG (21.5 ± 0.5 to 17.2 ± 0.5 with p= 0.021 and 21.4 ± 0.6 to 17.2 ± 0.5 with p=0.002).

**CONCLUSIONS:** Both ET and CT promote improvements in the functionality and the body composition of older adults; however, no statistical change was observed between ET/CT groups.

**Abstracts were prepared by the authors and printed as submitted.**
aimed to improve physical function outcomes (usual gait speed, UGS; 6-minute walk, 6MW; timed up and go, TUG), self-regulation and long-term maintenance of PA (CHAMPS questionnaire). The PA intervention was held in government subsidized housing complexes where participants lived (PA-NF, n=22 participants) or in convenient neighborhood facilities (PA-NF, n=18 participants). The intervention, based on self-regulation principles, includes a 10-week moderate intensity strength, flexibility and aerobic group exercise class 60 minutes/3 times/week plus a 6-month maintenance period with bi-weekly telephonic calls. Measures were assessed at baseline, after the 10-week group exercise class, and following a 6-month maintenance period. Participants included 6 males and 34 females, aged 59-85 years (M=67.9, sd=6.40) with mean BMI 34.2±(sd=9.19, range 14.99-57.47). 47.5% were morbidly obese.

**Results**: Significant improvements (p<0.01) in TUG, UGS, 6MW, moderate intensity and total PA and self-regulation were found immediately following the 10-week group class and were maintained for 6 months (p<0.01) in the PA-Amt group of all ages and have a significant impact upon golfer’s lives. Before suggesting that golfers limit their golf participation, other injury prevention avenues must be investigated to ensure that participation in physical activity is not viewed as harmful. Further, prevention strategies need to be investigated in relation to specific characteristics of golfers to attempt to reduce injury risk.

**Method**: The current study suggests that energy expenditure and sleep quality in older adults.

**Purpose**: Omentin-1 is a good adipokine produced by omental adipose tissue and plays a pivotal role in regulating the insulin resistance. The aim of this study was to compare serum omentin-1 concentration together with insulin resistance markers in active-obese, inactive-obese, normal-weight Chinese older adults.

**Methods**: 128 older adults (men: n=32, women: n=96) were recruited to participate in this study. Subjects were divided into the following three groups. 1) active-obese (n=49, age=63±6years; BMI=25±2.2kg/m²); 2) inactive-obese (n=48, age=66±6years; BMI=26±5.2kg/m²); 3) normal-weight (n=31, age =64±5years; BMI=21±1.1kg/m²). ActiGraph GTX-3 BT triaxial accelerometers were used to measure the levels of physical activity. We define it as active subjects based on average number of minutes spent on the moderate-to-vigorous physical activity (180min/week).

**Results**: The results showed that omentin-1 concentration was significantly lower in obese than normal-weight group (17.1±12.4 vs. 24.1±13.4ng/ml; p<0.01). Meanwhile, Glucose, insulin and HOMA-IR was significantly higher in obese than in normal-weight group (5.3±1.2 vs. 4.8±0.44mM/L; 7.9±3.3 vs. 4.7±1.9µU/mL, 1.94±1.8 vs. 1.00±0.39, both p<0.05). However, there was no significant difference between serum omentin-1 levels and glucose in active-obese and inactive-obese groups (both p>0.05). Insulin and HOMA-IR in active-obese were significantly lower than inactive-obese group (7.21±2.5 vs. 8.81±3.4µU/mL, 1.68±0.90 vs. 2.22±1.41, both p<0.05).

**Conclusion**: Our results suggested that physical activity can improve the negative effects of obesity on insulin resistance markers, but did not affect the concentration of omentin-1 significantly of obese older adults.

**Acknowledgments**: This study was supported by the Ministry of Science and Technology of the People’s Republic of China (Grants No.2013FY11407).

**INTRODUCTION**: Chronic low-grade inflammation (CLGI) is a hallmark of aging and significantly contributes to the development and progression of numerous chronic diseases including cardiovascular disease (CVD) and diabetes. CLGI is frequently defined as elevated serum levels of inflammatory proteins including c-reactive protein (CRP) and interleukin-6 (IL-6). Physical activity has been reported to have anti-inflammatory effects. **Purpose**: To explore the relationships among habitual physical activity, inflammation, and cardiometabolic risk factors in older adults.

**Methods**: In 82 subjects (23 male / 59 female) body composition was determined.
A significant group x time interaction was found for TC with a ≤0.05. A significant group x time interaction was found for TC with a ≤0.05.

A significant group x time interaction was found for TC with a ≤0.05.

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A significant group x time interaction was found for TC with a ≤0.05.
Resistance training (RT) programs employing an undulating periodization (UP) model have consistently shown to enhance muscle strength and physical performance in both trained and sedentary subjects; however, the effects on an elderly population are less studied. PURPOSE. This research aimed to compare the effects of UP vs. linear training (LT) on strength levels and functional capacity in elderly adults. METHODS. Eighteen (n=10; men; n=8; women) untrained elderly individuals (64±2 years; height=165.17±7.2 cm; body mass=72.5±11.4 kg) with no previous RT experience were randomly assigned to either a linear training (n=9; LT) or UP (n=9) program. Assessments: Chair stand test (CST), chair sit and rise (CSR), arm curl test (ACM), the 6-min walk test (6MWT), back scratch test right side (B SR), IRM rowing machine (RM), IRM vertical bench press (VP), IRM leg extension (LE), IRM unilateral leg press (ULP) and IRM squat based on mean velocity concentric. RESULTS. According to the analysis (A=5SD; P=ES to LT and UP, respectively), there were significant changes in CST (3.8±1.3 s; P=0.01 and 3.0±1.0 s; P=0.03), 6MWT (250±92.66 s; P=0.03 and 376±156 s; P=0.005), IRM bench press (VPB) (13.6±3.0 kg; P=0.001 and 14.2±2.0 kg; P=0.000), IRM leg extension (LE) (10.8±3.1 kg; P=0.003 and 11.5±2.5 kg; P=0.025), IRM unilateral leg press (ULP) (13.6±5.8 kg; P=0.000 and 14.3±4.4 kg; P=0.002), IRM squat (17.0±4.9 kg; P=0.000 and 17.8±3.1 kg; P=0.008). CONCLUSIONS: A supervised RT program using either linear or undulating periodized design has positive effects on indicators of functional autonomy and physical fitness in older adults, highlighting that the RT protocol generated the largest changes. Keywords: Power muscle, aging, muscle training

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showed statistically significant differences between groups with or without prefrailty in both men (with:23.2±3.2 kg, without:37.3±5.6 kg) and women (with:13.7±1.2 kg, without:23.7±3.5 kg) as well. The walking speed showed statistically significant difference between groups in both males (with:1.65 ±0.22 m/sec, without:2.06 ±0.51 m/sec) and females (with:1.49±0.28 m/sec, without:1.83±0.25 m/sec). After 4 years, an analysis of covariance using age as a co-variable showed that the changes of grip strength were significantly different between two groups (p<0.05), but the walking speeds were not significantly different between two groups. Changes in walking speed were increased in both groups with or without prefrailty (with: +0.10±0.17 m/s, without: -0.04±0.08 m/s). There were no gender differences in changes of grip strength and walking speed.

CONCLUSIONS: This is the first demonstration that the long-term participation in effective health-care classes contributed effectively increased walking speed in elderly adults with and without prefrailty.

2717 Board #178 May 29 10:30 AM - 12:00 PM Effects Of A Non-linear Resistance Training Program On Biochemical And Physiological Health Parameters In Elderly
Diego A. Bonilla1, Javier Benítez-Porres2, Ramón Romance1, Ignacio Medina1, Jorge L. Petro2, Brad J. Schoenfeld2, Manuel García-Sillero1, Richard B. Kreider, FACSM1, Salvador Vargas-Molina1.
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(No relevant relationships reported)

Resistance training (RT) has been shown to have positive effects on older adults’ health by increasing muscle mass and improving metabolic profile. Nonetheless, the potential benefits of a non-linear RT program on biochemical and physiological health parameters in older individuals are less known. PURPOSE: This study assessed the effects of an undulating-periodized (UP) RT program on glucose, total cholesterol (LT=-21.9±14.6 mg·dL-1; -1.19; 0.005, UT=-10.2±6.2 mg·dL-1; -0.28; 0.014) and triacylglycerol (TG) concentrations in blood, and arterial blood pressure (BP).

METHODS: Seventeen (n=9 men; n=8 women) untrained elderly individuals (64.2±2.0 years, 72.2±10.8 kg, 164.8±7.6 cm; 25.6±2.6 kg·m-2) were randomly assigned to either a linear training (n=9, LT) or UP-RT (n=9) program. After 3 weeks of familiarization, all participants performed three weekly workouts for 8 weeks. Blood samples were collected pre- and post-study after a 12-hour overnight fast, and biochemical analyses were carried out. Systolic and diastolic BP were measured using a digital sphygmomanometer. Statistical comparison was performed with the paired t test or Wilcoxon, and a repeated measures ANOVA model.

RESULTS: Basal glycemia (ES=0.77, 95% CI=0.43 to 1.10, I2=0.0%) and TG (LT= -18.3±16.0 mg·dL-1; -0.56; 0.014, UP=-6.7±3.9 mg·dL-1; -0.24; 0.001) were significantly different between two groups (LT vs. UP). Brachial arterial stiffness (ES=0.31, 95% CI=0.06 to 0.56, I2=0.0%) and blood pressure (SBP, DBP, and MAP) were not significantly different between groups. Changes in walking speed were increased in both groups with or without prefrailty (with: +0.10±0.17 m/s, without: -0.04±0.08 m/s). There were no gender differences in changes of grip strength and walking speed.

CONCLUSIONS: This is the first demonstration that the long-term participation in effective health-care classes contributed effectively increased walking speed in elderly adults with and without prefrailty.

2719 Board #180 May 29 10:30 AM - 12:00 PM Exercise Interventions, Physical Function And Mobility After Hip Fracture: A Meta-Analysis
Xiaorui Zhang1, William J. Butts2, Yushi Hu1, Tongjian You, FACSM1. 1Chengdu Sport University, Chengdu, China. 2University of Massachusetts Boston, Boston, MA. (Sponsor: Tongjian You, FACSM)
(No relevant relationships reported)

PURPOSE: To conduct a meta-analysis of current evidence regarding the effects of exercise interventions on physical function and mobility in individuals after hip fracture. METHODS: This meta-analysis was conducted following the PRISMA guidelines. An electronic search using a number of keywords (“hip fracture” or “trochanteric fracture” or “femoral neck fracture” and “exercise” or “physical activity” or “locomotion” or “movement” and “human” and “randomized controlled trial”) in six databases (Pubmed, Embase, Cochrane Library, Web of Science, Clinical and PsychINFO) was performed from their inception to September 2019. Inclusion/ exclusion criteria limited articles to randomized controlled trials investigating the effects of exercise interventions on physical function and mobility after hip fracture, compared to non-exercise controls. Standardized mean differences, relative effect sizes (ES; Hedge’s) and heterogeneity statistics (I2) were calculated using a random-effects model. RESULTS: Among 2028 citations retrieved, 15 citations (15 studies) met the inclusion criteria, and all were conducted in older adults (n=1196, age=80.04±7.72 yrs). The interventions included aerobic exercise only (n=1), resistance exercise only (n=3), functional exercise only (n=1), and various combinations of aerobic, resistance, functional, and/or balance exercise (n=10). The pooled Hedge’s SMD for overall physical function was 0.46 (95% CI=0.27 to 0.65, p<0.001, I2=58.9%) in favor of exercise interventions. Exercise interventions also had a significant effect on mobility (ES=0.22, 95% CI=0.08 to 0.36, p<0.001). The mean ESs on balance (ES=0.50, 95% CI=-0.31 to 0.69, I2=11.1%), muscle strength (ES=0.30, 95% CI=0.14 to 0.47, I2=0.0%), activities of daily living (ES=0.20, 95% CI=0.04 to 0.35, I2=0.0%), and self-efficacy (ES=0.39, 95% CI=0.19 to 0.60, I2=0.0%) were also significant. There was no publication bias on Egger’s test (p>0.302). CONCLUSION: Our findings suggest that exercise interventions can improve physical function and mobility in older adults after hip fracture. As exercise is a promising rehabilitation for this special population, future research is needed to establish best practices.
Nutritional misinformation may hinder healthy attitudes and impair athletes’ performance. **PURPOSE:** To compare the frequency of right understanding and behaviour on nutritional related issues among male and female elite Brazilian athletes.

**METHODS:** A total of 128 athletes, age 24.4±4.5 yrs, (61 males) who competed various modalities at international competitions participated in the study. The frequency of right answers (based on scientific literature) and the odds ratios for the association with sex were calculated. **RESULTS:** The table shows the frequency of right answers by sex.

<table>
<thead>
<tr>
<th>Questions</th>
<th>Female (%)</th>
<th>Male (%)</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding questions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is it important to eat more calories on more intensive training days?</td>
<td>56.7</td>
<td>65.5</td>
<td>0.68</td>
</tr>
<tr>
<td>Is it important to adjust the calories intake on rest days?</td>
<td>77.6</td>
<td>75.4</td>
<td>1.13</td>
</tr>
<tr>
<td>Do proper dietary recommendations benefit the athlete?</td>
<td>53.7</td>
<td>45.9</td>
<td>1.36</td>
</tr>
<tr>
<td>Is it important to eat fruits and vegetables as a source of vitamins and minerals?</td>
<td>7.4</td>
<td>14.7</td>
<td>0.46</td>
</tr>
<tr>
<td>Are dairy products sources of calcium and vitamin D?</td>
<td>74.6</td>
<td>80.3</td>
<td>0.72</td>
</tr>
<tr>
<td>Is water sufficient to replace all that is lost in sweat?</td>
<td>8.9</td>
<td>3.2</td>
<td>2.90</td>
</tr>
<tr>
<td>Is it important to eat in the first 45-60 minutes after training?</td>
<td>32.8*</td>
<td>8.1</td>
<td>5.47</td>
</tr>
<tr>
<td>Behaviour Questions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I increase carbohydrate consumption before competitions</td>
<td>30.3</td>
<td>41.6</td>
<td>0.60</td>
</tr>
<tr>
<td>I try to consume a lot of protein regardless of origin</td>
<td>48.4</td>
<td>49.1</td>
<td>0.97</td>
</tr>
<tr>
<td>I have protein supplements prescriptions by qualified professionals.</td>
<td>59.7</td>
<td>70</td>
<td>0.63</td>
</tr>
<tr>
<td>I Take sports drink</td>
<td>70.1</td>
<td>77</td>
<td>0.70</td>
</tr>
</tbody>
</table>

*p<0.05 (female% >male%), OR = odds ratios

The only significant sex difference was the higher misunderstanding of males regarding the attitude towards the importance of eating after training. Depending on the questions, there was a large range in the % of adequate answers. **CONCLUSION:** A screening questionnaire, as used in the present study, may therefore guide to identify some specific aspects that deserve more focus in an educational intervention.

**PURPOSE:** To determine the relative validity and reproducibility of an athlete-specific FFQ for assessing food group intake in high performing athletes.

**METHODS:** Athletes (n=66), 16-35 years, from several sports competing at regional level or above completed a 129-item FFQ at baseline (FFQ1) and four weeks later (FFQ2) to assess reproducibility. An estimated 4DFR was completed between these assessments to determine FFQ1 validity. Agreement between methods was assessed using Wilcoxon signed rank tests, Spearman correlation coefficients, cross-classification and the weighted kappa statistic.

**RESULTS:** The FFQ overestimated intake for 17 of 28 food groups compared with the 4DFR (p<0.05). Correlations ranged from 0.11 (processed meats) to 0.78 (tea, coffee & hot chocolate), with a mean of 0.41. Correct classification of food groups into the same tertile ranged from 35.4% (starchy vegetables) to 55.3% (fats & oils). Misclassification in the opposite tertile ranged from 4.6% (legumes) to 15.4% (starchy vegetables, sauces & condiments). The weighted kappa demonstrated fair to moderate (k = 0.21-0.60) agreement for most food groups. FFQ1 intake was significantly higher than from FFQ2 for 13 food groups (p<0.05). Reproducibility correlations ranged from 0.49 (potato chips; fats & oils) to 1.00 (tea, coffee & hot chocolate), with a mean of 0.65. Using tertiles, most (20 of 23 assessed) food groups had >50% of participants correctly classified and <10% grossly misclassified, and demonstrated moderate to good agreement (k=0.61-0.8).

**CONCLUSIONS:** The FFQ showed reasonable relative validity and good reproducibility for assessing food group intake in high performance athletes in New Zealand. The FFQ could be used in future research to assess athletes’ food group intake.
using a semi-structured question format. Interviews were audio-recorded, transcribed and thematically analyzed, then mapped to the foodservice system framework using a logic model as per case study reporting.

**RESULTS:** There were 7 major themes that emerged from the data: 1) consumers' expectations of food provision are increasing; 2) the menu needs improvement in design and delivery but is limited by the catering system; 3) early planning and coordination of the nutrition service in the food program is important; 4) previous experience and training of staff minimizes challenges; 5) there is greater demand to cater for food allergies and intolerances, which increases the risk to stakeholders; 6) food provision is segregated between the village and venues, which impacts the efficiency of the system; and, 7) better technology for labeling and communication of the menu is essential. Barriers were reported as organizing committees' viewpoints, limited budget for catering, local food environment, poor understanding of nutrition expertise, and segregation of food delivery. Mapping using a systems approach demonstrated that change is needed to the food vision and catering tender, due to the disconnect between high level policy and operation.

**CONCLUSIONS:** Development of a framework for provision of nutritionally adequate, culturally suitable and safe food will ensure consistency for future competition events.

### 2724 Board #185 May 29 9:30 AM - 11:00 AM Association Between Carbohydrate Intake And The Dental Caries Presence In University Athletes

Sayra Nataly Muñoz-Rodríguez, Alejandro Gaytan-Gonzalez, Sergio Alejandro Copado-Aguila, Marisol Villegas-Balcazar, Juan Ricardo Lopez-Taylor. Universidad de Guadalajara, Guadalajara, Mexico.

(NO relevant relationships reported)

**PURPOSE:** To analyze the association between carbohydrate intake and consumption of sugar group servings with the presence of dental caries in college athletes.

**METHODS:** 159 (90 men, 69 women) college athletes from different sports were evaluated. 24-hour dietary recalls were administered to estimate the carbohydrate intake and the number of sugar servings consumed. In the same period, a dental evaluation was performed to determine oral health and possible dental injuries (specifically dental caries). Logistic regression analysis was performed to analyze the association between carbohydrate intake (g/day, g/kg/d, or categories as ≤3 g/kg/day, 3.1 to 5 g/kg/day, and > 5.0 g/kg/day), sugar group servings (sugar, honey, jam, jelly, sweet beverages) and the presence of dental caries.

**RESULTS:** 22 athletes (13.8%) presented dental caries. Carbohydrate intake was not significantly associated with dental caries when expressed in g/day (OR [95% CI], 1.00 [0.966 - 1.003]; p = 0.810), nor g/kg/d (0.992 [0.992 - 1.232]; p = 0.943). The amount of sugar servings consumed was neither significantly associated with caries (1.010 [1.000 - 1.014], p = 0.793). In the analysis by carbohydrate categories (<3 g/kg/day reference group) consuming 3.1 to 5 g/kg/day (0.779 [0.191 - 3.180]; p = 0.728), neither >5.0 g/kg/day (1.303 [0.467 - 3.848]; p = 0.598) was associated with the presence of dental caries. Even after adjusting the model, there were no significant associations between carbohydrate and sugar servings with dental caries (Table 1).

**CONCLUSIONS:** Carbohydrate intake (expressed as g/day, g/kg/d, and categories) nor the number of sugar servings consumed was associated by themselves with the presence of dental caries. Further research is needed to elucidate if other non-dietary variables might modulate the association of carbohydrate intake and the presence of dental caries.

<table>
<thead>
<tr>
<th>Model</th>
<th>Variables</th>
<th>OR</th>
<th>95% CI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sugar servings</td>
<td>1.022</td>
<td>0.937 to 1.115</td>
<td>0.620</td>
</tr>
<tr>
<td></td>
<td>CHO (g/d)</td>
<td>0.999</td>
<td>0.995 to 1.115</td>
<td>0.633</td>
</tr>
<tr>
<td>2</td>
<td>Sugar servings</td>
<td>1.014</td>
<td>0.935 to 1.100</td>
<td>0.736</td>
</tr>
<tr>
<td></td>
<td>CHO (g/kg/d)</td>
<td>0.973</td>
<td>0.760 to 1.246</td>
<td>0.827</td>
</tr>
<tr>
<td>3</td>
<td>Sugar servings</td>
<td>1.012</td>
<td>0.937 to 1.093</td>
<td>0.760</td>
</tr>
<tr>
<td></td>
<td>CHO (3.1 to 5 g/kg/d)</td>
<td>1.639</td>
<td>0.419 to 6.416</td>
<td>0.478</td>
</tr>
<tr>
<td></td>
<td>CHO (&gt;5 g/kg/d)</td>
<td>1.200</td>
<td>0.274 to 5.266</td>
<td>0.809</td>
</tr>
</tbody>
</table>

**Adjusted model 3:** ≤3 g/kg/day reference group. CHO: Carbohydrates.

### 2725 Board #186 May 29 9:30 AM - 11:00 AM Assessment Of Pre-season Body Composition, Meal Patterns, Food Choices And Preferences In NCAA Division 1 College Athletes

Jennifer Peluso, Takudzwa A. Madzima, Hanna Clay, Suzanne Hoskinson, Melissa Marazzi, Shafali Christopher, Srikant Vallabhatjulasai, Svetlana Nepo cachys. Elon University, Elon, NC. (Sponsor: Eric Hall, FACSM)

Email: jpeluso@elon.edu

(NO relevant relationships reported)

The transition from high-school to college is typically associated with substantial changes in body composition, eating patterns, and food choices. **PURPOSE:** To assess pre-season body composition, eating patterns, food choices and preferences in Division 1 NCAA college athletes. **METHODS:** 118 incoming first-year athletes (males: n=69, BMI 25.5±5.5 kg/m²; females: n=49, BMI 22.3±2.7 kg/m²) from basketball, football, soccer, lacrosse, cross-country and tennis teams were recruited. Meal Patterns (MPQ), Food Preferences (FPQ) and Food Choices (FCQ) Questionnaires were used to assess eating patterns, factors that influence food choices and preferences. Body composition was assessed using dual energy x-ray absorptiometry (DXA) for lean body mass (LBMI), fat mass (FM) and body fat % (BF%). A two-way ANOVA was used for analysis with significance accepted at p<0.05. **RESULTS:** Evening (86.2%) and lunch (66.1%) meals were the most frequently consumed meals followed by breakfast (52.5%) and evening snacks (21.2%). Nocturnal eating (eating during the night after having been to sleep) was the least common form of eating (31.4%). There was no significant difference observed in FPQ and FCQ between genders (p=0.05). However, a significant difference was observed in the importance of food for weight control (p=0.02), preference for vegetables (p=0.03) and starches (p=0.02) among sports. In addition, significant body composition differences were observed between males and females (FM: 13.4±10.9 kg and 17.0±7.3 kg; LBMI: 67.5±9.0 kg and 48.8±5.3 kg; BF%: 14.8±8.4% and 26.7±7.3 %, p<0.001, respectively) and among sports (p=0.001). **CONCLUSIONS:** Certain eating patterns, such as skipping breakfast or lunch meals, may be detrimental to the maintenance of appropriate body composition in their sport. In addition, athletes in the endurance sports had higher preference for starches and based their food choices on the need to control weight.

### 2726 Board #187 May 29 9:30 AM - 11:00 AM A Novel Tool For Understanding Factors That Can Influence The Food Choices Of High-performance Athletes

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(NO relevant relationships reported)

There are many facets that can influence the foods athletes choose and thus impact on achieving optimal nutrition, hydration, body composition goals and gut comfort. Despite this there are a limited number of studies exploring these determinants in athletes and no validated tool for understanding athlete food choices. **PURPOSE:** This research aimed to develop and validate an Athlete Food Choice Questionnaire (AFCQ) to determine the key factors influencing food choice in an international cohort of athletes. **METHODS:** A preliminary questionnaire containing 84 items on a 5-point frequency scale was developed and used to collect the first sample from athletes at the 2017 Universiade, Taiwan. Principal Component Analysis (PCA) was conducted on this sample to identify key factors and develop the AFCQ. A second sample was collected using the AFCQ at the 2018 Commonwealth Games, Australia. The second sample was analysed via Confirmatory Factor Analysis (CFA) to validate the factorial structure. Descriptive analysis of the combined samples was used to examine the AFCQ sensitivity in detecting differences in factor ratings between athlete cohorts. **RESULTS:** Sample one (n=156) contained athletes from 31 countries and 17 sports. The PCA extracted 36 questionnaire items organised into nine factors explaining 68.0% of variation. Sample two (n=232) contained athletes from 45 countries and 20 sports. The final model confirmed the nine constructs from the PCA, these were 'nutritional attributes of the food', 'emotional influences', 'food and health awareness', 'influence of others', 'usual eating practices', 'weight control', 'food values and beliefs', 'sensory appeal' and 'performance'. The CFA resulted in a good model fit for the nine constructs. **CONCLUSION:** Simple enough to be utilised with athletes from a diverse range of sports, this new tool will enable researchers and sport dietitians to better tailor nutrition education and dietary interventions to suit the individual or team.
PURPOSE: To measure Omega-3 Index and assess dietary DHA and EPA intake using an abbreviated 7-question FFQ on a NCAA Division 1 collegiate women’s soccer team as well as investigate the association between respective measures.

METHODS: 24 women soccer athletes, pre-season, completed abbreviated FFQ and provided Omega-3 Index blood collection sample. One drop of whole blood from a finger stick was collected by research group and analyzed by OmegaQuant Analytics, LLC (Sioux Falls, SD). Means and standard deviations were computed. Pearson correlations between Omega-3 Index and FFQ were determined. RESULTS: The mean Omega-3 Index among all athletes was 4.3±0.6%. Mean FFQ DHA and EPA intake was 8mg/d and 12mg/d respectively. The abbreviated FFQ was moderately correlated with Omega-3 Index (r=0.487, p=.016). CONCLUSIONS: Division I women soccer athletes’ Omega-3 Index are like previously reported American football athletes indicating a possible deficiency. Also, the abbreviated FFQ was correlated to Omega-3 Index suggesting it to be a possible predictor of omega-3 nutrient status in an athlete population. Lastly, these reported Omega-3 Index and FFQ findings in women soccer athletes suggest inadequate dietary intake of DHA and EPA to support overall health.

NUTRITION KNOWLEDGE AND SELF-REPORTED CONFIDENCE IN THAT KNOWLEDGE AMONG DIVISION II ATHLETES

Brian P. Reagan, Christa Parkes, Riggs Klikka, FACSFM, Nathan Eckert. University of Indianapolis, Indianapolis, IN. (Sponsor: Dr. Riggs Klikka, FACSFM)

PURPOSE: To assess dietary intake patterns among elite collegiate runners administered through a one-on-one counseling session with the team sports dietitian. METHODS: During the Fall sports seasons of 2015 to 2018, endurance runners from two NCAA Division I Cross-Country teams were asked to participate in a prospective study that focused on optimizing the health of the athletes. A 13 to 30-minute nutritional assessment involving the team sports dietitian was conducted. Runners in the current sample were non-injured. In the one-on-one nutrition counseling session, a standardized assessment evaluated the runner’s dietary intake patterns and nutritional risks. Data was analyzed using chi-square and independent-samples t-tests. RESULTS: Final analyses yielded data from 158 male and female runners (47.1% male, 52.9% female), averaging 66.2±2.1 (males) and 49.0±9.4 (females) miles per week. A total of 23.4% of runners reported not eating for ≥4 hours on 4 or more days of the week, while 92.4% reported eating within 30 minutes upon completing exercise. Average meals/day and snacks/day among the sample were 2.9±0.5 and 2.6±1.1, respectively. Females, compared to males, were more likely to report eating <3 meals per day (23.2% of females vs. 2.7% of males, X2 = 13.8, p<0.001), following a vegetarian or vegan diet (6.3% of females vs. 0% of males, X2= 4.7, p= 0.03), avoiding a food component or food group (31.6% of females vs. 11.0% of males, X2= 9.6, p= 0.002). Based on the one-on-one meeting/nutrition assessment, the sports RD noted higher proportion of female runners with an energy deficiency risk. (48.1% of female vs. 19.7% of males, X2= 12.1, p= 0.001). CONCLUSIONS: Most elite endurance runners reported eating a post-workout snack, which may aid in recovery efforts. As more females reported eating <3 meals per day it is recommended that females avoid skipping meals to reduce risk of energy deficiency and subsequent potential consequences to health and performance.
mean values were 67±9mg.dL-1 (Glu - normal range: 70-100mg.dL-1).

Results:

for Mean Corpuscular Volume (MCV) calculation. Values were expressed as Mean ± SD. Whole blood was assayed for Haemoglobin (Hb) and used Fasting blood samples were taken from 69 athletes (21 males and 48

Games - London 2012 and Rio 2016 (Judo, Boxing, Rowing, Canoeing, Synchronized Olympic athletes at the moment they were called prior to the Olympic Summer

biochemistry markers may guide specific approaches for optimizing health and performance. Nutrition approach of athletes are still challenging in spite of progress on training

regression. A sub-analysis was performed with the subject’s categorization according to their CHO and PRO adequacy.

Table 1. Association of carbohydrate and protein intake with maximal dynamic strength.

<table>
<thead>
<tr>
<th></th>
<th>Bench press</th>
<th>Deadlift</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein (g/kg/d)</td>
<td>0.075 (3.874 to 5.652)</td>
<td>0.704</td>
</tr>
<tr>
<td>Protein (g/d)</td>
<td>0.145 (-0.430 to 0.920)</td>
<td>0.461</td>
</tr>
<tr>
<td>Carbohydrate (g/ kg/d)</td>
<td>0.176 (-1.438 to 3.731)</td>
<td>0.370</td>
</tr>
<tr>
<td>Carbohydrate (g/d)</td>
<td>0.255 (-0.110 to 0.540)</td>
<td>0.191</td>
</tr>
</tbody>
</table>

CONCLUSIONS: PEAKS-NQ is a valid and reliable instrument for assessing SNK in athletes. A final stage of testing with more athletes will assist in establishing score ranges and factors influencing SNK.

**Purpose:** To analyze the association between adequate carbohydrate and protein intake with the maximal dynamic strength in bench press and deadlift in university athletes.

**Methods:** 30 male college (soccer and fast-soccer) athletes were evaluated. A 24-h dietary recall was administered to determine the macronutrient intake. Carbohydrate (CHO) and protein (PRO) intake were calculated and adjusted for body mass (g/day). Consumption was classified as “adequate” if the athlete consumed the minimum amounts recommended for each macronutrient: 5 g/kg/day of CHO, 1.2 g/kg/day of PRO. Bench press and deadlift one repetition (1RM) tests were performed to determine the maximal dynamic strength. IRM was adjusted for body mass (kg lifted/kg body mass). The association between macronutrient intake and IRM was tested with linear regression. A sub-analysis was performed with the subject’s categorization according to their CHO and PRO adequacy.

**Results:** Neither g/d nor kg/g/d of CHO nor PRO was significantly associated with 1RM bench press nor deadlift. When participants were selected for their CHO (n=18) and PRO (n=29) adequacy there were no significant associations between CHO intake with 1RM of bench press (p = 0.763) and deadlift (p = 0.397). PRO showed the same pattern with no significant associations with bench press (p = 0.595) and deadlift (p = 0.912).

**Conclusions:** No association was observed between the adequate carbohydrate and protein intake with the 1RM of bench press and deadlift in university soccer players.

Iron depletion, with or without anaemia, is of concern to endurance athletes given increased iron loss risk factors such as sweating, foot strike hemolysis, menstrual blood loss, and gastrointestinal bleeding. However, little is known regarding the impact of training volume on iron status, fatigue, and recovery in endurance athletes.

**Purpose:** To observe iron status and its subsequent effects on aerobic capacity and perceived fatigue and recovery in distance runners over a cross-country season.

**Methods:** Blood samples were taken from 69 athletes (21 males and 48 females; 23±7 years). The plasma was analyzed for Glucose (Glu), Insulin (Ins), Triglycerides (TG), Cholesterol (CT), HDL-c, LDL-c, Albumin (Alb), Osmolarity (Osm) and Calcium (Ca). Whole blood was assayed for Haemoglobin (Hb) and used for Mean Corpuscular Volume (MCV) calculation. Values were expressed as Mean ± standard deviation.

**Results:** Mean values were 67±9mg.dL-1 (Glu - normal range: 70-100mg.dL-1), 7.6±2.1mmol.L-1 (Ins - 2-25mmol.L-1), 84.7±17mg.dL-1 (TG <150mg.dL-1), 17±3 mg.dL-1 (CT - normal range: 20-80mg.dL-1), 61.7±17 mg.dL-1 (HDL-c - normal >40mg.dL-1), 94±2mg.dL-1 (LDL-c – normal <130mg.dL-1), Hb 14.4±1g.dL-1 (normal range: 11.5-17.5g.dL-1), MCV 87±6 fl (80-96fl); Alb 4.8±1.1g.dL-1 (normal range: 3.5-5.5g. dL-1) and Ca 9.8±2mg.dL-1 (normal range: 8.5-10.2mg.dL-1). Osmolarity mean value was 293±52mmol.kg-1.

**Conclusion:** Besides all but glucose are within normal values, the haematological levels might be considered as target for some micronutrients supplementation. Similarly the found Osm would signal for additional hydration requirements. Nutritional requirements are specific due metabolic demand according to training log. Matching dietary pattern and supplementation aspects is challenging and should consider clinical as well as performance issues.
Crossover point describes the moment during exercise that an athlete transitions from fat to carbohydrate for energy. There is limited research on sport specific differences, especially in Combat Athletes. Additionally, there is a need to understand the influence of diet on crossover point in an effort to optimize performance. PURPOSE: To evaluate if differences in crossover point exist between two sport types during a submaximal exercise test, and if an acute dietary intervention, 30 minutes before exercise, can influence crossover point. METHODS: Five male athletes (29.8 ± 6.3 years of age, 82.5 ± 8.9 kilograms, 174.7 ± 7.6 centimeters) were measured for respiratory exchange ratio during a submaximal exercise treadmill test under a fasted (FAST) condition, a fat-fed condition (FAT), and a carbohydrate-fed condition (CHO). Descriptive statistics determined average time, heart rate and percentage of maximal oxygen consumption (VO2max). We used a Mann Whitney U test to denote differences between Combat Athletes and Runners, and Friedman’s test to denote differences across dietary conditions. RESULTS: Combat Athletes (n=3) and Runners (n=2) achieved crossover at 12:20 ± 0.52 minutes (min) and 23:30 min ± 0.42 seconds (sec), respectively, with no significant differences between sport types (p=0.05). All athletes achieved crossover at 16:48 ± 6.28 min, 59.5 ± 7.2% VO2max, and 122 ± 16 bpm. Under CHO, all athletes achieved crossover at 8:12 ± 0.27 min, 37.2 ± 13.5% VO2max, and 95.6 ± 7.1 bpm. We found significant differences in time to crossover across dietary conditions (p=0.02). CONCLUSIONS: Although we did not find differences in crossover points between sports, we did find differences across dietary conditions. It appears that CHO may dictate an earlier use of carbohydrate, while FAT did not influence fat consumption after exercise. Future studies should seek to replicate our findings with a larger sample of athletes with parametric analytics to elucidate mechanisms of exercise feeding across different sport type. This study was not funded.

Endurance runners frequently experience exercise-induced gastrointestinal symptoms, which can negatively impact their performance. As such, food choices pre-exercise have a significant impact on the gut’s tolerance to running, yet little guidance is available. PURPOSE: Assess pre-race dietary habits of runners to determine which foods and beverages are consumed and avoided and determine the most common gastrointestinal symptoms experienced by athletes during racing was administered to 388 runners (n=84% male). Fisher’s exact tests determined differences in gender, age, performance level, and symptoms experienced during racing was administered to 388 runners (n=44% male).
Low body fat percentage (%BF) and caloric intake may be associated with hormonal disruptions and adverse health effects in athletes. PURPOSE: The purpose of this study was to assess relationships between body composition (BC), diet composition, and hormonal disruptions in female ballet dancers with self-reported oligomenorrhea. METHODS: Female ballet dancers (N=7; Matured age (y) Mdn (IQR) 15.8 (14.1-18.1); M = 18.8 ± 1.5 kg/m²) underwent BC testing to determine %BF and fat-free mass (FFM). Blood was drawn and analyzed for lipids (total cholesterol [TC]; LDL, HDL, triglycerides [TG]), thyroid markers (thyroid-stimulating hormone [TSH], T3, T4), and adipokines (leptin [LEP], adiponectin [APN]). Five-day diet logs were recorded for energy expenditure (kcal) and macronutrients (CHO, PRO, fat) intake relative to body mass (kg). Pearson product correlations (r) were used to determine relationships between BC, biomarkers, and diet. Significance was set at r > 0.75; P < 0.05. RESULTS: While BC did not significantly correlate with lipids, the following correlations were observed: body fat percentage correlated with TSH (r = -0.85; p < 0.05), and the relationship with APN trended towards significance (r = 0.93; P = 0.07). Kcal/kg was positively correlated with TC (r = 0.82), and CHO/kg positively correlated with TG (r = 0.91). Correlations between CHO/kg and both LEP (r = 0.83) and APN (r = 0.93) approached significance (P < 0.10), while PRO/kg negatively correlated with TSH (r = -0.91; P = 0.01). Fat/kg correlated positively with TC (r = 0.76), positively with T3 (r = 0.67), and negatively with T4 (r = 0.75). CONCLUSION: Energy and macronutrient intake, rather than BC measures, appear to have greater associations to blood lipids levels, indicating dietary intake may play a larger role in augmenting lipid status and metabolism in this population. Additionally, increased PRO intake may play a unique role in overall metabolic status, suggested by the negative correlations with TSH. However, more research is needed to determine the influence of both energy intake and BC on metabolic status in this population. These findings warrant future investigations into dietary interventions designed to improve overall metabolism and health in ballerinas.

Funding provided by Quest Diagnostics.
Non-digestible oligosaccharides (NDOs) such as inulin and lactulose are regarded as the most beneficial prebiotics for improving bone health owing to their balancing effect on the gut microbiota. As many Japanese female athletes have issues related to bone health, a better understanding of the bioactivity of NDOs is vital.

**PURPOSE:** To determine the effect of nutritional food containing inulin and lactulose on bone turnover markers in Japanese female athletes.

**METHODS:** A total of 29 Japanese female athletes (age, 22 ± 1 years) were included. Participants took their regular meals with one pack of nutritional food per day, for 12 weeks. One pack of nutritional food provided 100 kcal of energy, 2.5 g of inulin, 1.0 g of lactulose, 100 mg of calcium, and 0.5 µg of vitamin D. Nutritional and exercise status were assessed at baseline, mid-intervention period, and 12 weeks later. Nutritional status was investigated using weighed food records, while exercise status was measured by using an accelerometer. Fecal samples were collected at baseline, 1, 2, 3, 4, 8, and 12 weeks for gut microbiota analysis. TRACP-5b, a bone resorption marker, was measured by using an accelerometer. Fecal samples were collected at baseline, 4, 8, and 12 weeks later. Body composition and bone status were measured using dual energy X-ray absorptiometry (DXA) at baseline and 12 weeks later.

**RESULTS:** The body composition, nutritional status, and exercise status of the participants did not change significantly during the intervention period. The occupation of *Bifidobacterium* spp. increased at 3, 4 and 12 weeks (18.0 ± 3.8%, 17.6 ± 8.5%, and 17.1 ± 7.6%, respectively) compared to that at the baseline (11.7 ± 7.3%) (p < 0.019, p < 0.05, and p < 0.073, respectively). Serum TRACP-5b was significantly decreased at 12 weeks (363 ± 112 mU/dL) compared to that at the baseline (430 ± 154 mU/dL) (p = 0.018).

**CONCLUSIONS:** These results suggest that intake of nutritional food containing inulin and lactulose over 12 weeks could help to reduce bone resorption marker in Japanese female athletes.

Written and verbal directions on how to log food in the MyNetDiary app. Nutrient reports were then extracted from food records using The Food Processor® version 10.222 (ESHA Research, Salem, Oregon). Daily average of n-3 PUFA (µg/kg body weight) was averaged across all 3 days. Biopsies were taken from injured and uninjured vastus lateralis (22.9 ± 10.7 days post-injury) to determine mean fiber cross-sectional area (CSA) between the injured and uninjured limb for each subject. Data are compared with a paired t-test or Pearson Correlation.

**RESULTS:** Uninjured limb mean CSA was 4833 ± 1530 mm² whereas n-3 PUFA was 8.4 ± 7.1 µg/kg body weight. There was a significant positive correlation (r = 0.38, p = 0.001) between n-3 PUFA and mean CSA. The difference in CSA between limbs was significant (15% ± 16%, p = 0.03). Mean protein consumed among subjects 0.86 ± 0.23 g/kg per day, above the Recommended Dietary Allowance (RDA; 0.8 g/kg). There was a positive, non-significant correlation between atrophy and mean daily protein consumption per kg body weight (r = 0.23). CONCLUSIONS: These results serve as preliminary evidence to support the consumption of protein at the RDA may be insufficient given the substantial degree of muscle fiber atrophy occurring following an ACL tear. There is a need to optimize nutritional support during rehabilitation and our data suggest that protein consumption may be a therapeutic target to improve rehabilitation outcomes.

**PURPOSE:** It is important for athletes in winter sports to maintain good conditions for performance during overseas expeditions. Recently, differences in gut microbiota among athletes have been reported related to inflammation and performance. Omega-3 polyunsaturated fatty acid (PUFA) potential action in restoring eubiosis in gut microbiota (Costantini et al. 2017). On the other hands, n-3 PUFA deficiency induces a state of gut dysbiosis through alteration of gut microbiota composition (Robertson et al. 2017). However, in the athletes, the chronic effect of n-3 PUFA (blueback-fish)-rich foods intake on the gut microbiota is remains unclear. The present study investigated whether 8-weeks dietary n-3 PUFA deficiency induces a state of gut dysbiosis through alteration of gut microbiota composition.

**METHODS:** Six male (27 ± 6 yrs) elite Japanese Nordic combined athletes consumed processed blueback fish (3.3 (1.0, 4.2) g·kg⁻¹·d⁻¹) for 8 weeks and its potential relationship to quadriceps muscle fiber atrophy. METHODS: Subjects were given written and verbal directions on how to log food in the MyNetDiary app. Nutrient reports were then extracted from food records using The Food Processor® version 10.222 (ESHA Research, Salem, Oregon). Daily average of n-3 PUFA (µg/kg body weight) was averaged across all 3 days. Biopsies were taken from injured and uninjured vastus lateralis (22.9 ± 10.7 days post-injury) to determine mean fiber cross-sectional area (CSA) between the injured and uninjured limb for each subject. Data are compared with a paired t-test or Pearson Correlation.

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The highest rates of vitamin and mineral deficiencies/disorders were for iron (104.3 cases/100,000 person-years (p-y)), vitamin D (53.7 cases/100,000 p-y), iodine (36.2 cases/100,000 p-y), other B-complex vitamins (20.2 cases, 100,000 p-y), vitamin B12 anemia (7.6 cases/100,000 p-y), deficiencies of “other vitamins” (5.9 cases/100,000 p-y), and vitamin A (2.5 cases/100,000 p-y). Thiamin, riboflavin, niacin, pyridoxine, folate, vitamin C, and vitamin K deficiencies and hypervitaminoses A and D had <1 case/100,000 p-y. Incidence rates for vitamin D, other B-complex deficiency, “other vitamin” deficiency, thiamin deficiency, iron, and iodine increased over time (1997-2015), while vitamin A and C deficiencies decreased. Women had higher incidence rates for all examined deficiencies/disorders except niacin and vitamin C, especially for iron which was 12-fold higher. Incidence rates rose with age in 10 of 18 deficiency/disorder categories and blacks had higher incidence rates in 13 of 18 deficiency/disorder categories. Conclusions: Clinically-diagnosed vitamin and mineral deficiencies/disorders in the military population were low, but higher in women and minorities. As for most illnesses, the diagnosed incidence of such disorders may be an underestimate of the actual incidence. These findings can be used to guide clinical decision making with regard to testing for nutritional deficiencies and delivering public health information to at risk military and civilian populations.
Inflammation in older adults are not well established. FO supplementation combined with resistance training (RT) in muscular strength, great attention for their health-enhancing benefits; however, synergistic effects of

**PURPOSE:** To determine

Data have indicated that creatine supplementation can result in an increase in lower leg anterior compartment pressure at rest and post exercise. Although the increased pressures seen during these studies were not pathological, this and additional factors associated with creatine supplementation could possibly influence skeletal muscle oxygen concentration (SmO2) during exercise and recovery. **PURPOSE:** To determine the effects of acute creatine monohydrate supplementation on SmO2 during treadmill exercise. **METHODS:** 21 male, physically active participants were randomized in a double-blind fashion to placebo (PL) (n=10, 23±1.2 yrs.) or creatine (CM) (n=11, 21±1.2 yrs.) groups. Subjects received 0.3 g/kg/day creatine monohydrate or placebo in gelatin capsules for 7 days. The subjects performed submaximal exercise tests (10 minute treadmill activity at 3.7 mph and 9% incline) at baseline and on day 7 of the study. During exercise SmO2 and lower leg pain (LP) were monitored utilizing near infrared spectroscopy and an analog visual scale, respectively. The % change in SmO2 was defined as: ((Baseline SmO2 - peak exercise SmO2)/baseline SmO2)*100. Pre- and post-exercise lower leg pain thresholds (PTH) were determined using a digital force gage. **RESULTS:** There was a significant group effect (P<0.03) but no significant effect of supplementation (P=0.05) on the % change in SmO2 during the exercise tests (CM: pre 66.49 ± 35.54; post 59.91 ± 23.87 vs. PL: pre 39.87 ± 16.72; post 38.51 ± 26.95 % change SmO2; M ± SD). No significant effects of supplementation were seen between the groups for PTH (P=0.05) or peak LP during exercise (P>0.05). **CONCLUSIONS:** Using a randomly controlled, double-blind trial with validated measurements of SmO2, acute creatine supplementation does not appear to impact skeletal muscle oxygen saturation during exercise in young, otherwise healthy males.

**INTRO:** Tart cherries possess antioxidant, anti-inflammatory and analgesic properties that may reduce inflammation and improve sleep. Additionally, animal models suggest tart cherry supplementation can reduce weight, however human data is lacking. Furthermore, processing may affects the properties of tart cherries and therefore reduce their health benefits. **PURPOSE:** To investigate the effect of different tart cherry supplements on markers of inflammation, body mass, and sleep time and quality over the course of 30 days in healthy individuals. **METHODS:** 58 participants (age: 28 ± 10 y, height: 169.76 ± 8.55 cm, body mass: 72.2 ± 12.9 kg) were separated into four groups: group 1 (Montmorency tart cherry juice), group 2 (Montmorency tart cherry capsule), group 3 (juice placebo) and group 4 (capsule placebo), and asked to consume their supplement for 30 continuous days. Participants in groups 1 & 3 drank two 8 oz. bottles per day. Groups 2 & 4 consumed 72.2 ± 12.9 kg) were separated into four groups: group 1 (Montmorency tart cherry juice), group 2 (Montmorency tart cherry capsule), group 3 (juice placebo) and group 4 (capsule placebo), and asked to consume their supplement for 30 continuous days. Participants in groups 1 & 3 drank two 8 oz. bottles per day. Groups 2 & 4 consumed 72.2 ± 12.9 kg) were separated into four groups: group 1 (Montmorency tart cherry juice), group 2 (Montmorency tart cherry capsule), group 3 (juice placebo) and group 4 (capsule placebo), and asked to consume their supplement for 30 continuous days. Participants in groups 1 & 3 drank two 8 oz. bottles per day. Groups 2 & 4 consumed 72.2 ± 12.9 kg) were separated into four groups: group 1 (Montmorency tart cherry juice), group 2 (Montmorency tart cherry capsule), group 3 (juice placebo) and group 4 (capsule placebo), and asked to consume their supplement for 30 continuous days. Participants in groups 1 & 3 drank two 8 oz. bottles per day. Groups 2 & 4 consumed 72.2 ± 12.9 kg) were separated into four groups: group 1 (Montmorency tart cherry juice), group 2 (Montmorency tart cherry capsule), group 3 (juice placebo) and group 4 (capsule placebo), and asked to consume their supplement for 30 continuous days. Participants in groups 1 & 3 drank two 8 oz. bottles per day. Groups 2 & 4 consumed 72.2 ± 12.9 kg) were separated into four groups: group 1 (Montmorency tart cherry juice), group 2 (Montmorency tart cherry capsule), group 3 (juice placebo) and group 4 (capsule placebo), and asked to consume their supplement for 30 continuous days. Participants in groups 1 & 3 drank two 8 oz. bottles per day. Groups 2 & 4 consumed 72.2 ± 12.9 kg) were separated into four groups: group 1 (Montmorency tart cherry juice), group 2 (Montmorency tart cherry capsule), group 3 (juice placebo) and group 4 (capsule placebo), and asked to consume their supplement for 30 continuous days. Participants in groups 1 & 3 drank two 8 oz. bottles per day. Groups 2 & 4 consumed...
**Purpose:** We have previously shown\(^1\) that four weeks of supplementation with PCSO-524®, a marine lipid fraction of the New Zealand green-lipped mussel (Perna canaliculus), rich in omega-3 fatty acids, attenuates muscle damage and delayed onset muscle soreness (DOMS) following eccentric exercise in untrained men. The present study sought to determine if a blend of 75% PCSO-524® and 25% krill oil (ESPO-572®) will be ‘at least as good’ as PCSO-524® in attenuating DOMS and functional indices of muscle damage during recovery from muscle damaging exercise in untrained men. **Methods:** This study was conducted as a randomized, parallel group, double-blind non-inferiority trial. Fifty-one untrained men were randomly assigned to consume 600 mg d-1 (4 capsules) of either PCSO-524® (n=24) or ESPO-572® (n=27) for 26 d prior to muscle damaging exercise (downhill running), and continued for 72 h following exercise. DOMS, pressure pain threshold (PPT), limb swelling, knee extensor range of motion (ROM), and isometric torque (MVC), were assessed at baseline following supplementation before eccentric exercise, and at 24, 28 and 72 h post-eccentric exercise. For data analysis purposes we included placebo group data generated from our previously published work\(^1\) that followed an identical study design. **Results:** ESPO-572® is ‘at least as good’ as PCSO-524®, but both blends were significantly better (p<0.05) than placebo, in reducing DOMS at 24, 48, 72 h following muscle damaging exercise. At 24 and 48 h following the eccentric exercise bout ESPO-572® significantly increased (p<0.05) ROM compared to PCSO-524®. Compared to placebo, ESPO-572® significantly improved (p<0.05) ROM at 24, 48 and 72 h, while PCSO-524® significantly increased (p<0.05) ROM at 48 and 72 h during recovery. There were no significant differences (p>0.05) between ESPO-572® and PCSO-524® for PPT, limb swelling and MVC during recovery from muscle damaging exercise. **Conclusion:** These data suggest that ESPO-572® may represent a useful therapeutic agent for attenuating muscle soreness following eccentric-type exercise in untrained men. \(^{1}\)Mickleborough et al. Journal of the International Society of Sports Nutrition (2015) 12:10. Supported by a grant from Pharmalink International Ltd, Hong Kong.

### EFFECTIVENESS OF TWO DIFFERENT FORMS OF MARINE OIL ON MUSCLE SORENESS FOLLOWING ECCENTRIC EXERCISE

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(No relevant relationships reported)

### PURPOSE:

We have previously shown\(^1\) that four weeks of supplementation with PCSO-524®, a marine lipid fraction of the New Zealand green-lipped mussel (Perna canaliculus), rich in omega-3 fatty acids, attenuates muscle damage and delayed onset muscle soreness (DOMS) following eccentric exercise in untrained men. The present study sought to determine if a blend of 75% PCSO-524® and 25% krill oil (ESPO-572®) will be ‘at least as good’ as PCSO-524® in attenuating DOMS and functional indices of muscle damage during recovery from muscle damaging exercise in untrained men. **METHODS:** This study was conducted as a randomized, parallel group, double-blind non-inferiority trial. Fifty-one untrained men were randomly assigned to consume 600 mg d-1 (4 capsules) of either PCSO-524® (n=24) or ESPO-572® (n=27) for 26 d prior to muscle damaging exercise (downhill running), and continued for 72 h following exercise. DOMS, pressure pain threshold (PPT), limb swelling, knee extensor range of motion (ROM), and isometric torque (MVC), were assessed at baseline following supplementation before eccentric exercise, and at 24, 28 and 72 h post-eccentric exercise. For data analysis purposes we included placebo group data generated from our previously published work\(^1\) that followed an identical study design. **RESULTS:** ESPO-572® is ‘at least as good’ as PCSO-524®, but both blends were significantly better (p<0.05) than placebo, in reducing DOMS at 24, 48, 72 h following muscle damaging exercise. At 24 and 48 h following the eccentric exercise bout ESPO-572® significantly increased (p<0.05) ROM compared to PCSO-524®. Compared to placebo, ESPO-572® significantly improved (p<0.05) ROM at 24, 48 and 72 h, while PCSO-524® significantly increased (p<0.05) ROM at 48 and 72 h during recovery. There were no significant differences (p>0.05) between ESPO-572® and PCSO-524® for PPT, limb swelling and MVC during recovery from muscle damaging exercise. **CONCLUSION:** These data suggest that ESPO-572® may represent a useful therapeutic agent for attenuating muscle soreness following eccentric-type exercise in untrained men. \(^{1}\)Mickleborough et al. Journal of the International Society of Sports Nutrition (2015) 12:10. Supported by a grant from Pharmalink International Ltd, Hong Kong.

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**Purpose:** To evaluate the antioxidant capacity (AOCc) of mango peel extract (MPE) on Oxs associated with SE in rats. **Methods:** An animal bioassay, approved by bioethics committee, which consisted in an acute SE session performed, or not, after a sub-chronic (1 month) supplementation was executed. The treatments applied were: A) Standard diet (CTRL); B) Standard diet + gallic acid (GA); C) Standard diet + MPE (SMPE). The plasma Oxs markers were quantified by Malondialdehyde (MDA) and protein carbonyls (PC). Creatine kinase (CK) and transaminases (ALT & AST) were evaluated as tissue damage markers. Finally, the plasma AOCc was evaluated by ferric reducing antioxidant power (FRAP) assay. **Results:** The bioassay results are depicted in Table 1. The SE raised PC but no MDA plasma concentrations, on all treatments, also increased CK and AST. Otherwise as response to SE, FRAP activity on plasma was boosted on GA and SMPE. Preliminary phytochemical analysis on MPE presented a total phenolic compound content of 77.3±3 mg Gallic Acid Eqg\(^a\) dry weight and 11.6 mg Catechin Eqg\(^a\) dry weight of total flavonoids. **Conclusion:** The MPE has a high concentration of phenolic compounds and its administration improves the plasma AOCc, but it was not able to inhibit the effects of tissue damage or Oxs associated with SE. Also, there was found that MPE has a prooxidative effect by altering the levels of protein oxidation after SE.

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**Table 1. Antioxidant capacity after the bioassay.**

<table>
<thead>
<tr>
<th>Marker</th>
<th>CTRL</th>
<th>GA</th>
<th>SMPE</th>
<th>CTRL</th>
<th>GA</th>
<th>SMPE</th>
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<tbody>
<tr>
<td>MDA</td>
<td>2.5±1(^b)</td>
<td>2.4±1(^b)</td>
<td>2.5±1(^a)</td>
<td>2.6±1(^a)</td>
<td>2.3±1(^b)</td>
<td>2.6±1(^a)</td>
</tr>
<tr>
<td>PC</td>
<td>31±1(^b)</td>
<td>23±9</td>
<td>17±7</td>
<td>221±16(^a)</td>
<td>239±50</td>
<td>353±71</td>
</tr>
<tr>
<td>CK</td>
<td>860±24(^a)</td>
<td>1146±20(^a)</td>
<td>1241±49(^a)</td>
<td>2459±1580</td>
<td>2399±645</td>
<td>2613±452</td>
</tr>
<tr>
<td>ALT</td>
<td>52±4(^a)</td>
<td>51±14</td>
<td>48±13</td>
<td>57±9</td>
<td>63±18</td>
<td>53±19</td>
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<tr>
<td>AST</td>
<td>72±10</td>
<td>78±16</td>
<td>75±16</td>
<td>100±33(^a)</td>
<td>93±20(^a)</td>
<td>113±38</td>
</tr>
<tr>
<td>FRAP</td>
<td>0.32±0(^a)</td>
<td>0.29±0(^a)</td>
<td>0.30±0(^a)</td>
<td>0.37±0(^a)</td>
<td>0.36±0(^a)</td>
<td>0.47±0(^a)</td>
</tr>
</tbody>
</table>

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**Mean±SD: MDA, Malondialdehyde, μM MDA• mL\(^{-1}\); PC, Protein carbonyls, nM• mL\(^{-1}\); CK, Creatine kinase, U•L\(^{-1}\); AST, Aspartate aminotransferase, U•L\(^{-1}\); ALT, Alanine aminotransferase, U•L\(^{-1}\); FRAP. Ferric reducing antioxidant power, μM Fe\(^{2+}\). Eq: Different letter means statistical difference between treatments (p<0.05).

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**Figure 1. Muscle soreness in different groups**

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Abstracts were prepared by the authors and printed as submitted.
PURPOSE: Oxidative stress is an important key player in the initiation of training induced adaptations but also a risk factor with respect to over training and lack of regeneration. Alpha lipoic acid (ALA) has been described to be a powerful antioxidant. Therefore it was the aim of this study to investigate the effects of acute and chronic ALA supplementation on the regeneration and performance of athletes after intensive exercise.

METHODS: In this double-blinded, randomised, controlled trial in cross-over design, 17 male resistance and endurance-experienced athletes successfully participated. The subjects were divided into two groups (ALA and Placebo) and underwent a standardized acute (3sets back squats of 12 reps each and 3sets of low jumps with 15 reps each) and chronic training protocol (6 days of intensive resistance and endurance training). Between the acute and chronic training experiments was a 4-week break. At certain time points before and after exercise (T0, T1 (+24h) and T2 (+7d)) blood samples were taken and the concentrations of muscle damage (creatine kinase, myoglobin), inflammation ( interleukin 6 and 10) and oxidative stress (ox LDL) markers were investigated. In addition, the maximum performance in the back squat was measured at all timepoints.

RESULTS: In the 6 day chronic training intervention a clear inhibition of muscle damage and inflammation could be observed in individuals under chronic supplementation of ALA compared to the control group. Whereas performance in the back squat was significantly reduced after 6 day of chronic training in the placebo group no significant loss of performance could be detected in the ALA group. In contrast after an acute training a single application of ALA did not result in significant differences between the placebo and ALA groups with respect to all before mentioned markers and back squat performance.

CONCLUSIONS: Based on these data we conclude that that ALA supplementation has only limited effects if given acute and directly after exercise but results in remarkably significant pro-regenerative and performance enhancing effects after chronic supplementation. Mechanistically these effects seem to be mediated via a modulation of the immune response and less by antioxidative effects, which needs to be investigated in more detail in future investigations.

Rhodiola and Cordyceps are two common herbal supplements that have been shown to increase VO2 max and exercise performance, but limited research has examined the combined effects. PURPOSE: TO determine the combined effects of Rhodiola and Cordyceps (R+C) supplementation, compared to Rhodiola alone (R) and placebo (PL), on VO2 max, blood glucose and lactate concentrations. METHODS: 13 physically active college students (7M, 6F; Mean ± SD; 21.08 ± 1.55 yrs, 22.60 ± 2.29 kg/m²) completed three conditions in a counterbalanced, crossover, double-blind fashion; 1) PL (250 mg calcium), 2) R (250 mg Rhodiola), 3) R+C (250 mg Rhodiola + 225 mg Cordyceps). In response to each condition, VO2 max (assessed by Bruce Protocol), blood glucose and lactate (via fingerstick) were examined using an ANOVA.

RESULTS: There was no significant condition effect for VO2 max or blood lactate concentrations, but increased blood glucose concentrations. Future studies are needed to examine ventilatory threshold and other markers of exercise performance in response to these supplements.
**Board #225**
**May 29 9:30 AM - 11:00 AM**
**Effects Of Short-term Continuous Montorency Tart Cherry Juice Supplementation In Participants With Metabolic Syndrome**

Terun Desai, Michael Roberts, Lindsay Bottoms. University of Hertfordshire, Hatfield, United Kingdom. 

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(No relevant relationships reported)

**PURPOSE:** The prevention of cardiovascular disease (CVD) and type II diabetes mellitus (T2D) would be a major step in retarding rising global prevalence and incidence rates. Metabolic Syndrome (MetS) augments the incidence of CVD by 2-fold and T2D by 5-fold. Montorency tart cherries are rich in phytochemicals and have previously been shown to improve cardiovascular biomarkers in humans. This study aimed to examine cardio-metabolic responses after 7 days Montorency tart cherry juice (MTCJ) supplementation and also acute responses to a single-bolus, in humans with MetS.

**METHODS:** In a randomised, single-blind, placebo-controlled, crossover trial, twelve participants with MetS (50 ±10 y; 6M/6F), consumed MTCJ or placebo (PLA) for 7 days. Blood-based (serum glucose, insulin, lipid profile) and functional (cardiac haemodynamics, arterial stiffness and resting metabolic rate) cardio-metabolic biomarkers were measured pre-and post-supplementation, and acute responses measured pre-bolus and up to 4 hours post-bolus on the 7th day. Comparisons were made by two-way, repeated measures ANOVA design.

**RESULTS:** 24-hour ambulatory systolic (PLA vs. MTCJ: 221 ± vs. -11 mmHg, P = 0.016), diastolic (231 ± vs. -21 mmHg, P = 0.009) blood pressure and mean arterial pressure (311 ± vs. -20 mmHg, P = 0.041) were significantly lower after 7 days MTCJ supplementation compared to PLA. Findings also showed a significant reduction in glucose (0.03 ±0.07 vs. -0.50±0.00 mmol L-1, P = 0.038), total cholesterol (0.04±0.06 vs. -0.40±0.07 mmol L-1, P = 0.036), LDL (0.26±0.09 vs. -0.36±0.14 mmol L-1, P = 0.023) concentrations and total cholesterol/HDL ratio (0.13±0.00 vs. 0.02±0.00, P = 0.004) with concomitant lower resting respiratory exchange ratio values (0.01±0.02 vs. -0.03±0.00, P = 0.009) after 6 days MTCJ consumption compared to PLA.

**CONCLUSIONS:** This study revealed for the first time MTCJ to significantly improve 24-hour BP, fasting glucose, total cholesterol and total cholesterol/HDL ratio, and also lower resting respiratory exchange ratio compared to a control in any human population. Responses demonstrated clinically relevant improvements on aspects of cardio-metabolic function, emphasising the potential efficacy of MTCJ in preventing further cardio-metabolic dyregulation in an ‘at risk’ population.

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**Board #226**
**May 29 9:30 AM - 11:00 AM**
**The Effect Of Calanus Finmarchicus Oil (Calanus® Oil) On Maximal Oxygen Uptake: A Randomized Controlled Study**

Trine Karlsen1, Lucas Tauchek2, Raghnild Rasbjorjen2, Havard Dale2, Terje Larsen2, 1Nord University, Bodø, Norway. 2Norwegian University of Science and Technology, NTNU, Trondheim, Norway. 3The Arctic University of Norway, Tromsø, Tromsø, Norway. 

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(No relevant relationships reported)

**PURPOSE:** To investigate the long-term effect of daily Calanus® Oil supplementation on maximal oxygen uptake (VO2max) in healthy 30-50 year old human participants. VO2max is the single best measure of human endurance capacity, as well as a predictor of longevity and cardiovascular disease mortality. Systematic exercise training increases VO2max and has beneficial health effects. The copepod-based omega-3 rich Calanus® Oil supplementation has previously been shown to increase VO2max in diet-induced obese mice. The present study is a follow-up study in healthy human participants.

**METHOD:** In a double-blinded study, 71 participants were randomized to receive 2 grams ‘day’ of Calanus® Oil or placebo supplementation for a total of 6 months. The participants underwent exercise testing and clinical investigations at baseline, 3 months and 6 months. The main study outcome was change in VO2max from baseline to 6 months. Results are given as mean ± standard deviation.

**RESULTS:** A total of 58 participants (baseline age, years: Calanus® Oil, 39.7 ± 4.5 and placebo, 38.8 ± 5.3; baseline BMI, kg.m2: Calanus® Oil, 24.8 ± 2.2 and placebo, 24.8 ± 2.8; baseline VO2max, ml.kg-1.min-1: Calanus® Oil, 50.4 ± 9.1 and placebo 50.2 ± 8.8) completed the 6-month test and were included in the final data analysis. There were no between group differences at baseline. There were no between group changes in VO2max measured in L min-1 (Calanus® Oil, 3.78 ± 0.79 and placebo, 3.79 ± 0.90) or normalized to body weight (Calanus® Oil 50.1 ± 9.6 ml.kg-1.min-1 and Placebo 49.5 ± 9.2 ml.kg-1.min-1) from baseline to 6 months (6 month values). No other clinical measures changed over the 6-month study period.

**CONCLUSION:** Six months of Calanus® Oil supplementation did not change maximal oxygen uptake in physically fit, healthy, normal to overweight middle age men and women between 30-50 years of age.

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**Board #227**
**May 29 9:30 AM - 11:00 AM**
**Polyphenol Rich Supplementation On Markers Of Recovery From Intense Resistance Exercise**


Email: dhopper4@ju.edu

(No relevant relationships reported)

**PURPOSE:** The purpose of this study was to assess whether polyphenol supplementation, previously shown to have anti-oxidative properties, reduces muscle damage and soreness and whether the recovery of physical performance is enhanced as a result.

**METHODS:** 15 men (mean age: 26.2±5.3 years; height: 184.3±8.2 cm; weight: 92.9±15.6 kg; barbell back squat 1RM: 146.8±30.6 kg) completed a randomized, cross-over, placebo controlled design where subjects performed 6 sets of 10 barbell back squats at 80% 1-repetition maximum and were assessed for markers of recovery immediately, 1-, 3-, 24- and 48-hours following the protocol on two occasions; once following 1 week of 500mg of tart cherry supplementation (TC) and once following a placebo (PL) supplement. Markers of recovery included plasma creatine kinase MB isoenzyme (CKMB), muscle soreness by visual analog scale, countermovement vertical jump height (CMJ) by forceplate, and grip strength by isokinetic dynamometer.

**RESULTS:** With regards to muscle damage, there was a statistically significantly (p=0.003) greater increase in CKMB concentration in the PL when compared to the TC group (PL: 21.1±11.5 ng.ml-1 vs. TC: 0.01±11.3 ng.ml-1) 60 min post. There was a statistically significantly (p=0.015) higher increase in muscle soreness in the PL when compared to the TC group (PL: 5.2±2.9 cm vs. TC: 3.2±1.3 cm) at 48 hours. There were no statistically significant differences in jumps in jump power or handgrip dynamometer strength, although there was a trend (p=0.08) towards significance (PL: -0.1±1.1 vs. TC: 1.5±2.1 cm) in grip strength change.

**CONCLUSIONS:** In conclusion, polyphenol supplementation was shown to suppress soreness following intense resistance exercise. In addition, polyphenols were shown to reduce CKMB, a marker of cardiac muscle damage. In this study, the damage protocol was not sufficient to cause reductions in power performance, and thus the supplement was unable to demonstrate reduced attenuations of performance as a result of the decreased damage.

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The World-Anti Doping Agency (WADA) stipulates that athlete use of glucocorticoid medication for asthma related conditions requires a therapeutic-use-exemption (TUE) during competition for oral administration, but not inhaled doses. It remains unclear if glucocorticoid therapy provides a competitive advantage for single, or repeated bouts of time-trial performance. PURPOSE: Compare two methods of acute glucocorticoid administration on 40-km time-trial and recovery for subsequent 10-km cycling time-trial. METHODS: Six trained male cyclists (VO2max: 59.1 ± 3.8ml.kg·min⁻¹) completed a 40-km time-trial four-hours after administration of prednisolone (0.5 mg·kg⁻¹ body mass, PRED), beclomethasone (160μg, BDEC), microcrystalline cellulose capsules (PLA), water vapour inhaler (IP-PLA) or control (CON). Following one-hour recovery, participants completed a further 10-km time-trial. Subjective overall recovery score, measured using Acute Recovery Stress Score (ARSS) was completed pre-10-km time-trial. Physiological (Heart-rate; HR, oxygen-uptake; VO2) and metabolic response (blood lactate; blood glucose) during 40-km time-trial were recorded. Data was analysed using repeated measure ANOVAs, and Bonferroni post-hoc comparisons. RESULTS: No significant difference was seen in completion time (CT) for both 40-km (PRED: 3958 ± 213 s; BDEC: 3969 ± 173 s; CON: 4010 ± 169 s; ARSS: 3978 ± 208 s; CON: 3968 ± 170 s; p=0.22) and 10-km (PRED: 950 ± 50 s; BDEC: 952 ± 54 s; CON: 956 ± 51 s; CON: 957 ± 54 s; p=0.87) time-trials. No condition time interaction was seen in physiological response (HR: p=0.69; VO2: p=0.54) during 40-km time-trial. PRED resulted in significant enhanced glucose concentration at all exercise time-points (p<0.05), but no condition time interaction was evident in blood lactate (p=0.53). Subjective overall recovery measured by ARSS was not different between conditions (p=0.77). CONCLUSION: Acute inhaled or oral glucocorticoid supplementation was shown to enhance 40-km time-trial performance. Furthermore, perceived recovery prior to, or measured performance during subsequent 10-km time-trial was not different between conditions.
RESULTS: No significant gender × trial interactions were observed for any of the RER, and rating of perceived exertion (RPE) were collected. All data were analyzed To investigate whether these findings can be interpreted as beneficial or adverse with the same time which is very likely caused by skeletal muscle relaxation effects of CBD. In training through CBD supplementation. However, the 1RM BS also deteriorates at the -6.56 kg; PL: 150.31 kg SD 18.63 to 146.56 kg SD 16.85, -3.75 kg). Damage. However, the 1RM BS of the CBD group 24h after exercise was significantly lower in comparison to the PL group (CBD: 152.81 kg SD 17.90 to 146.26 kg SD 16.04, -6.56 kg; PL: 150.31 kg SD 16.30 to 146.56 kg SD 16.85, -3.75 kg). Improvement in simple cognitive reaction speed, aerobic capacity, and blood metabolic biomarkers (blood glucose and insulin, cholesterol, HDL-C, LDL-C, uric acid and blood urea nitrogen) were measured. RESULTS: Improvement in simple cognitive reaction speed was significantly greater in the GTE group compared to the PLA group after training (PLA: -1.05% vs. GTE: 5.36%; p < 0.05). Although in both groups the exercise training markedly improved aerobic capacity (PLA: 6.24%; GTE: 7.67%) and increased circulating high density lipoprotein cholesterol (HDL-C) (PLA: 7.96%; GTE: 11.22%) compared to baseline values (p < 0.05), there were no differences in these variables between treatments. CONCLUSIONS: A 6 wk GTE supplementation may be able to amplify exercise training adaptations in cognitive performance in young sedentary individuals, but aerobic capacity and metabolic biomarkers were not affected after the intervention in this study population.

Cannabidiol (CBD) is a non-psychoactive cannabinoid extracted from cannabis sativa and is mainly sold as a nutrition supplement. The pharmacological effects of CBD are a matter of discussion in research. Anti-inflammatory activities and effects on muscle relaxation of CBD have been demonstrated in studies. However, there is only limited information on the direct effects of CBD on skeletal muscle regeneration (SMR) after physical activity. The purpose of this study was to investigate effects of CBD on SMR after intensive resistance training (IRT).

Method: Participants ingested 60mg of CBD or placebo directly after IRT. The study was conducted as a randomized double-blind study in crossover design. Muscle damage as serum creatine kinase (CK) and myoglobin (Mgy) as well as performance in 1RM back squat (1RM BS) before and at different times after exercise (+24h, +48h, +72h) were investigated. After the pre-performance tests, 3 sets of BS with 12 repetitions were performed with an intensity of 70%, followed by 3 sets of low jumps with 15 repetitions. Subsequently, the subjects received either a drink with CBD or a placebo drink. No further food was allowed to be consumed in the next 3h. After 24h, 48h and 72h further blood samples were taken and the performance in BS was examined. After two weeks of wash out period, the intervention was repeated. Results: CBD administration inhibits significantly the type I error rate was set at 5%. RESULTS: No significant condition x time interactions were observed for any variable (all p > 0.10). Significant main effects for time were observed for TRG (BL<1-h [-3.6 ± 17 mg/dL; p = 0.001]), BL<2-hour [-86.7 ± 79 mg/dL; p = 0.03]), TRG (BL<3 ± 5h [-40.1 ± 23 mg/dL; p = 0.002]), HR (BL<2-hour [3.8 ± 3.6 bpm; p = 0.04]), and for DBP, LDL, and PWV. However, Bonferroni-corrected post-hoc comparisons revealed no differences among time points in DBP, LDL, or PWV (Figure 1). Our results confirm that a HFM induces multiple acute, negative cardiometabolic effects. However, our initial analyses indicate that the NOx supplement did not protect against these impairments.
The Effects Of A Protease Enzyme Blend On The Amino Acid Response To Resistance Exercise
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⁴Lipscomb University, NASHVILLE, TN; ⁵Colorado State University, Fort Collins, CO. ⁶Kennesaw State University, Kennesaw, GA. (Sponsor: Yuri Feito, FACSM)

No relevant relationships reported

Purpose: The aim of the current study was to examine the efficacy of whey protein ingestion with or without a protease enzyme complex on amino acid (AA) availability following acute lower-body resistance exercise. METHODS: Ten resistance trained men (24.4±1.4yr, 179.1±18.6cm, 92.6±10.4kg) with at least one year of resistance training experience volunteered to participate in this placebo-controlled, randomized, cross-over designed study. Following an overnight fast, participants performed lower-body acute resistance exercises consisting of four sets each of the leg press and leg extension exercises (8-10 repetitions at 75% of 1RM) followed by consumption of one of three drinks of equivalent volume, taste, and appearance which consisted of either: (a) 26g whey protein + 250 mg protease supplement + whey (PW) (b) 26g whey protein (W), or (c) a non-caloric flavored water drink (PL). Blood samples were collected before exercise, immediately-post (0min), 30s, 30, 60, 90, 120-, and 180-minutes post-exercise (30min, 60min, 90min, 120min, 180min respectively). Plasma amino acid samples were analyzed for essential (EAA), branched-chained (BCAA), and leucine concentrations via liquid chromatography-mass spectrometry (LC-MS). A 2-way repeated measures analysis of variance (ANOVA) was used to identify differences between treatments over time. Area under the curve was calculated via the trapezoidal technique and analyzed via a one-way ANOVA.

Results: Significant main effects for time (p<0.001) and time x group interactions (p=0.001) were found for leucine, BCAA, and EAA. PW drink resulted in significantly greater plasma leucine, BCAA and EAA concentrations at 30min compared to PL (p<0.001) while not different than W. Leucine was significantly elevated at 180min (p<0.007) and EAA at 180min (p=0.004) compared to 0min for PW. The AUC for PW and W were both significantly elevated for leucine, BCAAs and EAs compared to PL (p<0.001).

Conclusion: While no significant differences were found between the W and PW supplementation groups during the 3hr period after resistance training, the PW group produced significantly greater leucine concentrations at 30min and for EAA at 180min than PL compared to 0min. Results indicate that PW may provide a modest improvement of AA appearance in blood following acute resistance exercise.

Acute Protease Supplementation Does Not Alter The Endocrine Response To Resistance Exercise In Trained Males
Megan D. Jones¹, Jeremy R. Townsends², Jaclyn Morimune¹, Laurel A. Littlefield³, Trisha A. VanDusseldorps², Yuri Feito, FACSM², Gerald T. Mangine³
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No relevant relationships reported

Proteases are enzymes which aid in the hydrolysis of proteins. Previous work has demonstrated protease supplementation may enhance recovery after high-intensity exercise by decreasing muscle damage and inflammation. While the mechanisms involved are not fully understood, it has been suggested that protease supplementation may alter the endocrine response to exercise, promoting a more favorable recovery state. PURPOSE: To determine if protease supplementation immediately after an exercise session influences circulating testosterone, cortisol, insulin, insulin-like growth factor-1 (IGF-1), and growth hormone (GH) concentrations. METHODS: Ten resistance trained males (24.1±1.4yr, 69.6±6.8 kg 179±8.6 cm) consumed 3 acute lower-body resistance exercise sessions consisting of 4 sets of leg press and leg extension in a randomized, crossover fashion. Each exercise session consisted of 3 treatments: W (26g whey); PW: 26g whey+250mg of a protease enzyme blend; PL: non-caloric control. Blood draws were obtained at baseline (BL), immediately-post (IP), 1-hour (1H) and 3-hours post-exercise (3H) and analyzed for testosterone, cortisol, insulin, IGF-1, and GH. Data for each hormone were analyzed with a 2-way repeated measures analysis of variance (ANOVA) under the curve (AUC) values were analyzed with a one-way ANOVA. RESULTS: Significant main effects for time (p<0.05) were observed for all hormones. There was a significant decrease in testosterone at IP (p<0.007), 1H (p<0.001), and 3H (p<0.001). There was a significant decrease in cortisol at all time points (p<0.001) compared to BL. There were significant increases in insulin, IGF-1, and growth hormone at all time points (p<0.001) following exercise. Additionally, no interaction for any hormone concentrations or AUC values were seen between treatments in this study. CONCLUSION: There were no differential effects of W or PW on the post-exercise endocrine response compared to PL. Therefore, neither protease nor protein supplementation appear to alter endocrine response to resistance exercise in trained males.

The Effects Of 28 Days Of Carnosine Supplementation On Exercise-induced Muscle Damage
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No relevant relationships reported

The chicken breast extract contains rich carnosine which plays an antioxidant role (Sato et al., 2012). Therefore, daily carnosine supplementation may attenuate exercise-induced muscle damage, as noted in a recent study. PURPOSE: To examine the effects of the long-term carnosine supplementation on exercise-induced muscle damage. METHODS: Thirty untrained male subjects were assigned into one of two groups; either carnosine group (n=7; height: 175.2 ± 2.5cm, body weight: 64.4 ± 1.8kg, 120%-body fat: 12.9 ± 1.7%); and placebo group (n=6; height: 175.1 ± 1.6cm, body weight: 70.3 ± 4.6kg, percentage body fat: 17.2 ± 3.1%). They took 1g/day of carnosine in carnosine group or placebo supplement in placebo group for 28 days. Before and after supplementation period, the subjects completed a 80 min running test (70% VO2max) to induce muscle damage and inflammatory response. Changes in drop jump (DJ) index, muscle thickness, soreness of muscle and blood sample [myoglobin (Mb), creatine kinase (CK), and C-reactive protein (CRP)] were evaluated before exercise and 24h of post-exercise. RESULTS: In both groups, DJ index and muscle thickness did not differ significantly before and after the supplementation period. Soreness of muscle were significantly increased after exercise in both groups. However, in the carnosine group, no significant differences were observed between before and post-supplementation period (p > .05). Exercise increased significantly serum Mb, CK, CRP levels in both groups (p < .05). However, the carnosine group did not present significant difference between before and post-supplementation period (p > .05). CONCLUSIONS: Long-term (28 days) of carnosine supplementation (1.5g/day) did not suppress exercise-induced muscle damage response following endurance exercise in untrained men.

Acute Consumption Of A Brewed Cocoa Beverage On Endothelial Function
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No relevant relationships reported

Previous studies have shown that the polyphenol components of cocoa can improve the health and function of blood vessels. It is currently unknown whether consuming a brewed drink made from roasted cocoa beans has the same beneficial effects on blood vessel function.

PURPOSE: The purpose of this study was to assess the acute effects of consuming brewed cocoa on resting blood pressure and endothelial function using near-infrared spectroscopy (NIRS) to evaluate changes in tissue oxygen saturation (SO2) following blood vessel occlusion.

METHODS: A total of 15 healthy college-aged adults participated in this study. SO2 levels were monitored continuously throughout the test using a NIRS device placed on the flexor digitorum superficialis of the dominant hand. Subjects were instructed to refrain from caffeine or alcohol consumption for 24 hours prior to the test. Subjects were randomly assigned to either the cocoa (C) or placebo (P) group. Subjects were seated with at least one year of resistance training experience volunteered to participate in this placebo-controlled, randomized, cross-over designed study. Following an overnight fast, participants completed a 80 min running test using a NIRS device placed on the flexor digitorum superficialis of the dominant hand. Subjects then consumed either plain water, or the cocoa beverage (40g of roasted cocoa brewed for 10 minutes), and all testing was repeated 90 minutes later. This process was then repeated, with the return to the lab on a separate day to repeat the test using the opposite beverage.

The change from baseline was not significantly different between water (W) and cocoa (C) for resting heart rate (C=6.6±6.5 bpm, W=4.4±7.0 bpm; p=0.29), resting systolic blood pressure (C=116±11.6 mmHg, W=117±11.6 mmHg; p=0.94), resting diastolic blood pressure (C=74±7.7 mmHg, W=74±7.7 mmHg; p=0.94), pre-occlusion SO2 (C=1.6±0.5%, W=1.9±0.6%; p=0.06), minimum SO2 during occlusion (C=0.61±10.5%, W=0.72±12.8%; p=0.98), reperfusion maximum SO2 (C=...
0.5±3.6 %, W= -0.8±5.0 %; p=0.40), or reperfusion rate quantified as the slope of the S0t during the first 10 seconds of reperfusion (C=0.1±0.4 % s^-1, W=0.06±0.4 % s^-1; p=0.79).

CONCLUSION: Consumption of a brewed cocoa drink does not significantly affect markers of endothelial function or blood pressure in healthy college-aged adults.

2777  Board #238  May 29 9:30 AM - 11:00 AM
Chronic Alcohol Consumption In Female Mice Yields Strain Dependent Differences In Muscle Atrophy
Joseph A. Laudato, Abby L. Tice, Kirsten R. Dunlap, Zachary A. Keith, Jennifer L. Steimer. Florida State University, Tallahassee, FL. (Sponsor: Ellen Glickman, FACSM)

Differences in alcohol preference between mouse strains is well known, yet there are no reports of whether alcohol non-preferring mice experience alcohol-induced myopathy.

PURPOSE: To determine whether the intake and response to chronic alcohol feeding differs between alcohol preferring (C57BL/6) and non-preferring (CD2F1) mice.

METHODS: Female C57BL/6 (n=16) and CD2F1 (n=6) mice aged 12-weeks-old were acclimated to a liquid diet (1 wk) prior to randomization into either a control (CON) or alcohol (EtOH) treatment group: B6-CON, B6-EtOH, CD2-CON, and CD2-EtOH. Alcohol was incorporated into the diet and daily consumption of EtOH was assessed relative to body weight. After 7 weeks the gastrocnemius (GAS), tibialis anterior (TA), and quadriceps (QUAD) muscles were excised, weighed, and are expressed relative to body weight. Blood was collected from the vena cava and separated into plasma for blood EtOH concentration at time of sacrifice (BAC). The spleen and heart were also removed and weighed. Data were analyzed via 2-way ANOVA for variables across time, and unpaired t-tests were used to detect differences within each strain.

RESULTS: A group x time interaction was observed for EtOH consumption (p=0.010; 0.001), where B6-EtOH consumed a greater amount of EtOH compared to CD2-EtOH weeks 3-7 (p=0.038). However, at time of sacrifice, no differences were observed for BAC between the strains (p=0.22). Alcohol intake reduced GAS weight similarly in both strains (B6: -96.7 ± 4.15%; p=0.037; CD2: -12.07 ± 3.19%; p=0.019), and muscle weights also did not differ between strains following alcohol intake (p=0.06). QUAD weight was also reduced by alcohol consumption in the CD2 mice (-17.68 ± 4.56%; p=0.02), while no significant atrophy was observed in the B6 mice. Conversely, B6 mice had a significant reduction in heart weight following chronic alcohol intake (p=0.014; -13.03 ± 4.58%), while the CD mice showed no effect. Finally, alcohol feeding did not alter spleen weight or TA weight in either strain (p<0.05).

CONCLUSION: The non-alcohol preferring CD2F1 mice experienced a greater loss of muscle mass in response to chronic alcohol feeding, despite consistently consuming a lower dose of alcohol. Future work will be needed to determine what molecular pathways contributed to the enhanced catabolic effect of alcohol in this strain of mice.

2778  Board #239  May 29 9:30 AM - 11:00 AM
Pistachios May Promote Recovery From Strenuous Exercise
Imogene Azalea Carson, Mark Kern PhD, RD, Shirin Hooshmand PhD, RD, Changli Liu PhD, Mee Young Hong PhD, RD, Tim O’neal RD, Aj Munoz, Jillianne Son. San Diego State University, San Diego, CA. (Sponsor: Michael Buono, FACSM)

Among nuts, pistachios are considered a rich source of leucine. They are also a good source of antioxidants. These are compounds known to promote muscle protein synthesis and reduce inflammation respectively. Therefore, we hypothesize that pistachios may confer favorable effects to athletes following strenuous exercise.

PURPOSE: to determine if pistachio nut consumption for two weeks prior to and during three days of recovery from vigorous, eccentrically biased exercise improves muscle soreness, vertical jump height and muscle strength in a dose (0, 1.5 oz and 3.0 oz per day) dependent manner.

METHODS: Female C57BL/6 (n=16) and CD2F1 (n=6) mice aged 12-weeks-old were acclimated to a liquid diet (1 wk) prior to randomization into either a control (CON) or alcohol (EtOH) treatment group: B6-CON, B6-EtOH, CD2-CON, and CD2-EtOH. Alcohol was incorporated into the diet and daily consumption of EtOH was assessed relative to body weight. After 7 weeks the gastrocnemius (GAS), tibialis anterior (TA), and quadriceps (QUAD) muscles were excised, weighed, and are expressed relative to body weight. Blood was collected from the vena cava and separated into plasma for blood EtOH concentration at time of sacrifice (BAC). The spleen and heart were also removed and weighed. Data were analyzed via 2-way ANOVA for variables across time, and unpaired t-tests were used to detect differences within each strain.

RESULTS: A group x time interaction was observed for EtOH consumption (p=0.010; 0.001), where B6-EtOH consumed a greater amount of EtOH compared to CD2-EtOH weeks 3-7 (p=0.038). However, at time of sacrifice, no differences were observed for BAC between the strains (p=0.22). Alcohol intake reduced GAS weight similarly in both strains (B6: -96.7 ± 4.15%; p=0.037; CD2: -12.07 ± 3.19%; p=0.019), and muscle weights also did not differ between strains following alcohol intake (p=0.06). QUAD weight was also reduced by alcohol consumption in the CD2 mice (-17.68 ± 4.56%; p=0.02), while no significant atrophy was observed in the B6 mice. Conversely, B6 mice had a significant reduction in heart weight following chronic alcohol intake (p=0.014; -13.03 ± 4.58%), while the CD mice showed no effect. Finally, alcohol feeding did not alter spleen weight or TA weight in either strain (p<0.05).

CONCLUSION: The non-alcohol preferring CD2F1 mice experienced a greater loss of muscle mass in response to chronic alcohol feeding, despite consistently consuming a lower dose of alcohol. Future work will be needed to determine what molecular pathways contributed to the enhanced catabolic effect of alcohol in this strain of mice.

2779  Board #240  May 29 9:30 AM - 11:00 AM
Optimization Of Heart-Brain-Axis Signaling Improves Mental And Physical Performance
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(Please report any relevant relationships)

PURPOSE: Dynamic changes in heart rate variability (HRV) are considered as markers for autonomic nervous system (ANS) balance and psychological mood states, including depression, anxiety, overtraining, and burnout. HRV is reduced in both depression and heart disease, suggesting common physiological mechanisms. Reduced HRV suggests poor stress adaptation, while increased HRV is associated with vigor (physical energy, mental acuity & emotional well-being). This study assessed the effects of nutritional supplementation on “Heart-Brain-Axis” dynamics whereby nutrition may impact physical (heart) and psychological (brain/mood) parameters in a coordinated manner.

METHODS: Before and after 30-days of supplementation, subjects performed a HRV assessment (emWave Pro; HeartMath Institute) and completed a validated Profile of Mood States (POMS) survey to assess Global Mood (GM) and related subscales: Vigor (V), Tension (T), Depression (D), Anger (A), Fatigue (F). Confusion (C). The supplement (MentaHeart; Amare Global) contained 5 natural ingredients previously shown to have health benefits, including Palm fruit bioactives (redox balance), Astaxanthin (antioxidant), Bergamot (cholesterol), Coenzyme Q10 (cardiac energetics), and Black cumin seed (inflammation).

RESULTS: Following 30-days of supplementation, HRV was improved 11% (SDNN: 47.5msce Pre versus 58.2msc Post) and 19% (RMSSD 3.7 Pre versus 4.4 Post), indicating superior ANS tone and enhanced stress resilience. Psychological Mood State (POMS) parameters showed dramatic improvements following supplementation, with reductions in negative mood states: T (-49%), D (-76%), A (-39%), F (-51%), and C (-62%); with corresponding increases in positive mood states; GM (+23%) and V (+22%).

CONCLUSIONS: Supplementation resulted in a meaningful 11-19% increase in HRV (suggesting a “physical” heart benefit) and also improved mood state parameters (suggesting a “mental” brain benefit). While previous studies have shown individual ingredients to improve general health, these are the first studies that targeted multi-nutrient supplementation supports the multi-faceted psychophysiological “Heart-Brain-Axis” with simultaneous and coordinated improvements in both physical and mental performance.

2780  Board #241  May 29 9:30 AM - 11:00 AM
Astatistaxanthin Formulation Leads To Greater Lipid Oxidation & Increased Exercise Tolerance In Elderly
Sophia liu1, Ana Valencia1, Matt VanDoren2, Eric Shankland3, Kevin Conley4, David Marcinek1. 1University of Washington, Seattle, WA. 2Fed Hutch, Seattle, WA. Email: sophia.liu21@uw.edu

(Please report any relevant relationships)

Purpose: Natural anti-oxidant and anti-inflammatory products have been found to increase fat oxidation and endurance in animals and humans when combined with exercise training. Here, we test this approach as a treatment for the reduced lipid oxidation and associated lower endurance in human aging using a formulation combining natural anti-inflammatory and anti-oxidant products (AX: astaxanthin, 12 mg; tocotrienol, 10 mg; and zinc, 6 mg). Methods: We conducted a randomized, double-blind, placebo-controlled study in the elderly of a daily oral dose (16 weeks) of AX formulation with 12 weeks of exercise training, 3x/week for 40-60 min of increasing intervals of incline walking, targeting 80% HRmax. Cardiovascular endurance and fat oxidation was calculated from respiratory exchange ratio via Balke treadmill test. Tibia anterior (TA) muscle strength and fatigue resistance was measured as force time integral (FTI) in ankle dorsiflexion exercise to fatigue. TA resistance to fatigue was also determined by number of contractions. Results: After 12 weeks of training both groups improved treadmill time, only AX group delayed time reach of anaerobic threshold (128±115s vs. 311±32s). Total fat oxidation improved in both group, but AX improved (Δ 80.4±19.4%) more compared to training alone (Δ 39.2±10.2%). TA fatigue resistance measured by total contractions (Δ184±77) and FTI (Δ102±30 N) improved only in the AX group. Conclusion: AX supplementation...
combined with interval training improved whole body fat use significantly more than training alone. Delayed anaerobic threshold in AX group suggested higher exercise capacity. This increased fatigue resistance of the TA in addition to the greater exercise capacity suggests that this metabolic effect is occurring at the level of the individual muscle. The increased fat oxidation and delayed anaerobic threshold may due to sustained fat use at lower rates of exercise that leads to carbohydrate sparing and ultimately increased carbohydrate availability at more intense exercise levels. The combination of exercise and single muscle fatigue testing removed the training effect (neuromuscular adaptation) that is commonly seen in exercise training. These results indicate that AX supplementation results in greater metabolic adaptation than endurance training alone.

2781 Board #242 May 29 9:30 AM - 11:00 AM
Influence Of Post-exercise Nutrient Intake On Recovery And Subsequent Exercise Performance In Young Cyclists
Nicholas T. Thomas, Andrew S. Law, Allison T. Cadamator, Nicholas D. Luden, George F. Schultz, Stephanie P. Kurti, Michael J. Saunders, FACSM, James Madison University, Harrisonburg, VA. (Sponsor: Michael J Saunders, FACSM)
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Purpose: The purpose of this study was to determine if chocolate milk (CM) consumption after high-intensity cycling affected post-exercise recovery and subsequent exercise performance in youth cyclists, compared to carbohydrate (CHO) consumption after high-intensity cycling. Methods: Eight youth cyclists (15-18 yrs, VO2peak = 61.8±7.7 mL·kg⁻¹·min⁻¹) performed two exercise sessions on three separate occasions. The first exercise session (EX1) included 30 min of constant-load cycling, and 60 min of standardized high-intensity intervals. Subjects consumed a recovery beverage (PL, CHO or CM) immediately following EX1 and again 2 h after EX1. A standardized lunch was consumed 4 h post-EX1, and a second exercise session (EX2) was completed 7 h after EX1. EX2 consisted of 30 min of constant-load cycling followed by a simulated 30 km time trial (TT). Ratings of muscle soreness, and mental and physical energy/fatigue were obtained prior to EX1, 4 h post-EX1, and pre-EX2. TT power output (W) was used to assess subsequent exercise performance. Results: Changes in muscle soreness over time were not significantly different between treatments. However, soreness was significantly elevated in PL from pre-EX1 (44±23 mm) to 4 h post-EX1 (67±22 mm) and pre-EX2 (68±20 mm). Soreness tended to be elevated in CHO from pre-EX1 (37±26 mm) to 4 h post-EX1 (52±28 mm; p = 0.051) but not pre-EX2, and soreness was not elevated at any post-exercise timepoint in CM. Physical fatigue ratings increased significantly from pre-EX1 to pre-EX2 in PL, but not CHO or CM. In addition, changes in physical fatigue after exercise tended to be less pronounced with CM versus other treatments (p-values for treatment x time effects: 0.03 - 0.19). Average TT power was similar between PL (181±27 W), CHO (197±39 W) and CM (195±38 W). Conclusions: CM ingestion after exercise may confer recovery benefits in youth cyclists, as demonstrated by the absence of elevated muscle soreness and fatigue ratings post-exercise. However, significant treatment x time effects were not consistently observed across all soreness/fatigue measurements. Subsequent cycling performance was not significantly different between treatments. However, TT performance effects (~8% higher power in CM/CHO versus PL) may be functionally relevant if upheld in trials with larger sample sizes.

2782 Board #243 May 29 9:30 AM - 11:00 AM
Abstract Withdrawn

2783 Board #244 May 29 9:30 AM - 11:00 AM
The Effects Of Sliver Perch Essence On Body Weight And Endurance Capacity
Kuan-Chen Wu1, Shiow-Chwen Tsai1, Chung Yu Chen1, Yi-Hung Liao1, Institution Of Sports Science, Taipei, Taiwan. 1Department of Exercise and Health Science, Taipei, Taiwan. (Sponsor: Chia-Hua Kao, FACSM)
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Purpose: To investigate the influence of silver perch essence (SPE) on the anti-fatigue effect and body weight gain (BW). Methods: Thirty-six Wistar rats were weight-matched and assigned into three groups, including: control (water placebo, n = 12), L-SPE (6.2 mL/kg BW/day, n = 12), and H-SPE (31 mL/kg BW/day, n = 12), and SPE were orally administrated for 32 consecutive days. The swimming exhaustive test (with 3% BW load attached on the tail) was used to evaluate the swimming endurance performance in response to SPE supplementation. All data were expressed as mean ± SEM, and ANOVA was used to examine the differences in swimming capacity and BW change among groups. Duncan multiple range test was used as post-hoc test. P<0.05 was considered statistically significant. Results: After SPE supplementation, the BW gain was not different among the three groups. However, the BW gain slowed down after the 22nd day, the weight gain of the H-SPE group was significantly lower than that of the control group (11.34%, p<0.038). When normalizing with caloric intake, both L-SPE (-19.75%) and H-SPE (-18.9%) showed significantly less weight gain compared to control group (p<0.016 and p<0.022, respectively), but there was no difference between L-SPE and H-SPE. The swimming time to exhaustion was significantly higher in the L-SPE but not H-SPE than in the control group (p=0.031). Conclusion: The results showed that 32-days of SPE supplementation can promote the swimming endurance capacity and attenuate the weight gain in the rodent models.

Keywords: anti-fatigue, calorie, swim, weight gain

E-34 Free Communication/Poster - Cold/Hyperbaric Physiology
FRIDAY, MAY 29, 2020
9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

2784 Board #245 May 29 10:30 AM - 12:00 PM
Effects Of A Demand-valve Scuba Regulator On Cardiovascular Function Under Normobaric Conditions: Preliminary Findings
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Purpose: An increased number of diving fatalities related to cardiac events, leading to loss of air and drowning have been reported (Divers Alert Network, 2018). These events are often preceded by acute physiological stress, such as when presented with situations that increase physiological workload (emergency event, strong current, etc.). Greater cardiopulmonary response, including significant increases in heart rate and cardiac output, often occur as a result of increased stress. Examining equipment factors that influence cardiopulmonary stress during diving has been limited. Therefore, the purpose of this preliminary investigation was to examine the effect of a scuba regulator on cardiopulmonary measures in a group of volunteer participants. Methods: Ten participants (x = 21.5 yrs.) completed two sub-maximal exercise tests (YMCA Protocol) under sea-level atmospheric conditions on a Monark (Vansbro, Sweden) cycle ergometer until 85% of calculated maximal heart rate was observed. Heart rate, blood pressure, rating of perceived exertion (RPE), and pulse oxygen levels were all collected. The first submaximal test was collected under typical conditions (control). After one week, each participant completed a second submaximal test while breathing compressed air from a demand valve scuba regulator (Dive Rite, FL) connected to an 80 cu/ft aluminum scuba cylinder. All procedures were approved by a university institutional review board prior to data collection. Results: A descriptive analysis of the data indicated all variable means for the regulator condition (except RPE) were within two standard deviations of the respective mean values for the control condition and therefore considered non-significant. Subsequent post-hoc analysis determined minimum sample sizes required for future research to detect if true differences between groups exist for each variable. Conclusions: Preliminary data suggest that breathing from a demand valve scuba regulator does not appear to affect exercise tolerance or increase cardiopulmonary stress at submaximal workloads under normobaric environmental conditions. Future sample size requirements from this preliminary investigation have been determined through statistical analysis and further research with a larger sample appears warranted.

Room: CC-Exhibit Hall

2785 Board #246 May 29 10:30 AM - 12:00 PM
Self-paced Aerobic Exercise Performance Is Attenuated Following Four Hours Cold Water Immersion
Hayden W. Hess1, Zachary J. Schlader, FACSM1, Blair D. Johnson, FACSM1, David Hostler, FACSM1. 1University at Buffalo, BUFFALO, NY, 2Indiana University, Bloomington, IN. (Sponsor: David Hostler, FACSM)
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(no relevant relationships reported)

Purpose: It is common for special warfare operators to complete land-based missions following prolonged transport dives. Time to exhaustion during high intensity aerobic exercise is attenuated following cold water submersion, which can be exacerbated when breathing oxygen (O2). However, the high intensity time to exhaustion model may not be operationally relevant. Purpose: We tested the hypothesis that self-paced exercise performance following four hours cold water immersion is reduced compared.
to a non-immersed control, and that performance would be further reduced when breathing O2 during immersion. METHODS: Eight subjects (4 men and 4 women; age: 25.2 ± 2.7 years; Body Fat (%): 19.3 ± 5.1; VO2max: 46.4 ± 13.8 mL/kg/min) completed a baseline (CON) performance and two, 4-hour cold water immersion visits (20°C) breathing air or 100% O2. During CON visit and following immersion, subjects completed a 60-minute loaded ruck-march with 20% body mass (data not shown) followed by a self-paced 5 km run on a motorized treadmill. Core temperature, heart rate, and rating of perceived exertion (RPE) were recorded every 5 min during the run. RESULTS: 5 km run time was reduced following immersion while breathing 100% O2 (p=0.006) and air (p=0.007) compared to the CON (32.6 ± 4.8 min vs. 32.5 ± 5.0 min vs. 28.8 ± 4.8 min, respectively). However, there was no difference between air and O2 (p=0.86). Core temperature increased during the 5 km run (p<0.001), but was not different between conditions (p=0.96). Heart rate increased during the 5 km run (p<0.001), but was not different between conditions (p=0.1). RPE increased during the run (p<0.001), but was not different between conditions (p=0.73). CONCLUSION: These findings suggest that prolonged cold water immersion attenuates self-paced endurance performance, but does not appear to be further affected by breathing gas type (i.e., air vs. 100% O2). However, the mechanisms for this attenuated post-immersion performance remain largely unknown.

2786 Board #247 May 29 10:30 AM - 12:00 PM Effects Of Environmental Condition And Body Fat Percentage On Metabolic Efficiency During Cycling Exercise
Brittany N. Falloway1, Jeremiah A. Vaughn2, Ellen L. Glickman, FACSM3, Adam R. Jajtner1, 1Ripon College, Ripon, WI; 2Bemidji State University, Bemidji, MN; 3Kent State University, Kent, OH. (Sponsor: Ellen Glickman, FACSM)

PURPOSE: To examine the effects of environmental condition and body fat percentage on metabolic efficiency during cycling exercise.

METHODS: Recreationally active men consisting of 4 low-fat (LF: 10.9% ± 2.5; 23.8 ± 3.1 yrs; 182.6 ± 7.1 cm; 80.7 ± 4.5 kg; 4.03 ± 0.34 L·min-1) and 4 high-fat (HF: 15.9% ± 2.2; 23.3 ± 1.9 yrs; 180.9 ± 4.2 cm; 79.6 ± 5.9 kg; 3.63 ± 0.13 L·min-1) completed a 60-minute cycling trial at 60% VO2max. Metabolic efficiency was calculated during cycling at 3min, 15min, 30min, 45min, and 60min. Data were analyzed using a three-way repeated measures mixed-design ANOVA.

RESULTS: A time x BF interaction was observed (F(4,147) = 0.001). Post hoc analysis indicated a main effect of time in LF (F(11,983) = 0.001) and HF (F(24,406) = 0.001) individuals. Specifically, significant decreases in metabolic efficiency were observed at 15min, 30min, 45min, and 60min compared to 3min (p < 0.05) in LF individuals, with no further reductions observed at 45min (p = 0.732) and 60min (p = 0.598) compared to 30 min. In HF individuals, significant decreases in metabolic efficiency were observed at 15min, 30min, 45min, and 60min compared to 3min (p = 0.001), with further reductions observed at 45min (p = 0.001) and 60min (p = 0.001) compared to 3min, and at 60min compared to 30min (p = 0.005) and 45min (p = 0.002). Furthermore, a condition x time interaction (F(3,351) = 0.006) was observed. A main effect of time was observed for the condition (F(22,436) = 0.001) and MT condition (F=20.850, p<0.001), with significant decreases at 15min, 30min, 45min, and 60min compared to 3min (p < 0.05) during the LT and MT conditions. Furthermore, paired samples t-test indicated significantly lower metabolic efficiency in the MT condition compared to the LT condition at 45min (MT: 19.17 ± 1.6%; LT: 20.2 ± 1.6%; p=0.001) and 60min (MT: 18.88 ± 0.63%; LT: 19.16 ± 0.68%, p=0.49).

CONCLUSIONS: Data suggests that individuals with a higher % BF may experience greater decreases in metabolic efficiency throughout prolonged cycling exercise at moderate intensity. Additionally, metabolic efficiency appears to decrease throughout cycling exercise, with cold environments resulting in greater efficiency compared to MT conditions.

2787 Board #248 May 29 10:30 AM - 12:00 PM Brain Derived Neurotropic Factor Response To Aerobic Exercise In The Cold
Carly Siedlacek, Ryan T. Wiet, Emily C. Tagesen, Elliott Arroyo, Ellen L. Glickman, FACSM, Adam R. Jajtner. Kent State University, Kent, OH. (Sponsor: Ellen Glickman, FACSM)

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No relevant relationships reported

PURPOSE: To examine changes in brain derived neurotropic factor (BDNF) concentration in both plasma and serum following exercise in the cold. METHODS: Six recreationally active men (26 ± 3 yrs; 180.3 ± 5.8 cm; 85.3 ± 8.4 kg; 48.6 ± 5.7 mL kg-1.min-1) completed an exercise protocol under two conditions: moderate temperature (MT: 23°C ± 4.5°C/RH) and low temperature (LT). The protocol consisted of a 60-minute cycling trial at 100% VO2max, a 15-minute rest, and a time-to-exhaustion trial at 90% VO2max (TTE). Blood was collected before (T1) and after (T2) the 60-minute trial, immediately after TTE (T3), and one hour post-TTE. Plasma and serum concentrations of BDNF were measured via ELISA. Changes were analyzed by two-way mixed-model regression for each dependent variable.

RESULTS: No significant condition x time interaction (F = 1.626, p = 0.201) or main effect of time (F = 0.626, p = 0.603) was observed for changes in serum BDNF concentrations; however, a significant main effect of condition (F = 7.685, p = 0.009) was observed. When collapsed across time, serum BDNF concentration was significantly lower during LT (2718.8 ± 1172.2 pg/mL) compared to MT (7240.5 ± 1134.2 pg/mL, p = 0.009). No significant condition x time interaction (F = 0.117, p = 0.950), main effect of time (F = 0.511, p = 0.677) nor main effect of condition (F = 0.000, p = 0.988) was observed for changes in plasma BDNF concentrations. CONCLUSIONS: The results of this study suggest that exercise in a cold environment (3°C) blunts serum BDNF concentration. However, plasma BDNF concentrations of the LT condition were not affected by environmental condition nor exercise. Previous research has found no relationship between serum and plasma BDNF, suggesting that these are independent measures of diverse physiological relevance. Peripheral BDNF is predominantly stored in platelets (~99%), with only a small amount of free BDNF present in plasma. Due to the smaller amount of platelet-associated BDNF in plasma, plasma concentrations of BDNF may reflect the amount of free BDNF. Therefore, exercise in a cold environment may decrease BDNF release from platelets while having no effect on free BDNF.

This study was partially funded by the Kent State University Research Council.
water reaching navel height, and b) control group (23°C, 12min passive, sit rest in similar body position). Mixed analysis of variance (ANOVA) was used, to verify the possible differences between matches and recovery protocols for each variable. There were no differences in internal or external load variables between recovery groups during treatment in men or women (see figure 1). Continuous cold water immersions and passive recovery are both effective to maintain the external and internal physical demands during a congested tournament in handball.

CONCLUSIONS: From these results, light-moderate exercise in hypoxia could attenuate α wave expression by decreasing SpO₂. It would be affect the exercise performance and acclimatization at altitude, as well as cognition.

E-35 Free Communication/Poster - Hypoxia/Altitude Physiology
Friday, May 29, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

It is well known that hypoxic stress causes various physiological responses and/or adaptations. Hypoxia also affects brain activities such as cognition, judgment and exercise performance, and it is thought that the influence on electroencephalogram (EEG) is great. However, there are few researches related to the change of EEG per se and exercise at hypoxia, and it is thought that the mechanisms underlying the physiological responses including brain activity of hypoxic stress per se and exercise at hypoxia were not fully understood. PURPOSE: The purpose of this study was to examine effect of light-moderate exercise at acute normobaric hypoxia on EEG and physiological responses. METHODS: Eleven college-age male subjects were participated in this study. They completed the light-moderate exercise (50-65%HRmax) at both normoxia and normobaric hypoxia (14.5% hypoxia). We measured EEG of left forehead, heart rate (HR), and oxygen saturation (SpO₂) before and after exercise. EEG measurement was carried out in a quiet environment, and subjects measured with their eyes closed. The measured EEG was classified into 3 frequency bands. In other words, it was classified into 0 wave, 4 to 7.5 Hz, α wave 8 to 13 Hz, β wave 13.5 to 30 Hz. The average value (µV) of the amplitude of the EEG and the total amplitude of the EEG in the entire frequency band (3 to 30 Hz) were obtained for each measurement for 10 minutes. Repeated measures ANOVA was performed across treatments. RESULTS: α wave, α at rest and during moderate exercise in hypoxia was significantly lower than that of normoxia (p<0.05). The average value of α wave tended to increase after exercise in normoxia from 3.08±0.79 to 3.26±0.06 µV. On the other hand, α wave tended to slightly decrease after exercise in hypoxia from 2.96±0.85 to 2.84±0.82µV. The average value of β and β wave did not change after exercise at both environments.

CONCLUSIONS: The alleviation of muscle atrophy by resistance training under hypoxia may be related to the regulation of autophagy by FoxO1. Supported by NNSF of China (31771317)

2791 Board #252 May 29 10:30 AM - 12:00 PM Resistance Training Alleviates Hypoxia-induced Skeletal Muscle Atrophy Of Rats By Inhibiting FoxO1-mediated Autophagy Pathway
Pengyu Fu, Yang HU, Lijing GONG. Beijing Sport University, Beijing, China.
Email: 1402884452@qq.com
(No relevant relationships reported)

PURPOSE: The aim was to investigate the effects of resistance training on hypoxia-induced muscle atrophy and the regulation of FoxO1-mediated autophagy.

METHODS: SD rats were divided into the normoxic control group (C), the normoxic resistance training group (R), the hypoxic control group (H), and the hypoxic resistance training group (HR). Group R and HR were trained by incremental load ladders every other day; Group H and HR lived in a hypoxia with 12.4% O₂ for 4 weeks. After autophagy was confirmed by testing the expression of autophagy regulatory protein and autophagy key protein, autophagy PCR chip was used to determine the function of autophagy and the interaction with FoxO1, then the localization and expression of FoxO1 were tested.

RESULTS: The lean body mass (LBM) (260.50±9.35 vs. 226.38±13.83), EDL weight (165.33±10.59 vs 143.83±13.85) and FCSA (16.13±1.92 vs 13.52±1.27), as well as the protein expression levels of Myosin (1.36±0.15) and Atrogin (1 vs 1.29±0.02) in Group H were significantly different from group C (p<0.05); The EDL wet weight (153.50±6.12) in Group HR was significantly higher than group H, and Atrogin (0.73±0.14) expression was significantly decreased (p<0.05). The expression (11.26±4.72 vs 8.73±2.13) and the nuclear localization of FoxO1 (56.28±3.47 vs 65.39±4.29) was significantly increased (p<0.05) under hypoxia: The expression (12.83±4.95) and nuclear localization (52.82±5.32) of FoxO1 were decreased (p<0.05) in group HR. The expression of Beclin 1 (0.6±0.31) and LC3II/I (1 vs 1.4±0.14) was increased in group HR, the expression of LC3II/I (1.23±0.08) was decreased in hypoxia HR group. PCR microarray showed the number of differentially expression genes in autophagy was higher in group H than C, and the function was concentrated in “Genes involved in autophagic vacuole formation”; the number of autophagy genes was decreased in group HR/H, and the function was concentrated in “Co-regulators of autophagy and apoptosis”. The interaction and Pathway analysis between genes in group R/C, H/C, and HR and FoxO1, found that the regulation of autophagy by FoxO1 was concentrated in autophagy prophase.

CONCLUSIONS: The impact Of Three Consecutive Days Of Endurance Training In Hypoxia On Hepcidin Responses.
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(No relevant relationships reported)

Endurance exercise in hypoxia resulted in similar hepcidin elevation compared with exercise in normoxia (Govus et al. 2014; Goto et al. 2017). However, how consecutive days of endurance training in hypoxia on hepcidin response. PURPOSE: The purpose of the present study was to determine the effect of three consecutive days of endurance training in hypoxia on hepcidin response.

METHODS: Nine active healthy males completed two trials on different days, consisting of either three consecutive days of endurance training in hypoxia (FiO₂: 14.5%) or normoxia (FiO₂: 20.9%). They performed 90-min sessions of endurance training consisting of high-intensity endurance interval exercise (10 ± 4 min pedaling at 80% of VO₂max, 20 min of active rest at 30% of VO₂max) followed by 30 min of continuous pedaling at 60% of VO₂max during three consecutive days (days 1-3). Venous blood samples were collected after an overnight fast during experimental periods (days 1-4) to determine the serum hepcidin, iron, ferritin and haptoglobin concentrations.

RESULTS: Pedaling workload during endurance training were significantly lower in the HYP (interval exercise: 166 ± 4.3 W) than in the NOR (194 ± 7.6 W, P < 0.0001). Serum iron (P < 0.0001) and ferritin (P = 0.005) concentrations on days 2-4 significantly increased in both trials, whereas there was no significant difference between the two trials. Serum haptoglobin concentrations did not significantly change throughout the experimental periods in either trial. Moreover, NOR showed significantly greater serum hepcidin elevation on the days 2-4 compared with day 1 (day 1: 13.9 ± 8.6 ng/ml, day 2: 30.4 ± 9.9 ng/ml, P < 0.004). However, no significant difference was observed in serum hepcidin concentrations between the NOR and HYP.
CONCLUSION: Three consecutive days of endurance training in hypoxia did not affect further hepcidin elevation compared with endurance training in normoxia.

2793 Board #254 May 29 10:30 AM - 12:00 PM
The Effects Of Hypoxic Training At Different Exercise Intensities On Endurance Performance
Fumiya TANJ1, Hayato OHNUMA1, Ryosuke ANDO1, Chihiro KOHMA1, Nobukazu KASAI1, Takahito NAITO1, Yasuhito SUZUKI1,2, Tokai University, HIRATSUKA-SHI, KANAGAWA, Japan. 1Kansai University of Social Welfare, AKO-SHI, HYOGO, Japan. 2Institute of Sport Sciences, KITA-KU, TOKYO, Japan. Email: fumiya.tanj@isc-tokai.ac.jp

Almost of endurance performance difference among athletes can be explained by running economy (RE). Short-term training under hypoxic conditions is useful in improving the RE; thus, enhancing endurance performance. However, the type of exercise intensity under hypoxic conditions effectively enhancing the RE and endurance performance has not been well documented. PURPOSE: We aimed to compare the changes in the RE and endurance performance between different exercise intensities by 5-day hypoxic training. METHODS: Twenty-two well-trained male distance runners were divided into these three training groups: low-intensity (FIO2 =14.5%, hypoxia), high-intensity (FIO2 =14.5%). They trained for five consecutive days (day 1-5), all groups performed short-time (5 rep x 30 s) maximal sprint training in the morning, the NOR and the HL performed long-time low-intensity (2 rep x30 min at <4M) endurance training and the HH performed long-time high-intensity (10 rep x2 min at 5405m) endurance training in the afternoon. Low-intensity (230 m/min) the RE (RE230), high-intensity (>4M) the RE (RE4mM), and time-to-exhaustion at 100% of VO_max intensity (TTE) on days 0, 8, and 14 were measured. RESULTS: A significant enhancement of the TTE and the RE230 was observed from day 0 to day 14 (267.56 ± 5 s to 374.83 s and 0.99 ± 0.05 kcal/kg/km to 0.97 ± 0.06 kcal/kg/km; P<0.05); whereas, no significant enhancement of the RE4M was observed (1.09 ± 0.08 kcal/kg/km to 1.08 ± 0.09 kcal/kg/km; P>0.05) in the HL. There was no significant enhancement of the TTE (139 ± 15 s to 135 ± 10 s; P>0.05), the RE230 (1.02 ± 0.03 kcal/kg/km to 1.01 ± 0.04 kcal/kg/km; P>0.05), and the RE4M (1.18 ± 0.03 kcal/kg/km to 1.15 ± 0.05 kcal/kg/km; P>0.05) in the HH. Similarly, there was no significant enhancement of the TTE (432 ± 90 s to 393 ± 100 s; P>0.05), the RE230 (0.99 ± 0.06 kcal/kg/km to 0.99 ± 0.04 kcal/kg/km; P>0.05), and the RE4M (1.10 ± 0.08 kcal/kg/km to 1.10 ± 0.06 kcal/kg/km; P>0.05) in the NOR. CONCLUSION: Our main finding was that the HH enhanced the RE at low-intensity and the TTE. However, the HH did not enhance the RE at high-intensity and the TTE. These results indicate that increasing the exercise time enhanced the RE at low-intensity and the TTE. However, the HH did not enhance the RE at high-intensity and the TTE. These results indicate that increasing the exercise time enhanced the RE at low-intensity and the TTE. However, the HH did not enhance the

2794 Board #255 May 29 10:30 AM - 12:00 PM
EFFECTS OF 3-WEEK NATURAL ALTITUDE TRAINING ON IMMUNOGLOBULIN LEVELS IN AMATEUR ADOLESCENT ATHLETES
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PURPOSE: Although the effects of exercise on immunoglobulin have been widely studied in adults, the available evidence in children and adolescents exposed to high altitude environment is more sparse. To determine the effects of altitude training on immunoglobulin, we aim to study the relationship between immunoglobulin and altitude training. METHODS: Twenty-one male amateur adolescent runners (age: 15.3 ± 0.7 years, height: 164.7 +/- 5.4cm, weight: 51.3 +/- 6.1kg, training period: 0.9 +/- 0.2 FAT g/kg/day and 2.4 +/- 0.2 PRO g/kg/day. In addition, 7 days of intermittent fasting during light exercise days (16-20 hrs) and 25 sessions of post-exercise 20-40 min sauna exposure occurred during the 12-week period. On May 10, 2019 (Day 1) the subject traveled from San Francisco to Everest Base Camp (5200m) (Day 2). The subject spent the next 3 days acclimatizing at altitudes of 5200-7500 m. On May 22, 2019 (Day 12) the subject successfully summited Mt. Everest (8848 m) and arrived back at the airport in Tibet on Day 13, arriving back in San Francisco on May 24th. CONCLUSION: A 12-week pre-acclimatization protocol at sea level successfully prepared the subject to summit Mt. Everest in 14 days.

2795 Board #256 May 29 10:30 AM - 12:00 PM
Pre-acclimation, Training, And Nutrition For 14-day Lightning Summit Of Mt. Everest
Roxanne M. Vogel1, Gretchen A. Casazza2, Roberto Quintana3,1. GU Energy Labs, Berkeley, CA. 2California State University, Sacramento, CA. 3Human Performance Research Lab, CSU Sacramento, CA. Email: rvogel@guenergy.com

Typical acclimatization protocols for summiting Mt. Everest involve sleeping and hiking at successively higher altitudes for more than 45 days. Prolonged exposure to hypoxia on the mountain increases the risk for Acute Mountain Sickness, hypothermia, accidents and non-successful summits. Reducing the time of exposure could decrease this risk and improve summit success. PURPOSE: This study examined the efficacy of a pre-trip acclimatization protocol combining nutrition and exercise training and hypoxia exposure from a single healthy experienced female mountaineer (Age 33 yrs) preparing to summit Mt. Everest. Pre-post measurements of body composition via DXA, heart rate (HR), SpO2, sleep quality, hematology (hematocrit & hemoglobin), graded exercise test, and nutritional intake values were analyzed. RESULTS: Simulated hypoxia gradually increased from 1800 to 5800 m over the 12 weeks (13.9 ± 0.9 hr/day). Over the 12 week protocol hypoxia tent HR increased from 52 to 64 bpm and SpO2 decreased from 93 to 77%. Lake Louise AMS symptoms were mild at 0.5 ± 0.6 on a scale of 0-3. Blood Hb increased from 13.3 ± 1.7 g/dl and Hct from 42.9 to 52.5 % from baseline to summit day. Body mass (61.6 to 52.5 kg), body fat (26.6 to 15.3%), fat free mass (43.2 to 42.7 kg), and fat mass (16.4 to 8.1 kg) decreased over the 12 weeks. Fat utilization increased and carbohydrate utilization and blood lactate decreased across absolute workloads post-acclimation. Average daily exercise intemate was 1902 ± 18 kals which consisted of 1.8 ± 0.3 CHO g/kg/day, 1.9 ± 0.2 FAT g/kg/day and 2.4 ± 0.2 PRO g/kg/day. In addition, 7 days of intermittent fasting during light exercise days (16-20 hrs) and 25 sessions of post-exercise 20-40 min sauna exposure occurred during the 12-week period. On May 10, 2019 (Day 1) the subject traveled from San Francisco to Everest Base Camp (5200m) (Day 2). The subject spent the next 7 days acclimatizing at altitudes of 5200-7500 m. On May 22, 2019 (Day 12) the subject successfully summited Mt. Everest (8848 m) and arrived back at the airport in Tibet on Day 13, arriving back in San Francisco on May 24th. CONCLUSION: A 12-week pre-acclimatization protocol at sea level successfully prepared the subject to summit Mt. Everest in 14 days.

2796 Board #257 May 29 10:30 AM - 12:00 PM
Extravascular Lung Water And Lung Diffusing Capacity In Response To Ultra-endurance Exercise Performed At Moderate Altitude
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Purpose: Strenuous exercise performed at altitude increases cardiac output and pulmonary arterial and capillary pressures to levels that may exceed a tolerable alveolar-capillary load, thereby evoking fluid leakage into the interstitial space. Accordingly, this study aimed to determine whether completing an ultra-marathon at moderate altitude increases extravascular lung water (EVLW) and whether this inhibits the transfer of gas across the alveolar-capillary membrane. METHODS: Cardiac biomarkers (cTnI & BNP), exhaled nitric oxide (ExNO), echocardiographic signs of EVLW, and lung (DLco) and alveolar-capillary membrane (Dm) diffusing capacity for carbon monoxide (determined via a single-breath DLco/DLco method) were

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assessed in 53 runners (10 Females; Age: 41±10y BMI: 23±2kg/m²) before, 1-4h and 24h after a 100km (CCC: 6.100m of ascent, altitude range of 1,035-2,584m) or 174km (UTMB: 10,000m of ascent, altitude range of 1,035-2,565m) mountain ultramarathon. Results: Participants finished the ultramarathon in 27±12h with an average heart rate of 124±15pmh. Cardiac biomarkers were increased acutely after the race (CrTnI: 0.01:0.00 vs. 0.04:0.01mg/ml, p<0.01; BNP: 21:2 vs. 123:12pg/ml, p<0.01), while ExNO decreased (25.6:0.2 vs. 14.5:1.3 ppb, p<0.01). Signs of EISW injury were noted after the race (average cornet tails count: 2:1 vs. 7:1, p<0.01) while DCO decreased (31.6±1.0 vs. 28.6±0.9 ml/min/mmHg, p<0.01) but DM remained unchanged (171±4.7 vs. 167.2±8.8 ml/min/mmHg, p>0.05). Cardiac biomarkers, ExNO, EISW and Dm were similar to baseline values after 24h of recovery, while DCO remained mildly reduced (30.6±1.6 ml/min/mmHg, p<0.05). Conclusions: These data suggest a mild and transitory increase in cardiac biomarkers and extravascular lung water occur after completing an ultramarathon at moderate altitude, but this has minimal impact on the transfer of gas across the alveolar-capillary membrane, despite an overall reduction in lung diffusion. In some subjects an exaggerated increase in extravascular lung water and decrease in alveolar-capillary membrane diffusion was observed, suggesting that some individuals may have an increased propensity for developing mild exercise-induced pulmonary edema at altitude.

2797 Board #258 May 29 10:30 AM - 12:00 PM Resting And Exercising Heart Rates Increase With Acute Altitude Exposure In Sacred Valley, Peru Rhiannon M. Seneci, St. Ambrose University, Davenport, IA. (No relevant relationships reported)

As one of the Seven Wonders of the World, Machu Picchu is a popular international destination. Being at high altitude and the physical demands of hiking in the region make acclimation to the change in altitude a challenge for individuals coming from low altitude. Understanding how individuals might respond to acclimation at various areas within the Sacred Valley region of Peru may be beneficial for electing specific logistics of a similar trip, particularly if physical exertion is planned.

Purpose: To identify the changes in heart rate (HR) and blood pressure during acute exposure to altitude and acute acclimation.

Methods: Eight individuals (males = 3, 24.8 ± 5.4 years) living at low altitude recorded resting heart rate and blood pressure throughout the course of a 10-day trip in the Sacred Valley, Cusco, Peru. In addition, the subjects completed four Rockport Walk Tests (RWT) prior to travel (180 m), two moderate to high altitude tests (2792 m and 3400 m), and return to low altitude (154 m). Repeated measures ANOVAs with post-hoc testing identified differences between RWT completion HR, time, and maximal oxygen estimation (VO2max) and also between resting HR and blood pressure during 9 different altitude changes.

Results: The RWT had significant differences in estimated VO2max estimations between 3400 m (45.7 ± 1.1 ml·kg⁻¹·min⁻¹) and 2792 m (47.9 ± 1.3 ml·kg⁻¹·min⁻¹) and return to low altitude (154 m, 49.1 ± 1.6 ml·kg⁻¹·min⁻¹, p<0.05) and HR from the RWT had differences between both altitude tests and high altitude tests (differences ranged from 29.6 ± 4.7 bpm to 31.4 ± 5.1 bpm, p<0.05). There were no differences in RWT completion time. Resting HR was the only resting measure to show changes and only after the highest ascent (4830 m) was HR increased (p<0.05) from prior travel measures (180 m) (+28.4 ± 4.5 bpm, 2792 m (+30.4 ± 4.5 bpm), 2792 m (+18.1 ± 2.4 bpm), and return to low altitude (+27.0 ± 4.2 bpm). Conclusion: Both resting and exercising heart rates are affected by acute altitude exposure, despite several days of moderate to high altitude exposure. When planning trips to high altitude regions for short periods (≤ 10 days), elevated heart rates should be expected.

2798 Board #259 May 29 10:30 AM - 12:00 PM Associationbetween AMS Score, leg Muscle Strength And SpO2 On One-day Rapid Ascent Of Mount Fuji Minoru Deguchi, Hiroki Honma, Mika Saito, Ayumu Kozuma, Yukina Mochizuki, Naoki Kikuchi. Nippon Sport Science University, Tokyo, Japan. Email: deguchi.minoru@icloud.com (No relevant relationships reported)

Previous studies reported that mountain sickness in climbers is associated with heart rate, peripheral capillary oxygen saturation (SpO2), and acute mountain sickness (AMS) score. These results supported the hypothesis that monitoring the SpO2 can help prevent mountain sickness. In addition, because the muscle groups in the lower limbs absorb oxygen during exercise, we hypothesized that the degree of muscle fatigue during exercise and leg muscle strength are related to blood circulation.

Purpose: To examine the association between the AMS score, leg extension strength, and SpO2 on a 1-day rapid ascent of Mount Fuji.

Methods: Sixteen subjects (10 male and 6 female, height; 168±8.1 cm, weight; 66.5±10.5 kg, age; 21±2.3 years) participated in the present study. Before and after climbing, the subjects underwent a leg extension strength analysis and their heart rate and SpO2 were measured using a pulse oximeter while climbing. To determine their AMS scores, we also conducted a questionnaire survey on the climbers’ headaches, loss of appetite/nausea, fatigue/weakness, dizziness/lightheadedness, and sleep disorders.

Results: The average climbing time was 6 hours and 12 minutes to ascend and 2 hours and 57 minutes to descend Mount Fuji. All subjects with high AMS scores tended to have low SpO2 at the mountaintop. There was a positive correlation between leg muscle strength and SpO2 at Mount Fuji’s summit in male subjects, but not in females. In addition, there was a positive correlation between the AMS score and leg strength in both male and female subjects. Conclusions: Our results suggested that subjects with high AMS scores had low SpO2 at the mountaintop. In addition, there is a positive correlation between leg muscle strength and SpO2 at the mountain’s summit in male subjects, but not in females.

2799 Board #260 May 29 10:30 AM - 12:00 PM Are There Differences In Oxygen Consumption Between A Breathing Restrictive Mask And Hypobaric Hypoxia? Minoru Deguchi, Hiroki Honma, Mika Saito, Ayumu Kozuma, Rhiannon M. Seneci. St. Ambrose University, Davenport, IA.

(No relevant relationships reported)

PURPOSE: To determine the acute effects of a breathing restrictive mask (M) set to 2743 m (M only) set to 2743 m during steady-state cycling compared with 1) wearing the mask set to 914 m at 2800 m of hypobaric hypoxia (H) (M+H combined = 2743 m) and 2) 2743 m of hypobaric hypoxia (H only) for subjects living at moderate altitude.

Methods: Nine subjects (5 males, 4 females; 25.9 ± 6.9 yr, 49.1 ± 7.1 ml · kg⁻¹ · min⁻¹) provided consent and completed four hospitalization cycles (180 m) (+28.4 ± 4.5 bpm), 2729 m (+30.4 ± 4.5 bpm), 4300 m (+18.1 ± 2.4 bpm), and return to low altitude (+27.0 ± 4.2 bpm). Conclusion: Both resting and exercising heart rates are affected by acute altitude exposure, despite several days of moderate to high altitude exposure. When planning trips to high altitude regions for short periods (≤ 10 days), elevated heart rates should be expected.

2800 Board #261 May 29 10:30 AM - 12:00 PM Transcriptional Activation Of Hypoxia Sensitive Genes Following Repeated Sprint Exercise In Hypoxia Zachary McKenna, Roberto Nava, Zachary Fennel, Quint Berkemeier, Anne Welch, Christine Mermier. University of New Mexico, Albuquerque, NM. (Sponsor: Ann Gibson, FACS/M)

(No relevant relationships reported)

Repetitive sprint training in hypoxia (RSTH) utilizes short supramaximal efforts followed by incomplete rest intervals. RSTH has been shown to improve repeated sprint performance compared to repeated sprint training in normoxia. Because of the relatively short exposure to hypoxia compared to live high, train low approaches, the benefits of RSTH have been attributed to local muscular adaptations rather than hypoxia-induced erythropoiesis. Activated transcription of the hypoxia sensitive transcription factors HIF-1α and PGC-1α, and regulation of their target genes related to angiogenesis (VEGF), mitophagy (BNIP3, PINK1) and following metabolism (PDK-M, GLUT4) may underlie these muscular adaptations. Purpose: To investigate the transcriptional activation of HIF-1α, PGC-1α and several HIF-1α-target genes following repeated sprint exercise in normoxia and hypoxia.

Methods: Eight recreationally active males (n = 8) and one female (n=1) performed 20, 10s all-out sprints in normoxic (1600m) and hypoxic (4600m) conditions on a cycle ergometer on two days separated by 2 weeks. Skeletal muscle samples from the vastus lateralis were analyzed for mRNA levels of HIF-1α, PGC-1α, BNIP3, PINK1, VEGF, PDK-M, and GLUT4 pre, post and 3h post exercise in hypoxia and normoxia. Comparisons between condition and time were made using two-way repeated measures ANOVAs.

Results: There was a significant time effect for HIF-1α (fold change: 2.61±1.8) and VEGF (fold change: 3.01±1.6) 3h post-exercise in hypoxia (p<0.05) but not normoxia. PGC-1α, which was higher 3h post-exercise in both hypoxia (fold change: 9.2±4.6) and normoxia (fold change: 6.2±3.8) (p<0.05). No significant effect of time or group
INTRODUCTION: Ischemic preconditioning (IPC) involves brief, repetitive manually-induced blood flow restriction of the limbs, capable of enhancing local blood flow and oxygen kinetics. As oxygen availability is of concern with increasing altitude, an evaluation of IPC’s potential to influence physiological compensations is defensible. PURPOSE: To investigate the use of acute versus repeated IPC to influence cardiopulmonary compensation and oxygen kinetics during exercise performed at normobaric hypoxia (NH). METHODS: Six recreationally trained males (21 ± 4 y, 178.6 ± 4.8 cm, 81.1 ± 13.0 kg, 15.0 ± 5.6 % BF, VO2peak: 43.6 ± 4.7 mL·kg·min⁻¹ at 210 ± 32 W) received 5-min of bilateral occlusion and reperfusion using automated cuffs (200 mmHg) placed on the upper thighs for a total of 40 min. This acute exposure (AI) was proceeded by 45-min of passive recovery, 30-min of passive NH (14.2 ± 0.1% exposure), and six 6-min discontinuous exercise bouts (2 each at 40, 60, 80% NH PPO). To evaluate a potential dose-response relationship, the same subjects also completed a 7-day IPC (RI) procedure after a sufficient washout. Muscle oxygen saturation (SmO₂) was measured using a portable NIRS-based sensor placed over the vastus lateralis. Cardiac hemodynamics were measured continuously using impedance cardiography. Continuous ventilatory and metabolic data were collected using a metabolic cart. Superficial femoral artery volumetric flow was calculated using arterial diameter and velocity measurements collected using a Doppler ultrasound. RESULTS: Both AI and RI elicited greater SmO₂ at supine rest (MD: 12.2 ± 2.5%, p = 0.004; MD: 12.8 ± 1.7%, p < 0.001) and seated rest (MD: 10.3 ± 3.9%, p = 0.045; MD: 11.2 ± 2.8%, p = 0.10) compared to a non-IPC NH procedure. At 80% NH PPO, AI and RI similarly attenuated decrement of SmO₂ compared to non-IPC NH (40.6 ± 20.2 and 40.2 ± 17.9 vs. 32.8 ± 19.5%). Minute ventilation was also heightened following both IPC conditions at 80% compared to sham NH (106.4 ± 17.3 and 106.5 ± 10.9 vs 97.9 ± 11.1 L·min⁻¹), however neither were able to produce a meaningful change in peripheral oxygen saturation (83 ± 4 and 84 ± 3 % vs. 84 ± 4 %). CONCLUSIONS: Preliminary data suggest that both acute and repeated IPC prior to exercise performed at NH may be capable of enhancing ventilation and subsequently working muscle oxygen saturation.

Elevation training masks are commonly used to enhance training and performance. While these masks do not generate a hypoxic environment, they are used to train the respiratory system, a common limiting factor in performance in both trained and sedentary individuals. There is limited evidence as to how these masks affect respiration or skeletal muscle oxygenation. PURPOSE: The purpose of this study was to determine how resisted inspiration affects respiration and muscle oxygenation during walking. METHODS: Twenty subjects between 33-54 years of age were recruited to walk at 1.6 m/s for 10 minutes with (CON) and without (RA4) resisted inspiration. Masks were connected to the metabolic cart and a Moxy monitor was placed on the lateral head of the gastrocnemius to measure muscle oxygenation (SmO₂) throughout the duration of walking trials. The last 5 minutes of each condition were analyzed and presented as mean ± SD. Student t-test was used to determine significance at p<0.05.

RESULTS: There was no effect on V̇O2 (CON: 14.17 ± 0.96 L·min⁻¹, RA4: 14.23 ± 0.94, p=0.95) or V̇CO2 (CON: 13.02 ± 0.89 L·min⁻¹, RA4: 13.18 ± 2.61, p=0.89). RA4 caused an average increase of 4.9% in subjects heart rate and induced a significant decrease in respiratory rate (CON: 25.93 ± 3.91 breath·min⁻¹; RA4: 18.63 ± 3.84 breath·min⁻¹, p=0.0006). This coincided with no change in total hemoglobin (ThB) in the skeletal muscle (CON: 12.58 ± 0.61 g·L⁻¹; RA4: 12.57 ± 0.60 g·L⁻¹, p=0.98) and an increase of 8 subjects’ heart rate during RA4 (CON: 41.94 ± 20.15 RI: 48.52 ± 23.08). Despite increased SmO₂, subjects reported a higher RPE in the RA condition. CONCLUSIONS: During walking, elevation training masks increased skeletal muscle oxygenation. This could be in part due to a longer inspiration allowing for improved blood oxygen saturated. An increased heart rate across most subjects despite no change in RA4 could suggest a shift in the hemoglobin dissociation curve allowing more oxygen dissociation in the muscles. Future studies should examine the effect of elevation training masks on muscle oxygenation during higher intensity exercises.

Elevated mood and decreased vigor were observed in subjects at sea level, however no difference was observed in mood state even during RA after 12 days at SL whether or not NH treatment was utilized. Authors’ view not official US Army or DOD policy. Funding USAMRDC.

Increased ventilation is one effect of altitude hypoxia. This increases the work and energy cost of ventilation. Therefore, during sustained aerobic exercise this may lead to respiratory muscle fatigue and secondary locomotor muscle fatigue. PURPOSE: Determine if resistive or endurance respiratory muscle training (RRMT and ERMT, respectively) vs. sham RMT (SRMT) improves exercise performance during acute exposure at 3,658 m. We hypothesize that ERMT would augment time to exhaustion more than RRMT and SRMT. METHODS: Twenty-four subjects (age: 24±3; body fat: 16.6±6%; VO2max: 38.6±8 mL·kg⁻¹·min⁻¹) cycled to exhaustion (55% VO2max) in a hypobaric chamber at a 3,658 m height and before and after four weeks of respiratory muscle training (RMT). Prior to training, subjects completed a VO2max, pulmonary function, and respiratory endurance test on V̇O2max. Subjects were randomly assigned to RRMT (n=8), ERMT (n=8) or SRMT (n=8). All RMT consisted of three, 30-min training sessions per week for four weeks. The SRMT group completed a 5-sec inspiration, 5-sec breath hold, and 5-sec expiration every 30-sec. The RRMT group completed a maximal inspiration and expiration against 60% of maximal inspiratory (PImax) and expiratory pressure (PEmax) every 30-sec. The ERMT breathed into bag that maintained isocapnia continuously for 30 min (bag volume=55% vital capacity; breath frequency=0.60×maximal voluntary ventilation/bag volume). RESULTS: There were no differences in pre-RMT anthropometrics, pulmonary function, VO2max or cycle...
time to exhaustion between groups (all p<0.05). There were no changes in forced vital capacity after RMT (p=0.85). The RRMT group increased P_{max} and P_{peak} after RMT (p<0.001 and p<0.04, respectively). The ERMT group increased P_{max} (p=0.04). There was no difference in VO_{peak} after RMT in any group. There was no difference in cycle time to exhaustion after RMT (p=0.14) or between groups (p=0.4).

CONCLUSIONS: Four weeks of RRMT and ERMT training selectively improved pulmonary function tests. Both RRMT and ERMT improved cycle time to exhaustion at simulated 3,658 m (12,000 ft) altitude.

2808
Board #269
May 29 10:30 AM - 12:00 PM
Intra-individual Variability In The Acute Erythropoietic Response To Consecutive Hypoxic Exposures
Matissara Baranauskas1, Joseph Powell1, Alyce D. Fly1, Bruce J. Martin1, Timothy D. Mickleborough1, Robert F. Chapman1, FACS1, ‘University of Sunderland, Sunderland, UK.

PURPOSE: Altitude training has become a standard strategy used by athletes to legitimately increase hemoglobin mass and induce favorable changes in sea-level endurance performance. While the acute erythropoietic response to a fixed level of hypoxia (altitude) varies considerably between individuals, it is generally assumed there is consistency within an individual for repeated exposures. Therefore, we aimed to document within-subject variation in the acute erythropoietic response to consecutive exposures to a fixed-level of continuous normobaric hypoxia.

METHODS: Seven subjects (men n = 4, women n = 3) completed three exposures to 12h of continuous normobaric hypoxia simulating an altitude of 3,000m/9,900ft (FIO2 = 0.14), with each exposure separated by 28 to 56 days. Each visit was performed at the same time of day, with close controls placed on hydration and environmental conditions. Serum concentrations of erythropoietin (EPO) were measured at baseline prior to hypoxic exposure (0hr), and then following 6hr, and 12hr spent in continuous hypoxia. The relative change in serum EPO was taken as the percentage difference from 0hr to 6hr (ΔEPO_{6}), and 0hr to 12hr (ΔEPO_{12}). A two-way repeated measures ANOVA was used to evaluate the effects of hypoxic exposure time on EPO concentration.

RESULTS: Twelve hours of continuous hypoxic exposure had a significant effect on the EPO response (P < 0.001), with serum concentrations increasing by an average of +55 ± 33% (range: 14-110%) after 6hr and +83 ± 33% (range: 31-125%) after 12hr compared to baseline. Within individuals, ΔEPO_{6} varied by 33 ± 23% (range: 4-77%) and ΔEPO_{12} by 58 ± 28% (range: 4-90%) between consecutive hypoxic exposures.

CONCLUSIONS: Practically, our data demonstrate that athletes traveling to altitude training camps may not have a consistent hemotolgical response given the wide intra-individual variability observed in serum EPO concentrations to repeated fixed hypoxic doses.
between time and group, a mixed model (MM) was calculated. Differences within groups between baseline and particular timepoints in hypoxia were calculated with paired t-tests (GTST). RESULTS: All variables except of MAP changed significantly over time (p<0.001), but only for HR the time course was different between ET and UT (group*time: p=0.032). This was due to an attenuated HR-increase in ET (8%; p=0.08) after 3 h in hypoxia being half as high than in UT (16%; p<0.001). At the same timepoint, average SV remained stable in ET (±2%; p=0.570), but tended to decline in UT (±7%; p=0.137). Consequently, PBF increased by 11% after 3 h at high altitude in both ET and UT (t(PTT= .010 and .027) without being different between groups at any timepoint (p<0.11). CONCLUSIONS: While cardiovascular response to hypoxia was generally similar, ET showed an attenuated increase in HR after initial exposure to hypoxia. The HR attenuation might be attributable to a higher parasympathetic activity in ET that has been documented before and is a general characteristic of ET.

2809 Board #270
May 29 10:30 AM - 12:00 PM
Relationships Between Ventilatory And Heart Rate Responses To Hypobaric Hypoxia: Influences Of Acetazolamide
Audrey Johnson, Aaron Caldwell, Karleigh Bradbury, Beau Yurkevicius, Kirsten Coffman, Roy Salgado, Nisha Charkoudian, FACSM. USARIEM, Natick, MA. (Sponsor: Nisha Charkoudian, FACSM)

Acetazolamide (AZ) is often used for prevention and/or treatment of acute mountain sickness (AMS), particularly during rapid ascent to altitudes > 3000 m. Although it is known that AZ increases ventilation (Ve), it is unclear how this may affect chemoreflex relationships among ventilatory variables and control of heart rate (HR). PURPOSE: The purpose of the study was two-fold (1), establish the effect of AZ and hypobaric hypoxia (HH) on Ve and HR; and (2), estimate the effect of AZ on the chemoreflex relationship between Ve and HR.

METHODS: After completing familiarization testing at sea level (SL), 10 male volunteers (22 ± 3 yr; height: 176.0 ± 7.1 cm; weight: 77.5 ± 11.5 kg) completed two 30 hr HH exposures (~ 3500 m); one while taking AZ (500 mg/day) and one while taking a placebo, in a single-blind crossover design in random order. Ventilation and gas exchange, including HR, Ve, and end-tidal partial pressure of carbon dioxide (PetCO2), were measured three times at rest, once at SL and then at ~2 and 24 hours into exposure to simulated altitude. A linear mixed model with a random intercept per subject was utilized to evaluate the influences of AZ and HH on HR, Ve, and PetCO2. RESULTS: Ve increased and PetCO2 decreased (p<0.05 for all) with both HH and AZ. HR increased with HH (p<0.001), but there was no further effect of AZ (p=0.15). HR was related to both Ve (p=0.009) and PetCO2 (p=0.001) in all subjects. AZ shifted the relationships between HR, Ve, and PetCO2, but there was no interaction between AZ and HH (p>0.10 for both). Overall, while AZ augmented Ve, it did not affect the relationship of the size of the effect on Ve and Ve, rather shifted the relationship to lower Ve values.

CONCLUSION: During exposure to HH, activation of the chemoreflex augments both ventilation and sympathetic outflow to the heart causing increased HR. Our present findings that Ve tended to be lower for a given level of HR during AZ trials, suggest that AZ may have an influence to shift the relationship between these two chemoreflex-mediated events.

Funded by USAMRMC; authors view not official US Army or DoD policy.

2810 Board #271
May 29 10:30 AM - 12:00 PM
The Effects Of Exercise Training In Hypoxia Compared To Normoxia On Cardiorespiratory Fitness: A Meta-analysis
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(No relevant relationships reported)

PURPOSE: Previous studies have indicated that endurance exercise training (i.e. hypoxia) may acutely enhance exercise performance, providing benefits for patients with limited physical capacity. However, the evidence for superior long-term adaptations of regular hypoxic exercise in clinical populations is limited. Therefore, this systematic review and meta-analysis aimed to evaluate the effects of chronic exercise in hypoxia compared to normoxia in patients diagnosed with chronic diseases.

METHODS: Databases were systematically searched for randomized controlled trials in accordance with PRISMA until May 20th, 2019. Criteria included adult patients with various chronic diseases (i.e. cardiovascular, pulmonary, neurological, metabolic, musculoskeletal or cancer) engaging in regular supervised exercise training in hypoxia compared to an exercising normoxic control group. The outcome of interest included maximal power output (PO), peak oxygen consumption (VO2peak) and maximal distance in the 6-minute walk test (6MWD). Standardized mean differences (SMD) were calculated and a random-effects model was used to pool effect sizes using R (3.6.1).

RESULTS: Out of the identified 4038 studies, 11 articles were deemed eligible. A total of 132 patients (64.3 ± 3.2 yrs., 36% women) and 131 patients (64.9 ± 3.6 yrs., 33% women) were included in hypoxia and normoxia groups, respectively. The majority of patients were diagnosed with chronic obstructive disease (COPD, 94.1%) while 18 patients were diagnosed with coronary artery disease. The average duration of interventions was 8.9 ± 5.1 weeks. The observed effects for PO (SMD -0.33; 95% CI -0.67, 0.01; p = 0.06), VO2peak (SMD -0.24; 95% CI -0.54, 0.05; p = 0.11) and 6MWD (SMD -0.21; 95% CI -0.78, 0.36; p = 0.46) showed no statistical significant difference between the two conditions. CONCLUSION: There is no evidence for beneficial chronic adaptations in cardiorespiratory fitness when exercise is performed in hypoxia. However, the studies to date have only examined patients diagnosed with COPD and coronary artery disease. Future studies should identify the optimal dose-response mechanisms to bridge the gap between acute responses and chronic adaptations in hypoxic exercise.

Reduced oxygen at high altitude can alter breathing at night which can disrupt sleep. Acetazolamide (AZ) has been shown to augment breathing and oxygen saturation (SpO2) during sleep. However, it is unclear whether heat acclimatization (HA), which has been suggested to have beneficial effects in hypoxia, may provide benefits similar to AZ.

PURPOSE: To determine if there is a difference in average SpO2 (avgO2), time below 88% SpO2 (T88), and average pulse rate (PR) between treatments with AZ versus HA. METHODS: Seventeen unacclimatized healthy men (age: 22 ± 4 years; mass: 75 ± 12 kg; height: 172 ± 8 cm; body fat: 22 ± 6%) participated in at least one of two (N = 6 completed both) 30-hour altitude studies: Study 1) AZ (250 mg twice/day for three days) vs placebo or Study 2) pre-HA altitude exposure, followed by an 8-day exercise-HA protocol (treadmill walking: 120 min, 3.1 mph 2% grade, 40°C, 40% RH), and then a post-HA altitude exposure. Both studies were identical in regards to altitude (3,500 m), ascent rate, exposure time, and sleep assessment. For analysis, PL and pre-HA acted as the control conditions (CON) and AZ and post-HA as the experimental conditions (EXP). Results: avgO2, T88, and average PR were recorded during sleep via wrist pulse oximeter. A linear mixed model with subjects as a random factor was used to compare treatments (AZ and HA), and conditions (CON and EXP) with total sleep time as a covariate for T88. RESULTS: There was a significant interaction between the condition and treatment-type for avgO2 (p < 0.001) and T88 (p < 0.001) during sleep, but no interaction was found for average PR (p = 0.49). Pairwise comparisons were performed for the former two variables within each study treatment. AvgO2 was greater in the AZ treatment (difference = 5.7%; 95% CI [4.2, 7.2]), and a non-significant increase in avgO2 was found post-HA (difference = 0.9%; 95% CI [-0.3, 2.2]). Additionally, T88 was reduced in the AZ treatment (difference = -207.7 min; 95% CI [-13.2, -1.3]) while there was a non-significant increase in T88 post-HA. PR was higher in CON (72 bpm) than EXP (69 bpm). CONCLUSION: Our data confirms AZ increases SpO2 during sleep at altitude, however, we were unable to observe a similar improvement in oxygen saturation after HA. Supported by USAMRDC; authors view not official US Army or DoD policy.

2812 Board #273
May 29 10:30 AM - 12:00 PM
Flow Mediated Vasodilation In Response To 3-Weeks Of Moderate Altitude Exposure
Eve M. Edwards, Lauren N. Manuzak, Sara S. Jarvis. Northern Arizona University, Flagstaff, AZ. (No relevant relationships reported)

The effects of moderate altitude on the cardiovascular system is an extensively researched subject, but no definitive timeline regarding the vascular acclimatization for flow mediated vasodilation (FMD) measurements is currently available in the scientific literature. It has been suggested that 3 wks might be sufficient (Frick et al., 2006). However, if this amount of time is not sufficient it will complicate data interpretation.

PURPOSE: To assess the timeline of acclimatization to moderate altitude (2,130 m), specific to FMD in healthy young males. METHODS: After spending 4 weeks at lower altitude (331±197 m), 5 male subjects (18.6±1 yr; 71.8±8.7 kg; 1.80±0.04 m; 22.8±1.9 kg/m²) were tested within 1 wk:1 day of arrival to moderate altitude (V1) and were tested again at 2 wks (V2) and 3 wks (V3) after their initial arrival. Heart rate (HR), blood pressure (BP; systolic, SBP; diastolic, DBP), and brachial artery diameter were measured (using Brachial Analyzer) during baseline (BL) and after 5
min of forearm cuff occlusion (250 mmHg). FMD was assessed as the percent increase in diameter after the cuff occlusion. RESULTS: When comparing V1, V2, and V3, HR was no different among the visits (63.10 ± 7.7 ± 11 vs. 64.6 ± 20 bpm; p = 0.52 for V1 vs. V2 vs. V3, respectively). SBP was significantly higher in V1 compared to V2 and V3 (116.6 ± 10.6 vs. 110.6 ± 12 mmHg; both p < 0.05). DBP was not different (63.9 ± 9 vs. 57.9 ± 6 mmHg; p = 0.43). BL diameter was also not different between the visits (8.1 ± 1.5 vs. 7.5 ± 1.5 vs. 7.5 ± 1.2 mm; p = 0.69). FMD showed a trend toward a difference between the three visits (5.0 ± 1.6 vs. 5.0 ± 1.5; p = 0.07). CONCLUSION: After 3 wks of exposure to moderate altitude, it appears that FMD may continue to fluctuate. This suggests that additional measurements beyond 3 wks should be obtained to determine a better timeline for when vascular acclimatization has been achieved. This will allow better guidance for FMD measurements obtained in subjects at altitude.

Supported by the State of Arizona Technology and Research Initiative Fund (TRIF)

RESULTS: The mean p50 of GBT- and saline-treated animals was 31.46 and 37.63, respectively, demonstrating increased O-H affinity with GBT (p = 0.0017). During steady state normoxia (FiO2 0.21), mean pial artery diameter decreased from baseline (FiO2 1.0) by 0.26% in saline animals compared to a 3.99% increase in GBT animals (p = 0.1807). Additionally, GBT-treated animals demonstrated an 11.7% increase in blood O2 saturation (p < 0.0001), an 11.4% increase in peak CO2 (p = 0.0692), and an 8% increase in heart rate (HR) (p = 0.015) compared to saline controls. During steady state hypoxia (FiO2 0.10), mean pial artery diameter decreased from baseline by 23.83% in saline animals compared to a 3.78% increase in GBT animals (p < 0.0001). Additionally, GBT-treated animals demonstrated an 11.4% increase in blood O2 saturation (p = 0.012), a 14.1% increase in peak CO2 (p = 0.074), and a 9.3% decrease in HR (p = 0.018) compared to saline controls.

CONCLUSIONS: Collectively, the data show that impairments in cerebrovascular and cardiopulmonary function resulting from exposure to severe hypoxia can be mitigated through increased O-H binding and subsequent increases in blood oxygenation.

Board #277 May 29 10:30 AM - 12:00 PM
Mood State Is Related To Acute Mountain Sickness At Both 3000m And 4050m Altitude
Peter S. Figueiredo, Ingrid V. Sils, Janet E. Staab, Charles S. Fulco, Stephen R. Muza, FACSM, Beth A. Beidleman. USARIEM, Natick, MA. (No relevant relationships reported)

PURPOSE: The purpose of this study was to further explicate the relationship between changes in mood states, assessed using the Automated Neuropsychological Assessment Metrics Mood Scale (ANAM-MS), and severity of acute mountain sickness (AMS) without the confounding factors of acetazolamide, climbing rate and environmental conditions.

METHODS: Nineteen healthy lowlanders (16 men; 3 women; mean±SE: 22 ±1.3 yr, 76.6 ±3.1 kg, 173.2 ±2.1cm, 46.0 ±1.2 ml ∙ kg−1 ∙ min−1) were randomly assigned to either 3000m (526mmHg) or 4505m (460mmHg) in a hypobaric chamber for 20h. Seven mood states (anger, anxiety, happiness, fatigue, depression, restlessness, and vigor) were assessed using the ANAM-MS; a series of 42 questions answered on a 0-6 Likert Scale. AMS severity was assessed using the AMC-Cerebral Factor Score (AMS-C) of the Environmental Symptoms Questionnaire. Both tests were administered on 8 occasions at sea level (SL), and after 2h and 20h at each altitude (HA2 and HA20). The SL baseline scores for ANAM-MS and AMS-C were calculated as the mean of the 7th (morning) and 8th (afternoon) assessments.

RESULTS: There were no differences between altitude groups in mood at SL, HA2 or HA20 so data were combined. There were differences between altitude groups in AMS-C score so data was analyzed separately. No mood state changed significantly from SL to HA2. However, fatigue and restlessness increased (p<0.05) from SL (0.57 ±0.13; 0.07 ±0.03) to HA20 (1.41 ±0.32; 0.52 ±0.20), respectively. In addition, anger decreased (p<0.05) from SL (1.97 ±0.30) to HA20 (0.88 ±0.21). Happiness, anxiety, depression and anger did not change over time. AMS-C was elevated (p<0.05) at 4050m (1.82 ±0.27) compared to 3000m (0.22 ±0.29) at HA20. Restlessness (r=0.66; P=0.037) and anxiety (r=0.65; P=0.044) correlated with AMS-C at HA20 in the 4505m group. Fatigue (r=0.77; P=0.016) and anger (r=0.95; P=0.001) correlated with AMS-C at HA20 in the 3000m group.

CONCLUSION: ANAM-MS ratings of fatigue, restlessness and decreased vigor emerge as low as 3000m due to hypobaric hypoxia alone. Mood disturbances were related to AMS severity; subjects with the highest ratings of fatigue and anger at 3000m, and restlessness and anxiety at 4050m possessed the highest AMS-C scores in their respective groups. Authors’ views not official U.S. Army or DoD policy. Funding: USAMRDC

Abstracts were prepared by the authors and printed as submitted.
Due to the combined effects of hemodynamic-molecular stress thereby proposing an increase in V̇A flow, whereas biomarkers of neuronal-axonal damage (neuron-ß from micro- to hypergravity (<0.05)), the latter proportional to the same procedures/experimental timeline with the exception of PF. Duplex ultrasound was employed to measure blood flow in the anterior (internal carotid artery, AICA) and posterior (vertebral artery, VA) circulation, with venous blood assayed for biomarkers specific to oxidative-nitrosative stress (electron paramagnetic resonance spectroscopy/ozone-based chemiluminescence) and structural integrity of the neurovascular unit (NVU, chemiluminescence/ELISA). RESULTS: PF was associated with a selective increase in VA flow during the most marked gravitational transition from micro- to hypergravity (<0.05). Increases in oxidative-nitrosative stress, gla-vascular GFAP and S100β were observed after PF (P<0.05), the latter proportional to the increase in VA flow, whereas biomarkers of neuronal-axonal damage (neuron-specific enolase, neurofilament light-chain, ubiquitin carboxy-terminal hydrolase L1 and tau) remained stable (P>0.05). CONCLUSION: Collectively, these data are the first to demonstrate that acute gravitational transitions result in minor BBB disruption due to the combined effects of hemodynamic-molecular stress thereby proposing an alternative mechanism and biomarkers for the reported neurological sequelae underlying SANS.

The microgravity environment can have detrimental impacts on human health. Muscle atrophy, declines in bone mass, wedging of vertebral bodies, loss of normal spinal curvature, and decreased functional capacity are all consequences of prolonged microgravity exposure. Atrophy of the muscles along, and around, the spine is one of the primary contributors to the development of low back pain in space. PURPOSE: To design and fabricate a low-cost, diurnally worn upper-body garment with integrated neuromuscular electrical stimulation to prevent and mitigate low back pain in astronauts. METHODS: A custom fitted, upper-body garment that contained a neuromuscular electrical stimulation system was originally designed in modeling software (Solidworks Premium 2018, Waltham, MA). The garment was fabricated using highly durable, anti-microbial material (88.7% polyester, 8.6% lycra, 2.7% silver ion fiber). An elastic belt for additional compression to maximize contact between the erector spinae and multifidus muscles, resulting in increased low back pain.

**Purpose:** Prolonged periods of bed-rest (BR), experimental simulation of microgravity, greatly affect oxidative metabolism by acting at several levels of the O2 pathway. Short duration (10 days) of horizontal BR negatively affects in-vivo functional biomarkers related to skeletal muscle oxidative metabolism without affecting mitochondrial respiration ex-vivo. The impairment of muscle oxidative metabolism can partially derive from reduced O2 delivery, altered peripheral O2 metabolism along the O2 pathway. Short duration (10 days) of horizontal BR negatively affects in-vivo functional biomarkers related to skeletal muscle oxidative metabolism without affecting mitochondrial respiration ex-vivo.**

**Methods:** Measurements were carried out on 10 recreationally active young males (age 23 ± 5 years [mean±SD]) before (PRE) and after (POST) 10 days of horizontal BR. Pulmonary O2 uptake (V̇O2) and other respiratory, cardiovascular and skeletal muscle variables were determined during an incremental exercise on a cycle ergometer. Microvascular endothelial function was assessed during vascular occlusion test (VOT) by evaluating the slope of re-oxygenation rate (SLOPE 2) and the area under the curve (AUC) over the baseline of 5min reperfusion phase of delta[oxy(Hb+Mb)] signal obtained from vastus lateralis muscle. Plasma nitrite concentration was determined by chemiluminescence.

**Results:** Peak VO2 was lower in POST (41.5±6.5 ml·kg⁻¹·min⁻¹) vs. PRE (44.5±7.4, P<0.01). SLOPE 2 was significantly slower in POST (5.3±0.8 %s⁻¹) compared to PRE (6.4±0.7, P<0.01). AUC was significantly reduced in POST (11025±2145 %s) compared to PRE (13094±1940, P<0.01). Plasma nitrite concentration diminished from PRE (85.4±35.0 nM) to POST (65.5±45.6, P<0.01). **Conclusions:** These preliminary data suggest that after 10 days of horizontal BR whole-body impairment of oxidative metabolism during exercise is associated with reduced level of nitrite and an altered microvascular endothelial function. Further analyses of systemic functional variables as well as biochemical data obtained during the bed-rest campaign, and not yet analysed, will help us to define sites of limitation to muscle oxidative metabolism along the O2 pathway.
Purpose: Traditional two-dimensional (2D) in vitro models of human skeletal muscle are limited in their ability to fully mimic in vivo muscle, as in vivo muscle exists in a complex three-dimensional (3D) structure. We have developed a novel engineered three-dimensional (3D) myobundle in vitro model that we believe more closely models skeletal muscle behavior. Here, we determined baseline gene expression differences among three models: the 3D myobundles, 2D cell cultures, and explant biopsies. Methods: Previously collected skeletal muscle (vastus lateralis) biopsy samples from adult men and women (n = 6) were used. Each sample was used to generate the following groups: explant (RNA from biopsy), 2D (RNA from differentiated myotubes) and 3D (RNA from 3D myobundles seeded from each primary sample). 200ng of isolated RNA for each sample was used to generate global gene expression profiles (HumanHT-12 v4.0 Gene Expression BeadChip Arrays). Data were processed using Illumina Genome Studio and imported into Partek Genomics Suite for statistical analysis. Differential gene expression was assessed via 2-way ANOVA (group*ID) with the following post-hoc comparisons: 2D vs. 3D, 3D vs. biopsies and 3D/2D vs. biopsies. Resultant lists were filtered at p<0.01 and fold change [>1.5]. Biological pathway analyses were done using Ingenuity Pathway Analysis. Results: ANOVA detected 3754 genes different between 2D/3D, 3273 genes different between 3D/biopsies and 488 genes different between 2D/3D cultures. Biological pathway analysis identified representation of the following canonical pathways in our gene set: calcium signaling (26 genes; z-score=1.508, log-p-value=13.5), and actin cytoskeleton signaling (29 genes; -log p-value=12.3). The 3D cell system produced relatively fewer differences from biopsies compared to 2D cell cultures, but some significant differences from biopsy samples remain. Comparison of 3D to 2D culture systems shows transcriptional changes that align with increases in calcium signaling, while downregulations in the actin cytoskeleton and integrin signaling demonstrate significant structural differences between the two in vitro models tested.

Changes In TSH, T4 And Prolactin Levels With Cycling And Running

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Several studies have examined the changes in TSH, T4 and Prolactin levels during cycling and running, however, to the best of the authors’ knowledge, none of the existing studies compared directly cycling and running on the same individuals. PURPOSE: To compare changes in TSH, T4 and Prolactin levels as a consequence of cycling and running exercise on the same individuals. METHODS: Ten active males (25.4 ± 11.0 years old, 175.8 ± 6.9 cm, body fat percentage 15.6 ± 3.6%, mean ± SD), following an overnight fast, cycled (C) or ran (R) for 30 min at about 80% maximal heart rate (HRmax). Venous blood samples were taken before and immediately after exercise. Data were analyzed using two-way ANOVA, whereas post-exercise exercise changes were compared by two tailed t-test. RESULTS: The two-way ANOVA revealed no differences at any level (time, mode and interaction) before exercise for serum TSH (C: 4.4 ± 7.2 vs. R: 2.7 ± 1.5 μIU/ml), T4 (C: 1.2 ± 0.2 vs. R: 1.1 ± 0.2 ng/dl) and Prolactin (C: 20.0 ± 4.4 vs. R: 20.7 ± 5.5 ng/ml) compared to post exercise [TSH: 6.7 ± 11.5 (C) vs. 3.8 ± 3.1 (R) μIU/ml; T4: 1.3 ± 0.4 (C) vs. 1.2 ± 0.2 (R); Prolactin: 20.9 ± 5.0 (C) vs. 20.3 ± 6.0 (R) ng/ml)]. No differences were also observed when post-pre exercise values were compared with the exception of a higher percentage change as a result of exercise in C (39 ± 36 %) compared to R (37 ± 20 %) for serum TSH (p=0.01). CONCLUSIONS: After 30 min cycling or running at about 80% HRmax no significant changes in the levels of serum TSH, T4 and Prolactin were elicited compared to pre-exercise in male active individuals.

Exercise is a stress stimulus leading to endocrine and immunological changes in the human body. There are interactions between the Hypothalamo-Pituitary-Adrenal (HPA) axis and the immune system in response to exercise, depending on the characteristics of exercise (type, duration, intensity and frequency). PURPOSE: This study examined adrenocorticotropic (ACTH) and interleukin-6 (IL-6) responses to a selected aerobic exercise protocol performed under inhibition or stimulation of the HPA (axis and the immune system in response to exercise, depending on the characteristics of exercise (type, duration, intensity and frequency). METHODS: Twelve healthy volunteers (8 males and 4 females; age: 30.6 ±4.4 yrs, body mass: 73.3 ±12.1 kg, height: 1.77 ±0.07 m), performed a single bout of 30 min aerobic exercise at 70%VO2max on a treadmill, on three different conditions [control (C), HPA axis inhibition (HPA-I, induced by glucocorticoid administration), HPA axis stimulation (HPA-S, induced by ACTH administration)], following standard diet. Blood samples were collected before (0h), at the end of the exercise bout (30h), and 30 min later (60h) and serum ACTH and IL-6 were measured. Two-way ANOVA was used for statistics and data is presented as mean/SE. RESULTS: In C condition, IL-6 increased at the end (p<0.05) and 30 min after exercise (p<0.001) (1.7±0.1; 1.3±0.5; 3.02±0.6 pg/ml; at 0h, 30h and 60h, respectively). ACTH significantly decreased 30 min after exercise (p<0.05) (23.4±2.3; 21.5±2.6; 16.9±1.6 pg/ml; at 0h, 30h and 60h, respectively). In HPA-I, IL-6 increased at the end (p<0.05) and 30 min after exercise (p<0.001) (1.6±0.1; 2±0.4; 2.9±0.6 pg/ml; at 0h, 30h and 60h, respectively). In HPA-S, IL-6 decreased at the end (p<0.05) and 30 min after exercise (p<0.001) (4.0±0.4; 4.1±0.1; 4.3±0.2 pg/ml; at 0h, 30h and 60h, respectively). Under HPA-S condition, IL-6 increased 30 min after exercise (p>0.01) (1.7±0.2; 2.6±0.3; 3.5±0.7 pg/ml; at 0h, 30h

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and 160 respectively). There were no significant changes in IL-6 between the three conditions, while ACTH was lower in HPA-1 compared to C condition at all time points (p<0.001).

CONCLUSION: The rapid increase of IL-6 in response to aerobic exercise is not affected by the modification of HPA axis, while the specific aerobic exercise regimen influencing circulating ACTH yet not under exogenous inhibition of the HPA axis. Further studies are needed to characterize how these responses are regulated by the characteristics of exercise.

2824 Board #285 May 29 10:30 AM - 12:00 PM Acute Resistance Exercise Elicits Bdnf But Not Cathepsin B In Well-trained Men

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(No relevant relationships reported)

PURPOSE: The aim of this study was to examine if multi-joint RE exercises (back squat, bench press, and deadlift) to volitional failure elicited a circulating response of biomarkers associated with neuroprotection and if differences in biomarker changes existed between exercises. Further, we examined if the pre- to post-exercise changes in BDNF and IL-6 were related.

METHODS: Thirteen males (age: 24.5±3.8 yrs, body mass: 84.0±15.44 kg, height: 173.3±8.57 cm, training age: 7.1±4.2yrs) performed 4 sets to failure at 80% of a one-repetition maximum (1RM) on the squat, bench press, and deadlift in successive weeks. The bench press was always performed second and the order of the squat and deadlift was counterbalanced. The measured biomarkers are brain derived neurotrophic factor (BDNF), insulin-like growth factor 1 (IGF-1), cathepsin B (CatB), and interleukin 6 (IL-6). Biomarkers were assessed immediately pre- and post-exercise.

RESULTS: There was a main time effect (p<0.01) and bench press (p<0.01) conditions on BDNF significantly increased, however, no significant change was observed the squid condition (p=0.21). There was a main time effect (p<0.01) for IL-6 with a significant increase in the squat (p<0.01), but not the bench press (p=0.88) and deadlift conditions (p=0.24). No main time effect was observed for either CatB (p=0.62) or IGF-1 (p=0.56). No significant correlations were observed between the acute change in BDNF and IL-6 (r=0.52-0.58, p<0.005), but not the bench press condition (r=0.0 to -0.30, p=0.24-0.99). See Table 1.

CONCLUSION: In summary, acute multi-joint RE elicits a significant increase in circulating BDNF. This investigation is the first to report the lack of a transient change of CatB to an acute RE protocol.

2825 Board #286 May 29 10:30 AM - 12:00 PM Treadmill Walking Increases Percent Of Circulating Monocytes (CD14+) Expressing CX3CR1 In Older Adults

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(No relevant relationships reported)

CX3CR1 is a chemokine receptor for the chemokine CX3CL1. Expression of CX3CR1 may influence the inflammatory response of the innate immune system. The PURPOSE: of this study was to examine the relationship between CX3CR1 expression on circulating monocytes with physical activity level and mode of exercise in healthy, older adults.

METHODS: Twenty-four healthy older adults (63.0±5.5 years) were recruited for this study. Participants were divided into two groups based on self-reported physical activity level: physically active (PA) and physically inactive (PI). Participants completed a randomized complete crossover trial of 30 minutes moderate-vigorous intensity cardiorespiratory endurance (CRE) or resistance exercise (RE) on two separate visits. Blood samples were collected from each person at rest (PRE), immediately after exercise (POST), and 1-h recovery after exercise (RECOV). Monocyte cell surface markers were measured by flow cytometry. RESULTS: PA participants (N=12, est. VO2max=45.3±16.8 mL·kg⁻¹·min⁻¹) had a higher estimated VO2max than the physically inactive participants (N=12, est. VO2max=35.0±16.0 mL·kg⁻¹·min⁻¹). Percent of circulating monocytes expressing CX3CR1 was higher (p<0.05) in CRE RECOV (92.3%±2.5%) than CRE POST (90.1%±2.9%). No other differences (p≥0.05) were observed within the PA group between PRE, POST, and RECOV timepoints for the CRE or RE modes of exercise. No differences (p≥0.05) were observed within the PI group for time or mode of exercise. No differences (p≥0.05) were observed between the CRE and RT modes of exercise within the PA group or the PI group at each PRE, POST, and RECOV timepoints.

CONCLUSION: Differences in monocyte expression of CX3CR1 were observed between the POST and RECOV stage following a 30-minutes CRE (treadmill) exercise intervention within the PA group. Time differences were observed between PA and PI groups. No other differences in CX3CR1 were observed between PA and PI groups following a 30-minute moderate-vigorous exercise intervention. Further research is needed to determine potential differences if CX3CR1 physical activity status and mode of exercise influence the inflammatory response of an acute exercise bout.

2826 Board #287 May 29 10:30 AM - 12:00 PM Resistance Training On Specific MicroRNAs In Physiological Adaptations In Older Adults

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(No relevant relationships reported)

PURPOSE: MicroRNA (miRNA) as the novel regulator in resistance training induced functional and physiological adaptations remains poorly understood. The goal of the present study was to analyze the response of a panel of circulating miRNAs to resistance training-mediated adaptations.

METHODS: Ten healthy older adults (age: 67.6±2.2 years, BMI: 22.8±2.6 kg/ m², 7 female, 3 male) without previous resistance training experience were recruited. Blood samples were collected at baseline (PRE) and after 12 week of resistance training (POST). Next-generation sequencing (NGS) was used to determine circulating microRNAs responses to chronic resistance training.

RESULTS: Physical function, including grip strength, chair stand test, and walking capacity, was improved in older adults after 12-week training. Serum levels of leptin (18.1±20.0 vs. 14.9±1.76 ng/ml, P = 0.029) and TNF-α (4.4±0.6 vs. 4.0±0.6 pg/ ml, P < 0.001) were significantly decreased after 12-week training. After 12 week of resistance training, 11 adipogenesis, 3 anti-adipogenesis, 5 myogenesis, and 5 inflammation associated miRNAs were changed significantly in older adults (Fold change > 2, P < 0.05). Length change of miRNA-125-1-3p was inversely correlated with delta walking time (R = -0.685, P = 0.029) and change in IGF-1 (R = -0.644, P = 0.044). CONCLUSIONS: Resistance training alters specific circulating miRNAs to account for functional and physiological adaptations in older adults.

2827 Board #288 May 29 10:30 AM - 12:00 PM Genetic Predictions Of Bone Mineral Density In Ultramarathon Runners: For Men, But Not For Women

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(No relevant relationships reported)

BACKGROUND: Various genetic markers have been identified as influencing bone mineral density (BMD). In a prior study in the UK Biobank, 22,866 SNPs were selected using LASSO based on ability to predict calcaneal bone mineral density. Kim in PLoS ONE 2018 tested this genetic risk score against other models and found it to have the best correlation with BMD.

PURPOSE: Given the prevalence of low BMD and low energy availability in female and male endurance runners, this study investigated the correlation between this genetic risk score and BMD of runners at the Western States endurance race.

METHODS: 51 runners at a 100-mile race underwent a genetic evaluation using an Affymetrix PMRA array including approximately 800,000 SNPs, which includes all those required for the Kim BMD genetic risk score. These runners also underwent dual-energy x-ray absorptiometry. We calculated Pearson’s correlation coefficients between the genetic risk score and spine, hip, femoral neck, and forearm BMD.

RESULTS: 17 female and 34 male participants had a mean age, respectively, of 41.8 and 46.8 years (range 26.4-76.2). BMD ranged from 17.2±2.52 kg/m² (femur) and 19.3±3.94 kg/m² (male). The results for the male runners, the genetic risk score significantly correlated with z-scores of the lumbar spine, total hip, femoral neck, forearm, and total body (r = -0.52-0.58, p<0.005). For female athletes, all correlations were 0 or negative and non-significant (r =0.0 to -0.30, p =0.24-0.99). See Table 1.

CONCLUSIONS: The BMD genetic risk score was significantly correlated with BMD in the male, but not female ultramarathon runners in this study. The sample size for women (n=17) is too small to draw robust conclusions, but we speculate that for female athletes, environmental and hormonal factors, such as low energy availability or menstrual irregularities, may decrease the influence of genetic factors.
**PURPOSE:** Chronic traumatic encephalopathy (CTE) is a neurodegenerative disease associated with exposure to contact and collision sports, including American football. We hypothesized that, as duration of American football played increased, CTE neuropathological risk and severity would correspondingly increase. To account for selection bias, we adjusted for known predictors of selection into brain banks using inverse probability weighting (IPW); because of unique criteria, we also conducted simulation to further evaluate the effect of selection bias. METHODS: In a convenience sample of 266 deceased American football players from the VA-BU-CLF and Framingham Heart Study (FHS) Brain Banks, we estimated the association of years of football played with CTE pathological status and severity. To be eligible the VA-BU-CLF Brain Bank, donors needed a history of CCS, military service, or domestic violence, regardless of whether symptoms manifested during life. All brains from either brain bank were processed and analyzed using identical methods. Neuropathologists were blinded to the participant’s CCS exposure and clinical history. RESULTS: In models adjusted for age at death, there was a dose-response relationship between longer duration played with CTE status and severity; each additional year of play corresponded to 30% higher odds of having CTE at death (95% CI, 1.19-1.41; P=3.8x10-9) and 14% higher odds of having severe CTE at death (95% CI, 1.07-1.22; P=3.1x10-4). Participants with CTE were 1/10th as likely to have played >4.5 years (negative likelihood ratio [LR]=0.102, 95% CI, 0.100-0.105) and were 10X as likely to have played >14.5 years (LR=10.2, 95% CI, 9.8-10.7). Simulation demonstrated that years played remained adversely associated with CTE status across all values of selection regression scenarios. CONCLUSIONS: Duration played was significantly associated with odds of CTE at death, with odds increasing >30% every year, doubling every 2.6 years and increasing by >10-fold every nine years. Among those with CTE, duration played also was also significantly associated with having severe CTE pathology and greater NFT burden. Duration played was a good classifier of CTE status based on ROC curve analysis.

**RESULTS:** Poor prognostic accuracy of sport-related concussion (SRC) recovery times has limited prognostic clinical care. Currently, clinicians consolidate a battery of assessments and combine their own practical knowledge to develop prognosis and treatment plans. Machine learning may provide a useful method to augment clinicians’ prognostic decision-making: a critical first step to enhance proactive care. **Purpose:** Determine utility of a novel genetic fuzzy system (GFS) machine learning approach, FuzzyBolt, to predict protracted recovery after SRC. **Method:** Data from 76 pediatric patients (age 14.44 ± 2.54 years; 28 F) were obtained from 186 combined clinic visits following initial SRC. Recovery time was indexed from the physician-recorded full clearance to return to play date in the medical record and then classified as less than or equal to 28 days (N=88) vs. greater than 28 days (N=98)—the consensus pediatric threshold for persistent symptoms. A GFS model classified protracted recovery on patients that were less than 28 days in recovery. GFS uses fuzzification, rule-inference and defuzzification to make decisions, and FuzzyBolt provides an efficient method of optimizing model parameters via genetic algorithms. The model used 36 inputs, including ordinal and binary variables related to patient demographics, standardized Post-Concussion Symptom Inventory responses, and self-reported responses from a clinic-based Head Injury Questionnaire. **Results:** Data were split, via stratified sampling, into a training set (80%; 61 athletes with 151 visits) and a hold-out validation set (20%; 15 athletes with 35 visits). Each patient visit was considered a unique case, with visits from the same patient never part of both the training and validation sets used to reduce the risk of over-fitting and inflation of non-generalizable prediction accuracy. The FuzzyBolt model correctly predicted 12 of 16 protracted (and 16 of 19 typical) recovery cases, for an overall classification accuracy of 90%. **Conclusion:** This is the highest prediction accuracy, to date, for any published prognostic model of concussion recovery. It is a first step toward promoting early allocation of resources for patients at high-risk for protracted recovery, and demonstrates a novel technique to empower a data-driven solution to improve outcomes in these athletes.

**References:**

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(No relevant relationships reported)
of SRC non-disclosure. Univariate logistic regression analyses determined the odds of SRC non-disclosure (yes/no) for each predictor. Significant univariate predictor variables were used in the multivariate logistic regression analysis. Significance was set at a priori p < 0.05. RESULTS: A total of 116 (15.65%) collegiate athletes reported not disclosing a potential SRC. Following univariate logistic regression analysis, sex (p = 0.004), sport type (p = 0.002), SRC history (p < 0.001), pressure from teammates (p < 0.001), pressure from coaches (p < 0.001), pressure from parents/family (p < 0.001), and pressure from friends (p < 0.001) were entered into a multivariate logistic regression. Previous history of SRC (OR, 2.66 [95% CI 1.74-4.08]; p < 0.001), being a male (OR, 1.69 [95% CI, 1.04-2.75]; p = 0.033), and experience playing to pressure following a head impact from a coach (OR, 1.36 [95% CI 1.16-1.59]; p < 0.001) were significant predictors of SRC non-disclosure. CONCLUSIONS: SRC non-disclosure behaviors are influenced by intrinsic and extrinsic factors and may be magnified in athletes with a history of SRC, males, and athletes that experience pressure from coaches. To reinforce favorable reporting behaviors, future educational initiatives should consider these predictive factors.

Preseason testing is important when developing concussion-related safety programs in high-school athletes. However, the relationships between many commonly-used and valid-baseline assessments are unknown.

**Purpose:** To determine the relationships between King-Devick (KD) and the Sport Concussion Assessment Tool - 5th Edition (SCAT5), commonly used as part of a pre-season concussion-safety program for high-school athletes. **Methods:** SCAT5 and KD baseline scores from high-school athletes (n = 404, 28 = female, aged 16±1 years) were recorded and later analyzed. KD testing required participants to complete two, error-free trials, which were reported to the nearest 0.9 s and a single SCAT5 assessment completed one-on-one with a physician or athletic trainer. The SCAT5 test is composed of several relevant neurocognitive components (concentration, current number of symptoms, symptom severity, orientation, memory, neurocognitive screening, balance, and recall). Due to the dichotomous nature of the neurocognitive screening component, those data were excluded from this analysis (n = 9 scored in the abnormal category). Pearson-product moment correlations were calculated between the best-baseline KD score and SCAT5’s component tests, including a composite score. The composite score was calculated as a sum of z-scores from each individual test making up the SCAT5 test. The mean ± standard deviation of the KD test were 52.5 ± 13.3 s. Pearson-product moment correlations revealed a weak-negative relationship with the SCAT5 component - Concentration (r = -0.12, p = 0.02). However, no other meaningful relationships were detected (number of symptoms (r = -0.04, p = 0.48), symptom severity (r = -0.06, p = 0.22), orientation (r = -0.07, p = 0.14), memory (r = 0.02, p = 0.63), balance (r = -0.04, p = 0.39), recall (r = 0.01, p = 0.88), and composite z-score (r = -0.05, p = 0.30).**CONCLUSIONS:** These data show that KD and SCAT5 scores are generally unrelated in this sample of high-school athletes. Clinically, the data support the true utility of neurocognitive testing resides in one’s ability to use the same test to directly compare pre- vs. post-test scores in diagnosing and monitoring recovery in athletes suspected of having a concussion. King-Devick protocol appeared free of charge.

**Purpose:** A wide variety of assessment tools are currently available to help clinicians assess Sport Related Concussion (SRC). Currently, the most widely available tools are neither objective nor portable and are therefore not ideal for assessment at the site and time of a suspected injury. **Methods:** A portable system was developed to deliver a measurement of the steady-state visual-evoked potential (SSVEP). This system involved a smartphone housed in a Google Cardboard frame, which delivered a 1Hz flicker visual stimulus while an electroencephalography (EEG) headset recorded EEG signals. 65 rugby union players were tested during their regular season and were stratified into healthy, concussed and recovered groups based on clinical examination. Their SSVEP response was quantified into a signal-to-noise ratio (SNR). The SNRs of players in each study group were summarized. Additionally, the SNRs of individual players who had baseline, post-injury and post-recovery readings were analyzed. **Results:** 65 participants completed a baseline evaluation to measure their SSVEP. Twelve of these participants sustained a medically diagnosed concussion and completed SSVEP testing within 72 hours. Eight concussed players received follow-up SSVEP testing after recovery. Concussed participants had a lower SNR (2.20 [2.04-2.38]) when compared to their baseline (4.54 [3.79-5.10]). When clinically recovered, participant SNR was not significantly different to their baseline (4.82 [4.13-5.18]). The baseline SNRs of the players who experienced a concussion during the season were significantly different to those who did not experience a concussion (4.80 [4.07-5.68]). **Conclusions:** This is the first study to identify differences in SSVEP responses in male amateur rugby union players with and without concussion. It is also the first SSVEP demonstration for concussion evaluation at point-of-care. SSVEPs are significantly attenuated in the presence of concussion in these male athletes. Individuals returned to their baseline SSVEP following clinical recovery from the concussive injury. The use of SSVEPs has the potential to be a supplemental aid for the assessment and management of concussion.
INITIATION OF CLINICAL CARE MAY PLAY A CRITICAL ROLE IN PROMOTING RECOVERY FOLLOWING SPORT-RELATED CONCUSSION (SRC). THERE HAS BEEN NO RESEARCH ON THE ROLE OF TIME TO FIRST CLINIC VISIT ON RECOVERY FOLLOWING SRC IN PEDIATRIC ATHLETES. RAPID RECOVERY MAY BE ESPECIALLY IMPORTANT IN PEDIATRIC POPULATIONS, AS PROLONGED RECOVERY MAY LEAD TO DEVELOPMENTAL CHALLENGES AND/OR IMPACT SCHOOLWORK AND LEARNING CAPACITY.

METHODS: This study was a retrospective review of medical records from a concussion-specialty clinic representing 164 pediatric athletes (aged 12-17) with diagnosed SRC between April 2016-January 2019. Participants were separated into EARLY (≤7 days) and LATE (8-20 days) time to first clinic visit cohorts. Participants completed the Post-concussion Symptom Scale (PCSS), Immediate Post-concussion Assessment and Cognitive Testing (ImPACT), Vestibular/Ocular Motor Screening (VOMS), and demographics/medical history. Adjusted odds ratios (OR) were derived from a backwards stepwise logistic regression (LR) with normal (≤30 days) or prolonged (>30 days) recovery as the outcome. Time to first clinic visit, pre-injury factors, and post-injury clinical assessments were included as predictors.

RESULTS: There were no differences in age or cognitive performance between EARLY and LATE. EARLY had a higher PCSS score (29.4±19.6) than LATE (22.1±18.3; p=0.018). LATE had a higher proportion of females (55%) than EARLY (28%; p=0.001). The LR (R2=0.14; p=0.001) identified days to first clinic visit (OR=2.9; p=0.007), as the strongest predictor of recovery >30 days. Vestibular dysfunction (OR=1.1; p=0.040) and PCSS score (OR=1.04; p=0.004) were also predictors of recovery >30 days.

CONCLUSIONS: Among all pre- and post-injury predictors, days to first clinic visit was the most robust predictor of prolonged recovery. Vestibular dysfunction and PCSS score also predicted prolonged recovery. The findings highlight the importance of early intervention and care following SRC in pediatric populations.
Heart rate variability (HRV) is viewed as a measure of autonomic nervous system (ANS) function. Various approaches are available for recording heart rate, however, few studies have compared Holter type recordings vs heart rate monitors (HRM) during orthostatic challenges. **PURPOSE:** Compare HRV measures from an electrocardiogram (ECG) Holter and HRM for further investigation on ANS response usefulness for post-concussion rehabilitation follow-up. **METHODS:** Asymptomatic subjects (n=12; 6 females, 6 males), age 18 to 35 yrs, non-smoking, no history of cardiac illness and physically active (3 times per week, 60 mins, moderate intensity exercise) participated in the study. ECG signals were recorded in a 12 lead configuration with a Holter (Medilog D2Jplus2, Schiller, Sw and proprietary HRV analysis software) and simultaneously with an HRM (H10, V800, Polar, Fi and Kubios HRV analysis software). A spacious room with controlled environment was used to assess the orthostatic challenge. A motorised tilt table was set at 180 degrees for supine and 85 degrees for standing position. Participants were instructed to remain for 7 minutes in each of the following positions: supine and standing. Analysis was performed for obtaining temporal and frequency domains measurement in both positions. ANOVA analysis was used to compare measurements obtained from both systems. Pearson correlations were used for comparing same variables measured with both systems. Significance was set at p<0.05. Results are presented as means ± SD are appropriate. **RESULTS:** No significant differences were observed between measurements taken with both systems under equal conditions (supine and standing). Significant differences, however, were observed between conditions (supine and standing), except for SDNN that did not show any significant differences between conditions. Same variables under similar conditions were significantly different between conditions (supine and standing), except for SDNN that did not show any significant differences between conditions. **CONCLUSION:** Two recording and analysis systems and conditions. Same variables under similar conditions were significantly different between conditions (supine and standing), except for SDNN that did not show any significant differences between conditions. Significant differences, however, were observed between conditions (supine and standing), except for SDNN that did not show any significant differences between conditions.
Achilles tendon ruptures are debilitating injuries that lead to long-term functional deficits in two thirds of patients. Shear wave tensiometry is a non-invasive technique for measuring tendon loading during functional activities by inducing waves traveling along the tendon and measuring their propagation speed. Tensiometers have the potential to be implemented in clinical settings to objectively track tendon loading to assist in clinical decision-making. **Purpose:** To determine whether shear wave tensiometry can detect abnormalities in tendon loading during recovery following Achilles tendon rupture and repair. **Methods:** Tensiometers were placed bilaterally on the Achilles tendons of one subject who had undergone surgical repair of a unilateral Achilles tendon rupture 14 weeks prior (M, 87.6 kg, 193 cm) and two control subjects. Tensiometers were placed bilaterally on the Achilles tendons of one subject who had undergone surgical repair of a unilateral Achilles tendon rupture 14 weeks prior (M, 87.6 kg, 193 cm) and two control subjects.

**RESULTS:** Achilles tendon ruptures are debilitating injuries that lead to long-term functional deficits in two thirds of patients. Shear wave tensiometry is a non-invasive technique for measuring tendon loading during functional activities by inducing waves traveling along the tendon and measuring their propagation speed. Tensiometers have the potential to be implemented in clinical settings to objectively track tendon loading to assist in clinical decision-making.

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Knee injuries are one of the most common ball sport related injuries and cause hundreds of millions of dollars in rehabilitation costs annually. Girls and women are 4-9 times more likely to experience a knee injury compared to boys and men, and typically suffer more severe knee injuries. Strength imbalance of the hamstrings and quadriceps muscles during complex sport movements and/or as a result of fatigue may contribute to knee injury occurrence. PURPOSE: This study attempted to predict the ratio of isokinetic muscular strength of the hamstring and quadriceps muscles from a battery of exercise field tests both before and after fatigue. METHODS: Women (n = 29) were recruited from the University of Windsor and completed an exercise field testing protocol consisting of 20m forward sprint, 20m backward sprint, 5×10-5 agility test, single leg hop for distance, side hop, vertical jump, and eccentric Nordic hamstring curl (NHC), as well as an isokinetic dynamometer protocol to obtain muscle peak torques (PT) and hamstring to quadriceps PT ratios (HQR), before and after an NHC protocol. CONCLUSION: The field tests employed in the current study could be used to identify female athletes at risk of knee injury, and potentially provide intervention for injury prevention. Future studies should employ additional field tests that may contribute to knee injury occurrence.

Purpose: Despite the importance of monitoring knee injury risk, the success-response relationship is, thus, still unknown. PURPOSE: To systematically review the evidence for a dose-response relationship of MCSE on pain and disability in chronic non-specific LBP patients.

Methods: A systematic review with meta-regression was conducted. We searched in relevant scientific databases (PubMed, Medline, Web of Knowledge, Cochrane). The eligibility criteria for the studies were: RCTs and CtS on chronic (>12 weeks) non-specific LBP patients, written either in English or German and adopting a longitudinal MCSE intervention with at least one pain intensity and/or disability outcome assessment. Meta-regressions (dependent variable = effect sizes (Cohens d) of the interventions (once for pain and once for disability), independent variable = training characteristics (duration, frequency, time per session)) were conducted to reveal the optimal dose required for MCSE therapy success.

Results: From the 3,415 studies initially selected, 46 studies on n = 2,661 LBP patients were included in the analysis. N = 1,220 patients received MCSE; the training duration was 6.4 ± 2.3 weeks and the training frequency was 3.4 ± 2.0 sessions per week with a mean training time per session of 44.2 ± 17.7 min. The meta-regressions’ mean effect size was d = 1.7 for pain and 2.1, for disability, respectively. Total R² was 0.34 and 0.38. Moderate quality evidence (R² = 0.136) revealed that a training duration of 20 to 30 minutes elicited the largest effect (both in pain and disability, logarithmic association). Low quality evidence (R² = 0.202) revealed that training 3 to 5 times per week led to the largest effect of MCSE in chronic non-specific LBP patients (inverted U-shaped association). Training duration showed no systematic variance explanation on the effect sizes.

Conclusions: In non-specific chronic LBP patients, MCSE with a training frequency of 3 to 5 times per week (Grade C recommendation) and a training time per session of 20 to 30 min (Grade A recommendation) elicited the largest effect on pain and disability. Future work may focus on the definition of a minimum dosage for therapy success.
A hamstring to quadriceps ratio (H:Q) ≥60% and hamstring length index symmetry (LSH) ≥90% during unilateral assessments of strength and function have been used as return to play (RTP) benchmarks following anterior cruciate ligament reconstruction (ACLR). PURPOSE: Determine the relation between H:Q and single (SH), triple (TH), and H:Q at 60°·s−1 (r = −0.80 [−0.80 to −0.38], p < 0.001), and TH and H:Q at 180°·s−1 (r = −0.63 [−0.76, −0.27], p < 0.001). No significant correlations between H:Q and hopping performance were identified in females. At 300°·s−1, FAIL males had greater normalized SH scores for IL between SH and H:Q at 300°·s−1 (r = −0.49 [−0.71, −0.37], p < 0.001), and TH and H:Q at 180°·s−1 (r = −0.63 [−0.76, −0.27], p < 0.001). No significant correlations between H:Q and hopping performance were observed to be different in sitting or standing. Further investigation about differences in foot strength measured in sitting versus standing is needed.
implemented, 2017 and 2018, NC ACL injuries were reduced to 0. In the 2017 season, 9 athletes were injured specifically, 3 concussions, 1 (Contact) ACL injury, and 5 other injuries. In 2018, ACL injuries were reduced to 0, while concussions (5) and fractures (3), and other injuries limited participation.Twice a week, 2-hour practice sessions and games were included to estimate a team NC ACL injury rate per activity hour ratio. In 2016 the ratio was 3/3000 hrs. There were no NC ACL injuries in both 2017 (0/3472 hrs) and 2018 (0/3900 hrs) together equal 0/7372 hrs. If the injury rate from 2016 were maintained, NC ACL injuries would be predicted to be >7. \textbf{Conclusion:} This preliminary study suggests the FIFA 11+ may have broader application to other field sports and that specific training programs may reduce the incidence of ACL injuries in Rugby athletes.

<table>
<thead>
<tr>
<th>Yr / Players</th>
<th>Games (estimated 2 hrs/game)</th>
<th>Weeks of participation</th>
<th>Typical Practice Hrs per week</th>
<th>Estimated Total Team participation hrs</th>
<th>NC ACL/ hrs</th>
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</table>

There is no consensus about the absolute immobilization time period and whether the rehabilitation should start in the first or in the third week after Bankart Repair. \textbf{PURPOSE:} The aim of this study was to compare the clinical outcomes of 1 and 3 weeks of absolute immobilization time after the surgery and evaluate their effects on recurrent instability. \textbf{METHOD:} Forty-two patients witharthroscopic Bankart surgery were included to the study. Patients were randomly allocated into two groups. One week of absolute immobilization was performed to the patients in group-1 (n=21, age:22.5±6.5 years, BMI: 24.8±2.8 kg/cm²). All of the patients come to the clinic once in a week and performed supervised exercise program and the rehabilitation program was progressed. They were also prescribed home exercise program. Shoulder ROM, pain level and shoulder function were assessed, according their groups at the first or third weeks, 4, 8 and 12 weeks of post-operative period. The pain level during resting, activity and at night was assessed with VAS. Shoulder ROM was assessed with standard goniometer and shoulder function was assessed using ASES questionnaire. At the average of 30. weeks after the surgery, it was questioned whether there was a re-dislocation. The demographics of the patients on both groups were analyzed with student t test. Two-way repeated measures ANOVA was used for the statistical analyses. \textbf{RESULTS:} There were no significant “Group*time” interactions for pain at rest and activity and flexion, abduction, external rotation, internal rotation angles (p>0.05). The main effect of time was significant at rest and activity pain and all ROM measurements (p<0.05). There was a significant “Group*time” interaction for pain at night (p<0.05). Pain at night was higher in the group-1 at post-operative 1 and 4 weeks compared to group-2. There were no statistically significant differences between the two groups in shoulder function at post-operative 12 weeks (p>0.05) and 30 weeks (p>0.05). One patient had re-dislocation in the group-2. \textbf{CONCLUSION:} One or three weeks of absolute post-operative immobilization period does not differ in terms of functional outcomes on patients with Bankart repair.

\textbf{Objective:} To analyze the correlation between Functional Movement Screen (FMS), Y-Balance Test(YBT) and the Sports Injuries of different sword-type elite fencing athletes during the 2018-2019 World Cup season. \textbf{Methods:} During the 2018-2019 fencing World Cup, recruited three groups of elite fencing athletes(Epee group: age 22.50±5.08 years, 8 males and 10 females), Foil group(age:21.00±0.20 years,8 years,8 females) and Sabre group(age: 20.56±5.08years, 9 males and 10 females), a total of 45 Chinese elite fencing athletes. Before the World Cup season, FMS (six movements), double upper quarter(UQ) limbs' YBT (Anterior, A; Posteromedial, PM; Posterolateral, PL) and double upper quarter(UQ) limbs' YBT(A: PM- PL) were tested to assess the movement function. After the World Cup season, athletes were classified as having sports injuries during the season in 6 levels (mild to severe trauma) according to the Abbreviated Injury Scale(AIS) Scores: Spearman’s correlation analysis methods were used to analyze the relationship of FMS score, UQ/YBT, LQ/YBT with the different sword species. \textbf{Results:} We found FMS score, YBT were related to the sports injuries indifferent types of fencing athletes(1)FMS score: Epee group:FMS(14.89±7.0)and AIS’s correlation coefficient(r=-0.223,P<0.05);(2)Foil group’s FMS(15.71±13.24) and AIS’s correlation coefficient(r=-0.436,P<0.05);(3)Sabre group’s FMS(15.67±6.82) and AIS’s correlation coefficient(r=-0.352,P<0.05). The higher the FMS score, the lower the injury risk.(2) UQ-YBT: Epee group’s (A=9.69±9.70, P<0.05) and AIS’s correlation coefficient(r=-0.926, P<0.05). The higher the YBT relative anterior distance, the lower injury risk. Epee group (P<0.05)(3)LQ-YBT: Epee group’s (A=66.32±33.96) and AIS’s correlation coefficient(r=-0.672,P<0.05);Sabre group’s LQ-YBT(A=62.65±26.49) and AIS’s correlation coefficient(r=-0.543,P<0.05). The higher the YBT’s relative anterior distance, the lower of injury risk (P<0.05). \textbf{Conclusion:} For elite fencing athletes, FMS score is highly related with the sports injury; YBT’s was only related to of the Epee group and the Sabre group, and was not significantly related to the flower sword group; Future randomized, controlled studies are needed to confirm these findings.
Evidence indicating the important role psychological factors contribute to patient reported outcome (PROs) post anterior cruciate ligament reconstruction (ACLR) has been growing over the last decade. However, it is unclear whether sex-specific differences in psychological profile exist in ACLR recovery. Determining the potential psychological differences between sexes has important implications on the development of targeted intervention strategies post ACLR. PURPOSE: To determine whether sex differences in PROs exist at six months following ACLR.

METHODS: Forty-one subjects (23 F, BMI 24.0 ± 3.5, Age 19.2 ± 5.9, Tegner 8.8 ± 1.2) six months post ACLR completed PRO questionnaires. Subjects were administered the ACLR-Return to Sport after Injury Scale (ACLR-RSI), the Knee Self-Efficacy Scale (K-SES), and the Psychological Readiness to Return to Sport Scale (I-PRRS). Independent samples t-tests were used to compare PRO responses between males and females.

RESULTS: No significant differences were observed between male and female demographic information (p > 0.05). Significant differences were observed between male and female responses. Males reported higher scores on the ACL-RSI (M: 7.63 ± 1.43, F: 5.46 ± 2.17; p = 0.004, Cohen’s d = 2.11), K-SES (M: 8.88 ± 0.85, F: 7.53 ± 1.11; p = 0.001, Cohen’s d = 1.54) when compared to females.

CONCLUSIONS: These results show that, six months following ACLR, males have significantly higher knee-function self-efficacy, as assessed by K-SES. I-PRRS and ACL-RSI responses show that males are more psychologically ready to resume sports participation. These results show a discrepancy between male and female psychological response following ACLR, which should be a consideration for re-injury risk. While most patients are cleared to return to activity six to nine months post ACLR, there is a lack of consideration for patient’s psychological readiness at the time, for both sexes. If females are returning to sports before being psychologically ready, they are likely to be hesitant and less confident in game situations, contributing to injury risk. Future work is needed to determine if psychologically-focused rehabilitation programs are needed to potentially reverse the reported sex differences.

Injuries of the ulnar collateral ligament (UCL) are a common pathology and have been well documented for overhead athletes. However, little research has focused on the UCL in competitive golfers, though medial elbow injuries are commonly reported. Ultrasound imaging is becoming a common diagnostic tool to diagnose UCL pathology. In addition, USI protocols have been able to reliably identify the width of the UCL at the mid substance and apex of the trochlea. PURPOSE: The purpose of this pilot study was to examine if differences in UCL width at the mid substance and apex of trochlea existed between the trailing and lead arm of asymptomatic golfers. METHODS: Seven asymptomatic NCAA Division I collegiate female golfers (age 19.4 ± 1.4 yr) participated in this study. Ultrasound images were obtained of the UCL on the participant’s trailing and lead arms using a GE LOGIQ e ultrasound unit. Participants were placed supine with elbow position at 30 degrees, with a wedge placed underneath the humerus creating a gravity induced valgus force on the UCL. Ultrasound imaging measurements to evaluate the UCL at two points were performed from the apex of the trochlea to the apex of the olecrana. A paired t-test was performed to evaluate differences in UCL width measurements.

RESULTS: The mean width of the UCL at mid-substance was 29.7cm (SD .047) in the trailing arm (mean width 29.7cm, SD .047) and 23.4cm (SD .033) in the lead arm. The mean width at the apex of the trochlea was 12.9cm (SD .022) and 11.4cm (SD .016), respectively. There was a significant difference between the UCL measurements at the mid-substance between the leading arm and the trailing arm (mean difference .062 cm, t = 5.680-, p =.036), but the difference at the trochlea was not statistically significant. CONCLUSIONS: The results of this pilot study indicate that the trailing arm’s UCL has a larger width when comparing trailing arm with leading arm, potentially due to the increased valgus forces on the trailing elbow versus the leading elbow. These changes may be associated with structural adaptations or pathologies related to this increased load. However, it was beyond the scope of this study to identify the potential sources of the differences in width of the UCL at the mid-substance. Further research is thus recommended using larger sample size, extended study period and symptomatic populations.

**Board #323 May 29 9:30 AM - 11:00 AM**

**The Use Of Ultrasound Imaging In Assessing Ucl Width For Asymptomatic College Female Golfers**

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(No relevant relationships reported)
QUADRICEPS WEAKNESS IS Ubiquitous post anterior cruciate ligament reconstruction (ACL) and is strongly associated with adverse long-term patient outcomes. To date, research is equivocal in healthy subjects that males are stronger than females. However, there has been little work defining sex differences in quadriceps strength post ACLR. Identifying sex differences in quadriceps strength may allow for targeted rehabilitation strategies.

**PURPOSE:** To determine whether sex differences in quadriceps strength and rate of torque development (RTD) exist in subjects 6 months after ACLR.

**METHODS:** Seventy-five subjects (43 M, age 19.5 ± 6.0, Tegner 8.2 ± 1.7) 6 months after an ACLR performed maximum voluntary isometric contractions (MVIC) of the quadriceps. Subjects were positioned on a Biodex System 4 per previously reported literature. The average of four MVIC trials were normalized to the subjects’ body weight. Sex differences in quadriceps strength and RTD in injured and uninjured limbs were compared using analysis of covariance, controlling for age.

**RESULTS:** The males were older (M = 22.6 ± 6.7 years, F = 16.8 ± 3.4 years, p < 0.01) and heavier (M = 79.1 ± 12.5 Kg, F = 66.4 ± 18.6 Kg, p = 0.01) than females. Despite controlling for age and body weight, males displayed higher peak quadriceps strength in the injured limb (M = 2.1 ± 0.6 Nm/Kg, F = 1.7 ± 0.6 Nm/Kg, p = 0.02, Cohen’s d = 0.63) and uninjured limb (M = 3.2 ± 0.8 Nm/Kg, F = 2.6 ± 0.6 Nm/Kg, p = 0.01, Cohen’s d = 0.76). There were no significant sex differences in the injured limb’s RTD (M = 5.5 ± 2.1 Nm/Kg, F = 5.0 ± 2.4 Nm/Kg, p = 0.65, Cohen’s d = 0.22) but males displayed higher RTD in the uninjured limb (M = 10.4 ± 3.8 Nm/Kg, F = 8.1 ± 3.5 Nm/Kg, p = 0.025, Cohen’s d = 0.59).

**CONCLUSION:** Six months post ACLR, males had greater peak quadriceps strength bilaterally and increased RTD in the uninjured limb compared to females with moderate to large effect sizes. However, there was no significant sex difference in RTD on the injured limb. These data suggest that females may need continued progressive resistance strength training while males may be ready to progress power-based quadriceps training strategies 6 months post ACLR. Addressing the disparity in recovery of muscle strength may reduce long-term impairments associated with osteoarthritis and subsequent ACL injury risk.

**2864** Board #325 May 29 9:30 AM - 11:00 AM

**Sex Differences In Quadriceps Strength And Rate Of Torque Development 6 Months Post ACL Reconstruction**

Victor Huynh, Joshua J. Van Wyngaarden, Kathryn Lucas, Darren Johnson, Mary L. Ireland, FACSM, Brian Noehren, FACSM. University of Kentucky, Lexington, KY.

(No relevant relationships reported)

**2865** Board #326 May 29 9:30 AM - 11:00 AM

**Ultrasound Imaging To Assess Medial Elbow Joint Space In Female Collegiate Division I Golfers**

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(No relevant relationships reported)

Medial elbow complex injuries have been reported in competitive and recreational golfers. Ultrasound imaging (USI) is a common method for assessing medial joint stability in baseball and other overhead athletes, however there is a paucity of literature in golfers. During the golf swing, there are increased valgus forces on the trailing arm elbow versus the leading elbow, potentially leading to increased medial joint laxity of the trailing arm.

**PURPOSE:** The purpose of this pilot study was to examine differences in medial elbow joint space (MJS) measured by USI between the trailing and lead arm of asymptomatic female collegiate golfers.

**METHODS:** Seven asymptomatic NCAADivision I collegiate female golfers (age 19.4 ± 1.4 yrs) participated. Ultrasound images of the medial joint space of both arms were obtained using a GE LOGIQ E ultrasound unit. Participants were placed supine with elbow position at 90 degrees, with a wedge placed underneath the humerus creating a gravity induced valgus force on the MJS. Measurements of the MJS were performed, and differences between the trailing and leading arm were analyzed with a paired t-test.

**RESULTS:** Mean elbow MJS opening on the trailing arm was .32cm (SD.097cm), and .28cm (SD .096cm) on the leading arm. There was a statistically significant difference (t= 3.495, p= .01) between MJS opening measurements of the trailing and leading arms.

**CONCLUSIONS:** The results of this investigation indicate that there is increased elbow MJS opening of the trailing arm compared to the leading arm. While this study does not allow for cause and effect conclusions, this is consistent with the increased load placed on the trailing arm MJS during the golf swing. Further research is needed using larger sample sizes, more heterogeneous study populations, and examination of injury rates and MJS measurements.

**2866** Board #327 May 29 9:30 AM - 11:00 AM

**Loss Of Glenohumeral Range Of Motion And Its Effects On Eccentric Strength In Intercollegiate Pitchers**

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(No relevant relationships reported)

Deficits in glenohumeral joint rotational range of motion (ROM) and strength in baseball pitchers’ shoulders have been linked to increased risk of musculoskeletal injury. Total arc of motion deficit (TAMD) is an objective parameter that involves the comparison of bilateral shoulder internal rotation (IR) and external rotation (ER) ROM values as a measure of soft tissue changes at that joint. **PURPOSE:** To determine whether TAMD in the throwing shoulder, when compared to the non-throwing shoulder, affected the eccentric strength of IR and ER muscles of the glenohumeral (GH) joints of intercollegiate baseball pitchers. **METHODS:** 47 male pitchers (age, 19.8±2.1 yrs; hgt, 183.9±5.5 cm; mass, 85.7±10.2 kg; pitching experience, 9.9±2.5 yrs) were recruited to this study and assigned to 1 of 2 groups: 24 pitchers with ≥10° side-to-side differences in total rotational motion were assigned to the TAMD group, while 23 pitchers with less than 10° side-to-side ROM differences qualified for a non-deficit group (Non-TAMD). We measured eccentric IR and ER peak torques at 300°/sec bilaterally with an isokinetic dynamometer. **RESULTS:** We observed higher ER/IR strength ratios of the dominant arms when compared to the non-dominant arms of pitchers in both the TAMD (85.2%±24.3% and 45.4%±23.7%) and non-TAMD groups (87.3%±22.8% and 48.5%±28.1%) (p=0.001). There were no significant differences between the normalized TAMD and non-TAMD dominant arm eccentric IR torques (0.497±0.073 Nm/kg BW vs. 0.478±0.062 Nm/kg BW) or eccentric ER torques (0.407±0.082 Nm/kg BW vs. 0.411±0.077 Nm/kg BW) (p=0.05). Dominant arm eccentric IR/ER ratio strength (86.2%±23.3% vs 47.0%±7.8%) and ER eccentric peak torque (0.410±0.088 Nm/kg BW vs. 0.295±0.049 Nm/kg BW) were both significantly greater than in the non-dominant arm (p<0.05). Internal rotation eccentric peak torque (0.488±0.088 Nm/kg BW vs. 0.636±0.101 Nm/kg BW) was significantly higher in the non-dominant arm (p=0.05). **CONCLUSIONS:** We found ER/IR ratios that were significantly higher in the dominant arms, but no significant differences in ER or IR eccentric strength between the TAMD and Non-TAMD groups. Loss of shoulder rotation ROM did not have a significant effect on the production of IR and ER eccentric torques at the GH joint in this sample of intercollegiate pitchers.

**2867** Board #328 May 29 9:30 AM - 11:00 AM

**Hamstring To Quadriceps Ratio After ACL Reconstruction In Males And Females**

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(No relevant relationships reported)
ratio in participants with ACL reconstruction (ACLR) and to explore the influence of participants sex. METHODS: Participants with primary, unilateral ACLR were included in the study. Participants with re-injury or revision surgery or bilateral injury were excluded. Data from 318 (155 males, 163 females) participants was recorded (22.4±9.2yrs., 1.72±0.8m, 75.8±18.1kg, 8.9±7.8 months post-ACLR). We measured isokinetic peak torque at 90°/sec and 180°/sec for the quadriceps and hamstring muscles bilaterally. H/Q ratio was calculated from peak torque. Repeated measures ANOVA was used to compare H/Q between limbs (within-subject) and between sexes (side x sex interaction). RESULTS: We observed a significant main effect for side at 90°/sec (P<0.001) and 180°/sec (P<0.001) indicating the differences among ACLR side and contralateral side (Table 1) such that ACLR side had higher H/Q ratio compared to the contralateral side with medium effect size. Statistically significant differences in H/Q ratio were found among males and females such that females had higher ratio than males at 180°. No significant side x sex effects were found at 90°/sec (P=0.226) and 180°/sec (P=0.383). CONCLUSION: Sex differences in H/Q ratio in the current study are similar to prior reports. We observed higher H/Q ratio on the ACLR sides compared to the contralateral sides at both velocities. Differences in the H/Q ratio persist among ACLR side and the contralateral side following ACLR and this finding is not influenced by sex.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (Std. Deviation)</th>
<th>Isokinetic Speed (deg/sec)</th>
<th>P value</th>
<th>Mean difference 95%confidence intervals, Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>H/Q Ratio</td>
<td>ACLR side</td>
<td>58.27 (15.66)</td>
<td>90</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>49.69 (13.4)</td>
<td>90</td>
<td>0.06</td>
</tr>
<tr>
<td>Female</td>
<td>51.68 (15.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>48.02 (12.7)</td>
<td>180</td>
<td>0.01</td>
<td>2.28 (-4.98 to 0.67)</td>
</tr>
<tr>
<td>Female</td>
<td>50.85 (14.2)</td>
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</table>

Conclusion: These data suggest that increased activity, including running and HEP, during the critical 4-6-month period after surgery may result in increased self-reported outcomes and psychological readiness to RTS. Increased activity may improve athletes’ comfort and confidence in their knee function. Those who were committed to running early and their home exercises early after recovery may have continued to maintain this regimen through to their 9-month time point and thus felt better about their outcome. These data highlight the importance of athlete adherence to an early and consistent rehabilitation program, paired with clinician reinforcement of the HEP, for improved patient outcomes following ACLR.

**Table 1 Within and between subject differences**
plyometric training without BFR. Knee muscle strength, muscle thickness and knee function were evaluated before and after the interventions. Concentric knee extension and flexion muscle strength were evaluated with isokinetic dynamometer at 60°/s and 180°/s angular velocities. The thickness of the rectus femoris (RF), vastus medialis oblique and lateralis (VMO-VL) were assessed with ultrasonography. Vertical jump (VJ) and one-leg hop (OLH) tests were used to assess the performance of the patients. The subjective knee function was evaluated with IKDC knee form and ACL-RSI score. In addition one leg hop test and ACL-RSI score were evaluated only after intervention. Mann Whitney-U test was used to analyze the change before and after the intervention between groups.

**RESULTS**: Group-1 had significantly higher quadriceps (p<0.05, p<0.05) hamstring muscle strength (p<0.05, p<0.05) at 60°/s and 180°/s angular velocities respectively and higher muscle thickness of RF (p<0.05), VL (p<0.05) and VMO (p<0.05) compared to group-2. In addition, the VJ test (p<0.05) and ACL-RSI score (p<0.05) were higher in group-1 compared to group-2.

**CONCLUSIONS**: The results of the study indicated that plyometric training with BFR was more effective in improving the muscle thickness, muscle strength and knee function.

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**Background**

This study compared the prevalence of hypertension based on the Fourth Report guidelines issued in 2004 (old) and the recent (new) 2017 American Academy of Pediatrics (AAP) clinical practice recommendation for describing hypertension among Nigerian children and adolescents.

**Methods**: Descriptive cross-sectional study of 1758 (boys= 631; 35.9% and girls=1127; 64.1%) aged between 9 and 19 years in Ado-Ekiti, Southwest Nigeria participated in the study. Stature, body mass, abdominal obesity, systolic and diastolic blood pressure (BP) were determined using the standard protocols of ISAK, and BPs for all school-going children at each screen were classified by both fourth report guidelines (FRGs) and AAP guidelines.

**Results**: Mean body mass, waist-to-hip ratio (WHR) (p≤0.05), body mass index (BMI) (p<0.01), body fat percentage and both systolic and diastolic blood pressure were significantly higher among boys compared to girls (p < 0.001). Based on the new guideline (AAP), the prevalence of hypertension by gender systolically, stands at 9.5% and 5.9% compared to the 4th report guidelines of 1.5% and 1.7% for boys and girls, respectively, and diastolically stands at 6.3% and 3.9% compared to the 1.6% and 0.9% for boys and girls, respectively. Based on AAP and by age, 12.1% and 12.8% of children aged 15 and 16 years were systolically and diastolically hypertensive, respectively. The result of the hypertension prevalence based on the 4th report criterias by age revealed that 5.8% and 2.8% of those aged 15 and 14 years were systolically respectively. The result of the hypertension prevalence based on the 4th report criteria (AAP), the prevalence of hypertension by gender systolically, stands at 5.8% and 2.8% respectively.

**Conclusions**: The results of the study indicated that plyometric training with BFR was more effective in improving the muscle thickness, muscle strength and knee function.

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**Purpose**: Endothelial dysfunction appears to have a central role in the progression to high blood pressure by reducing nitric oxide bioavailability and increasing oxidant stress. Flow mediated dilation (FMD) is the most common non-invasive test to assess endothelial function. It has been reported that traditional lower-extremity exercise modalities are associated with improvements on FMD, however, limited research has evaluated the effects of upper body exercise, such as boxing training, on endothelial function. Therefore, the purpose of this study is to determine the response of brachial and popliteal FMD within a prehypertensive population after 6 weeks of boxing training.

**Methods**: A total of 14 prehypertensive participants were randomly allocated to a boxing intervention or a control group. The boxing training intervention consisted of a 6-week program with 3 visits per week in non-consecutive days. Each session was made up of 10 rounds of 3 minutes and 1-minute rest in between rounds. The control group included a 6-week flexibility and balance training with 3 visits per week made up of 10 minutes of dynamic stretching, 5 minutes of unipedal stance, and 5 minutes of upper limb stretching. FMD of the brachial and popliteal artery were measured with a 12-MHz linear phase array ultrasound transducer before and after the intervention.

**Results**: After the intervention, the boxing group showed a significant increment on brachial FMD by 2.4% (p = 0.001) and popliteal FMD by 2.8% (p = 0.043), while no statistical differences were found in the control group for brachial FMD (p = 0.181) and popliteal FMD (p = 0.538).

**Conclusion**: Boxing training is a suitable exercise alternative to improve endothelial function in the upper and lower extremity of individuals with prehypertension.
A graded exercise test (GXT; Bruce protocol), body composition (through DEXA), and a decreased 2UV% (p=0.003), as expected. Both groups showed a significant increase of 0V% values (p<0.05). Only the group without ID showed a significant increase of 0V% values (p<0.05).

RESULTS: Correlations for obesity measures and other cardiovascular risk markers of interest are displayed in Table 1 (* = p < 0.05).

**Table 1: Heart rate variability on older adults with and without ID**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Adults without ID (n=25)</th>
<th>Adults with ID (n=17)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Linear Parameters</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variance (ms²)</td>
<td>824 (168)</td>
<td>755 (167)</td>
<td>0.06</td>
</tr>
<tr>
<td>R^2</td>
<td>0.82</td>
<td>0.79</td>
<td>0.09</td>
</tr>
<tr>
<td>0V% **</td>
<td>26 (16)</td>
<td>33 (16)</td>
<td>0.003</td>
</tr>
<tr>
<td>2UV% **</td>
<td>22 (12)</td>
<td>17 (8)</td>
<td>0.003</td>
</tr>
<tr>
<td><strong>Non-Linear Parameters</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note: values are means (Standard Deviation). Abbreviations: ID (intellectual disability); 6MWT (six-minutes walk test); IRR (R-R intervals). Statistically significant values are showed in bold (p ≤ .05). * Significant difference (p &lt; .05) between rest and 6MWT w/ID group. ** Significant difference (p &lt; .05) between rest and 6MWT w/o ID group.</td>
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</table>

CONCLUSIONS: VO2max was significantly, but weakly related to lean mass, fat mass, and the percentage of both android and gynoid fat. Factors other than fat mass and distribution may contribute to lipid profiles in our male firefighters with fatty livers, a population at high risk for CVD.

PURPOSE: To study the Aerobic Capacity (AC) in adults with Congenital Heart Disease (CHD) and their physical activity (PA) level. METHODS: A cross-sectional study with 93 adults (45 women 36±2,10±1 years; and 48 men 35.4±11.9 years) participated in the study. The AC was assessed by cardiopulmonary exercise test (CPET) using a modified Bruce protocol. Considering values of peak oxygen uptake (VO2max), participants were divided into four Fitness levels (FL) quartiles (Very Low, Low, Moderate, and High).RESULTS: Significant differences appeared in VO2peak between all FL groups for both sexes. In women, the VO2peak of the very low FL group was 18.5±2.8 ml/kg/min, Low FL 23.2±1.5 ml/kg/min, Moderate FL 34.9±4.7 ml/kg/min, and High FL 35.7±5.6 ml/kg/min. In men, the high FL group showed an upward trend in spending MET/min/week compared to other FL groups. In women, the very low FL group was 26.9±3.12, Moderate FL 29.6±4.15, and High FL 35.7±5.6 ml/kg/min. The high FL group showed a significant increase in VO2peak between all FL groups (p=0.001). In men, the VO2peak of the very low FL group was 17.8±2.58, Low FL 23.2±1.5 ml/kg/min, Moderate FL 27.6±2.12, and High FL 35.7±5.6 ml/kg/min. In women, VO2peak of the very low FL group was 18.5±2.8 ml/kg/min, Low FL 23.2±1.5 ml/kg/min, Moderate FL 34.9±4.7 ml/kg/min, and High FL 35.7±5.6 ml/kg/min. There was a significant difference between the very low and high FL groups (p=0.001). Significant differences were observed among FL groups in terms of PA with a mean of 2659.3±2210.0 MET/minutes/week. However, the high FL group showed a significant increase in spending MET/minute/week compared to the other groups. Thirty-two participants (34.4%) reported HEPA, 49 (52.7%) reported minimally active and 12 (12.9%) reported inactivity.inactive. CONCLUSION: Aerobic Capacity in adults with CHD was low compared to regular values in healthy population. These findings suggesting that when the goal is to improve aerobic capacity and prognosis of disease should be recommended increase PA. Future studies with a larger sample size are needed to determine level of PA appropriate to improve aerobic capacity in adults with CHD.Supported by SRF DEC Generalitat de Catalunya and European Union 2019F1_B1_00168. Abstracts were prepared by the authors and printed as submitted.
Near infrared spectroscopy (NIRS) a non-invasive technique used to measure tissue perfusion and oxygenation. Recent studies used the combination of a Venous occlusion plethysmography (VOP) with NIRS to study microvascular function. NIRS have demonstrated to monitor effectively perfusion changes in muscle microcirculation. The purpose of this study was to determine if NIRS can predict microvascular blood flow measurement via VOP.

A total of 20 young apparent healthy subjects, were recruited for this study. NIRS and VOP were performed simultaneously at the right forearm and calf both perpendicular to the longitudinal axis. Baseline levels were obtained for a minute for NIRS and VOP. Followed by an ischemic stress were cuffs were inflated to a suprasystolic pressure for five minutes. Post ischemic stress data was collected for one minute. Strength association was evaluated by Pearson correlation.

Lower extremity demonstrated a positive correlation with average basal oxyhemoglobin (HbO₂) versus, slope of deep oxyhemoglobin (HbHb) (R = 0.541; P = 0.014). HbHb 30 seconds before ischemic stress is release has a positive correlation with tissue oxygen saturation (SO₂) slope (R = 0.873; P < 0.05). HbHb post ischemic stress slope had a positive correlation with HbO₂ slope (R = 0.665; P = 0.001). Upper extremity, HbO₂ post ischemic stress versus HbHb post ischemic stress showed a positive correlation. (R = 0.916; P < 0.05). HbO₂ 30 seconds before ischemic stress versus HbHb 30 seconds before ischemic stress slope had a positive correlation (R= .784; P < 0.05). No correlation was found with VOP measurements.

There were no agreements between NIRS and VOP, for the assessment of microvascular function.

**Purpose:** To evaluate the effect of resting pulmonary function on metabolic responses to exercise in patients with a bicuspid aortic valve (BAV) compared to normal control subjects (C). **Methods:** We evaluated 18 BAV patients and 18 C subjects, age and size matched, using a Ramp Treadmill protocol. Pulmonary function was evaluated with resting spirometry measures of Forced Vital Capacity (FVC) and Forced Expiratory Capacity in the first second (FEV1). Breathing reserve was calculated (BR). Oxygen consumption, absolute (VO2) and indexed (VO2i), percent predicted VO2 (%VO2i), respiratory minute volume (VE) and respiratory exchange ratio (RER) were obtained at an aerobic threshold (AT) and maximal exercise (Max).

**Results:** There were no significant differences between the BAV and C groups in age (14.6 ± 2.1 vs 15.8 ± 3.1 (yr)), height (1.63 ± 0.1 vs 1.66 ± 0.1 (m)) or weight (55.7 ± 15.1 vs 57.6 ± 13.2 (kg)). The BAV group had significantly decreased FVC (3.54 ± 0.84 vs 4.16 ± 1.03 (L/min) p<0.05) and FEV1 (3.54 ± 0.84 vs 4.16 ± 1.03 (L/min) p<0.02) compared to the C group. BAV group had a significant decrease in VO2 (1524 ± 466 vs 1876 ± 540 (ml/min) P<0.04), VO2i (28 ± 8 vs 33 ± 5 (ml/min/kg) p<0.04) and VE (35 ± 11 vs 42 ± 10 (L/min) P<0.02) at AT but not at Max. The %VO2i was significantly decreased in the BAV group at AT (67 ± 19 vs 83 ± 18 %) (P<0.01) and Max (91 ± 24 vs 109 ± 17 %) (P<0.01). BR was significantly decreased in the BAV group (46 ± 6 vs 50 ± 6 %) (P<0.05) Max RER was not significantly different in BAV and C groups (1.19 ± 0.08 vs 1.19 ± 0.06). Significance was set at P<0.05.

**Conclusion:** BAV and C groups reached the same intensity of exercise reflected by the RER. BAV group had decreased pulmonary function, reflected by FVC and FEV1, with a decreased BR. BAV had decreased aerobic performance at AT and Max, reflected by the VO2, VO2i, and VE at AT and %VO2 at AT and Max. These data suggest that a significant pulmonary function component contributes to the decreased aerobic performance in these BAV patients.
It is unclear whether individuals with high skeletal muscle mass may have beneficial effects on cardiovascular health. PURPOSE: To compare cardiovascular risk factors between individuals with Standard skeletal Muscle Group-Male (SMG-M)/Female (SMG-F), and High skeletal Muscle Group-Male (HMG-M)/Female (HMG-F). METHODS: Fifty Healthy young male (n=27, 23.4±4.0 years old) and female (n=23, 22.1±4.0 years old) were recruited to participate in this study. Body composition of the subjects was measured by a Bioelectrical Impedance Analysis. Depending on the results, they were divided into 2 groups(HMG-M vs. SMG-M, HMG-F vs. SMG-F). Blood pressure, brachial-ankle pulse wave velocity(baPWV), and blood analysis ([HMG-M vs. SMG-M, (cm/s): 1129.5 ± 18.2 vs. 1100.0 ± 49.8, p=.589; HMG-F vs. SMG-F, LDL-C(mg/dL): 90.5 ± 12.1 vs. 79.0 ± 3.8 vs. 54 ± 2.3, p<.0001], whereas LDL-C and TRG levels were comparable in the groups regardless of gender[HMG-M vs. SMG-M, LDL-C(mg/dL): 90.5 ± 12.1 vs. 76.2 ± 12.4, p=0.472, TRG(mg/dL): 124.0 ± 22.5 vs. 104.5 ± 22.0, p=.549, HMG-F vs. SMG-F, LDL-C: 97.2 ± 8.5 vs. 91.8 ± 6.6, p=0.626, TRG: 80.4 ± 15.0 vs. 96.0 ± 14.6, p>.477]. In addition, baPWV did not show significant differences between groups[HMG-M vs. SMG-M, (cm/s): 1129.5 ± 18.2 vs. 1100.0 ± 49.8, p=.589, HMG-F vs. SMG-F, 1001.7 ± 41.4 vs. 997.0 ± 73.2, p=.957]. Interestingly, HDL cholesterol levels were higher in HMG than in SMG: HMG-M vs. SMG-M, (mmol/L): 1.03 ± 0.07 vs. 0.98 ± 0.06, p=.028; HMG-F vs. SMG-F, 1.04 ± 0.07 vs. 0.99 ± 0.06, p=.037]. Furthermore, triglycerides were comparable between groups: HMG-M vs. SMG-M, (mg/dL): 90.3 ± 13.6 vs. 93.7 ± 15.4, p=.649; HMG-F vs. SMG-F, 91.8 ± 9.3 vs. 90.3 ± 8.1, p=.477]. CONCLUSIONS: In both male and female groups, HDL was significantly higher in HMG than in SMG, and a significant correlation was found between skeletal muscle mass index and HDL cholesterol. These results suggest that an increase in skeletal muscle mass may have an additive benefit on a cardiovascular risk factor, especially LDL cholesterol level.
Board #347
May 29 10:30 AM - 12:00 PM
Associations Of Fitness, Physical Activity, And Fatness With A New Index Of Endothelial Function
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Current methods for assessing endothelial function, an early marker of cardiovascular disease (CVD), are either invasive or use noninvasive methods that are highly operator dependent or require nonreusable expensive probes, thereby limiting their use for CVD risk prediction. Purpose: To assess the relationship of fitness, physical activity (PA), and fatness, each a CVD risk factor, with a novel measure of endothelial function. Methods: This was a cross-sectional data analysis in adults recruited for a study examining the clinical utility of a new device that measures endothelial vasodilator function using a modified BP cuff. The resulting Endys is derived from direct calibrated measurements of brachial arterial compliance throughout the entire transmural pressure curve during a staged cuff release after 5 minutes of upper arm occlusion. A higher score means better endothelial function. Fitness was assessed by a 6-minute walk test (6MWT). Self-report of PA was assessed by the Rapid Assessment of Physical Activity tool. Body mass index (BMI) was used as a marker of general fatness and waist circumference (WC) as a marker of abdominal fatness. Results: In all 153 subjects, 51% were female, 7% were smokers, 7% had CVD, and 10% had type 2 diabetes. The mean ± SD for age was 49.3 ± 17.2, EnDys was 80.8 ± 30.4, BMI was 29.3 ± 6.9 kg/m², WC was 75.7 ± 7.6 inches, and 6MWT was 495.4 ± 113.5 meters. Endys was highest in females, 87.6 ± 30.5, vs males, 73.8 ± 28.9, p≤0.01. EnDys did not differ by being sedentary, 80.8 ± 27.6, or active, 81.0 ± 33.0, p=0.97. Using bivariate analysis, a lower EnDys was associated with higher BMI, r=-0.23, higher WC, r=0.33, lower 6MWT, r=-0.32, and older age, r=-0.20, all p<0.02 or less. In a multivariate model, 6MWT (p=0.06, p<0.01), WC (p=1.02, p=0.02), and sex (females, β=0.9, p=0.01) were each independently associated with EnDys. There were no interactions for sex with 6MWT and WC. Conclusion: Among measures of fitness, PA, and fatness, and in both sexes, a lower walking distance and a higher waist circumference were each independently associated with a lower EnDys, indicating worse endothelial function. A next logical step is to assess if EnDys improves with interventions like exercise and weight loss, thereby providing a novel and relatively simple way to track progress towards CVD risk reduction.

Board #348
May 29 10:30 AM - 12:00 PM
Baroreflex Sensitivity And Autonomic Modulation In Elders With Hypertension Undergoing Lifestyle Interventions: Secondary Outcomes Of The Hael Study
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Purpose: Hypertension affects more than 60% of older individuals and is associated with reduced baroreflex sensitivity (BRS). Lifestyle interventions, such as exercise, are recommended to promote healthy aging. Exercise training improves autonomic modulation and BRS in varied populations but not in patients with severe autonomic dysfunction. Due to the scarcity of the literature in the context of older adults with hypertension, we aimed to evaluate BRS and autonomic modulation of elders exposed to lifestyle interventions. Our hypothesis was that the exercise intervention would be superior to a health education program in improving these variables.

Methods: In a secondary outcome analysis of the AEL Study (NCT03264443), 34 older adults (mean age 67.7±7.0) with hypertension (mean blood pressure 142.3±32.22/78.8±12.6 mm Hg) and in use of anti-hypertensive drugs were randomized to one of two 12-week interventions: EXERCISE (a 3 days/week¹, moderate-intensity, 1h-long, combined exercise program based on walking/running and body-weight/ elastic bands resistance exercises) and EDUCATION (a weekly health education program based on hypertension management). BRS, frequency-domain indexes of blood pressure and heart rate variability and time-domain indexes of heart rate variability were calculated pre and post interventions through a continuous beat-to-beat blood pressure signal acquired with a sampling rate of 1000Hz.

Results: Baseline values for BRS were 16.7±5.3 ms.mm Hg⁻¹ for EDUCATION and 16.5±9.3 ms.mm Hg⁻¹ for EXERCISE. BRS change from baseline and respective 95% confidence intervals were +0.1 (-4.7 to +4.9) ms.mm Hg⁻¹ for EDUCATION and +1.4 (-1.5 to +4.4) ms.mm Hg⁻¹ for EXERCISE (P=0.53). No differences were found in frequency-domain indexes of blood pressure variability and heart rate and time-domain indexes of heart rate variability.

Conclusions: In elders with hypertension, no changes in BRS or autonomic control were induced by 12 weeks of either health education or exercise training. These subjects might present some degree of blunted responsiveness to interventions with characteristics similar to what we proposed in relation to autonomic control modulation.

Board #349
May 29 10:30 AM - 12:00 PM
Exercise And Spirulina Maxima Improve General Fitness And Blood Lipids In obesity: A Randomized Trial
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ABSTRACT
Cardiovascular diseases are part of the highly preventable chronic diseases associated with changes in lifestyle. Within them, physical activity, low-fat & high-fiber diets are distinguished as the main support for prevention, even when supplementation with nutraceuticals has become a very common practice.

Purpose: A systematic physical exercise program and Spirulina maxima (S. maxima) intake have beneficial effects on general fitness and blood lipid profile in overweight and obese men. Methods: Fifty-two young sedentary men with excess body weight (Body mass index [BMI]>25 kg·m⁻²) were enrolled in a randomized-crossover controlled trial [six weeks of a systematic physical exercise with S. maxima or placebo supplementation (4.5 g·day⁻¹)]. Maximal oxygen uptake (VO2max), BMI, blood lipid profile (total cholesterol [TC], triglycerides [TG], low-density lipoproteins cholesterol [LDL-C], high-density lipoproteins cholesterol [HDL-C]), and their correlations were determined pre/post intervention. Results: After the study, obese subjects showed statistical differences (p<0.01, basal vs. final) in BMI (33.3±3.8 vs. 30.1±4.9 kg·m⁻²), VO2max (30.8±5.6 vs. 34.7±6.2 mL·min⁻¹·kg⁻¹), and blood lipids (mg·dL⁻¹): TC (218±30 vs. 184±33), TG (150±46 vs. 127±55), LDL-C (158±31 vs. 122±34), and HDL-C (32.5±10.9 vs. 36.6±9.6). Moreover, according to the correlation analysis (p<0.01), in the exercise and S. maxima supplementation group, BMI decrease as VO2max increase (r=0.492), TC and LDL-C decrease linearly (r=0.798), finally, while HDL-C levels decrease, LDL-C increases (r=0.690). Conclusion: These results indicate that the S. maxima supplementation could be acting in a synergistic way with exercise due to the enhanced effects on body composition, cardiorespiratory fitness, and blood lipid profile, this phenomenon should be considered to reduce risk of cardiovascular disorders.

The study protocol was approved by the Autonomous University of Ciudad Juarez review board (Bioethics Committee Code: CBE.ICB/062.09-15) and carried out following the declaration of Helsinki, and the trial was registered at clinicaltrials.gov (Trial ID: NCT0387666).

Board #350
May 29 10:30 AM - 12:00 PM
Exercise And Detraining Change Lipid Profile In Older Women?
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Exercise in older adults results in very important benefits to health and quality of life. Low cardiorespiratory capacity, high cholesterol (HCHOL) and high triglycerides (HTRIG) are three of the major risk factors for cardiovascular diseases that can be improved with regular exercise.
Purpose: Cardiac rehabilitation (CR) improves functional capacity (FC), quality of life (QoL), psychosocial well-being, and reduces cardiovascular risk factors using lifestyle management strategies. Despite well known benefits, little is known about the long-term effects of CR on risk factor management and changes in FC following discharge. Therefore, the purpose of this retrospective cross-sectional investigation was to examine changes in 6-minute walk distance (6MWD) 11-15 months following CR.

Methods: Patients referred to the UAB Cardiac Rehabilitation Program from 2016-2019 who completed 24-36 sessions and 6-minute walk tests (6MWT) at intake, discharge, and post-discharge were included in this pilot study. Analysis of variance (ANOVA) was used to examine differences over time for 6MWD walk tests (6MWT) at intake, discharge, and post-discharge were included in this pilot study. Cardiorespiratory capacity was assessed through 6-min walk test (6MWT), and total cholesterol (TCHOL) and triglycerides (TG) blood sample were assessed in accordance with the procedures of Diabetes Atlas Committee. All assessments were conducted before and after the exercise program and after three months of detraining. Mixed-model ANOVA was used to examine differences within and between groups.

Results: In both groups RE promoted declines in TCHOL (LDG: 7.93%, p < 0.01; CG: -9.12%, p < 0.01), TG (LDG: -10.89%, p < 0.01; CG: -11.14%, p < 0.01) and 6MWT (LDG: 10.87%, p < 0.01; CG: 12.39%, p < 0.01), and DT led to negative effects on TCHOL (LDG: 5.81%, p < 0.01; CG: 7.8%, p < 0.01) and TG (LDG: 9.41%, p < 0.01; CG: 9.07%, p < 0.01), and 6MW (LDG: -4.78%, p < 0.01; CG: -6.20%, p < 0.01).

Conclusions: Three months of DT are enough to reverse the benefits of exercise in TCHOL of non-lipid disorder older women, and regular exercise in older women with lipid disorders promotes benefits in cardiorespiratory capacity, TG and TCHOL with lower impact compared to older women without this disorder but are strong enough to be retained after three months of DT.
AHI was not associated with the change in plasma calprotectin (beta coefficient = -0.11, (95% CI -0.61 - 0.39, p=0.646)) or total body fat percentage (beta coefficient = -0.00017, (95% CI -0.00005 - 0.00003), p=0.120). CONCLUSIONS: Contrary to previous findings, we found no association between OSA severity and levels of plasma calprotectin at baseline. Furthermore, a six week moderate intensity aerobic exercise intervention failed to alter calprotectin levels despite decreasing total body fat. Research funded by R15HL133884

Aerobic exercise training has been shown to elicit physiological changes in cardiopulmonary capacity in people with advanced lung disease such as pulmonary hypertension (PH) and interstitial lung disease (ILD), despite impaired pulmonary ventilation (V̇E) and perfusion. PURPOSE: To examine whether aerobic exercise training alters the V̇E/Q̇t ratio in subjects with PH or ILD. METHODS: Twelve people with ILD (5 men and 8 women; age 56.83 ± 8.26 years; BMI 28.83± 5.01) and 17 females with PH (age 55.8 ± 8.8 years; BMI 29.97± 7.89 kg/m²) participated in the study. All subjects were enrolled in the National Institutes of Health Exercise Therapy for Advanced Lung Disease Trial [ClinicalTrials.gov identifier NCT00768821]. All subjects underwent cardiopulmonary exercise testing (CPET) with bioelectrical impedance measure of cardiac output (Qt) before and after 10 weeks of supervised vigorous treadmill walking. 30-45 minutes per session, 3 times per week (24-30 sessions). RESULTS: V̇E, Qt, and Q̇t increased with CPET work stage before and after training. There was a significant increase in peak work rate after training in both groups (PH before 106±48.36 watts, after 133±64.12 watts p=0.002; ILD before 135±57.04 watts, after 180±77.35 watts p=0.001). There were no significant differences in peak V̇E, peak Qt, and peak V̇E/Q̇t before and after training in either group. Similarly, significant differences were not observed at rest or at anaerobic threshold.

CONCLUSION: Aerobic exercise training does not appear to have an effect on the ventilation-cardio output ratio in subjects with PH or ILD.
The combination of cancer treatment, lack of physical activity, and reduced energy expenditure causes reduced physical fitness in children with cancer. Valid measures of children’s day-to-day activity levels are therefore warranted. PURPOSE: We investigated the feasibility of the Actiheart-monitor to determine total daily energy expenditure (TDEE) and the validity of the Actiheart-step-test as an accurate estimate of peak oxygen uptake. METHODS: VO2peak was estimated with The Actiheart-step test and compared with a cardiopulmonary-exercise-test. TDEE was measured using the Actiheart-monitor on days with and without classmate co-admission. RESULTS: Of 26 eligible measurement periods (15 children), 89% participated, 91% could participate safely, however, 35% fulfilled demands for valid monitoring. The percentage of children not completing the monitoring period was 10% (attrition) and adherence to classmate-visits was 84%. Forty eight percent of the measurement periods provided data, and only 27% was calibrated data. Actiheart-step-test significantly overestimated VO2peak (95% CI 8.2 to 19.7 mL.kg.min, p<0.001) compared with CPET. CONCLUSIONS: Measuring TDEE using Actiheart is not feasible nor implementable in children with cancer. Further, the-Actiheart-step-test is not a valid test to estimate VO2peak in children with cancer.
Purpose: Cancer-related fatigue (CRF) is recognized as one of the most distressing side effects in children suffering from cancer. In adult cancer patients, specific exercise training has revealed positive effects on muscular and aerobic capacity, which has been associated with benefits on CRF and health-related quality of life. However, in children with cancer, the evidence level of beneficial exercise programs is sparse. Within the “Effects of Combined Resistance and Endurance Training in Pediatric Cancer Patients During Intensive Treatment Phase (Mucki)-trial” training effects on CRF were evaluated.

Methods: In this randomized, controlled trial, childhood cancer patients aged between 4 and 18 years were enrolled during intensive cancer treatment phase. Individuals within the exercise group (EG) participated in supervised exercise training. Training was based on child adapted, moderate intense resistance and endurance exercises and took place 3 to 5 times weekly over a period of 6 to 8 weeks. Individuals of the control group (CG) received usual care. Children’s pre- and post-interventional CRF levels were evaluated by the children themselves and separately by their parents using the „PedsQL™ 3.0 Multidimensional Fatigue Scale“. Patients During Intensive Treatment Phase (Mucki)-trial” training effects on CRF were evaluated.

Results: In total 14 patients were included in the EG (mean age 10.8 ± 4.2y) and 15 in the CG (mean age 11.5 ± 5.2y). Children in the EG reported less fatigue post- than pre-intervention (p = 0.026; d = 1.11). In the CG were no pre-post differences (p = 0.969). Group-time-interaction of children’s reported fatigue level was not significant (F(1,10) = 1.061; p = 0.327). Parents reported favoring effects for their children’s fatigue level in the EG in the group-time-interaction (F(1,13) = 8.355; p = 0.013; η²p = 0.391).

Conclusions: The present results show benefits on CRF in the EG. It is known, that the majority of childhood cancer patients report to suffer from CRF. Mental, physical and social wellbeing might be affected by CRF. So far, there is no gold-standard treatment against CRF. Adapted exercise programs have been gaining attention only since recently in pediatric cancer. The present findings support further elaboration and implementation of adapted exercise offers in pediatric oncology.

Purpose: Exercise referral programmes delivered by charity organizations have the potential to facilitate cancer survivors to be active. The purpose of this work was to evaluate the uptake and effect of the RENEW programme, a twelve-week exercise referral programme for young adult cancer survivors aged 18 to 39 delivered by Trekstock, a cancer charity based in the UK.

Methods: The RENEW programme provides one-to-one individually tailored support from a Level 4 Cancer Rehabilitation qualified gym instructor, free gym membership and access to information resources online. Objective and self-report data on cardiovascular function, flexibility, mass, muscle mass, fatigue, sleep quality and general health-related quality of life (HRQoL) was collected from participants before the programme (week 0), immediately after (week 12) and one month later (week 16).

Results: Ninety-eight RENEW referrals were made between August 2018 and May 2019, 76 young adults with cancer initiated the programme with 48 young adults (83% female; mean age 29 yrs; 73% off active treatment) consented to participate within the evaluation. The predominant cause of programme drop-out was illness or treatment complications. Physical activity (PA) levels significantly increased following the programme and remained raised at follow-up. Improvements in physical function were significant: peak expiratory flow (mean change: 30.96, p=0.003), sit-and-reach test (mean change: 6.55±4.54, p=0.0001), and six-minute-walk-test (mean change 1.05±0.49, p=0.004). Changes in self-efficacy to exercise and motivations to exercise were not observed at 12 weeks or at follow-up.

Conclusions: Results suggest that the RENEW exercise referral programme has a positive effect upon young adult cancer survivors’ physical function, PA levels, HRQoL, and well-being. Health professionals and charitable bodies specialising in the care of young adults with cancer should look to address factors (including gender and treatment status) which prevent engagement and uptake of ‘real-world’ PA interventions such as the RENEW programme.
A life-altering diagnosis, such as cancer, and its coinciding treatments, can lead to a number of adverse side-effects in patients. Along with physiological changes, cancer-related anxiety, depression, and fatigue are common side effects of patients with cancer. The cause of such psychological side-effects can be multifactorial and difficult to treat. Exercise under the supervision of an exercise professional has been shown to reduce levels of anxiety, depression, and fatigue in patients with cancer, commonly measured using the Hospital Anxiety and Depression Scale (HADS) and the Functional Assessment of Chronic Illness Fatigue (FACT-F). PURPOSE: To determine the impact of a 12-week, supervised exercise program on levels of anxiety, depression, and fatigue in a rural population of cancer survivors. METHODS: Seven male (4) and female (5) cancer survivors age 59.7 ± 9.50, BMI 33.13 ± 7.88, with a variety of cancer diagnosis and treatment, participated in twelve weeks of an individualized exercise program. The exercise program included balance, resistance, aerobic and flexibility on two or three days of the week. No significant changes were seen in depression scores, t(8) = -7.1, p = 0.50, or levels of fatigue, t(8) = -1.14, p = 0.90. CONCLUSION: A 12-week supervised exercise program may help the rural cancer survivor feel less anxiety during and after treatment and help them continue their activities of daily living with more normalcy. Depression scores and fatigue levels were trending toward significance suggesting that an exercise program can maintain these scores throughout and after cancer treatment.

Treatments for breast cancer are invasive, causing visible changes such as loss of the breast, weight gain, and body image disturbance. These changes in conjunction with the societal pressure for women to conform to feminine beauty ideals may lead to body image disturbance in breast cancer survivors (BCS). Exercise is a positive health strategy that has shown promise in improving body image perception in both general and cancer populations. PURPOSE: To determine the prevalence of body image and body weight concerns in BCS. METHODS: BCS taking part in the Alberta Cancer Exercise (ACE) Program at the Wellspring site, twice weekly for 12 weeks. Participant-reported outcomes, including questions related to body appearance and weight concerns were collected before and after the intervention. Data were analyzed to compare the proportion of women reporting issues at baseline and post-intervention. Data collection began January 2017 and ended June 2019. RESULTS: Eighty-six BCS enrolled and completed the ACE program (100%), with an exercise attendance rate of 84%. Twenty-five (29%) BCS reported body appearance disturbance and 42 (49%) reported issues with body weight. Significant reductions were seen post-intervention in the proportion of BCS reporting issues with both body appearance (n = 14; p=0.05) and body weight (n=31; p=0.05), representing reductions of 44% and 26% respectively. Similar to findings of previous research, no significant changes (p=0.05) were observed in BMI or body weight. CONCLUSION: Issues with body appearance and weight are common among BCS at our Wellspring site. Although benefit was seen in some BCS from exercise alone; given that body image can affect BCS physically, psychologically and socially, research involving a multi-disciplinary approach is warranted. Wellspring provides an ideal setting for future research involving multimodal interventions.

Supported by the University of Alberta
Objectives: To identify and describe self-reported incidences of PEM in a group of prostate cancer survivors. 

Methods: Survivors of prostate cancer were recruited from three men's prostate cancer support groups in the USA. A total of 49 participants were included in the study. Participants were assessed in the 2 weeks prior to the study and then monitored for PEM over a 6-month period. The study used a cross-sectional design. 

Results: Of the 49 participants, 28 (57.1%) experienced PEM, with 15 (30.6%) experiencing PEM for more than 4 weeks. The most common symptoms reported were fatigue, sleep disturbance, and cognitive impairment. The median duration of PEM was 4 weeks (range 1-24 weeks). The severity of PEM was moderate in 82.1% of cases. 

Conclusion: PEM is a significant symptom that affects a majority of prostate cancer survivors. These findings highlight the need for improved symptom management and support for this population.
Effects of Strength Training and Antioxidant Supplementation on Perceived and Performance Fatigability in Breast Cancer Survivors

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PURPOSE: To investigate the effect of strength training combined with vitamin C and E supplementation on perceived and performance fatigability in breast cancer survivors (BCS).

METHODS: Twenty-five breast cancer survivors were enrolled in this double-blind placebo-controlled study. BCS were randomly assigned to one of two groups: Antioxidant (AG; n = 12; 51 ± 9 years; 68.08 ± 10.57kg; 1.61 ± 0.07m); or Placebo (PG; n = 13; 48 ± 8 years; 70.45 ± 9.29kg; 1.58 ± 0.05m). Both groups participated in a 10-week strength training protocol, twice a week, containing six exercises. AG was supplemented with vitamins C (500mg/day) and E (400 UI/day) and PG with polydextrose (1g/day). At the beginning and at the end of training period, perceived fatigue was assessed using two dimensions of MFI-20 (general fatigue - GF; 0-40) and perceived effects of muscular strength, early evaluation did not demonstrate a correlation between these variables in this small feasibility study. We will continue to recruit participants to further explore this relationship.

CONCLUSIONS: Oxidative stress is a well-described consequence of cancer and its treatment. Oxidative stress has also been associated with late and persistent side effects, such as metabolic impairments and cancer-related fatigue. Strength training and antioxidant supplementation attenuate oxidative stress and may improve performance fatigability. However, chronic interventions analyzing the effect of ST combined with antioxidant vitamins on perceived and performance fatigability in breast cancer survivors (BCS) are scarce.

2914 Board #375 May 29 9:30 AM - 11:00 AM Impact Of One On One 12 Week Individualized Exercise Program On Cancer Related Fatigue And Functional Capacity

Danielle M. Halsey1, Nicholas B. Kelly2, NicCole R. Keith, FACSM1, 1Indiana University-Purdue University-Indianapolis, Indianapolis, IN. 2Indiana University School of Medicine, Indianapolis, IN. 3Indianapolis University Health, Indianapolis, IN. 4University of Indianapolis, Indianapolis, IN. (No relevant relationships reported)

Cancer related fatigue (CRF) is the most commonly reported side effect during and after cancer treatment. This level of fatigue can have disruptive effects on individuals’ daily lives, continuing on up to 5 years post treatment. CRF is defined as a persistent feeling of fatigue that is not brought on by cognitive or physical exertion, and is not relieved by sleep or rest. Aerobic exercise is suggested to alleviate symptoms of CRF. Yet, the relationship between improved muscle strength and CRF decline is unclear.

PURPOSE: To examine the relationship between strength gains and CRF decline in cancer survivors.

METHODS: 6 cancer survivors aged 40-73 (mean 59.5) participated in three, 60-minute, guided exercise sessions each week for 12 weeks. Sessions involved 20 minutes of cardiorespiratory training, 30 minutes of resistance training, and 10 minutes of neuromotor/balance/stretching. Participants completed baseline and follow up assessments including the FACIT-F and FACIT- fatigue scales and estimated one rep max testing (1RM) using the brzycki equation for chest press, latissimus pull down, and leg press.

RESULTS: Fatigue scores increased from baseline to follow up (average=7.39%, range=1.3-13.4%). Average e1rm scores also improved following the intervention (chest press average=28.9%, range=1.7-76.2%, latissimus pulldown average=6.4%, range=12.2-18.5%, and leg press average=6.2%, range=13.1-43.4%). Individual comparisons showed much variation when comparing CRF to e1m improvements, and no correlation or relationship was observed. R squared values for each strength measure compared to CRF were: chest (r²=0.234), latissimus pulldown (r²=0.120), and leg press (r²<0.017).

CONCLUSIONS: While exercise has been shown to improve outcomes in CRF and muscular strength, early evaluation did not demonstrate a correlation between these variables in this small feasibility study. We will continue to recruit participants to further explore this relationship.
Prostate cancer patients are subject to psychological distress which may be exacerbated for those undertaking androgen deprivation therapy (ADT) due to treatment-related adverse effects. Exercise is one strategy to counter a range of treatment toxicities in men with prostate cancer and to improve overall physical function and quality of life.

**PURPOSE:** To assess the effect of up to 12 months of exercise on psychological distress in men with prostate cancer on ADT.

**METHODS:** Of 163 men (43-90 years) with prostate cancer on ADT and undertaking a 12-month RCT of various exercise modes, 135 had psychological distress assessed using the Brief Symptom Inventory-18 (BSI-18). Patients were randomized to twice weekly impact loading and resistance training (ILRT, n=49), aerobic and resistance training (ART, n=50), and usual care/delayed aerobic exercise (DEL, n=36). ILRT was supervised for 12 months, ART was supervised for 6 months and home-based for 6 months, and DEL underwent supervised aerobic exercise in the second 6 months. The BSI-18 provides three subscales for anxiety, depression, and somatisation, as well as the global severity index (GSI) where higher scores indicate higher distress. Intention-to-treat was utilised for the analyses which included group x time repeated measures ANOVA using log transformed (ln) data.

**RESULTS:** There were no differences among groups at baseline. Somatisation did not change over the study period, however, there were significant interactions (p<0.01) for depression, anxiety, and the GSI. In ILRT, depression was reduced at 12 months compared to baseline and 6 months (0.78 ± 1.39 vs. 1.88 ± 3.24 and 1.48 ± 2.65, respectively), as was the GSI (3.67 ± 4.34 vs. 5.94 ± 7.46 and 4.64 ± 4.73, respectively) with anxiety reduced compared to baseline (1.08 ± 1.54 vs. 1.98 ± 2.56). Depression and the GSI decreased in ART at 6 months but increased by 12 months, while in DEL the GSI was reduced following exercise at 12 months (3.78 ± 3.94 vs. 5.25 ± 4.22 at 6 months).

**CONCLUSION:** Various exercise modes (when supervised) are effective in reducing psychological distress in men with prostate cancer on ADT. As a result, supervised exercise should be prescribed to not only improve physical but also psychological health in this patient group.
Cardiac incidents cause over 50% of LODD in firefighters (FF) and may be related to their BP responses. Also, years of service may affect FF stress and depression levels and impact overall health. Using ambulatory BP (ABP) monitoring to quantify the BP surge with alarm is a novel way to assess risk, and preliminary data showed that newer FF have higher BP surge. PURPOSE: To compare changes in health between FF with <1yr service (FF-10) and FF with >1yr service (FF+10) after a 6wk Mediterranean diet & circuit training program. METHODS: We included 21 FF who completed a 6wk intervention. Pre- and post-intervention testing included ABP monitoring with pager activation, a fasted clinical appt, and fitness testing. Participants wore the ABP cuff for 12hrs, during which they were paged by a pager app (OnPage) or by emergency service dispatch. When the pager sounded, they were instructed to force an ABP reading to assess the BP surge. Average BP levels and surges were determined. Fasted visit included BP, body fat, lipid panel, and vascular health measures. Fitness test included a treadmill VO2max and a battery of other fitness tests. Participants also completed a health history form and the DASS-21 questionnaire assessing stress, anxiety, and depression. RESULTS: FF+10 (N=12, 45.7 ± 7yrs) had worse health and lower BP surges, but larger improvements with intervention compared to FF-10 (N=9, 36.8 ± 6.2yrs). P<.05 for differences. FF+10 had lower HDL levels (38.3 ± 9.5 mg/dl), were heavier (213.1 ± 8.6 vs 205.1 ± 8.6 lbs), had higher average SBP (136.6 ± 4.8 vs 126.9 ± 3.6 mmHg) and DBP (83.2 ± 2.8 vs 75.7 ± 2.8 mmHg) levels, higher pre-alarm and post-alarm BP, but had a smaller surge in SBP (11.6 ± 3.2 vs 15.0 ± 3.3 mmHg) and DBP (4.1 ± 2.7 vs 7.3 ± 1.7 mmHg) when the pager sounded. FF+10 also had worse overall psychometric scores: higher DASS-21 (11.2 ± 5.3 vs 7.6 ± 1.3; depression 3.4 ± 1.3 vs 1.4 ± 0.3; and stress 5.4 ± 1.7 vs 3.3 ± 0.5); but similar anxiety scores 2.4 ± 1.0 vs 3.0 ± 0.9. With intervention, in FF+10 we found that BP lowered, fitness improved, and psychosocial constructs improved. CONCLUSION: With this subset of baseline data, we show that FF+10 have smaller BP surge, worse CV health, stress, and depression levels, but larger improvements with intervention compared to FF-10. Data confirms the importance of wellness programs for FF.
PRE. This facilitated a rapid spike in HR to 85% of age-adjusted HRMAX. Compared to waking normally, waking for call response elicits a distinctly different response where perturbations in HR tend to persist 90-minutes. This persistent ANS imbalance may indicate physiological perturbations that could explain increased atherosclerosis and CVD risk for FFs.

2944 Board #4 May 29 1:00 PM - 3:00 PM Prevalence Of Coronary Heart Disease Risk Factors In A Large Sample Of Southern Californian Firefighters Terri Wann, Kris Ross, Jennifer Meloni, Ralph Rozenek. Santa Ana College, Santa Ana, CA. Email: wann_terri@sac.edu (No relevant relationships reported)

Firefighters (FF) are exposed to a variety of work-related stressors that can lead to increased risk of disability and premature death. Heart attack is the primary “on-duty” cause of death in these individuals. Few studies have investigated the prevalence of the various coronary heart disease (CHD) risk factors (RF) in FF and how they are affected by age in this specific group. PURPOSE: To determine the prevalence of CHD RF and; 2) to examine the relationship between the CHD RF and age in a large group of FF. METHODS: Data from 1949 male (n= 1924) and female (n = 25) FF (mean age ± s.d. = 39.8 ± 8.8 yr.) representing 27 departments in Southern California were used for analyses in this cross-sectional study. Apart from age, the RF selected represented those that were independent of gender. Standard statistical techniques were applied to determine RF frequencies and percentages. Chi-Square Analyses with Cramer’s V were used to assess the relationship between age-group and RF prevalence and to estimate effect size. RESULTS: Overall 70.0% of FF had exceeded at least one CHD RF threshold. High blood pressure (HBP) was the most prevalent RF (26.9%) in the 20-29 yr. age-group followed by elevated body mass index (BMI) (11.2%) and low-density lipoprotein cholesterol concentrations ([LDL-C]) (11.2%). By contrast, 64.4% of FF in the 50+ yr. age-group had HBP with 31.9% having elevated BMI and 30.7% with elevated [LDL-C]. While the percentage of FF in the 20-29 yr. age-group with ≥ 2 RF was only 9.9%, it rose to 80.5% in the 50+ yr. age-group. Other than blood glucose, moderate effect sizes were observed for relationships among age-group and the individual RF. Percentage of FF with CHD risk factor by age group.

<table>
<thead>
<tr>
<th>Age Group (years)</th>
<th>Risk Factor</th>
<th>Risk Factor</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>HBP ≥ 130 mm Hg</td>
<td>BMI ≥ 30 kg m²</td>
</tr>
<tr>
<td>20-29</td>
<td>26.9%</td>
<td>11.2%</td>
</tr>
<tr>
<td>30-39</td>
<td>38.7%</td>
<td>18.4%</td>
</tr>
<tr>
<td>40-49</td>
<td>47.7%</td>
<td>30.8%</td>
</tr>
<tr>
<td>50+</td>
<td>64.4%</td>
<td>31.9%</td>
</tr>
</tbody>
</table>

CONCLUSION: A sizable number of FF had multiple CHD RF. Advancing age increased the percentage of FF with multiple RF. Continued efforts must be made to reduce the number of CHD RF in this specific population who serve a vital function protecting our communities.

2945 Board #5 May 29 1:00 PM - 3:00 PM Seasonal Changes In Cardiovascular Function, Risk Factors, And Oxidative Stress Of Wildland Firefighters Cassie Williamson-Reisendorf, Katie S. Christison, Shae C. Gurney, Kathryn G.S. Tiemessen, Joseph A. Sol, Tiffany S. Quindry, Charles G. Palmer, Matthew W. Bundle, Charles L. Dumke, FACSM, FACSM. University of Montana, Missoula, MT. (Sponsor: John C. Quindry, FACSM) (No relevant relationships reported)

Wildland firefighters (WLF) experience extreme physiological stress throughout a typical season due to intense occupational demands and consistent woodsmoke exposure. There is a rationale to indicate that accumulated physiological strain, and oxidative stress, throughout a WLF season has the potential to negatively alter cardiovascular function and risk factors. PURPOSE: The purpose of the study was to examine the effects of a season on cardiovascular function, risk factors, and markers of oxidative stress in WLF. METHODS: Fourteen members of a Type I interagency hotshot crew participated in the study (males: n=13, females: n=1, age: 30.1 years ± 2.6). Eighteen male (29.4±1.1 yr, 182.1±1.6 cm) and three female (26.7±2.6 yr, 169.5±4.2 cm) participants were recruited from a Type I interagency hotshot fire crew and monitored for the duration of their two-week critical training. Subjects were asked to arrive fasted and uncaffeinated for blood draws on days 1, 4, 8, and 11. Plasma was analyzed for changes in the metabolic profile and oxidative stress markers 3-Nitrotyrosine (3-NT) and 8-Isoprostane (8-ISO). A one-way repeated measures ANOVA was used to analyze 8-ISO and 3-NT. Paired samples t-tests were used to compare metabolic biomarkers. Data presented as mean±SEM. Results: Critical training elicited a decrease in total cholesterol (173.6±12.1 to 153.4±8.6 mg dL⁻¹, p<0.001), hemoglobin Alc (5.2±0.1 to 5.1±0.1 %, p=0.003), hemoglobin (15.5±0.8 to 14.3±0.3 g dL⁻¹, p=0.003), and estimated plasma volume (53.8±0.7 to 50.7±1.4 %, p=0.005) from day 1 to 11. No difference was observed in high-density lipoprotein cholesterol. A main effect for time was observed in 8-ISO (p<0.001) and 3-NT (p<0.033). A significant decrease was observed in 8-ISO at day 4 and 8 when compared to day 1 (day 1: 15.5±1.3, day 4: 11.8±1.0, day 8: 12.9±1.1 μg mL⁻¹). 3-NT was significantly elevated from day 4 to day 8 (day 4: 2.4±0.6, day 8: 2.9±0.6 μg mL⁻¹). Conclusion: These data suggest that the exertion required of WLF during critical training results in positive alterations to the metabolic profile. The unexpected decreases in oxidative stress markers may reflect adaptation to the stressors of critical training, although this cannot be confirmed. Additional markers should be examined across other WLF crews to confirm and provide further information on alterations during this two-week period.

2946 Board #6 May 29 1:00 PM - 3:00 PM Metabolic And Cardiovascular Alterations During Critical Training In Wildland Firefighters Shae C. Gurney, Katie S. Christison, Cassie M. Williamson-Reisendorf, Kathryn G.S. Tiemessen, Joseph A. Sol, Tiffany S. Quindry, Matthew W. Bundle, Charles G. Palmer, John C. Quindry, FACSM, Charles L. Dumke, FACSM. University of Montana, Missoula, MT. (No relevant relationships reported)

Introduction: Wildland firefighters (WLF) are confronted with numerous physical and mental stressors. Pre-fire season includes an intense two-week critical training period; a preparatory phase that sometimes results in injuries, illness, and rhabdomyolysis. Purpose: To identify physiologic changes to oxidative stress and other metabolic biomarkers that occur during 2 weeks of critical training in WLF. METHODS: Eighteen male (29.4±1.1 yr, 182.1±1.6 cm) and three female (26.7±2.6 yr, 169.5±4.2 cm) participants were recruited from a Type I interagency hotshot fire crew and monitored for the duration of their two-week critical training. Subjects were asked to arrive fasted and uncaffeinated for blood draws on days 1, 4, 8, and 11. Plasma was analyzed for changes in the metabolic profile and oxidative stress markers 3-Nitrotyrosine (3-NT) and 8-Isoprostane (8-ISO). A one-way repeated measures ANOVA was used to analyze 8-ISO and 3-NT. Paired samples t-tests were used to compare metabolic biomarkers. Data presented as mean±SEM. Results: Critical training elicited a decrease in total cholesterol (173.6±12.1 to 153.4±8.6 mg dL⁻¹, p<0.001), hemoglobin Alc (5.2±0.1 to 5.1±0.1 %, p=0.003), hemoglobin (15.5±0.8 to 14.3±0.3 g dL⁻¹, p=0.003), and estimated plasma volume (53.8±0.7 to 50.7±1.4 %, p=0.005) from day 1 to 11. No difference was observed in high-density lipoprotein cholesterol. A main effect for time was observed in 8-ISO (p<0.001) and 3-NT (p<0.033). A significant decrease was observed in 8-ISO at day 4 and 8 when compared to day 1 (day 1: 15.5±1.3, day 4: 11.8±1.0, day 8: 12.9±1.1 μg mL⁻¹). 3-NT was significantly elevated from day 4 to day 8 (day 4: 2.4±0.6, day 8: 2.9±0.6 μg mL⁻¹). Conclusion: These data suggest that the exertion required of WLF during critical training results in positive alterations to the metabolic profile. The unexpected decreases in oxidative stress markers may reflect adaptation to the stressors of critical training, although this cannot be confirmed. Additional markers should be examined across other WLF crews to confirm and provide further information on alterations during this two-week period.

2947 Board #7 May 29 1:00 PM - 3:00 PM Nutrition, Physical Activity And Cardiovascular Disease Risk Of Career Firefighters In A Low-Income Area Brady Ellen Phipps, Kathy Carter, FACSM. Central State University, Wilberforce, OH. (Sponsor: Kathy Carter, FACSM) Email: bhippis@centralstate.edu (No relevant relationships reported)

The majority of on-duty firefighter (FF) deaths result from cardiovascular incidents, and FF wellness is related to job effectiveness and safety. Departments in low-income communities are often unable to provide wellness programming, allowing opportunities for local universities to fill the need. PURPOSE: To determine health and cardiovascular disease (CVD) risk of local career FF in a low-income community for use in developing ongoing wellness interventions. METHODS: Nutrition behavior, physical activity information, anthropometric measurements [body fat percentage (%BF); mass of body fat (MBF); waist circumference (WC); height; weight], and blood lipid levels [total cholesterol (TC); low-density lipoprotein (LDL); high-density lipoprotein (HDL); and triglycerides (TG)] were collected from a cohort of FF and analyzed. RESULTS: Thirty-three percent (42/127) of department members participated in the study, with even representation across unit, age, and years worked. Eighty-three percent of FF were overweight/obese, as determined by bioelectrical impedance. Similarly, 85% were at-risk or at-significant-risk for CVD by waist-to-height ratio (WTHR, 0.5-0.6 and >0.6, respectively) Segmental trunk mass of body fat (SMBF ) was correlated with waist circumference (r=0.915), and also with WC (r=0.167), LDL (r=0.189) and TG (r=0.484), while inversely correlated with HDL (r=-0.133). BMI and %BF were positively correlated (r=0.81). Fifty percent of FF had TC, 38% had LDL, and 45%...
had TG levels which placed them at-risk for CVD. Only 33% of participants reported exercising the recommended amount (3-5 times) per week, and 36% and 14% of FF reported intake of the recommended amount of fruits and vegetables, respectively per day. CONCLUSION: In a cohort of career FF in a low-income area, the majority were classified as at-risk for CVD, across multiple indices, including BMI, %BF, WC, WTHR, SMBFtrunk, and lipid profiles. In addition, the cohort reported unhealthy levels of fruit and vegetable intake, as well as less-than-recommended levels of physical activity. These results suggest that local FF are an at-risk population for CVD, and that there is a need for nutrition and exercise interventions to help lower the risk and increase job effectiveness in our regional first responders.

Over 80% of the US fire service is overweight (BMI: 25-29.9 kg/m²), increasing the risk for cardiovascular disease (CVD). Although age is an important CVD risk factor, it is not often examined among firefighters (FFs). Risk scores are a common tool used by medical professionals. However, no investigations have examined calculated risk scores and changes over time among FFs. PURPOSE: To describe changes in weight, BMI and CVD risk scores among a large cohort of younger (<45 years) and older (≥45 years) FFs over a 5-year period. METHODS: Age, body weight, body mass index (BMI), and calculated CVD risk scores of 672 FFs (n=522; 35.1 ± 6.5 years; n=150; 48 ± 3 year) in a large northeastern fire department were assessed during an occupational medical exam in 2009-2011 and 5 years later. CVD risk scores were calculated using the Framingham Risk Score (FRS) calculation. Descriptive statistics summarized data, logistic or linear regression models compared proportions or means, and paired t-tests were used for within subject comparisons to test for significance. RESULTS: At baseline, younger FFs weighed 88.5 kg with a BMI 27.9 kg/m² and FRS of 3.4. Older FFs weighed 89.9 kg with a BMI of 28.5 kg/m² and FRS of 12.1. Over the 5 years, FFs <45 yr gained (+3.0 ± 3.0 kg) significantly more weight than those ≥45 yr (+0.8 ± 0.8 kg; p<0.001). BMI for both groups significantly increased (+0.9 ± 0.1 and +0.4 ± 0.2 respectively for <45 and ≥45 yr. Significantly more (55%) FFs <45 yr gained weight compared to 38% of FFs ≥45 yr (p<0.01). However, older FFs had significantly higher (p<0.001) CVD risk scores at baseline and follow up (9.3; 12.1) than younger FFs (3.4; 4.9). Although the majority of FFs ≥45 lost/maintained body weight (62%), overall their CVD risk increased (+2.8 ± 0.4; p=0.001). CONCLUSION: Although FFs cannot avoid aging, they can aggressivly manage other risk factors that affect their CVD risk score including preventing weight gain. Research indicates health care providers are more likely to counsel older FFs regarding weight loss. Our findings suggest younger FFs are more at risk of gaining weight and could benefit from guidance on this important risk factor. Further efforts are needed to encourage physicians and fire departments to direct FFs to establish healthy habits early in their career. Supported by FEMA Grant EMW-2017-FP-PP-00445

Peak tibial and peak sacral accelerations have been shown to increase during a fatiguing run. Peak accelerations are often used as a surrogate for impacts on the body during running. High tibial impacts have been linked to development of tibial stress fractures. To understand how impacts are related to injury development, we need more insight in how shocks propagate through the body, especially under the influence of fatigue. PURPOSE: To investigate bilateral peak accelerations and shock attenuation over the course of a Marathon. METHODS: 5 trained athletes (2M 3F, 33.8±11.8 years, 182.3±5.8 cm, 73.9±9.1 kg years) ran a Marathon during competition. Inertial measurement units (240Hz) were placed on the sternum, pelvis, and bilaterally on the tibia and foot. Mean peak accelerations around initial contact and shock attenuation (% decrease of peak acceleration) were calculated over 25 strides during the 2nd and 42nd km of the Marathon. Paired sample t-tests were used to test for statistical differences between the 2nd and 42nd km and between the dominant and non-dominant side. RESULTS: See Table 1. Mean finish time was 4:07:40±10:19:07. CONCLUSION: Impacts and shock attenuation changed asymmetrically during a Marathon. Both side dominance and fatigue significantly influenced shock attenuation. However, on sternum level, only fatigue influenced impacts and shock attenuation, implying some sort of protective mechanism to keep proximal impacts low. The non-dominant side showed larger impacts during the whole Marathon, possibly because this side is less strong and therefore less able to actively (i.e. muscle contractions) absorb shocks. Overall, impacts increased and shock attenuation decreased towards the end of the Marathon, possibly increasing the risk of overuse injuries.

Peak accelerations

<table>
<thead>
<tr>
<th>m/s²</th>
<th>Non-dominant</th>
<th>Dominant</th>
</tr>
</thead>
<tbody>
<tr>
<td>2km</td>
<td>99.4±24.0⁹</td>
<td>92.7±24.5⁹</td>
</tr>
<tr>
<td>42km</td>
<td>116.2±35.4⁹</td>
<td>94.4±21.2⁹</td>
</tr>
<tr>
<td>Foot</td>
<td>92.2±21.6⁹⁺</td>
<td>84.8±18.4⁺</td>
</tr>
<tr>
<td>Lower leg</td>
<td>124.2±68.0⁹⁺</td>
<td>87.2±26.6⁺</td>
</tr>
<tr>
<td>Pelvis</td>
<td>82.8±55.9⁺</td>
<td>64.2±31.1⁺</td>
</tr>
<tr>
<td>Sternal</td>
<td>25.1±11.3⁺</td>
<td>25.9±10.0⁺</td>
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Shock attenuation

<table>
<thead>
<tr>
<th>% reduction</th>
<th>Non-dominant</th>
<th>Dominant</th>
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</thead>
<tbody>
<tr>
<td>2km</td>
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</tr>
<tr>
<td>42km</td>
<td>116.2±35.4⁹⁺</td>
<td>94.4±21.2⁹⁺</td>
</tr>
<tr>
<td>Foot-Lower leg</td>
<td>7.3±18.4⁺</td>
<td>6.9±49.1⁺</td>
</tr>
<tr>
<td>Lower leg-Pelvis</td>
<td>10.2±22.3⁺</td>
<td>24.3±16.9⁺</td>
</tr>
<tr>
<td>Pelvis-Sternum</td>
<td>69.6±19.6⁺</td>
<td>59.0±43.0⁺</td>
</tr>
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</table>

Table 1. Bilateral peak accelerations and shock attenuations for the 2nd and 42nd km of a Marathon. An asterisk (*) indicates a significant difference (p<0.05) between the 2nd and 42nd km. A superscript (⁺) indicates a significant difference (p<0.05) between the non-dominant and dominant side at either the 2nd or 42nd km.
High tibial acceleration peaks have been associated with tibial stress fracture in runners. Field-testing with wearable wireless accelerometers in now commonplace, but some devices have a lower sampling frequency than in laboratory testing. PURPOSE: To determine the influence of sampling rate on peak axial tibial acceleration and peak resultant acceleration magnitude during running. METHODS: As part of a larger study, 19 healthy adults were recruited (10 women; 31±6 years; 1.70±0.08 m; 68.6±11.6 kg) and provided informed consent to participate. A precision accelerometer sampling at 100Hz was attached to the distal anteromedial aspect of the right tibia. Participants ran at 3.0 m/s in the laboratory for five good trials making contact with a force plate sampling at 1000Hz. Raw data were down-sampled to 500Hz and 100Hz, common sampling rates for wearable wireless accelerometers. All data were low-pass filtered at 70Hz. Stance phase was identified by foot contact on the force plate. Peak positive axial acceleration and peak resultant acceleration were determined pass filtered at 70Hz. Stance phase was identified by foot contact on the force plate.

RESULTS: Both peak axial and peak resultant acceleration were significantly reduced when tibial acceleration was sampled at 100Hz compared to 500Hz or 1000Hz (p = 0.041). Reductions were 0.7g or about 10% of the peak magnitude at 1000Hz, a small effect. Values were stable between the 500Hz and 1000Hz sampling rates. CONCLUSION: We recommend that tibial acceleration data are sampled at rates of 500Hz or greater to avoid attenuation of peaks producing erroneously low values for both peak axial and peak resultant acceleration.

Table: Mean and standard deviation of peak axial and peak resultant tibial acceleration during running when sampling data at different rates

<table>
<thead>
<tr>
<th>Accelerometer Sampling Rate (Hz)</th>
<th>Peak Axial Acceleration</th>
<th>Peak Resultant Acceleration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (SD)</td>
<td>p value</td>
<td>Effect Size (SD g)</td>
</tr>
<tr>
<td>100</td>
<td>5.4 (1.8)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>500</td>
<td>6.0 (2.1)</td>
<td>0.09</td>
</tr>
<tr>
<td>1000</td>
<td>6.1 (2.1)</td>
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An 8 x 400 meter interval training is often performed with the aim of improving aerobic fitness. Besides being physiologically and physically challenging this type of training is also mechanically demanding. As such it could have potential negative effects on running mechanics. Inertial magnetic measurement units (IMUs) allow for continuous measurement of running mechanics during this type of training.

PURPOSE: To investigate changes in running mechanics during an 8 x 400 meter interval training on the track Measured With IMUs
Jasper Reenaard1, Emily J.C. Zoetbrood1, Marit A. Zandbergen2, Jaap H. Buurke1, Brian W. Noehren, FACSM2, Roessingh Research and Development, University of Twente, Enschede, Netherlands. 1University of Kentucky, Lexington, KY. (Sponsor: Brian W. Noehren, FACSM)

METHODS: Six trained athletes (4M; 25.4±7.9 years, 185.6±8.3 cm, 69.2±12.7 kg) ran 8 x 400 meters on the athletic track. They were paced to run each 400 meter at 5 km race pace with half of the time run as rest. Eight IMUs (240 Hz) were placed at the feet, tibia, upper legs, sacrum and sternum. Accelerometer data and sensor orientation were used to calculate the following parameters using custom code after calibration trials: Hip, knee and ankle angle at Initial Contact (IC), knee angle at Midstance (MST) and Midswing (MSW), peak tibial and sacral acceleration (PTA, PSA), and centre of mass (COM) displacement. Parameters were calculated for both straight of the 2nd, 4th, 6th and 8th 400 meters. Borg scale (0-20) was asked after each bout for perceived exertion. Paired sample t-tests were used to test for statistical differences between the 2nd and 8th bout.

RESULTS: Table 1

CONCLUSIONS: Running mechanics (mainly ankle and knee mechanics and tibial impact) changed over the course of a typical interval training, putting runners at higher risk with increasing bouts. This indicates that this type of training is not only physically and physiologically demanding but puts increasing mechanical stress on the body. These results suggest caution should be used among athletes returning from an injury or surgery.

Table 1: Results of the 8 x 400 meters interval training on the athletic track. Mean values (t SD) are presented for the selected parameters during the 2nd, 4th, 6th and 8th run. P value is given for the significance between the 2nd and 8th bout.

<table>
<thead>
<tr>
<th>Bout</th>
<th>R2</th>
<th>R4</th>
<th>R6</th>
<th>R8</th>
<th>R2 vs R8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip angle IC</td>
<td>25.7±7.4</td>
<td>30.0±8.1</td>
<td>29.9±8.0</td>
<td>31.2±8.4</td>
<td>P=0.23</td>
</tr>
<tr>
<td>Knee angle IC</td>
<td>24.1±7.5</td>
<td>26.8±8.5</td>
<td>27.3±9.0</td>
<td>27.2±7.7</td>
<td>P=0.01</td>
</tr>
<tr>
<td>Knee angle at MST</td>
<td>42.0±7.8</td>
<td>42.8±7.3</td>
<td>43.8±8.4</td>
<td>43.8±7.4</td>
<td>P=0.00</td>
</tr>
<tr>
<td>Knee angle at MSW</td>
<td>112.4±8.3</td>
<td>114.1±10.6</td>
<td>113.4±11.5</td>
<td>116.2±17.7</td>
<td>P=0.00</td>
</tr>
<tr>
<td>Ankle angle IC</td>
<td>-6.2±5.6</td>
<td>-3.1±8.1</td>
<td>-1.5±9.1</td>
<td>-1.9±8.6</td>
<td>P=0.02</td>
</tr>
<tr>
<td>PTA (m/s2)</td>
<td>91.9±11.5</td>
<td>97.8±14.2</td>
<td>94.0±11.0</td>
<td>95.3±13.0</td>
<td>P=0.05</td>
</tr>
<tr>
<td>PSA (m/s2*)</td>
<td>37.4±14.0</td>
<td>41.4±4.0</td>
<td>40.1±3.8</td>
<td>43.2±4.9</td>
<td>P=0.28</td>
</tr>
<tr>
<td>COM (mm)</td>
<td>67.7±14.7</td>
<td>77.1±6.8</td>
<td>87.7±8.9</td>
<td>101.3±5.7</td>
<td>P=0.06</td>
</tr>
</tbody>
</table>

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Using wearable sensors to assess running gait variability may be a valuable tool to identify deterioration in performance or health in competitive and recreational runners. PURPOSE: To measure associations between gait variability and training intensity, mood state, and perceived fatigue in collegiate runners (CR) and novice/recreational runners (NR).

METHODS: 30 CR wore a waist-mounted ActiGraph GT3X+ accelerometer for all non-interval and non-competition training sessions for a full season. 16 NR wore a waist-mounted GT3X+ and an arrests activity monitor (MilestonePoll) during 13 weeks of progressive training. Subjects completed written (CR) or email (NR) daily surveys. Recently developed running and step recognition algorithms were applied to isolate running gait cycles from raw sub-second level accelerometer data. Gait variability was assessed using amplitude deviation of resultant acceleration. Associations between variability and training intensity, mood state, and fatigue were assessed with generalized additive mixed models.

RESULTS: 1069 runs and 7.64 million steps were analyzed. Variability was greater in CR than NR (0.301 vs 0.262 g, p<0.001). Within individual runs, variability was stable from 10-60 minutes in both CR and NR (Fig. 1). In CR, mood state was not significantly associated with variability (p=0.70). In NR, variability increased nonlinearly with average running speed (p=0.001), and a 1-point increase in fatigue on a 0-10 scale was associated with a 0.003g decrease in variability (p=0.051). CONCLUSION: A runner’s gait variability may be more strongly influenced by skill level and running speed than by acute changes in perceived fatigue or mood state. Unmeasured variables, such as training surface, may also affect gait variability.

Figure 1. Gait variability in CR and NR across different individual runs (top left, black dots), across different levels of fatigue (top right), and within any given run (bottom left and right, thin lines).

With wearable technology becoming more popular, more companies are creating sensors to assess biomechanical parameters including peak tibial acceleration (PTA) during running. However, validity of data from wearable technology relative to “gold-standard” research-grade instruments is highly important. PURPOSE: Assess the difference in PTA obtained from wearable inertial measurement units (IMU) and a research-grade accelerometer at different running speeds.

METHODS: Six participants completed 1-2min treadmill running bouts at 3.0 m/s and 4.0 m/s while...
wearing standardized footwear (1080, New Balance). A research-grade tri-axial accelerometer (ACC; 1200Hz, model 356A26, PCB Piezotronics) and a 9-axis IMU (1000Hz, Blue Trident, IMeasureU) were secured to the distal tibia to capture PTA during running. The testing at both speeds was completed with the ACC below and above the IMU to account for possible position effects. Data were collected for the final 15 seconds of each running bout and the average of both positions for 10-15 peaks of axial tibial acceleration were used for analyses. Paired t-tests and Cohen’s d effect sizes were calculated to compare instrument PTA means at different speeds.

**RESULTS:** At 3.0 m/s, mean PTA was not different between ACC (5.2±1.9 G) and IMU (5.9±2.2 G; p = 0.33; d = 0.34). At 4.0 m/s, mean PTA was not different between ACC (8.5±3.7 G) and IMU (9.8±4.2 G; p = 0.33; d = 0.33). Figure 1 demonstrates the individual variability in the difference in PTA obtained from the ACC and IMU at different speeds (A) and different positions (B). CONCLUSION: Despite the statistically similar PTA means obtained from both instruments, the difference in PTA between ACC and IMU appears to be highly variable among individuals. This variability in PTA may be due to differences between devices, device placement, attachment method, or individual running style. This highlights the difficulty in controlling sources of variability during testing.

**METHODS**

Dynamical systems theory suggests that examining the complexity of biological signals may be more sensitive in differentiating between groups of varying health status, including predicting who may develop a running-related overuse injury (RROI). This theory has yet to be tested in prospective running studies. PURPOSE: To evaluate if changes in complexity, as measured by the mean control entropy, of center of mass (COM) resultant acceleration during running is associated with RROI development. METHODS: 30 collegiate runners wore an ActiGraph GTX3+ during ‘easy’ training runs throughout a cross-country season. Clinician-diagnosed RROI were reported via an online survey. Complexity was calculated on the resultant acceleration time series from each run. Cox proportional hazards analysis assessed injury risk as a function of the mean complexity for each runner across the season and the change in complexity per week.

**RESULTS:** Seven runners sustained an injury. Across all 30 participants over the season, the mean ± SD complexity was 0.623 ± 0.086 units. The mean change in complexity over the course of the cross country season was -0.0014 ± 0.0043 units per week. Although not statistically significant, each 0.1-unit increase in complexity was associated with a 1.65-fold increase in injury rate (95% CI 0.70-3.89, p=0.30) and a 0.01-unit increase in complexity per week was associated with a 1.50-fold increase in injury rate (95% CI 0.06-35.5, p = 0.80). CONCLUSION: These preliminary findings suggest that COM complexity could at least contribute to RROI detection strategies in cross-country runners. Given these preliminary results, additional prospective studies with larger sample sizes are necessary to further assess relationships between baseline complexity and changes in complexity during running training that can be monitored with wearable technology.
provides a new approach for examining the mean and variability of min/d of MVPA in longitudinal data. To demonstrate, we applied this model to a randomized controlled trial and BMI and glucose were shown in Figure 1. Neither effects were constant, indicating that intensity mattered after controlling for volume (count-min or MET-min). The relationship between BMI and intensity was complicated, while PA accumulated at higher intensity was found to be associated with lower fasting glucose levels after controlling for volume. **CONCLUSION:** We provided a cutpoint-free analytic framework to model PA intensity continuously. The effect of PA on BMI and fasting glucose varied across intensity levels, even when fixing PA volume. The proposed methods are applicable not only to counts data, but also to other acceleration-based metrics calculated using raw data. **Figure 1.** Association of PA intensity (counts/15-sec or equivalent METs) with BMI and fasting glucose. The adjusted analysis included age, race-ethnicity and education for BMI, and for glucose additionally adjusted for BMI. Corresponding METs were calculated based on an internal calibration study.
Conclusions: Unlike models trained on laboratory activity trials, ML activity classification models for pre-schoolers trained on free-living accelerometer data perform well when evaluated under true free-living conditions.

Funding: Australian Research Council Discovery Project Grant: DP150100116

### RESULTS

In adjusted models, those in the high and moderate/vigorous activity ranges (CPM 800-2499) followed by prolonged baseline sit-to-stand performance. Other significant contributing factors include high WOMAC score, low minutes in the performance moderate/vigorous activity range (CPM 800-2499). The overall prediction accuracy is 82%. For poor WOMAC status prediction (Fig.1B), the top predictors are impaired baseline sit-to-stand time, as well as accelerated decline in gait speed (active minute vs. active minute) vs. unit of time (falls/year).

Conclusion: These results demonstrate a J-shaped association between PA and falls, with stronger differences in PA between fallers and non-fallers during the morning hours. Furthermore, the trend towards more robust results for falls/active minute vs. falls/year highlight the complex nature of the association between PA and falls and suggest that novel PA metrics may serve as more sensitive indicators for discerning falls risk.

### PURPOSE

To investigate the risk factors associated with longitudinal functional decline in people with knee OA using free-living accelerometer data.

### METHODS

Longitudinal data from the Osteoarthritis Initiative (OAI) accelerometer study was extracted from 1229 participants tested at baseline and 2 years, including 35 features of functional capacity (gait speed, sit-to-stand time, etc), demographic characteristics, patient-reported outcome measures (WOMAC, etc.), and accelerometry-based physical activity. Poor functional status was defined as declining into or remaining in the worst function quintile compared to baseline status for two outcome measures (WOMAC score and gait speed). A Random Forest classifier was trained to predict individuals’ functional status.

### RESULTS

For poor functional status in gait speed (Fig.1A), the top predictor is baseline low minutes in the performance moderate/vigorous activity range (CPM 2500+). For poor WOMAC status prediction (Fig.1B), the top predictors are impaired baseline sit-to-stand and gait speed, as well as accelerated decline in gait speed. The overall prediction accuracy is 79%.

### CONCLUSIONS

Accelerometry-based measures of physical activity were identified as key indicators for the decline in gait speed over time. Whereas only functional capacity measures (gait speed and sit-to-stand performance) were identified as key indicators for the longitudinal decline in the WOMAC score. These findings may enable early detection and intervention for functional decline prevention in knee OA patients.

### PURPOSE

To determine the criterion validity and test-retest reliability of a smartphone app in measuring bicycling behavior.

### METHODS

A GPS device was used as the gold standard for comparison to the smartphone app. Courses –2 miles in length at two locations were tested: 1) urban college campus and 2) rural bicycle path. Adult bicyclists (N=50; 21 urban, 29 rural) carried a Global Positioning System (GPS) device and their smartphone while riding a bicycle on a course loop twice (5 minute break in between); both the GPS device and smartphone app recorded location data. Movement time was recorded for the GPS device and the smartphone app, and MET*min were calculated for bicycling assuming an aerobic MET (Cohen’s d). Using a geographic information system (GIS), a 36-foot buffer was created around the road network for each course. Location data from the GPS and smartphone devices were mapped over the course buffers in GIS, and the percent of location data within the buffers was calculated for each. Validity and reliability of the percent within buffer and validity of MET*min for each device were examined using paired sample t-tests.

### RESULTS

GPS device data fell within the urban course buffer 69% of the time and within the rural course 37% of the time, while data from the smartphone app was within the urban course buffer 78% of the time and within the rural course 51% of the time. For the GPS device, maximum distance of a single GPS point away from the road buffer averaged 14 meters (range 0-290), while maximum distance of a single GPS point from the smartphone app averaged 15 meters (range 0-92). Mean difference between the GPS and smartphone devices was 9% in favor of the smartphone app on the rural course (n=28, p<0.01). For reliability of the smartphone app, mean difference between the two repeated rides was 4% on the urban course (n=20, p<0.05), and 9% on the rural course (n=28, p<0.01). For reliability of the smartphone app, mean difference between the two repeated rides was 3% on the urban course (n=21, p<0.05), and 6% on the rural course (n=28, p<0.05). MET*min from the GPS device was 1.22 versus 1.21 from the smartphone app (n=94, p<0.05).

### CONCLUSIONS

The smartphone app tested is a reasonable alternative to GPS devices in assessing bicycling behavior in urban and rural environments.
Dynamic segmentation algorithms are used to find activity transitions in accelerometer data. Youth Sojourn models use a crude algorithm, which may be improved by instead using a change point detection (CPD) algorithm. Pruned exact linear time (PELT) is a CPD algorithm that finds transitions by minimizing a cost function while iterating over the data and pruning out inviable transition points. PURPOSE: To compare the performance of youth Sojourn and PELT. METHODS: Raw acceleration data (hip-worn ActiGraph GT3X) from 86 youth (age 6-18 yrs; 48% male; 16% overweight/obese) were processed using Sojourn and PELT. Participants performed two semi-structured activity routines on separate days, with each visit lasting approximately 2-2.5 h. A total of 16 activities (eight each day) were performed, twice each, and the study protocol was designed to promote variability in the ordering and duration of activities. Throughout each trial, direct observation was performed using focal sampling, which served as a criterion measure of when activity transitions occurred. Sojourn and PELT were compared to the criterion using the transition pairing method, with a maximum of 5-s lag time allowed for a prediction to be considered a true positive. Performance metrics were recall, precision, and root mean squared error (RMSE). The metrics were calculated for each participant (both visits combined), after which paired t-tests were used to compare Sojourn-vs-PELT means for each metric. RESULTS: Values are mean ± SD. Recall was similar for Sojourn (49.6% ± 9.0%) and PELT (51.5% ± 9.2%, p = 0.15), and the same was true for RMSE (2.9 ± 0.3 for Sojourn, versus 3.1 ± 0.4 s for PELT, p = 0.01). However, precision for Sojourn (21.7% ± 4.9%) was substantially lower than for PELT (38.7% ± 11.0%, p < 0.001). CONCLUSION: Youth Sojourn models may benefit from replacing their current segmentation algorithms with CPD algorithms like PELT. Thus, PELT warrants further investigation. Supported by NIH R01HD083431

Purpose: To compare the energy expenditure of driving. Measured MET values for driving more closely correspond to sedentary behaviors than light-intensity walking. Since the average energy expenditure of driving is 2.8 METs, we compared mean measured MET values (1.46 vs 3.08 p<0.0001) to those for quiet sitting while working. In addition, we tested the feasibility of implementing fitness measures in an HLMP to support this approach. The Institute of Medicine, which is establishing a systematic implementation approach for implementation. Using an established healthy-lifestyle management program (HLMP) to support this approach could reduce burden on clinical practitioner. The purpose was to test the feasibility of implementing fitness measures in an HLMP. METHODS: Healthy Me is an HLMP offered to patients in a public, Midwest health system. Patients are enrolled through physician referral via EHR. Eligible patient have a BMI > 25, cardiovascular disease, pre/type II diabetes, and/or depression. Low-risk patients who meet eligibility criteria can enter Healthy Me through an EHR automated bulk referral process. Healthy Me is delivered by health coaches trained in motivational interviewing, group fitness, health promotion, and chronic disease management. Patients performed chair stand, arm curl and two-minute step tests.
RESULTS: The sample included 1254 patients (80.1% women), who were 48.9 ± 15.46 years of age, with a BMI of 37.4 ± 10.46 and reported fair/good (74.9%) poor (16%) or very good/excellent (9.1%) health. Exercise: Three patients (6.7%) completed multiple fitness tests and 654 (52.2%) completed one test only. Only females completed multiple fitness tests. Chi-square test found those who completed one test had higher perceived health ratings ($\chi^2 = 15.6, p = 0.048$). Bivariate correlations found BMI was associated positively with waist measures ($r = 0.38, p < 0.001$), and negatively with chair the stand score ($r = 0.21, p = 0.015$), march score ($r = -0.32, p = 0.029$), general physical rating ($r = -0.33, p = 0.001$), and mental ($r = -0.16, p = 0.043$) health.

CONCLUSIONS: Results revealed differential characteristics between patients who only visited Healthy Me and those who completed the health/fitness tests. Future directions include using tailored approaches to encourage fitness test completion. Multiple correlations with BMI and health/fitness parameters align with previous work and emphasize the importance of promoting healthy behaviors in HLMPs, such as exercise.

2969 Board #3 May 29 1:00 PM - 3:00 PM Determining Intervention Components For A Physical Activity Program Designed For Former Division I College Athletes Paula-Marie M. Ferrara 1, Rebecca A. Zakrzesk 1, Morgan R. Eckenrode 2, Cory T. Beaumont 2, Kelley Strohacker, FACSM 3, The University of Tennessee, Knoxville, TN. 2The University of Southern Mississippi, Hattiesburg, MS. 
Email: pferrar1@utk.edu

Emerging research shows retired college athletes experience detrimental physical and mental health declines following retirement from sport. Such effects include worsening body composition, health-related quality of life, and physical function, as well as increased prevalence of depression, alcohol dependence, and eating disorders. Despite sports training, former college athletes exhibit substantial decreases in physical activity (PA) levels following retirement, which may contribute to these health declines.

PURPOSE: Explore what intervention components would be attractive, effective, and feasible for a PA program designed for former NCAA Division I (DI) college athletes.

METHODS: Semi-structured, bracketed interviews were conducted with former NCAA DI athletes retired ≤10 years from college sport and inactive based on the PA Guidelines for Americans (PAGA; assessed via the Paffenbarger PA Questionnaire). Qualitative analysis was conducted using the Consensual Qualitative Research Method to determine domains, categories, and core ideas from participant responses.

RESULTS: Participants (N=17, 7 men, 26 ± 3 y, 91% Caucasian) retired 3 months to 10 years (4±3 y) and representing 9 sports across 13 athletic conferences underwent individual interviews. Based on the PAGA, 18% did not meet the muscle strengthening guidelines, 29% did not meet the aerobic guidelines, and 53% did not meet both thresholds. Emergent domains include: 1) The Recreated Team, 2) Program Needs, 3) Preventive Factors, 4) Timing.

CONCLUSIONS: While IT and RT provide enjoyable bone-targeted exercise experiences for young adult women, on balance RT appears most favorable. It seems prudent, that bone-targeted exercise interventions for this demographic address home-based low-intensity exercise control (CON). All 32 participants (IT=10, RT=12, CON=10) who finished the trial completed questionnaires on physical activity enjoyment (PACES-8, Kruskal-Wallis and Friedman’s test), quality of life (AQoL-6D, repeated measures ANOVA), and semi-structured interviews to evaluate qualitative analysis (Leximancer v4.50) of participant experiences. RESULTS: At follow-up, RT had the highest total score for PACES-8 (48.6±4.7), while only the IT group experienced an increase in total score over the 10 months (34.8±4.1 to 41.6±6.9, p<0.05). Only CON experienced an improvement in total AQoL-6D score. For the sub-domains, all groups experienced clinically significant improvements (>0.06 points) for ‘mental health’, while IT improved for ‘senses’ and CON improved for ‘coping’ (p<0.05). The qualitative analysis revealed that overall trial exercises were viewed positively by all groups, yet the two high-intensity groups had the ‘richest’ exercise experiences, developing a more positive attitude to exercise. Barriers to exercise related to time, convenience, accessibility, and cost. Both IT and CON groups experienced a 41% drop-out compared to 29% in the RT group. Compliance did not differ between CON (78.8±4.1%), IT (61.4±15.1%), or RT (66.1±11.2%) (p=0.085).

CONCLUSIONS: While IT and RT provide enjoyable bone-targeted exercise experiences for young adult women, on balance RT appears most favorable. It seems prudent, that bone-targeted exercise interventions for this demographic address perceptions of time demands and environmental barriers to participation in order to maximize compliance and adherence.

2970 Board #4 May 29 1:00 PM - 3:00 PM Commercial App Use Linked With Sustained Physical Activity In Two Canadian Provinces: A 12-month Quasi-experimental Study Marc Mitchell1, Erica Lau2, Lauren White1, Guy Faulkner1, Scott N. Drum, FACSM 3, 1Western University, London, ON, Canada. 2University of British Columbia, Vancouver, BC, Canada. 3Carrot Insights Inc, Toronto, ON, Canada. 
Email: marc.mitchell@uwo.ca


BACKGROUND: Top tier commercial physical activity apps rarely undergo peer-reviewed evaluation. Even fewer are assessed beyond six months, the theoretical threshold for behaviour maintenance.

PURPOSE: The purpose of this study was to examine whether a commercial app rewarding users with digital incentives for walking was associated with an increase in physical activity over one year.

METHODS: This 12-month quasi-experimental study was conducted in two Canadian provinces (n=39113 participants). Following a two-week baseline period, participants earned digital incentives ($0.04 CAD/day) every day they reached a personalized daily step goal. Mixed-effects models estimated changes in weekly mean daily step count over the entire baseline period and the last two recorded weeks. Models were fit for several engagement groups and separately by baseline physical activity status within engagement groups.

RESULTS: Nearly half of participants (43%) were categorized as physically inactive at baseline (fewer than 5000 daily steps), and 60% engaged with the app for at least six months (≤24 ‘Regular’ (24-51 data points) or ‘Committed’ sub-groups (52 weeks)). Weekly mean daily step count increased for physically inactive users regardless of engagement status (P<0.001). The increase was largest for ‘Regular’ and ‘Committed’ participants—1215 and 1821 steps/day, respectively. For physically active participants, step count increases were only observed in the ‘Committed’ sub-group (P<0.0001).

CONCLUSIONS: A commercial app providing small but immediate digital incentives for individualized goals was associated with an increased weekly mean daily step count on a population-scale over one year. This effect was more evident for physically inactive and more engaged participants.
by STC with a promise of ownership if the full program was completed. The program met 16-wks, 1 x week, and 2-hrs day1 starting late spring and into late summer. Indoor physical conditioning and bike maintenance skills classes were implemented the initial 4-wks with mentored, group rides occurring the last 12-wks. Maximal oxygen uptake (i.e., via the progressive aerobic cardiovascular endurance run or PACER test) and CVD risk (via a prediction equation from prior, unpublished research) were assessed pre- and post-intervention following the indoor training sessions (i.e., after 4-wks) and immediately prior to a final, 28-mile organized bike race. Data were analyzed using paired t-tests between pre- and post-intervention within NM, RM, and CM groups with significance set at p < 0.05. Effect size is reported as Cohen’s d with d = 2.5, 2.5, and .8 = small, medium, and large effect sizes, respectively. RESULTS: Significance from pre- to post-test (mean ± SD), respectively, is as follows for VO2max in ml kg^-1 min^-1 (NM, 37.1 ± 2.5 vs 41.8 ± 5.4, p = 0.004, d = 0.99); RM, 40.7 ± 6.9 vs 46.2 ± 10.9, p = 0.037, d = 0.19; and CM, 38.7 ± 5.1 vs 43.8 ± 8.3, p = 0.000, d = -0.04) and CVD risk with lower score = decreased risk (NM, 5.2 ± 2.8 vs 3.8 ± 2.8, p = 0.018, d = -0.38; RM, 6.2 ± 6.2 vs 3.9 ± 8.0, p = 0.027, d = 0.19; and CM, 5.7 ± 4.7 vs 3.8 ± 5.8, p = 0.001, d = -0.07). Body mass index (BMI) did not change across any group. CONCLUSION: A community-based, adult-mentored, youth mountain bike program is a practical means to improve aerobic capacity and reduce CVD risk in at-risk minors.

The Physical Activity Guidelines for Americans (PAG) recommend 150 min/wk of moderate intensity aerobic physical activity (PA) plus 2days of muscle strengthening PA for health. Yet, 26% of Americans and 36% of college students perform no leisure time PA, stressing the need to increase PA in these populations. PURPOSE: We conducted a randomized controlled trial (RCT) comparing two different exercise prescription (ExR) approaches to increase PA among college students. The purpose of this interim analysis was to assess differences in the Translational Model stage of change (SOC) and drop-out (DO) rates at the 6wk mid-point (6W) of the RCT compared to baseline (BL) between the two ExR approaches. METHODS: 60 sedentary, healthy college students >18 yr were randomized to two groups: ExR #1 emphasized meeting the PAG via the Frequency, Intensity, Time, and Type or FITT principle of ExR; and ExR #2 emphasized that all PA counts. Both ExR approaches progressed students from being sedentary to meeting weekly PA goals over the 12wk PA intervention. The primary RCT outcome was the change in PA volume at 12wk, assessed pre- and post-intervention following the indoor training sessions (i.e., after 4-wks) and immediately prior to a final, 28-mile organized bike race. Data were analyzed using paired t-tests between pre- and post-intervention within NM, RM, and CM groups with significance set at p < 0.05. Effect size is reported as Cohen’s d with d = 2.5, 2.5, and .8 = small, medium, and large effect sizes, respectively. RESULTS: Significance from pre- to post-test (mean ± SD), respectively, is as follows for VO2max in ml kg^-1 min^-1 (NM, 37.1 ± 2.5 vs 41.8 ± 5.4, p = 0.004, d = 0.99); RM, 40.7 ± 6.9 vs 46.2 ± 10.9, p = 0.037, d = 0.19; and CM, 38.7 ± 5.1 vs 43.8 ± 8.3, p = 0.000, d = -0.04) and CVD risk with lower score = decreased risk (NM, 5.2 ± 2.8 vs 3.8 ± 2.8, p = 0.018, d = -0.38; RM, 6.2 ± 6.2 vs 3.9 ± 8.0, p = 0.027, d = 0.19; and CM, 5.7 ± 4.7 vs 3.8 ± 5.8, p = 0.001, d = -0.07). Body mass index (BMI) did not change across any group. CONCLUSION: A community-based, adult-mentored, youth mountain bike program is a practical means to improve aerobic capacity and reduce CVD risk in at-risk minors.

The University of Mississippi, University, MS. (Sponsor: Jeremy P. Loenneke, FACSM). Email: vwong@g.olemmiss.edu (No relevant relationships reported)

Post activation potentiation (PAP) is a phenomenon whereby strength is acutely increased following a conditioning contraction. This effect is purported to be small and specific to the contraction history of the muscle (local), however, a potential cross-over effect in PAP has not been ruled out. PURPOSE: To determine if PAP is specific to the muscle being conditioned or if it is also observed within the homologous muscles of the contralateral limb. METHODS: 56 men and women participated in a four-visit study. Visit 1 included baseline measurements and familiarization of the unilateral biceps contractions (isometric and isokinetic for each arm). Visits 2-4 included the completion of one of the three experimental conditions: 1) control, 2) same side PAP, and 3) cross over PAP in a randomized order. Each visit included a warm up followed by three maximal isokinetic contractions at 210°/second (baseline). The control condition then rested eight minutes prior to completing three more maximal isokinetic contractions (post). The other two conditions completed the pretest followed five minutes later by a six-second maximal isometric contraction on the same side as the baseline isokinetic test (same side PAP) or on the opposite side (cross over PAP) followed by three additional maximal isokinetic contractions (post) three minutes after conditioning stimulus. The variable of interest was the change in strength from baseline in isokinetic isometric conditions. Three hypotheses were compared using Bayesian Informative Hypothesis Evaluation (BIHN). The hypotheses were as follows: H1: same > cross = control; H2) same > cross > control; H3 same > cross > control. RESULTS: Torque produced during the potentiating stimulus was similar between PAP conditions (same: 47 Nm vs. cross: 45 Nm). The change [mean (95% credible interval)] in isokinetic strength for each condition was: control = -0.41 (-0.91, 0.07) Nm; same side PAP = -0.48 (-0.20, 1.16) Nm, and cross PAP = -0.03 (-0.67, 0.60) Nm. The posterior probabilities were 0.45, 0.28, 0.19, and 0.06 for H1, H2, H3, and the uncontrasted model, respectively. H1 was 1.5 and 2.2 times more likely than H2 and H3, respectively. CONCLUSIONS: The current evidence indicates that if a PAP effect exists, it is small and may be specific to the muscle being conditioned. There does not seem to be a substantial cross over effect in PAP.

The position that hypertrophy mechanistically increases muscle strength is currently debated among scientists. PURPOSE: To determine indirect (via hypertrophy) and direct (not hypertrophy) effects of training on muscle strength. METHODS: 151 participants were randomized into control, one-repetition maximum training, or traditional training. For 6 weeks control avoided resistance exercise; training groups performed elbow flexion 3x/week (dominant arm). One-repetition maximum participants had 5 attempts to lift the greatest load possible. Traditional participants performed 4 sets to task failure (load adjusted for ~8-12 repetitions). Attempts/set were separated by 90 s. Anterior muscle thickness (B-mode ultrasound) at 50, 60, and 70% upper arm length, and strength (one-repetition maximum) were assessed pre- and post-training. Change-score mediation models (adjusted for sex, pre-muscle thickness, and pre-strength) were constructed for each muscle thickness site. Effects of each training were evaluated relative to control. Data presented as coefficient (95% CI).

RESULTS: Relative direct effects on strength were greater for one-repetition maximum [50% = 1.89 (1.20, 2.58); 60% = 1.88 (1.19, 2.58); 70% = 1.81 (1.12, 2.50) kg] and...
Muscle Morphology In Previously Trained, College-aged Males.

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Purpose: To compare the effects of high-volume (HV) versus high-intensity (HI) resistance training on vastus lateralis muscle morphology. Methods: Resistance trained, college-aged males (n=15) participated in 6 weeks of resistance training in which their legs were randomized to undertake HV and in the contralateral leg HI. Resistance training was undertaken 3 days per week. All participants went through 10 days of deload following the 6 weeks of training. Muscle ultrasound of both vastus lateralis muscles was conducted prior to week 1 of training (T1), 72 hours following the last training bout of week 6 (T2), and 10 days following the last training bout (T3) for muscle thickness, pennation angle, and fascicle length assessments. Results: There was a significant condition by time effect (p=0.039) for muscle thickness. Post hoc analysis revealed that muscle thickness significantly increased from T1 to T2 (2.7±0.4 cm to 2.9±0.4 cm, p=0.023) in the HV leg, but not in the HI leg. However, there was no difference between conditions at any time point. Furthermore, there were no significant interactions or main effects for pennation angle or fascicle length. Conclusion: HI versus HV training elicits differential effects in vastus lateralis muscle thickness over a 6-week period, albeit neither training modality increased pennation angle or fascicle length.

Conclusions: One-repetition maximum and traditional training increase strength, there was no difference between conditions at any time point. Furthermore, there was no difference between conditions at any time point. Conclusion: HI versus HV training elicits differential effects in vastus lateralis muscle morphology in previously trained, college-aged males.

Papers were selected for inclusion in the supplement based on relevance to the American College of Sports Medicine's research interests and priorities, as well as the quality and novelty of the research presented. The selected papers represent a range of topics related to exercise science, including muscle morphology, resistance training, muscle adaptation, and signaling responses to resistance exercise. The papers were chosen to provide insights into the potential of a muscle memory concept and its implications for the development of training programs and exercise protocols.
Performing unilateral contractions to exhaustion has been shown to lead to force deficits of both the exercised and unexercised limbs. It has been proposed that the contralateral force deficits are of neural origin, and not due to peripheral mechanisms of fatigue (e.g., glycogen depletion). While this proposed model appears likely, it remains speculative as the absence of peripheral factors to contralateral force deficits have not been verified.

**PURPOSE:** Therefore, the purpose of the study was to quantify the changes in muscle glycogen content and muscular force of both limbs in response to unilateral fatigue. **METHODS:** Nineteen healthy subjects performed two maximal voluntary isometric (MVC) knee extensions of each leg before (PRE) and after (POST) a fatiguing protocol of the right leg. The fatiguing protocol consisted of repeated 56 second long ramp contractions of the right leg at 30% MVC until failure. During the plateau phase of each contraction, ultrasound images were taken at the midpoint of the rectus femoris (RF). The echo intensity, which has been shown to be sensitive to acute changes in muscle glycogen content, was analyzed from each image of the RF muscle. **RESULTS:** A two way repeated measures ANOVA showed a significant time x limb interaction (p < 0.001) for MVCs. Follow-up paired sample t-tests indicated that both limbs showed significant force loss. However, the right leg (-33%, from 773.36±191.79 to 517.13±136.72, p < 0.001) demonstrated a much larger force deficit than the left leg (9.7%, from 805.07±215.32 to 725.04±198.44, p = 0.002). For echo intensity, the right leg demonstrated a significant change (8.8%, from 48.64±7.70 to 52.58±8.69, p = 0.009) from PRE to POST. However, the left leg did not change (1.34%, from 53.93±7.60 to 54.65±7.25, p = 0.621). It is worth noting the increase in echo intensity, since with the right leg, represents a decrease in tissue density (e.g. decreased muscle glycogen content). **CONCLUSION:** Our findings suggest peripheral fatigue mechanisms, such as muscle glycogen content, were not responsible for the decrease in force in the contralateral limb. This absence of peripheral, intracellular changes supports the original proposal that the contralateral force deficit is of a central, neural origin.
PURPOSE: To investigate the effect of exercise intensity on the presence and severity of exercise-induced diaphragm and respiratory muscle fatigue in healthy humans.

METHODS: Ten healthy adults (25 ± 3 yrs, 3 females) performed a ‘ramp sprint’ test to determine critical power (CP), peak ramp power (P^peak) and VO_2max (54 ± 9 ml/kg/min). The subjects then performed two constant-power cycling tests to exhaustion: 1) 5% < CP (173 ± 50 W, heavy intensity); 2) ~25% of the difference between CP and P^peak (215 ± 53 W, severe intensity). Diaphragm and respiratory muscle fatigue were quantified as the pre- to post-exercise reduction in the transdiaphragmatic (P_dia) and gastric (P_ga) twitch pressure response to magnetic stimulation of the cervical and thoracic nerves, respectively.

RESULTS: Exercise time was longer for heavy vs. severe exercise (36 ± 6 vs. 10 ± 3 min, P< 0.05). Final min VO_2 was lower during heavy (3.12 ± 0.74 L/min; 82 ± 5% of VO_2peak) vs. severe exercise (3.60 ± 0.83 L/min; 95 ± 4% of VO_2peak) (P < 0.05). Both heavy and severe exercise elicited a significant reduction in P_dia (−13 ± 11% and -19 ± 13%) and P_ga (−23 ± 20% vs. -24 ± 17%) (both P< 0.05); however, the magnitude of exercise-induced respiratory muscle fatigue was not different between trials (P > 0.05). The cumulative diaphragm and gastric pressure-time products were greater for heavy vs. severe exercise (PTP_dia: 16790 ± 6727 vs. 5945 ± 1956 cmH_2O; PTP_ga: 7818 ± 3368 vs. 2595 ± 1233 cmH_2O, both P< 0.05).

CONCLUSION: The diaphragm and respiratory muscles fatigue in response to exhaustive heavy- and severe-intensity exercise in healthy humans. The magnitude of exercise-induced respiratory muscle fatigue between trials was not different despite a substantially greater cumulative PTP_dia and PTP_ga for heavy- vs. severe-intensity exercise.

2986

May 29 1:30 PM - 1:45 PM

Reduction In Pulmonary Arterial Pressure At Rest And During Exercise Following Percutaneous Closure Of Patent Foramen Ovale

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(No relevant relationships reported)

Purpose: The PFO is a source of intracardiac right-to-left shunt and is present in ~1-3% of the adult population. Deficits in pulmonary gas exchange efficiency associated with PFO have been well-documented (Lovering et al, J Appl Physiol 2016). However, changes in pulmonary arterial pressure and total pulmonary resistance (TPR) following closure have not previously been reported.

Methods: Four candidates (3F, 1M) for closure of PFO were identified by local cardiologists and referred to our laboratory as subjects. 3 subjects (3F) received physician clearance to participate in the exercise trials. 1 subject (1M) was not cleared for exercise so only resting measures were taken. Presence and size of PFO was confirmed utilizing transthoracic saline contrast echocardiography (TTSCE). Subjects for exercise were only cleared for a maximum of 3 exercises. Subjects were referred to our laboratory as subjects. 3 subjects (3F) received physician consent and were referred to our laboratory. 1 subject (1M) was not cleared for exercise so only resting measures were taken. Presence and size of PFO was confirmed utilizing transthoracic saline contrast echocardiography (TTSCE).

Subjects exercised at 4 sub-maximal workloads (25%, 50%, 75% and 90% of pre-closure diastolic pulmonary artery pressure, PASP). Subjects exercised at 4 sub-maximal workloads (25%, 50%, 75% and 90% of pre-closure VO_2max). Transthoracic ultrasound measures of cardiac output (QT) and pulmonary arterial systolic pressure (PASP) were taken prior to exercise and during the final minute of each workload. TPR was calculated as PASP/QT. All measures were repeated in the laboratory 3-6 months after closure of PFO following confirmation of endothelialization of the closure device with TTSCE.

Results: Data were analyzed by a 2-way (Closure x Workload) RMANOVA. There was a main effect of closure on PASP/F1, 11) = 21.05, P < 0.05. There was a main effect of workload, but not closure, on PASP/F1, 11) = 60.18, P< 0.0001.

Conclusion: Improved respiratory gas exchange efficiency is expected with removal of the intracardiac right-to-left shunt. However, our results demonstrating a significantly reduced pulmonary artery pressure, due to a significantly reduced TPR, are intriguing and deserve more attention to better understand the contributing factors of a PFO to exercise-induced pulmonary hypertension.

2987

May 29 1:45 PM - 2:00 PM

Effect Of Active Muscle Mass On Work Of Breathing And Oxygen Cost Of Ventilation

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(No relevant relationships reported)

PURPOSE: To compare estimates of work of breathing (Wb) and O2 cost of ventilation in the respiratory muscles (VRMO2) among three types of exercise, representing smaller and large active muscle masses.

METHODS: Twenty healthy adults (25±4.9 yrs, BMI: 23.9 ±2.6 kg/m^2) completed three randomized peak cardiopulmonary exercise tests (CPET) on separate days: 2-leg (large muscle mass) and 1-leg (medium mass) tests and 1-arm (small mass). Estimates of Wb and VRMO2 were compared at power outputs corresponding to 25%, 50%, 75%, and 100% of the peak power output on the tests and at Isomax, defined as the power output identical to peak exercise on the 1-arm CPET. Wb was estimated using an established algorithm: [ ] and VRMO2 = [ ].

RESULTS: Peak power output was 32 ±11.96 watts for the 1-arm, 97.8 ±30.48 watts for the 1-leg, and 186.25 ±44.03 watts for the 2-leg CPETs. At 50% of peak WR, significant differences in Wb and VRMO2 between 1-arm and 2-leg (Wb p<0.001; VRMO2 p<0.001). At 100%, there were differences in Wb and VRMO2 between 1-arm and 2-leg (Wb p<0.01; VRMO2 P<0.01) and between 1-leg and 2-leg CPETs (Wb p<0.02; VRMO2 p<0.02)

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<th>1-arm</th>
<th>1-leg</th>
<th>2-leg</th>
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<tr>
<td>Wb (W)</td>
<td>50%</td>
<td>100%</td>
<td>Isomax</td>
</tr>
<tr>
<td></td>
<td>1.2±0.9</td>
<td>4.7±1.2</td>
<td>6.5±1.2</td>
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<tr>
<td></td>
<td>2.2±1.2</td>
<td>4.8±0.8</td>
<td>6.5±1.2</td>
</tr>
<tr>
<td>VRMO2 (ml/min)</td>
<td>44.9±7.4</td>
<td>35.4±1.2</td>
<td>10.5±2.8</td>
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<table>
<thead>
<tr>
<th></th>
<th>50%</th>
<th>100%</th>
<th>Isomax</th>
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<tbody>
<tr>
<td></td>
<td>74.8±1.2</td>
<td>51.2±0.9</td>
<td>43.8±1.2</td>
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<td></td>
<td>35.4±1.2</td>
<td>10.5±0.9</td>
<td>5.9±0.9</td>
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At Isomax, significant increases were found in Wb and VRMO2 between the 1-arm and 1-leg (p<0.001) CPETs and between the 1-arm and 2-leg (p<0.001) CPETs. The findings suggest that breathing economy is diminished with exercising that requires progressively smaller active muscle masses. This study suggests that CPETs requiring smaller active muscle masses may not be sufficient for examining maximal Wb or VRMO2 capacity.

Abstracts were prepared by the authors and printed as submitted.
External Dead Space Changes Sex Differences in The Exercise Ventilatory Response In Obese And Nonobese Children

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(Purpose: Increases in external dead space augment the exercise ventilatory response independent of the potential respiratory effects of sex and obesity. Therefore, the dead space imposed by the mouthpiece and breathing valve (V̇DM) should be accounted for when comparing the exercise ventilatory response, particularly in prepubescent children who have smaller lungs. We evaluated the impact of V̇DM on the exercise ventilatory response, defined as the slope of the relation between minute ventilation (V̇E) and carbon dioxide (V̇CO2) in obese and nonobese prepubescent boys and girls.METHODS: 27 nonobese (age: 10 ± 1 y; height: 146 ± 8 cm; weight: 39 ± 7 kg; BMI percentile: 57.2 ± 2.13) and 46 obese (age: 10 ± 1 y; height: 147 ± 8 cm; weight: 62 ± 16 kg; BMI percentile: 98.0 ± 1.3) children were studied. Subjects were divided into groups by sex (nonobese: 13 girls and 14 boys; obese: 17 girls and 29 boys). All subjects performed a 6-minute constant load cycling test at a fixed intensity (40W). To correct the V̇E/V̇CO2 slope for the effects of V̇DM, we subtracted V̇DM (0.225 L) from VE to derive a slope that was absent from the effects of V̇DM. A two-way group (obese vs nonobese) by sex (girls vs boys) analysis of variance was conducted. RESULTS: When V̇DM was not accounted for, V̇E/V̇CO2 slope was not different (p = 0.48) between obese and nonobese children (32.7 ± 6.1) however, there was a main effect for sex (p = 0.03) where the V̇E/V̇CO2 slope was higher in girls (35.4 ± 5.6) compared with boys (32.6 ± 4.9). When V̇DM was accounted for, the V̇E/V̇CO2 slope remained similar (p = 0.31) between obese and nonobese children; however, the main effect for sex was eliminated (p = 0.12). There was no main effect for group (obese vs nonobese) or sex (girls vs boys) in the end-tidal partial pressure of carbon dioxide at rest (p > 0.05) or during exercise (p > 0.05). CONCLUSIONS: Accounting for the external dead space imposed by the valve and mouthpiece eliminates the difference in the exercise ventilatory response detected between pre-pubescent boys and girls. Considering that the breathing apparatus comprises a large portion of both resting and exercise tidal volume in children, it should be accounted for before evaluating the V̇E/V̇CO2 slope, especially in prepubescent children.

Bronchodilation Increases Estimated Ventilatory Capacity In Children With Mild Asthma

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Purpose: Children with asthma experience reduced maximal expiratory flows, which can decrease ventilatory capacity and increase ventilatory limitations during exercise; however, the effects of mid-flow bronchodilation on these variables are underappreciated. The purpose of this study was to examine the effect of bronchodilation on ventilatory capacity and ventilatory limitations during a maximal exercise test.

Methods: Nine children with mild asthma (7 boys, 10 ± 1 y; BMI percentile: 66 ± 30%, forced expiratory volume in 1s, FEV1: 106 ± 24% predicted, Range: 78-144%) completed spirometry before and after 360µg of albuterol. On a separate visit, they completed an exercise test.

Results: Estimated ventilatory capacity increased by 16% after bronchodilator (60 ± 23 vs. 69 ± 27 L/min; p = 0.01). Measured maximal tidal volume was lower than estimated (1.12 ± 0.32 vs. 1.33 ± 0.25; p = 0.002) but measured maximal total respiratory cycle time (TTot) was not different from estimated (1.41 ± 0.36 vs. 1.47 ± 0.46; p = 0.792). In a subset of seven children who received 180µg albuterol before the incremental test, five would have been ventilatory limited (i.e., ≤100% breathing reserve) at maximal exercise using “before bronchodilation” estimated ventilatory capacity (breathing reserve range: 61% to 9%). However, only one child was ventilatory limited at maximal exercise using “after bronchodilation” estimated ventilatory capacity.

Conclusions: Bronchodilator administration prior to maximal exercise testing may be necessary to increase measured ventilatory capacity and reduce ventilatory limitations even in children with mild asthma.
training at altitude. **Purpose:** To determine how markers of iron homeostasis, including ferritin (fer), hemoglobin concentration (Hb), reticulocytes, HEP, ERY, interleukin 6 (IL-6), and tumor necrosis factor alpha (TNFα), lactate dehydrogenase (LDH) and creatine phosphokinase (CPK) change during training in female endurance and team sport athletes residing at moderate altitude. **Methods:** We recruited 94 female athletes from the University of Colorado DI cross country (XC; n = 28), nordic (n = 6) and alpine (n = 8) skiing, lacrosse (LAX; n = 35) and soccer teams (n = 17). In addition, 12 full time female college students were recruited as controls. Between 2 to 7 fasted blood samples were collected over a minimum of 3 months. All athletes were provided with oral iron supplements from a certified nutritionist during this period. **Results:** Average fer and Hb were higher in endurance athletes (fer: 53 ± 30 ng/dL; Hb: 14.6 ± 0.8) compared to team sport athletes (31 ± 19; 13.8 ± 0.8) and controls (18 ± 9; 13.9 ± 1.1). Fer remained stable over time for all groups except LAX, who decreased by 20 ng/dL post season. HEP was higher in endurance (36.6 ± 60.3 ng/dL) compared to team sport athletes (18.0 ± 12.0), but there were no differences between groups for ERY (overall average: 10.1 ± 50.8 ng/dL); neither HEP or ERY changed significantly over time. In LAX, soccer, and nordic, IL6 and TNFα were lower than XC and remained stable over time; however, IL6 and TNFα started higher in XC and decreased over time. All teams except nordic showed fluctuations in LDH and CPK over the training cycle, but there were no differences between groups for these parameters or percent reticulocytes for any groups. **Conclusion:** Endurance athletes had higher Hb, fer, and HEP. While IL6 and TNFα were higher in XC athletes, other biomarkers of iron homeostasis tended to not be different between groups, although some parameters fluctuated over time.

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**2993 May 29 1:15 PM - 1:30 PM**

**Markers Of Training Stress Associated With Functional Overreaching In Middle Distance Runners**

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(*No relevant relationships reported*)

**PURPOSE:** The present study aimed to identify markers of training stress that were related to the incidence of overreaching in response to overload training in middle distance runners. **METHODS:** Twenty-four middle distance runners (n=16 M, VO2peak: 33.3±4.3 mL·kg·min⁻¹; n=8 F, VO2peak: 63.2±3.4 mL·kg·min⁻¹) completed 3 wk of normal training, followed by 3 wk of high-volume training (HVTr; 10% increase in volume each subsequent week), and a 1-wk taper (TapTr; 55% of HVTr work). Before and immediately after each training phase, an incremental treadmill test was performed to measure time to exhaustion (TTE), peak heart rate (HRpeak), Hb recovery, peak blood lactate concentration ([La]peak) and VO2peak. In addition, resting metabolic rate (RMR), body composition, energy intake and resting blood biomarkers of training stress were measured. Runners who had a decreased TTE (>CV) after HVTr were classified as being functionally overreached (FOR), others as acutely fatigued (AF; [La]peak: 13.2±2.1 mmol·L⁻¹, 95% CI: 11.3 to 15.2, d = 1.4, p = 0.01; HRpeak: 159±6 BPM, 95% CI: 151 to 166, d = 0.7, p = 0.01). There were no between group differences in these variables during submaximal states, nor were there changes in absolute or relative RMR, while only the FOR group increased energy intake during the HVTr. There was no statistically significant change in body composition in either group throughout the study nor were there changes in resting blood biomarkers that reflected inflammation (IL-6, GDF-15 and CRP), metabolism (thyroid hormones), catabolism and anabolism (DHEA, HRE, total protein, testosterone, cortisol and GH) or iron regulation (iron, ferritin, and UIBC). **CONCLUSIONS:** Middle distance runners who were classified as FOR following an overload training period did not have alterations in RMR, resting blood biomarkers or submaximal exercise responses compared to runners who did not have impaired performance.

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**2994 May 29 1:30 PM - 1:45 PM**

**Molecular Mechanisms Underpinning The Regulation Of Peak Fat Oxidation Rates During Exercise**

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(*No relevant relationships reported*)

**PURPOSE:** The molecular regulation of peak fat oxidation (PFO) during exercise remains poorly characterized. The aim of this study was to examine the relationship between the content of key proteins involved in adipose tissue and skeletal muscle fat metabolism with PFO. **METHODS:** Thirty-six healthy men and women adults [15 females; mean (SD) age 40 (11) years; VO2peak 42.5 (9.5) mL kg BM⁻¹·min⁻¹; body fat % 21.8 (8.2 %)] completed two incremental exercise tests (separated by 7-28 days) to determine PFO via indirect calorimetry. A DEXA scan and adipose tissue and/or skeletal muscle biopsies were obtained 2-7 days after the second exercise test to determine the protein content of PLIN1, CGI-58, ATGL, HSL, ACSL1, and oestrogen receptor α (ERα) in adipose tissue, and FABPpm, ATGL, ACSL1, CPT1b and ERα in skeletal muscle. Sex comparisons were performed on sub-groups of males and females matched for aerobic capacity relative to fat free mass and classifications of the physical activity level index and fat mass index (n = 14 and 12 for adipose tissue and skeletal muscle mass comparison sub-groups, respectively). **RESULTS:** Moderate strength correlations were found between PFO (mg kg FFMM⁻¹·min⁻¹) and the protein content of ATGL [r = 0.41 (0.05 - 0.68), p = 0.05] and CPT1b [r = 0.41 (0.05 - 0.68), p = 0.05] in skeletal muscle. No other statistically significant bioenergetics correlations were found between PFO and the content of proteins in adipose tissue or skeletal muscle. Females had a greater PFO compared to males when expressed relative to fat-free mass [mean (SD): 7.1 (1.9) and 7.3 (1.7) mg kg FFM⁻¹·min⁻¹ in the adipose tissue and skeletal muscle sub-groups, respectively, p < 0.05]. No statistically significant sex differences were found in the content of any of the measured proteins involved in lipid metabolism in adipose tissue or skeletal muscle. **CONCLUSIONS:** The molecular regulation of PFO may primarily lie within skeletal muscle rather than adipose tissue, involving processes related to intramyocellular triglyceride hydrolysis (ATGL) and mitochondrial fatty acid transport (CPT1b). Future studies should explore alternative molecular mechanisms that may account for sexual dimorphism in exercise fuel metabolism.

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**2995 May 29 1:45 PM - 2:00 PM**

**The Effect Of Ischemic Preconditioning And Hypoxia On Neuromuscular Function During Intense Exercise**

Samuel Halley, Paul Marshall, Jason Siegler, FACSM. Western Sydney University, Sydney, Australia. (Sponsor: Dr Jason Siegler, FACSM)

(*No relevant relationships reported*)

Ischemic preconditioning (IPC) has been proposed to preserve neural drive during fatiguing exercise, however the underlying mechanism of this response remains unclear. Previous research has shown exercises impairing local tissue oxygenation to be more favourable in eliciting the humoral effects of IPC. **PURPOSE:** To determine whether IPC mediated effects on neuromuscular function are dependent on tissue oxygenation. **METHODS:** Eleven resistance-trained males completed four exercise trials (6 sets of 11 repetitions of maximal effort dynamic single-leg extensions) in either normoxic (fraction of inspired oxygen (FiO₂): 21%) or hypoxic (FiO₂: 14%) conditions, preceded by treatments of either IPC (3 x 5 min bilateral leg occlusions at normoxic (fraction of inspired oxygen (FiO₂): 21%) or hypoxic (FiO₂: 14%) conditions, preceded by treatments of either IPC (3 x 5 min bilateral leg occlusions at normoxic (fraction of inspired oxygen (FiO₂): 21%) or hypoxic (FiO₂: 14%) conditions, preceded by treatments of either IPC (3 x 5 min bilateral leg occlusions at normoxic (fraction of inspired oxygen (FiO₂): 21%) or hypoxic (FiO₂: 14%) conditions, preceded by treatments of either IPC (3 x 5 min bilateral leg occlusions at normoxic (fraction of inspired oxygen (FiO₂): 21%) or hypoxic (FiO₂: 14%) conditions, preceded by treatments of either IPC (3 x 5 min bilateral leg occlusions at normoxic (fraction of inspired oxygen (FiO₂): 21%) or hypoxic (FiO₂: 14%) conditions, preceded by treatments of either IPC (3 x 5 min bilateral leg occlusions at normoxic (fraction of inspired oxygen (FiO₂): 21%) or hypoxic (FiO₂: 14%) conditions, preceded by treatments of either IPC (3 x 5 min bilateral leg occlusions at normoxic (fraction of inspired oxygen (FiO₂): 21%) or hypoxic (FiO₂: 14%) conditions, preceded by treatments of either IPC (3 x 5 min bilateral leg occlusions at normoxic (fraction of inspired oxygen (FiO₂): 21%) or hypoxic (FiO₂: 14%))

**RESULTS:** MVC and twitch torque declined 4.8 ± 0.3%, 95% CI 4.7 to 5.0%, d = 1.9, p = 0.001; twitch recruitment: 37 ± 11 Nm, 95% CI 26 to 48 Nm, d = 1.6, p = 0.001), between pre- and post-exercise measurements without reductions in voluntary activation (mean decrease 0.2 ± 6.2%, 95% CI 5.7 to 6.1%, d = 0.05, p = 0.21); there were no differences between conditions. Hypoxia reduced both blood and tissue oxygenation by 5% and 6%, respectively, compared to normoxic conditions (blood oxygenation: 4.8 ± 0.3%, 95% CI 4.7 to 5.0%, d = 1.9, p = 0.001; tissue oxygenation: 3.5 ± 1.5%, 95% CI 2.6 to 4.4%, d = 2.4, p < 0.001), with a further 3% reduction in tissue saturation evident in the hypoxic IPC compared to hypoxic sham trial (mean decrease 1.8 ± 0.7%, 95% CI 0.5 to 3.5%, d = 1.0, p < 0.05).
CONCLUSION: IPC did not affect any measure of neuromuscular function regardless of tissue oxygenation. A reduction in FiO₂ did invoke a humoral response and improved muscle O₂ extraction during exercise, however it did not manifest into any performance benefit.

2996 May 29 2:00 PM - 2:15 PM
Blood Lactate Steady State Is Maintained During Moderate Intensity Interval Training Depending Rest Time Duration
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No relevant relationships reported

Interval training (IT) is a method commonly used by coaches. The rest between stimuli is a variable that can be manipulated in IT. Rest time influences the specificity of workload. Considering that Blood Lactate (BLA) represents the balance of metabolic intracellular production-removal-oxidation, it is very important to determine different levels of Lactate Steady-State (La SS) with variation in rest time, which is able to sustain La SS for longer periods, using IT workouts. PURPOSE: To analyze BLA during 90s of passive rest (pr) in steady-state moderate intensity IT (mIT). In previous work, we have shown that La SS was maintained for 60s of pr (Mazza et al., 2018), without significant differences (SD). METHODS: Eleven trained swimmers (19.4±3.8 y) performed a mIT (BLA 4 to 6 mmol/L). The bout was 10x100m freestyle with 90s pr. BLA and heart rate (HR) were measured at 10s, 50s and 80s at some time during pr, every 2 reps. We applied Shapiro-Wilk test to analyze distribution data. We compared BLA-10s vs. BLA-50s vs. BLA-80s applying One-way ANOVA (p<0.05) in reps 2-4-6-8 and 10; also, we determined Pearson correlation coefficient (r) between BLA-10s, BLA-50s, BLA-80s vs. HR-10s, HR-50s, HR-80s, respectively. RESULTS: BLA data show normal distribution (p>0.05). The mean BLA max./min. values were 6.25/0.58 mmol/L, respectively, at 1.49±0.07 m/s. Statistical analyses are shown in the following table: & SD BLA-10s vs. BLA-50s vs. BLA-80s; * SD BLA-10s vs. BLA-80s. We found a low r between BLA and HR (r=0.25-0.30). CONCLUSION: This work shows that La SS in mIT depends on pr duration to generate sustained metabolic stress during whole exercise - rest bout. BLA-10s vs. BLA-50s does not register SD (except rep. 6). However, BLA-50s vs. BLA-80s are SD, showing a tendency to lower BLA level. La SS is maintained within BLA 4 to 6 mmol/L range with only 1.17 mmol/L differences between max./min. mean values. Also, we found that HR is not valid variable to control metabolic stress in IT.

2997 May 29 2:15 PM - 2:30 PM
Training Alterations In Total Hemoglobin Mass And Plasma Volume In Collegiate Athletes Residing At Altitude
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No relevant relationships reported

Total hemoglobin mass (THM) is directly related to maximal oxygen consumption and can be used to determine blood volume, red cell volume and plasma volume (PV). The effect of training on THM and PV for male and female intercollegiate athletes across sports residing at altitude has received limited attention. PURPOSE: To examine if training alters THM and PV in NCAA DI athletes residing at altitude. In addition, the effects of sex and/or sport were investigated. METHODS: We recruited 88 NCAA DI athletes from the University of Colorado Boulder alpine ski, (8M & 7F), nordic ski (7M & 6F), cross-country (6M & 4F), and biathlon (4M & 3F) teams. The aim of this study was to relate cardiorespiratory fitness (VO²max) and cognitive control to dynamic brain-heart connectivity. A partial least squares analysis characterized the brain-heart connections that significantly and reliably contributed to a relationship between MI and VO²max and cognitive control. RESULTS: One latent variable (p<0.06) represented independent, negative correlations between MI and VO²max, inhibitory control, and cognitive flexibility. High VO²max and cognitive control were positively associated with right-lateralized MIs (boot-strap ratios ≥1.96) in the delta band (1-3 Hz) and negatively associated with left-lateralized MIs (boot-strap ratios ≤1.96) in the delta and theta bands (1-7 Hz). There was no relationship between MIs and cognitive control (posterior) electrodes and the dependent variables (p<.236).

CONCLUSION: The benefits of exercise for cognitive control may be associated with right-lateralized communication between the prefrontal cortex and heart.

For albino, FB and NSKI (996 ± 43, 1169 ± 35 & 1089 ± 64 g, respectively) were not different and did not change with training. Initial THM for controls (894 ± 38.1) was lower than FB and NSKI. Initial PV values for controls, albino, FB and NSKI were 3763 ± 158, 3901 ± 268, 4855 ± 121 and 4597 ± 260 mL, respectively. Initial PV for controls were lower than FB and NSKI, while albino was lower than FB. NSKI had a decrease in PV (−477 ± 157 mL), which then returned to initial values. Conclusion: THM remained constant during training, regardless of sport or sex, indicating that the training stimuli experienced by the athletes may not alter THM. During the course of training certain teams exhibited a decrease in PV, which could be a result of the nature of training stimuli and/or hydration status.

3001 May 29 1:15 PM - 1:30 PM
Aerobic Exercise Regulates Synaptic Homeostasis In The Hippocampal CA1 Region Of APP/PS1/tau Mice
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No relevant relationships reported

PURPOSE: Physical exercise is an important lifestyle behavior that may reduce the risk of Alzheimer’s disease (AD) and delay the onset and progression of AD. Most of the mechanisms underlying these effects are based on molecular biology and little reports are involved in cellular function. In this study, we were to explore the changes
of synaptic homeostasis in the early pathology (6 months) of APP/PS1/Tau transgenic (3xTg) mice, and the possible mechanism of aerobic exercise improving synaptic plasticity.

METHODS: 3xTg mice (2 months old) were randomly divided into exercise groups and sedentary groups (AS, AE), and C57BL/6J mice as cohort control (CS, CE). The exercise groups would run on the treadmill for 16 weeks. Brain slice patch clamp were used to detect changes of I-O curve, PPF, LTP, LTD, miniature IPSCs (mIPSCs), miniature EPSCs (mEPSCs), and E/I ratio of pyramidal neurons in hippocampal area CA1.

RESULTS: In hippocampal area CA1 of AS, the I-O curve (0.31±0.02) was reduced compared with the CS (0.60±0.02, p<0.01), also in LTD (0.31±0.02 vs 0.51±0.02, p<0.01) and mIPSCs amplitude (12.83±0.35 pA, p=0.01) and frequency (0.25±0.02 vs 0.81±0.02, p<0.01) of pyramidal neurons. At the interval time of 20 ms, the PPF (1.78±0.08 vs 1.55±0.04, p<0.01) was increased, as were LTD (62.61±3.25 vs 76.14±2.88%, p<0.01), the amplitude of mIPSCs (23.48±0.44 vs 26.11±0.55 pA, p<0.05) and E/I ratio (0.51±0.02 vs 0.60±0.02, p<0.01) of pyramidal neurons. Aerobic exercise reversed the changes above of AS in I-O curve (0.74±0.03, LTD (170.97±5.42%), the frequency of mEPSCs (0.51±0.04 vs 0.60±0.02, p<0.01), the amplitude of mIPSCs (41.20±13.31 pA) and E/I ratio (0.71±0.03), and decreased PPF (1.42±0.07, LTD (79.01±4.99), the amplitude of mIPSCs (11.52±0.29 pA) and the frequency of mIPSCs (1.72±0.02 vs 2.05±0.02, p<0.01) of pyramidal neurons. Meanwhile, those electrophysiology signals were also increased in the CE group.

CONCLUSIONS: Aerobic exercise could regulate synaptic homeostasis plasticity by increasing mIPSCs frequency and mIPSCs amplitude, and decreasing mEPSCs amplitude and mIPSCs frequency. Then it would improve basic synaptic transmission and LTD, weaken LTD in hippocampal area CA1 of the early pathology in 3xTg mice to enhance synaptic plasticity.

3002 May 29 1:30 PM - 1:45 PM
Is Aerobic Fitness Associated With The Dopaminergic System? Evidence From Spontaneous Eye Blink Rate
Ryuta Kuwamizu, Kazuya Suwabe, Takemune Fukuie, Genta Ochi, Taichi Hiraga, Hideaki Soya. Faculty of Health and Sport Sciences, University of Tsukuba, Tsukuba, Ibaraki, Japan.

Many studies, including ours, have revealed that aerobic fitness, as a physiological indicator of physical activity, is associated with cognitive performance based on their prf doronal system and the hippocampus (Hyodo, Soya et al., Neuroimage, 2016; Suwabe, Soya et al., Sci Rep, 2017). As a potential neurobiological basis for this, the brain dopaminergic system is postulated by a animal and a few human studies. Current studies hypothesize that higher physical activity levels may prevent elderly peoples from declining cognitive function probably via a protective effect against reduced dopamine. D2-3-receptor availability (Köhnecke et al., Neuroimage, 2018; Jonasson et al., Neuroimage, 2019). It remains uncertain, however, whether this association could generally be observed in a healthy population without cognitive decline.

To this end, we measured spontaneous eye blink rate (EBR), a potential non-invasive marker for activity in the dopaminergic system related to D2-receptors (Groman et al., J Neurosci, 2014). PURPOSE: We examined the association between aerobic fitness, physical activity and EBR as an indicator of the dopaminergic system in healthy young adults.

METHODS: Thirty-six 18- to 24-year-old healthy young men completed an aerobic fitness assessment (V(0)max) using a graded exercise test with a recurrent ergometer, self-reported on their leisure-time physical activity (the Japanese language version of the International Physical Activities Questionnaire), and had their EBR measured while staring at a fixation cross while at rest.

RESULTS: Greater aerobic fitness (V(0)max) was correlated with both higher leisure-time physical activity (p=0.51, p<0.01) and higher EBR (p=0.40, p<0.05) for controlling for age. In addition, Leisure-time physical activity was also positively correlated with EBR (p=0.37, p<0.05).

CONCLUSION: These results show that aerobic fitness is associated with EBR in healthy young adults, supporting the hypothesis above that aerobic fitness is an indicator of physical activity associated with cognitive function via the dopaminergic system related to D2-3-receptors.

3003 May 29 1:45 PM - 2:00 PM
Forced Running Exercise Modulates Amyloid-beta Protein Clearance And addegradation Pathways Involved In Prevention Of Alzheimer'S Disease
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PURPOSE: Most of studies demonstrate positive effects of exercise on AJ levels in Alzheimer’s Disease (AD) model, while a small subset of investigations report no change. Nearly all studies using the APP/PS1 mouse showed reduced AJ levels after a forced exercise, but studies using the 3xTg-AD mouse did not after a voluntary exercise. Discrepancies in the data may be due to the wide range of transgenic animal strains, starting age, intervention type, and length of intervention used in these studies. Here, we used 12-week protocol starting with different age of 3xTg mouse to investigate forced running effect on AJ levels.

METHODS: 6, 9 and 12 months 3xTg mice were randomly divided into exercise and sedentary groups, 2-month 3xTg mice as the control group. The exercise groups would run on the treadmill for 12 wks. Immunofluorescence and Dot blot were used to detect AJ plaque and soluble AJ respectively. Western blot was used to detect β-site APP cleaving enzyme (BACE1) and AJ degradation or clearance enzyme Neprilysin (NEP) in the cerebral cortex and hippocampus and Insulin-degrading enzyme (ID) in liver.

RESULTS: The hippocampal and cortical tissue showed soluble AJ increased with age. Obvious AJ plaque accumulation was showed at 9 and 12-month-old. With AD-pathology the BACE1 levels were increased (p<0.05) while NEP expression decreased (p<0.05) in hippocampus and cortex, and ID expression decreased (p<0.05) in liver. Disturbances went more severe with aging. Exercise treatment ameliorated soluble AJ aggregation and AJ plaque, BACE1 (0.70±0.13, 0.78±0.13, 0.81±0.08/1.06±0.12, + saline, + exercise) and NEP (1.50±0.10, 1.91±0.12, 1.00±1.02, + saline, + exercise). changes were partially protected by exercise.

CONCLUSIONS: In the 3xTg-AD mouse at different age of 6, 9 and 12 months, 12 wks forcing treadmill exercise can obviously reduce the levels of AJ with lower BACE1, higher NEP expression in the brain and IDE of the liver. Although it is not definite if forced exercise interventions are better for reducing AJ levels, the benefits of exercise interventions still support the value of this healthy lifestyle against neurodegeneration.

3004 May 29 2:00 PM - 2:15 PM
Effects Of Aerobic Exercise On The Nicotine Addiction Induced Inhibitory Synaptic Plasticity In The Vta
Yan Li, Jie Zhang, Li Zhao. Beijing Sport University, Beijing, China.

(No relevant relationships reported)

PURPOSE: Disinhibition of the ventral tegmental area (VTA) dopamine neurons has been implicated in nicotine addiction. This study aimed to investigate the effect of aerobic exercise on the nicotine addiction behavior in mice, and the effect on GABAergic transmission and dopaminergic activity in the VTA.

METHODS: 2 months old male C57BL/6J mice were randomly divided into sedentary (SS), sedentary + nicotine group (SN), exercise + saline group (ES) and exercise + nicotine group (EN) respectively. The ES and EN groups were made to run on the treadmill for 1 hour per one day, five times a week, for 12 weeks. The exercise workload consisted of running at a speed of 12 m/min for the first 10 min, 15 m/min for the last 30 min, with 0% grade of inclination. The conditioned place preference (CPP) assay was used to evaluate nicotine addiction related behavior. In the CPP assay, SN and EN mice were given an intraperitoneal (i.p.) injection of nicotine (0.5 mg/kg) while SS and ES mice were given an injection of saline. Patch clamp was used to investigate the dopamine neuron excitability and GABAergic transmission in the VTA. Immunofluorescence was used to detect the expression of tyrosine hydroxylase (TH) in the VTA.

RESULTS: 8 weeks of treadmill exercise decreased nicotine exposure induced CPP expression (CPP score, SS, -33.69±15.75; SN, 121.51±14.53; ES, +21.72±15.12; EN, 66.34±15.12; SS vs. SN, p<0.001; ES vs. SN, p<0.05, two-way ANOVA). Exercise decreased nicotine CPP induced dopamine neuron hyperexcitability (SS, 3.36±0.45; SN, 6.63±0.56; ES, 3.22±0.05; EN, 4.60±0.18; SS vs. SN, p<0.001; ES vs. SN, p<0.01, two-way ANOVA). Exercise decreased nicotine CPP induced increase of TH expression in the VTA (relative fluorescence intensity, SS 1.00; ES, 2.03±0.15; EN, 1.38±0.06; SS vs. ES, p=0.04; SS vs. EN, p<0.001, two-way ANOVA). Exercise restored nicotine CPP induced impairment of GABA transmission in the VTA (IPSCs frequency, % as baseline, SS, 154.62±86%/SN, 102.19±62%; ES, 141.36±6.84; EN, 121.82±24.41; SS vs. SN, p<0.001; EN vs. SN, p<0.05, two-way ANOVA).

CONCLUSIONS: Aerobic exercise restores nicotine addiction induced VTA dopamine neuron hyperexcitability by enhancing the inhibitory transmission. Supported by the China Postdoctoral Science Foundation (2018M641260, 2019T120067).
Task-evoked pupillary responses (PR) are established psychophysiological measures for neural resource allocation. During working memory tasks, pupils dilate proportionally to increasing cognitive demands and constrict when demands exceed resource availability. PRs have demonstrated greater sensitivity to load-dependent processing differences in clinical populations, beyond performance accuracy, under high cognitive demands. Few studies have examined concussion history, sex, and performance accuracy effects on PRs across varying cognitive load levels. PURPOSE: To examine effects of concussion history, sex, and performance accuracy on PR in healthy individuals during a digit-span task. METHODS: Participants self-reported sex (female vs. male) and concussion history (yes vs. no), and completed a backwards digit-span task in a single testing session. A virtual reality headset with 60Hz infrared eye tracking displayed the task and recorded pupil size fluctuations. Pupil size (diameter in mm) was recorded before each trial (baseline=3sec) and fixating randomly presented digit sequences between 4 and 14 digits long (retention=2sec). PR was calculated as the mean size during retention time normalized to mean baseline. Accuracy was calculated as the proportion of correctly recalled digits by serial position. A mixed effects model examined concussion history, sex, and interactions. Specifically, females exhibited smaller mean PRs compared to males. Smaller mean PRs were also associated with higher average task accuracy. CONCLUSION: In our study, females exhibited smaller overall pupillary responses during a digit-span working memory task compared to males, indicating potential sex-dependent processing differences. The association between better task accuracy and smaller PRs may further support PR measures to better inform neurocognitive processing differences in healthy and clinical populations, when demands exceed cognitive resource availability.

PURPOSE: We evaluated the effects of several behaviors (e.g., acute exercise, fist clenching, and saccades) on episodic memory, and whether prefrontal cortex oxyhemoglobin (PFC O

PUPILARY RESPONSES INDICATE WORKING MEMORY PROCESSING DIFFERENCES: IMPLICATIONS FOR HEALTHY AND CLINICAL POPULATIONS

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(No relevant relationships reported)

PURPOSE: An increasing number of studies have shown a positive correlation between aerobic fitness and cognitive control, and hippocampal memory performance. However, the relationship between muscular strength and specific domains of cognitive function has not yet been well elucidated. The aim of this study was to examine cross-sectional relationships between muscular strength and cognitive control (i.e., attention and inhibitory control), as well as hippocampal-dependent relational memory. METHODS: Adults (N=35) between 45 and 64 years underwent strength assessments measured by leg extension one-repetition maximum (1RM), maximal voluntary isometric contraction (MVC), and isokinetic knee extension. Selection attention, inhibitory control, and hippocampal-dependent relational memory was assessed using the Flanker, Go/NoGo, and a Spatial Reconstruction task, respectively. Lean mass was measured via dual X-ray absorptiometry (DXA). RESULTS: Following adjustment for covariates (i.e., age, sex, and lean mass), greater MVC (r=−0.37, P=0.04) and isokinetic peak knee extension torques measured at 60°·s−1 (r=−0.47, P=0.008), 120°·s−1 (r=−0.37, P=0.04), and 180°·s−1 (r=−0.39, P=0.03) were related to faster incongruent reaction time during the Flanker task. Misplacement error during spatial reconstruction task was inversely related to peak knee extension torques measured at 120°·s−1 at the trend level (r=−0.36, P=0.05). No significant associations were observed for Go/NoGo accuracy (all r≤0.34, all P≤0.06). CONCLUSION: Individuals with greater muscular strength exhibit greater cognitive function. These findings provide insights into the potential for domain-specific interrelationships between muscular strength and attentional abilities over memory performance and inhibitory control. This work was funded by The Beef Checkoff.

F-14

Free Communication/Slide - Older Adults: Methods, Interventions, and Outcomes

Friday, May 29, 2020, 1:00 PM - 3:00 PM
Room: CC-2022

3008

Chair: Loretta DiPietro, FACSM. The George Washington University School of Public Health and Health Services, Washington, DC.

(No relevant relationships reported)

3009

May 29 1:00 PM - 1:15 PM

Effect Of Type And Intensity Of Community-based Exercise Interventions In Older Women

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(No relevant relationships reported)

PURPOSE: To assess the effect of different community-based exercise interventions on hemodynamic and functional variables in older women. METHODS: 33 sedentary or insufficiently active older women (69 ± 5 y) were randomly assigned to perform a twice-weekly community-based moderate-intensity continuous aerobic training plus resistance training (MICT+RT), high-intensity interval training plus resistance training (HIIT+RT) or resistance training (RT) programs. Anthropometric (weight, height and BMI), hemodynamic (resting blood pressure and carotid-femoral pulse wave velocity) and functional variables (seat-and-stand, handgrip, five times sit-to-stand (FTSS), timed up-and-go (TUG), and 6-minute walking (6MW) tests) were assessed before and after 9 months of follow-up.
RESULTS: There were no significant difference between groups in any variable at baseline. Anthropometric and hemodynamic variables, as well as sex and-at-race and handgrip did not change during follow-up in any group. However, FTSS, TUG and 6 MW improved (p < 0.05) similarly between groups during follow-up (Table 1).

CONCLUSION: The present preliminary results suggest that twice-weekly community-based exercise programs of different types and intensity are effective to improve functional capacity, but not anthropometric and hemodynamic variables, in older women.

Table 1. Anthropometric, hemodynamic and functional variables before and after 9 month follow-up

<table>
<thead>
<tr>
<th>Variable</th>
<th>MICT, RT</th>
<th>HIIT+RT</th>
<th>RT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>70 ± 12</td>
<td>74 ± 14</td>
<td>66 ± 9</td>
</tr>
<tr>
<td>BMI</td>
<td>28.2 ± 4.2</td>
<td>28.5 ± 5.1</td>
<td>27.0 ± 4.4</td>
</tr>
<tr>
<td>Systolic BP (mm Hg)</td>
<td>118 ± 11</td>
<td>122 ± 8</td>
<td>124 ± 19</td>
</tr>
<tr>
<td>Diastolic BP (mm Hg)</td>
<td>64 ± 6</td>
<td>66 ± 7</td>
<td>63 ± 7</td>
</tr>
<tr>
<td>PWV (cm/s)</td>
<td>9.4 ± 2.3</td>
<td>9.0 ± 3.0</td>
<td>10.5 ± 10.1</td>
</tr>
<tr>
<td>Seat and reach (cm)</td>
<td>22.5 ± 7.7</td>
<td>28.0 ± 8.2</td>
<td>23.0 ± 21.5</td>
</tr>
<tr>
<td>Handgrip (kg)</td>
<td>25.0 ± 5.3</td>
<td>24.0 ± 4.3</td>
<td>22.5 ± 5.9</td>
</tr>
<tr>
<td>FTSS (0-21)</td>
<td>11.6 ± 2.1</td>
<td>7.8 ± 1.6**</td>
<td>11.1 ± 2.9</td>
</tr>
<tr>
<td>TUG (s)</td>
<td>8.3 ± 1.1</td>
<td>6.2 ± 1.3*</td>
<td>7.6 ± 2.5</td>
</tr>
<tr>
<td>6MW (m)</td>
<td>482 ± 33</td>
<td>512 ± 43**</td>
<td>464 ± 88</td>
</tr>
</tbody>
</table>

FTSS: five six-time sit-to-stand test; HIIT+RT: high-intensity interval training plus resistance training group; PWV: carotid-femoral pulse wave velocity; RT: resistance training group; TUG: timed up-and-go test; 6MW: six minute walking test; Asterisk: significant difference from before follow-up at the same group (*P < 0.05; **P < 0.01; ***P < 0.001).

REGULAR exercise is associated with a reduced risk of developing chronic diseases and improved physical capacity. However, to our knowledge, the effects of modality, intensity and consequences of detraining have not yet been investigated in the elderly population. We sought to evaluate and compare the effect of modality and intensity (moderate intensity continuous aerobic training - MICT, high intensity interval aerobic training - HIIT, resistance training - RT, or combined - MICT + RT and HIIT + RT) of a training program, the hemodynamic and functional variables of elderly women after 12 weeks of training and 16 weeks after their interruption.

PURPOSE: To verify the effect of exercise modality and intensity on the hemodynamic variables of the elderly.

METHODS: 69 elderly women (69.19 ± 7.89 years) were randomized into MICT (n = 29), RT (n = 15), MICT + RT (n = 12), and HIIT + RT (n = 13). Participants performed physical exercises twice a week during 60 minutes. The variables investigated were blood pressure (BP), heart rate (HR), abdominal circumference (AC) at pre, after 12 weeks of intervention, and after 16 weeks of training interruption (detraining).

RESULTS: Diastolic blood pressure decreased in HIIT + RT between pre and untrained (p < 0.01) and in RT between post and untrained (p < 0.02). There was a significant increase in HR between post and detraining MICT (p <0.02) and a decrease in MICT + RT between pre and post training (p <0.00), with no significant difference in detraining. AC decreased in HIIT + RT between pre and post (p <0.03), in RT between pre and detraining (p <0.009) and post and detraining (p <0.00). There was an increase in post and detraining WC for MICT (p <0.05) and MICT + RT (p <0.03).
**3013**

**May 29 2:00 PM - 2:15 PM**

**Effects Of Moderate Versus Vigorous Intensity Exercise Training In Older Adults With Prediabetes**


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(No relevant relationships reported)

**PURPOSE:** Aerobic exercise is recommended to improve glycemic control; however, the optimal intensity of exercise for older adults with prediabetes is unknown. The objective of this pilot study was to compare the effects of moderate vs. vigorous intensity aerobic exercise on glycemic control and non-exercise physical activity (NEPA).

METHODS: 19 older adults (14F: 68.1±5.8 yrs) with prediabetes (HbA1c 5.7-6.4%) or fasting glucose 100-125 mg/dL were randomized to 12-weeks of supervised aerobic exercise (45-min sessions 4 days/wk) at either moderate (MOD: 50-60% HRmax) or vigorous (VIG: 60-70% HRmax) intensity. Free-living aerobic exercise (24 min, mean: 20.8±4.7min/d) was measured using continuous glucose monitors (CGM, Dexcom). NEPA (~1.5 METs, excluding exercise sessions) was assessed using a thigh worn accelerometer (ActivPAL v4). A 3h Oral glucose tolerance test (OGTT, 75g) was performed at baseline and following the exercise intervention (72-96h following the last exercise bout) to compare free-living CGM and as measure of insulin sensitivity (Matbuda Index). Data are presented as mean±SE.

RESULTS: Adherence rates to the exercise interventions were 85±9% and 80±5% in MOD and VIG with mean heart rates during exercise of 99±4 bpm (65% HRmax) and 123±8 bpm (74% HRmax), respectively. Mean 24h glucose (~8:41±4.6 vs. ~2:21±6.7 mg/dL) and percent of day ≥140 mg/dL (~7.1±11.0% vs. 7±4.6%) did not significantly change in MOD or VIG, respectively. However, there was a significant group by time interaction (p=0.05) for change in insulin sensitivity (MOD vs. VIG: +2.4±1.1 vs. +3.4±0.8). There were no differences between groups in change of NEPA, fasting glucose, or 24h glucose. Changes in free-living CGM were not significantly correlated with changes in OGTT outcomes.

CONCLUSION: In older men and women with prediabetes, both MOD and VIG had minimal effects on free-living glycemic control, but MOD induced greater improvements in insulin sensitivity. These preliminary results suggest that a more comprehensive lifestyle intervention combining dietary intervention and exercise may be needed to improve glycemic control in this population.

**Table 1. Blood pressure, heart rate and abdominal circumference during follow-up**

<table>
<thead>
<tr>
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<th>HIIT+RT</th>
<th>MICT+RT</th>
<th>MICT</th>
<th>RT</th>
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<tbody>
<tr>
<td><strong>Systolic blood pressure (mmHg)</strong></td>
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<tr>
<td>Pre</td>
<td>136±17</td>
<td>129±19</td>
<td>131±17</td>
<td>127±17</td>
</tr>
<tr>
<td>Post</td>
<td>132±27</td>
<td>126±17</td>
<td>133±20</td>
<td>120±20</td>
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<tr>
<td>Detraining</td>
<td>129±15</td>
<td>119±15</td>
<td>126±20</td>
<td>133±14</td>
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<tr>
<td><strong>Diastolic blood pressure (mmHg)</strong></td>
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<tr>
<td>Pre</td>
<td>78±9</td>
<td>68±10</td>
<td>68±11</td>
<td>71±9</td>
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<tr>
<td>Post</td>
<td>73±13</td>
<td>70±7</td>
<td>71±8</td>
<td>68±10</td>
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<tr>
<td>Detraining</td>
<td>72±7†</td>
<td>66±9</td>
<td>66±9</td>
<td>72±10†</td>
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<td><strong>Heart rate (bpm)</strong></td>
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<td>74±8</td>
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<td>Post</td>
<td>70±7</td>
<td>70±7†</td>
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<td>75±6</td>
<td>72±12</td>
<td>73±8†</td>
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<tr>
<td><strong>Abdominal circumference (cm)</strong></td>
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<td>Pre</td>
<td>91±14</td>
<td>97±15</td>
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<tr>
<td>Post</td>
<td>96±13</td>
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<tr>
<td>Detraining</td>
<td>97±12</td>
<td>108±21†</td>
<td>99±10</td>
<td>111†</td>
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</tbody>
</table>

HIIT+RT: high-intensity interval training plus resistance training; MICT: moderate-intensity continuous training; MICT+RT: moderate-intensity continuous training plus resistance training; RT: resistance training; * different from pre (P<0.05); † different from pos (P<0.05)

**3014**

**May 29 2:15 PM - 2:30 PM**

**The Stay Strong, Stay Healthy Program's Effect On Fall Risk In Older Adults**


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(No relevant relationships reported)

Falling and fear of falls among older adults can have significant impacts on daily life such as restricted activity, functional decline, and social isolation. Exercise interventions need to target modifiable risk factors to have the greatest impact.

**PURPOSE:** The first aim was to determine the effectiveness of an eight-week Stay Strong, Stay Healthy (SSSH) exercise intervention on older adults’ fear of falling and risk of falls. The second aim was to determine the strongest predictors of reported number of falls among older adults.

METHODS: 60 adults over the age of 60 yrs, were randomized into SSSH, active control (WALK), or sedentary control (CON) groups. 46 participants (SSSH n=15, WALK n=17, CON n=14) completed pre/post intervention questionnaires on physical activity (PA), fall of fear, and sleep quality using the Pittsburgh Sleep Quality Index Survey (PSQI). Participants also completed the 8 ft timed up and go (TUG) and 30 x sit to stand (30STS), dynamic balance tasks and grip strength testing. Repeated measures ANOVAs were used to determine group (SSSH, WALK, CON) × time (pre, post) interaction effects for TUG, 30STS, and grip strength; one-way ANOVAs were used to analyze percent changes (%Δ); and simple linear regression was used to predict the number of falls in the last 12 months; alpha was at 0.05.

RESULTS: SSSH and WALK significantly improved 30STS performance by 2.4 repetitions and 1.1 repetitions, respectively, while CON did not improve. PSQI scores significantly increased (worsened) in CON (p=0.040), did not change in WALK, and decreased (improved) by 1.3 points in SSSH (p=0.009).

Reported PA did not change for WALK or CON; however, SSSH increased by 60+ min/wk (p=0.049). A significant time effect was observed as TUG times decreased and grip strength did not change for all groups. CON and WALK increased their overall fear of falling scores by 7.7% and 3.9% respectively, while SSSH decreased by 2.3%.

The strongest predictive model for the number of falls reported in the past 12 months included PSQI scores, PA, and grip strength (R=0.282, p=0.003). CONCLUSIONS: These data suggest participation in eight weeks of the SSSH significantly improves important modifiable risk factors (e.g., sleep and PA), and reduced fear of falling scores which is consistent with our prediction model for the number of falls sustained.

**3015**

**May 29 2:30 PM - 2:45 PM**

**The Stay Strong, Stay Healthy Program Improves Physical Function And Fall Risk In Older Adults**


Email: bakerbc@health.missouri.edu

(No relevant relationships reported)

The aging process, even in the absence of chronic disease, is marked by a decline in the mass, quality, and function of skeletal muscle, increasing the risk of falls.

**PURPOSE:** The purpose was to determine effectiveness of an 8-week Stay Strong, Stay Healthy (SSSH) exercise intervention on improving older adults’ muscle strength, balance, dynamic balance, and fall risk compared to controls. METHODS: 60 adults aged ≥60 yrs, were randomized into SSSH, active control (WALK), or sedentary control (CON) groups. 46 participants (SSSH n=15, WALK n=17, CON n=14) completed pre and post intervention general health and physical activity (PA) questionnaires, the Pittsburgh Sleep Quality Index Survey (PSQI), and total body DXA. Participants also completed the 10 m walk test (10MWT), 8 ft timed up and go (TUG), 30 × sit to stand (30STS), back scratch (BS), sit and reach flexibility tests, and the CDC four phase balance test.

Repeated measures ANOVAs were used to determine group (SSSH, WALK, CON) × time (pre, post) interaction effects and percent changes (%Δ) were analyzed using one-way ANOVAs, alpha was set at 0.05. RESULTS: SSSH and WALK participants significantly improved 30STS performance by 2.4 repetitions (p < 0.001) and 1.1 repetitions (p < 0.008), respectively, while CON did not improve. PSQI scores significantly increased (worsened) in CON (p = 0.040), did not change in WALK, and decreased (improved) by 1.3 points in SSSH (p = 0.009).

Average BS distance significantly increased (worsened) in CON (p = 0.040), did not change in WALK, and decreased (improved) by 1.3 points in SSSH (p = 0.009). A significant time effect was observed as TUG times decreased and grip strength did not change for all groups. CON and WALK increased their overall fall risk of falling scores by 7.7% and 3.9% respectively, while SSSH decreased by 2.3%.

The first aim was to determine the effectiveness of an eight-week Stay Strong, Stay Healthy (SSSH) exercise intervention on older adults’ fear of falling and risk of falls. The second aim was to determine the strongest predictors of reported number of falls among older adults. The first aim was to determine the effectiveness of an eight-week Stay Strong, Stay Healthy (SSSH) exercise intervention on older adults’ fear of falling and risk of falls.
3016 May 29 2:45 PM - 3:00 PM

Influence Of Exercise And Gardening Activity On Successful Aging: A Six-year Cohort Study

Yuxin Yang, Xu Wen. Zhejiang University, Hangzhou, China. Email: yangyx20@163.com

Purpose: Population aging has become a prominent social problem in China. This study aimed to examine the influence of exercise and gardening activity on successful aging (SA).

Methods: This study was based on the 2008-2014 data set of Chinese Longitudinal Healthy Longevity Survey (CLHLS). A total of 5245 elderly people aged 65 and older were included in this study. SA was defined as no major illness, being free of disability, normal cognitive function, engaging in social or productive activity, and satisfaction on life. Correlates of SA included demographics (gender and age) and socio-economic feature (education). With activities being measured in 2008 and 2011, SA being assessed both in 2008, 2011 and 2014 Binary logistic regression analysis was used to determine whether these two activities have positive effects on SA.

Results: According to the activity data of 2008 and SA situation in 2014, the regression analyses indicated that regular exercise (OR=1.223, 95%CI: 1.001-1.495) and gardening (OR=1.640, 95%CI: 1.272-2.115) were significant predictors to better SA(P<0.05). From the combination activity data of 2008 and 2011, compared with the sedentary elderly, the elderly participated exercise (OR=1.661, 95%CI: 1.286-2.145, P<0.05) or gardening (OR=1.807, 95%CI: 1.331-2.453, P<0.05) continuously were found to have higher odds to be successful agers in 2014. Moreover, the results showed that the elderly just participated from 2011 have higher probability to be successful agers in 2014 than the sedentary elderly, the odds ratios of exercise and gardening were 1.396 and 1.441 respectively.

Conclusion: These findings suggest that exercise and gardening activity may have positive effects on SA, and continuous participation has better effects.

F-32 Thematic Poster - Blood Flow Restriction

Friday, May 29, 2020, 3:15 PM - 5:15 PM

3070 Room: CC-2010

Chair: Truls Raastad. Norwegian School of Sport Sciences, Oslo, Norway. (No relevant relationships reported)

3071 Board #1 May 29 3:15 PM - 5:15 PM

Exercise With Blood Flow Restriction To Improve Muscular And Physical Function After Total Knee Arthroplasty

Alexander Kueck1, Benjamin Cockfield2, Alicia DenHerder1, Lydia Lytle1, Isaac Wodig3, Steven Elmer3. 1Central Michigan University, Mt Pleasant, MI. 2Michigan Technological University, Houghton, MI. 3Aspirus Keweenaw Outpatient Therapies, Laurium, MI. 4Michigan Technological University, Houghton, MI. Email: bacockfi@mtu.edu (No relevant relationships reported)

After a total knee arthroplasty (TKA), quadriceps strength and physical function can be impaired for several years. Blood flow restriction (BFR) exercise is an effective method to improve muscular and physical function in clinical populations with knee joint pathologies. To date, there are two case studies documenting application of BFR after TKA. A next step is to determine the feasibility of BFR in a larger TKA cohort.

PURPOSE: To evaluate the effectiveness of a 10wk home-based BFR exercise program to improve muscular and physical function after TKA. METHODS: Six adults (age: 59±9yrs, BMI: 33±5) with a unilateral TKA (2.7±1.7yrs post-surgery) performed body weight half squats, isolated knee extension using a resistance band, and walking exercises with BFR 3x/wk for 10wk. During exercise, blood flow in the affected limb was restricted using a 15cm wide thigh cuff inflated to 50% of limb occlusion pressure which was identified using Doppler ultrasound. Outcome measures of vastus lateralis thickness, maximal knee extensor isometric torque, and physical function (repetitions performed during 30s chair stand test, distance covered during 6min walk test) were assessed at baseline and post-training. RESULTS: Participants completed 98% of the home-based BFR training sessions and tolerated the exercise program well as joint pain (0.6±0.1cm) and muscle soreness (0.5±0.1cm) were very low (0-10cm visual analogue scale). Vastus lateralis thickness and knee extensor strength in the affected leg increased by 18±11% and 17±13%, respectively (both P<0.05). After training, number of repetitions during the 30s chair stand test increased (11±2 vs. 18±4 repetitions, p<0.01) and this change (6 repetitions) exceeded the minimally important clinical difference. There was a significant increase in distance covered during the 6min walk test (511±28 vs. 556±36m, 9±7%, p<0.03) but this improvement (46m) did not exceed the clinical threshold. CONCLUSION: Results from this pilot study are promising and suggest that home-based BFR exercise can be feasible, safe, and effective for improving muscular and physical function after TKA. Further research is needed to confirm these initial findings in a larger randomized TKA control trial.

3072 Board #2 May 29 3:15 PM - 5:15 PM

Acute Physiological Responses To Low-intensity Exercise With Different Levels Of Blood Flow Restriction

Jia Wei1, Zhengqiu Gu1, Yongdi Zou1, Xiaolu Wang1, George Nassiotis2, Yongmeng Li3. 1Shanghai University of Sport, Shanghai, China. 2City Unity College, Athens, Greece. 3Aspirus Keweenaw Outpatient Therapies, Laurium, MI. Email: weijia_gavin@807@163.com (No relevant relationships reported)

PURPOSE: External pressure is a key factor in blood flow restriction (BFR) training. Previous studies have used a limited range of occlusion pressures to compare the acute physiological and perceptual responses during leg exercise. The aim of this study was twofold: i) to compare the physiological and perceptual responses of low-intensity exercise (LI) with different levels of BFR, and ii) to compare LI with BFR on the bike with high-intensity (HI) exercise without BFR.

METHODS: Twenty-one healthy, moderately-trained male (age: 24±6.2 yrs; VO2peak 47.2±7.0 ml/kg/min, mean±sd) volunteered to perform one maximal graded exercise test on the bike and seven 5-min constant intensity exercise bouts on separate days and in a counterbalanced order. Six bouts were at 40% peak power (Ppeak), LI; six bouts without BFR and five with different levels of BFR (40%, 50%, 60%, 70%, 80% of arterial occlusion pressure, LI-BFR40/50/60/70/80). Finally, they performed one HI bout (70%
Resistance training (RT) with blood flow restriction (BFR) induces similar adaptations to traditional RT but uses markedly lower training loads. However, information about the acute exercise pressor, hemodynamic, and local metabolic cost of this training approach is sparse. These data are needed to understand the acute safety implications of this training approach and help identify an optimal BFR protocol.

**PURPOSE:** To compare the acute central and systemic cardiovascular, and local metabolic responses to resistance exercise performed with continuous (BFR-C) and intermittent (BFR-I) BFR.

**METHODS:** 12 resistance-trained males (mean ± SD aged 22.3 ± 3.2yrs, 1.82 ± 0.06m, and 84.1 ± 9.0kg) performed 4 separate acute resistance training sessions in a random order, each separated by 7 days. Training sessions involved four sets of squats-based RT at 30% of individuals’ 1 repetition maximum with 1) no BFR (CON), 2) BFR-C, 3) BFR-I, and 4) traditional high load training at 70% of 1 repetition maximum with no BFR (HL). Systemic blood pressure and derivatives of cardiac output, central aortic blood pressure wave characteristics, and local blood volume and metabolism were assessed periodically during, and after each training session. Data were assessed by two-way ANOVA with Bonferroni-corrected post-hoc comparisons.

**RESULTS:** All sessions similarly increase average metabolic demand, seen by a decreased tissue saturation index (-15%, 95% CI 13.3 to 17.4, p<0.05). Whilst changes in haemoglobin-derived Vastus Lateralis blood volumes were similar between conditions, they were higher with BFR-C than CON (6.97 μmol/L, 95% CI 0.2 to 13.6, p<0.05). The MT, ITmax, R-ITmax and Pmax in both dominant and non-dominant limbs suggesting both central and peripheral mechanisms of action.

**CONCLUSIONS:** Adding BFR to resistance training didn’t exacerbate the magnitude or duration of the associated cardiovascular stress.
were placed on the proximal thigh at the level of the gluteal fold and were inflated to 80% of the participants’ limb occlusion pressure (LOP), which was assessed prior to participation. Participants completed a five-minute dynamic warm-up wearing the blood flow restriction cuffs, and the same dynamic warm-up was completed during the control intervention without the use of the cuffs. After each warm-up, a three-minute revascularization period was provided before participants ran a 100-meter sprint at maximal effort, in which 25, 50, and 100-meter times were recorded. Heart rate was measured throughout the entirety of the study, and RPE was measured immediately after the sprint for both trials. Time measures, RPE scores, and heart rate were compared using a paired samples t-test (α < .05). RESULTS: There were no significant differences between control and BFR sprint times, post warm-up HR, or post run HR. There was a significant difference between the control and BFR RPE scores (3.14 ± 0.66 vs. 4.79 ± 1.42, p < .001). CONCLUSION: We are currently examining evidence investigating the acute effects of BFR. Based on our results, there were no significant differences in sprint times between the control and BFR trials. RPE scores during the BFR trial were significantly higher than the control, indicating that participants felt the intensity of the BFR trial was more difficult although the times did not vary. Although not statistically different, average heart rates in the BFR trial were lowered by up to nine beats per minute compared with the control. This may indicate the perceived difficulty of the BFR trial as participants possibly could not exert themselves as much as when completing the control trial. These results do not support acute use of BFR to increase short-term performance, but more research should be performed.

Aerobic exercise with blood flow restriction (BFR) is emerging as an effective method to improve both aerobic capacity and muscular function. Using an inflatable cuff, blood flow is usually restricted during walking and cycling. The extent to which BFR can be applied during upper-body aerobic exercise such as arm cranking is not well documented. Arm cranking with BFR might offer an exercise option for clinical populations that need to exercise upper-body muscles (e.g., wheelchair users, individuals with shoulder injuries). PURPOSE: To evaluate physiological and perceptual responses to acute submaximal arm cranking with BFR. METHODS: Female and male adults (age: 23±4yrs, arm cranking VO2peak:33±8ml/kg/min) performed 4 intermittent arm cranking protocols (6x2 min, 1min recovery): 1) low-load arm cranking (LL, 40% VO2peak), 2) low-load arm cranking with BFR (BFR, 40% VO2peak), and 3) high-load arm cranking (HL, 80% VO2peak). For BFR, blood flow was restricted using 5cm cuffs inflated to 70% of limb occlusion pressure as identified using Doppler ultrasound. Cardiorespiratory and perceptual responses (VO2, HR, perceived effort) and tissue perfusion (tissue saturation, deoxyhemoglobin concentrations) were measured using a metabolic cart and near-infrared spectroscopy, respectively. RESULTS: Oxygen consumption during BFR (1.15±0.32ml/kg/min) did not differ from LL (1.04±0.26ml/kg/min, P=0.31) and was less than HL (2.28±0.60ml/kg/min, P=0.01). Compared with LL (104±6b/min), heart rate during BFR increased (115±13b/min, P<0.004) but was less than HL (166±19b/min, P<0.01). BFR required less gas exchange (P=0.03) and perceived effort in the arms (12.33) compared to LL (9.2±2.0, P=0.03) but less effort than HL (16.2±2.0, P<0.01). In general, BFR decreased tissue saturation and increased deoxyhemoglobin concentrations compared to arm cranking without BFR (all P<0.05). CONCLUSION: These results suggest that arm cranking with BFR has potential to increase metabolic stress without excessive respiratory strain. This exercise mode may provide a useful alternative to HL for populations that need to exercise upper-body muscles for rehabilitation. These findings provide guidance for future acute and chronic studies examining the feasibility and efficacy of arm cranking with BFR.

The effects a particular kind of short term fasting called time restricted feeding (TRF) have been recently investigated on resistance training athletes; no data are available, instead, on endurance athletes. PURPOSE: We sought to investigate the effects of 4 weeks of 16:8 TRF (with windows of 16 hours of fasting and 8 hours of feeding) on elite cyclists. METHODS: 16 elite under-23 cyclists were randomly assigned to a TRF group or to a control group (CTRL) with a traditional meal pattern. The TRF group consumed 100% of its estimated daily energy needs in an 8-hour time window: from 10:00 AM to 6:00 PM whilst the CTRL group consumed 100% of its estimated daily energy needs in 3 meals between 7:00 AM and 9:00 PM. During the experimental period, training loads were similar in the two groups. Athletes were tested before and after 4 weeks of the intervention. Fat and lean body mass were measured by bioelectrical impedance analysis, VO2max and basal metabolism were measured by indirect gas analyzer. In addition, blood counts, free testosterone, SHBG, IGF-1, IL-6, TNF alpha, VES, PCR, total cholesterol, triglycerides, TSH, free T3, insulin, adiponectin, and cortisol were measured. RESULTS: After 4 weeks, there was a significant decrease of body weight of body weight (TRF: -1.26 kg ± 1.57 vs. CTRL: +0.22 ± 0.96 kg, p=0.038) and fat mass in the TRF group (p=0.0093) compared to CTRL group with no differences in lean body mass. Performance tests showed no significant differences between groups even though there was a significant increase in the peak power output/body weight ratio (p=0.024) in the TRF group due to weight loss. Free testosterone and IGF-1 decreased significantly (p=0.004 and p=0.048 respectively) in the TRF group; leukocyte count decreased more in the CTRL group (p = 0.039). Lymphocyte count increased in TRF group (p=0.001) whilst neutrophils decreased in both groups (p<0.001), thus the neutrophil to lymphocyte ratio (NLR) decreased significantly (p=0.003) in TRF group. No significant changes in other blood chemistry values were observed. CONCLUSIONS: Our results suggest that a TRF program with an 8-hour feeding window causes fat loss, maintains lean mass and performance indexes and improves peak power output/body weight ratio. The changes of white blood cells parameters worth further investigation.
purpose: The objective of the present study was to investigate the effects of the 16/8 diet on cardio-metabolic risk factors in competitive male runners. Methods: This ongoing study is a randomized cross-over intervention that consists of two 4-week acute cycle with a "normal" arm (12 hours fasting and 12 hours fed) and a "fasted" arm (TRF: 16 hours fasting and 8 hours fed) arm along with a 2-week washout. Sixteen subjects will complete the study and will participate in 4 test days (12 hour fasted), one at the beginning and end of each arm, where they will undergo a DXA scan, resting energy expenditure measurement and a fasting blood draw for biomarker quantification. Overall calories, macronutrient intake and exercise training will be held constant over the 2 interventions. Preliminary Results: Data on 9 subjects shows no significant differences between groups in changes in body mass (+0.41 ND vs. -0.72 kg TRF, p=0.25), fat mass (+0.29 ND vs. -0.63 kg TRF, p<0.05), free fat mass (+0.56 ND vs. -0.25 kg TRF, p=0.18) and body fat (-0.42 ND vs. +0.61 % TRF, p=0.72) with the 4 week intervention. Changes in resting energy expenditure (+152.1 ND vs. +113.3 kcal TRF, p=0.18), resting respiratory exchange ratio (-0.003 ND vs. -0.04 TRF, p=0.36), blood glucose (-3.9 ND vs. -1.9 mg/dl TRF, p>0.01), total cholesterol (+1.0 ND vs. -3.0 mg/dl TRF, p=0.68), HDL cholesterol (+1.7 ND vs. 0.0 mg/dl TRF, p=0.71), LDL cholesterol (0.0 ND vs. -3.8 mg/dl TRF, p=0.04), and triglycerides (+17.9 ND vs. 74.3 mg/dl TRF, p=0.46) also did not differ between interventions. Conclusion: So far, with limited power, there does not appear to be any physiological health benefits in male runners adhering to a 16/8 diet when compared to a normative eating timeframe.

3082 Board #3 May 29 3:15 PM - 5:15 PM The Effect Of Continuous Energy Restriction Vs Intermittent Fasting, With Resistance Training, On Lean Mass

Stephen Keenan1, Matthew Cooke2, Sam Wu1, Ebrahim Bani Hassan1, Denny Meyer1, Won Sun Chen1, Josef Sullivan1, Gustavo Duque1, Regina Belski1. Swinburne University of Technology, Melbourne, Australia. 2Swinburne University of Technology, Victoria University, Australian Institute for Musculoskeletal Science (AIMSS), Department of Medicine-Western Health, Melbourne Medical School, The University of Melbourne, Melbourne, Australia. 3Australian Institute for Musculoskeletal Science (AIMSS), Department of Medicine-Western Health, Melbourne Medical School, The University of Melbourne, Melbourne, Australia.

PURPOSE: To determine if two energy restricted diets (continuous energy restriction (CER) and 5.2 intermittent fasting (IF)) combined with resistance training (RT) results in lean body mass (LBM) retention while reducing bodyweight.

METHODS: Thirty-four young, untrained males and females were randomised to undertake the following diet for 12 weeks: CER (consume 80% of estimated energy requirements (EER) every day), or IF (consume approximately 30% of EER twice per week on fast days and 100% of EER every other day). Fast days included meals of protein shakes, a soup and vegetables. Both groups aimed to be isocaloric with an average energy restriction of 20% EER, and isonitrogenous consuming an average protein intake of 1.5 grams per kilogram of bodyweight per day. Both groups completed 2 supervised RT sessions and 1 unsupervised workout per week. The IF group completed their exercise on non-fast days. Body composition was assessed by dual x-ray absorptiometry. Data was analysed using an intention-to-treat linear mixed model, assuming AR(1) dependence across time. In addition, a change analysis was conducted for participants who completed both the baseline and 12 week assessments.

RESULTS: For females, bodyweight was significantly reduced (mean decrease 3.1%, p<0.009), and LBM significantly increased (mean increase 5.8%, p<0.001), with no difference observed between diets. Similarly for men, there was no significant diet effect on bodyweight, both groups experienced an overall reduction of 6.3% (p<0.001). Combined, in men both diet groups experienced a significant increase in LBM (mean increase 1.4%, p=0.021), however there was a trend towards a greater increase in LBM in the IF group compared to the CER group (mean increase CER = 0.7%, IF = 2.0%).

CONCLUSIONS: Across both diet groups, males and females experienced a significant reduction in bodyweight while, on average, increasing LBM. Neither diet was more effective for bodyweight reduction, however there was a trend towards greater LBM accrual in IF compared to CER males. Gender specific responses to the intervention were evident, with a greater increase in LBM for females. Moderate energy restriction with high protein intake and RT can lead to concomitant weight loss and LBM accrual.

3083 Board #4 May 29 3:15 PM - 5:15 PM Impact Of Time-Restricted Feeding On Cardiometabolic Health And Performance Among Firefighters

Andrew E. Gonzalez1, Mark G. Abel2, Matthew J. McAllister1. 1Texas State University, San Marcos, TX. 2University of Kentucky, Lexington, KY.

PURPOSE: Firefighters (FF) have an elevated risk for heart disease and sudden cardiac death (SCD) due to physiological and psychological stressors such as low cardiovascular fitness levels, disturbed sleep patterns, frequent snacking, smoke exposure, and intense physical exertion. Research suggests time-restricted feeding (TRF) may improve cardiometabolic health markers and performance variables. Therefore, the purpose of this study was to examine the effects of an 8-week TRF intervention on cardiometabolic health markers and performance variables.

METHODS: Twenty healthy male professional structural FF completed a battery of health and fitness assessments prior to and following an 8-week TRF dietary intervention while performing a standardized resistance training program. The FF were assigned to either the normal diet (n=4) or TRF group (n=16) based on preference. The TRF group followed a daily 14 hr fast vs. 10 hr feeding protocol.

RESULTS: Despite no interaction effect, there were significant improvements for both groups for push-ups completed (41.7 and 37.1 reps; p = 0.007) and ventilatory threshold in absolute (2.47L/min to 2.58L/min; p = 0.01) and relative (65.8%VO2 to 69.7%VO2; p = 0.001) terms. The control group had significantly lower mean body fat percentage compared to the TRF group (14.27 and 20.5%, respectively; p < 0.0001). The TRF group had significantly higher VO2 values compared to the control group (3.80 L/min and 3.65 L/min, respectively; p = 0.016).

CONCLUSIONS: While TRF did not directly improve health or performance variables, the diet did not hinder health or performance outcomes. The standardized resistance training program resulted in improvements for muscular endurance and ventilatory threshold. The improved performance variables may result in reduced risk for heart disease and SCD while optimizing markers of performance.
Exercise conditions and time of day in overweight males. Regardless of the time of day, fasted exercise favours fat metabolism and may induce a short-term negative energy balance.

**3085 Board #6**
May 29 3:15 PM - 5:15 PM

**Changes In Fat And Carbohydrate Oxidation From Rest To Exercise After Different Fasting Lengths**
Emelia Ryan Thompson, James Brown, Kelly E. Johnson, Jakob D. Lauver, Justin P. Guilkey. Coastal Carolina University, Conway, SC.

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(No relevant relationships reported)

An overnight fast (10-12 hours) is a popular pre-exercise trial control in fuel use studies, but can lead to premature fatigue during exercise in participants. Measuring substrate oxidation at rest could be an alternative, but it is unclear how length of fasting effects fuel use responses from rest to during exercise. **PURPOSE**

The purpose was to examine the changes in fat (fatox) and carbohydrate (carbox) oxidation rates during rest and exercise after various fasting lengths. **METHODS:** Participants (24.5 ± 5.1 yrs) randomly performed 3 experimental trials. Trials were preceded by a standard meal (19.4 ± 1.8% of daily energy expenditure) followed by a fast for 12 hours (hrs), 3 hrs or 1 hr. Each trial consisted of 30 min of rest and 30 min of exercise at 55% of peak oxygen uptake (VO2peak). VO2 and carbon dioxide production (VCO2) were averaged over the final 10 minutes of rest and exercise. The equations fatox = 1.695 * VO2peak - 1.70 * VCO2, and carbox = 4.585 * VCO2 - 3.226 * VO2 were used to calculate oxidation rates (g/min)². Two-way repeated measures (RM) ANOVAs and one-way RM ANOVAs analyzed differences. Significance was established if p<0.05.

**RESULTS:** Participants exercised at a similar VO2 and % of VO2peak in the 12hr (1.58 ± 0.28 L·min⁻¹; 56.8 ± 2.4 % of VO2max), 3hr (1.60 ± 0.30 L·min⁻¹; 57.7 ± 4.6 % of VO2max), and 1hr (1.64 ± 0.30 L·min⁻¹; 59.1 ± 1.7 % of VO2max). There was no significant interactions for fatox and carbox, but there were significant main effects of time. Fatox increased from rest to exercise in the 12hr (0.30 ± 0.04 g*min⁻¹ vs. 7.34 ± 3.00 g*min⁻¹), 3hr (0.30 ± 0.10 g*min⁻¹ vs. 7.56 ± 3.53 g*min⁻¹) and 1hr (0.34 ± 0.10 g*min⁻¹ vs. 8.43 ± 4.00 g*min⁻¹) trials. Additionally, carbox increased from rest to exercise (12 hr = 0.30 ± 0.07 g*min⁻¹; 3hr = 0.27 ± 0.09 g*min⁻¹; 1hr = 0.34 ± 0.10 g*min⁻¹) to exercise (12hrs = 1.92 ± 0.55 g*min⁻¹; 3hrs = 1.90 ± 0.64 g*min⁻¹; 1hr = 2.18 ± 0.81 g*min⁻¹). Relative percent changes from rest to during exercise were not different between 1hr, 3 hrs and 12 hrs for fatox (2489.1 ± 1008.9 % vs. 2257.5 ± 833.3 % vs. 2200.8 ± 901.7 %) or carbohydrates (660.2 ± 294.8 % vs. 579.6 ± 231.2 % vs. 492.5 ± 241.9 %). **CONCLUSIONS:** Fatox and carbohydrate responses from rest to during exercise were similar between trials. This suggests that a standard meal and resting oxidation rates could control for differences in substrate use during exercise, regardless of fasting length.

**3086 Board #7**
May 29 3:15 PM - 5:15 PM

**Low Carbohydrate Availability, Not Energy Availability, Alters The Immune Response To Exercise In Elite Race-walkers**
Alannah K.A McKay¹, Peter Peeling¹, David B. Pyne, FACSM², Nicolin Tee¹, Ida A. Heikura¹, Louise M. Burke, FACSM².
¹University of Western Australia, Perth, Australia. ²University of Canberra, Canberra, Australia. ³Australian Institute of Sport, Canberra, Australia.

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(No relevant relationships reported)

**PURPOSE:** To compare the effects of a ketogenic low carbohydrate (CHO) high fat (LCHF) diet, and a low energy availability (LEA) diet, on innate immune response during a short-term training intervention in endurance athletes.

**METHODS:** Twenty elite male race walkers completed one of three 5-7 day diet/training phases in a parallel groups design. During the initial 5 day Harmonization phase, all athletes consumed a high energy availability (HEA) diet equating to 40 kcal·kg⁻¹·fat free mass (FFM)·day⁻¹. Athletes were then assigned to either a HEA (n=6), LCHF (<50 g CHO·day⁻¹) and isocaloric to HEA, n=7) or a LEA diet (15 kcal·kg⁻¹·FFM·day⁻¹, n=7) for the 7 day Intervention phase. Subsequently, all athletes were placed back on a HEA diet for a further 5 days (Re-feed phase). On day 5 of each phase, athletes completed a 25 km hybrid laboratory-field race walk protocol at ~75% VO2peak in the 12hr (1.64 ± 0.30 L·min⁻¹, 59.1 ± 1.7 % of VO2max), 3hr (1.60 ± 0.30 L·min⁻¹, 57.7 ± 4.6 % of VO2max), and 1hr (1.64 ± 0.30 L·min⁻¹, 59.1 ± 1.7 % of VO2max). There was no significant interactions for fatox and carbox, but there were significant main effects of time. Fatox increased from rest to exercise in the 12hr (0.30 ± 0.04 g*min⁻¹ vs. 7.34 ± 3.00 g*min⁻¹), 3hr (0.30 ± 0.10 g*min⁻¹ vs. 7.56 ± 3.53 g*min⁻¹) and 1hr (0.34 ± 0.10 g*min⁻¹ vs. 8.43 ± 4.00 g*min⁻¹) trials. Additionally, carbox increased from rest to exercise (12 hr = 0.30 ± 0.07 g*min⁻¹; 3hr = 0.27 ± 0.09 g*min⁻¹; 1hr = 0.34 ± 0.10 g*min⁻¹) to exercise (12hrs = 1.92 ± 0.55 g*min⁻¹; 3hrs = 1.90 ± 0.64 g*min⁻¹; 1hr = 2.18 ± 0.81 g*min⁻¹). Relative percent changes from rest to during exercise were not different between 1hr, 3 hrs and 12 hrs for fatox (2489.1 ± 1008.9 % vs. 2257.5 ± 833.3 % vs. 2200.8 ± 901.7 %) or carbohydrates (660.2 ± 294.8 % vs. 579.6 ± 231.2 % vs. 492.5 ± 241.9 %). **CONCLUSIONS:** Fatox and carbohydrate responses from rest to during exercise were similar between trials. This suggests that a standard meal and resting oxidation rates could control for differences in substrate use during exercise, regardless of fasting length.

Carbohydrate restrictive diets have become increasingly prevalent among recreational and professional athletes as a means of losing weight and improving body composition. Currently, few data indicate a clear relationship between carbohydrate restriction (CR) and performance in resistance exercise (RE). **PURPOSE:** To investigate the acute effects of CR on squat performance and serum energy substrate levels in recreationally trained individuals. **METHODS:** Seven healthy recreationally trained males (22.6 ± 3.47 yrs., 80.74 ± 8.40 kg, 178.05 ± 5.00 cm) completed RE under two conditions in randomized order: 1) control (CON) and 2) a (CR) condition, which included a carbohydrate depletion exercise trial (CDEX). In CR, subjects first performed the CDEX, which consisted of 60 minutes of cycling at ~75% of participants’ heart rate (HR) max followed by four 1-minute bouts at ~95% HR max with two minute rest in between sets. CDEX was then followed by 48 hours of reduced carbohydrate (CHO) intake (<5% daily caloric intake). RE in both CON and CR consisted of squats, loaded via inertial resistance using a Yo-YoTM flywheel squat device. Fasting blood glucose and triglyceride (TG) levels were measured pre-exercise in both conditions as well as throughout the CDEX. **RESULTS:** Total caloric intake was significantly (p < 0.001) lower during CR (mean ± SD: 1661.24 ± 691.6 kcal) compared to the CON (2433.85 ± 527.4 kcal). No differences were found in total grams of protein (PRO) or fat intake between conditions. Percent total daily caloric intake from CHO (p > 0.001) was significantly lower in the CR condition (7.40 ± 3.32 CHO), while percent total daily caloric intake from PRO and fat were significantly higher in the CR (32.90 ± 8.54% PRO, 58.17 ± 11.96% fat) compared to CON (37.81 ± 9.26% CHO, 20.03 ± 5.53% PRO, 37.47 ± 11.80% fat). Fasting blood glucose levels (p = 0.017) were significantly lower in the CR (84.57 ± 4.79 mg/dL) compared to the CON (93.28 ± 6.90 mg/dL) yet there was no difference in blood TG levels (p = 0.177; 64.43 ± 15.13 mg/dL vs. 59.29 ± 14.16 mg/dL). Total average power output (p = 0.05) and total peak power output (p = 0.047) were significantly lower in the CR. **CONCLUSION:** While CDEX combined with CR may acutely reduce fasting blood glucose, this may be at the sacrifice of RE performance, especially during the initial phase of CR adaptation.
Major depressive disorder (MDD) is a debilitating mental health condition that presents a major public health burden. Respiratory sinus arrhythmia (RSA) reactivity has been proposed as an index of impaired emotion and self-regulation in depression. Acute exercise has consistently been shown to improve affect, but it is unknown whether exercise affects RSA reactivity to emotional challenge. In addition, previous studies have not addressed nonresponse to sad emotion inductions, which limits understanding of important individual differences in affective processing.

PURPOSE: To determine the effects of a single bout of moderate-intensity aerobic exercise on RSA and affective responses to a sad mood induction. Additionally, to characterize responders and non-responders to the sad mood paradigm and whether acute exercise impacts emotional responding to the emotion induction paradigm.

METHODS: Using a within-subjects design, young adults diagnosed with MDD completed a 30-minute exercise and sedentary control session in counterbalanced order. Following recovery period, RSA reactivity was assessed using electrocardiography (ECG) during a 3-min sad mood induction. The Positive and Negative Affect Scale (PANAS) was used to assess affective responses throughout each session and sadness to the mood induction was assessed on a 9-point Likert scale.

RESULTS: Individuals with depression demonstrated dampened RSA withdrawal during the sedentary control condition. Following exercise, RSA withdrawal increased, p < .05, although post-exercise changes in NA and PA were not related to neurocardiac reactivity to the sadness induction. There were significantly more responders than non-responders to the mood induction following the exercise condition, p < .05.

CONCLUSIONS: These findings support the idea that acute exercise may be an effective approach to increase emotional regulation and behavioral flexibility in clinically depressed individuals. Future research should continue to examine individual differences in emotional responding as well as investigating who will successfully respond to exercise treatment.

PREFACE TO THE 2020 ANNUAL MEETING OF THE AMERICAN COLLEGE OF SPORTS MEDICINE®

San Francisco, California

FRIDAY, MAY 29, 2020

ACSM May 26 – May 30, 2020
High-intensity interval training (HIIT) is a popular modality for conducting intense aerobic exercise. Research indicates that HIIT is generally well-tolerated and produces relatively positive affective valence and enjoyment responses, especially when compared to intense continuous exercise. Recent research has started considering how autonomy and choice might impact psychological responses to HIIT.

PURPOSE: The purpose of this study was to determine the impact of autonomy and variation on enjoyment and affective valence during HIIT exercise. METHODS: Twenty-one physically active participants (12 male, 9 female; mean BMI = 27 ± 3; mean age = 28 ± 6) completed three, 20-minute HIIT trials after completion of maximal testing. Work and recovery were conducted at 90% and 10% of peak work, respectively. All trials included a total of 10 minutes of work and 10 minutes of recovery. Trials included: a standard interval bout with repeating 60-sec work and recovery segments (Traditional), an interval bout with a mix of predetermined 30-, 60-, 90-, & 120-second segments (Varied), and a bout with a self-selected number of 30-, 60-, 90-, & 120-second segments (Autonomous). In-task affective valence and enjoyment were measured four times during work and recovery. Data was analyzed using ANOVA. RESULTS: Affective valence declined during the Traditional and Varied trials (P < 0.05) but not during the Autonomous trial (P > 0.05). There was also a trend for the Autonomous trial to produce greater pleasure than the Traditional trial (P = 0.059). Similarly, the higher the body fat % (BF%), the worse the cognitive test performance. There was a positive correlation between age, NLR and PLR, but there was no significant correlation between inflammatory markers and cognitive performance. Furthermore, after controlled BF%, the age-related correlation effects are unchanged, and only the correlation between BLM% and the speed of answering represent significant (r = 0.393, p = 0.015). CONCLUSION: In addition to age, body fat is an important factor affecting cognitive performance. Supported by MOST 107-2410-H-845-018-MY3.
cognition for approximately 60-70 minutes. Future research should provide a more direct comparison to better understand the sustained effects of acute exercise across different populations of children.

Supported by MOST grant NSC102-2410-H-003-128.

F-35 Thematic Poster - Functional Movement with Parkinson’s Disease
Friday, May 29, 2020, 3:15 PM - 5:15 PM
Room: CC-2007

3098 Chair: Chris J. Hass, FACSM. University of Florida, Gainesville, FL.
(No relevant relationships reported)

PURPOSE: People with Parkinson’s disease (PD) have impaired balance during walking that contributes to reduced physical activity and lower quality of life. Overground locomotor training (OLT) is one method to improve dynamic balance for people with PD during walking. The purpose of this study is to examine the effect of an OLT program on dynamic balance during overground walking in people with PD.

METHODS: Five participants with PD (age: 68.9±6.7 yrs) were enrolled in a 12-week OLT program with an emphasis on power, stepping and stability within all planes of movement. Participants completed a 10-minute walk test (10MWT) overground, wearing portable tri-axial motion sensors at baseline (PRE) and after (POST) intervention. Temporal spatial data were collected pre- and post-intervention to obtain time in double support (TDSLs) and calculate gait stability ratio (GSR) during the 10MWT. TDSLs represents one’s strategy for maintaining dynamic balance during gait. GSR is the ratio between number steps per minute and gait velocity. For both TDSLs and GSR, lower values following intervention represent improved dynamic balance during walking. Gait characteristics were analyzed separately for each limb using paired Student’s t-tests.

RESULTS: Average TDSLs was reduced for both limbs after intervention (PRE: L: 82.83±9.58; R: 82.61±8.83; POST: L: 18.88±3.03; R: 18.89±3.04); PRE: L: 15.10±2.66; R: 15.11±2.68, p<.001). GSR improved following intervention (PRE (L: 82.83±9.58; R: 82.61±8.83); POST (L: 18.88±3.03; R: 18.89±3.04%); POST (L: 15.10±2.66; R: 15.11±2.68), p<.001).

CONCLUSION: The 12-week individualized and supervised physical therapy program improved dynamic and static balance, but not gait initiation. The intervention was individualized towards the functional deficits and goals that were obtained in pre-testing. A limitation for this study was the small sample size.

MEDICINE & SCIENCE IN SPORTS & EXERCISE®

Parkinson’s disease (PD) is a progressive neurodegenerative disease associated with motor impairments. Deep brain stimulation (DBS) is associated with vast improvements in the motor symptoms of PD. Recent evidence has identified improvements in movement complexity during treadmill walking in response to DBS [1]. However, the effects of DBS on gait coordination have not been well elucidated.

PURPOSE: to evaluate the effects of DBS on ankle and knee joint coordination and coordination variability during a treadmill walking task.

METHODS: Five individuals with PD performed a 4-minute treadmill walking task while 3D kinematics were collected over two 30-s periods. Participants completed testing in the DBS-OFF followed by DBS-ON conditions to avoid the confounding factor of fatigue. Kinematics were recorded simultaneously using an 9-camera motion capture system (120 Hz, Qualysis Inc., Goteburg, Sweden). Visual 3D was used to calculate segmental angles and velocities. Custom software (MATLAB, MathWorks) calculated continuous relative phase angles. Mean absolute relative phase (MAR) and deviation phase (DP) were used to quantify joint coordination (MAR) and coordination variability (DP).

A paired samples t-test was used to determine the effects of DBS on MAR and DP.

RESULTS: At the ankle, DBS was associated with greater MAR values (p=0.016; DBS-ON: 3.2±1.5; DBS-OFF: 2.1±0.9) and DP values (p=0.047; DBS-ON: 2.2±1.0; DBS-OFF: 1.4±0.4). At the knee, DBS was associated with greater MAR (p=0.021; DBS-ON: 3.2±2.8; DBS-OFF: 2.2±2.4) and DP values (p=0.045; DBS-ON: 2.9±1.5; DBS-OFF: 2.0±0.6). CONCLUSIONS: DBS allows individuals with PD to perform walking tasks with greater freedom of coordination and coordination variability. Increased availability of coordinative patterns may represent a greater number of successful strategies available to the system to optimize mechanical and metabolic efficiency during walking.


Board #3 May 29 3:15 PM - 5:15 PM
3101 Improved Coordination And Coordination Variability In Response To Deep Brain Stimulation In Individuals With Parkinson’s Disease
Alexis K. Nelson1, Hailey B. Fong1, Clinton J. Wutzke2, Alexandra Schaller3, David O’Reily4, Douglas W. Powell, FACSM.1 University of Memphis, Memphis, TN. 2Department of Rehabilitation Science, Fairfax, VA. 3University of Tennessee Health Science Center, Memphis, TN. 4Central Remedial Clinic, Dublin, Ireland. (Sponsor: Douglas Powell, FACSM)
(No relevant relationships reported)

Board #4 May 29 3:15 PM - 5:15 PM
3102 Effects Of Motor Timing Training On Golf Swing Motion In Parkinson’s Disease
Jin hyun Kim, Zach Lemke, Younguk Kim, Angela Ridgel, FACSM. Kent State University, Kent, OH. (Sponsor: Angela Ridgel, FACSM)
Email: jkim74@kent.edu
(No relevant relationships reported)

Individuals with Parkinson’s disease often show deficits in motor timing, specifically during tasks that require rhythmic motor patterns such as golf and finger tapping. However, it is not clear if rehabilitation training that focuses on improving motor timing can improve rhythmicity during coordinated movements. In this study, we utilized a computer-based rehabilitation tool, called Motor Timing training (MT), which trains individuals to improve motor timing by reacting to an auditory or visual reference cue. Changes in motor timing and coordination were measured using a golf swing motion.

PURPOSE: The purpose of this study was to examine if MT training with golf swing motion improves motor timing in Parkinson’s disease.

FRAIDAY, MAY 29, 2020

ACS M May 26 – May 30, 2020
San Francisco, California
METHODS: Participants completed 12 MT sessions, three times weekly for 4 weeks. The aim of each session was to perform the golf swing motion to match the audible beat. Visual feedback was given to the participants to encourage them to hit the ‘target zone’ (±15 ms) during the golf swing. Motor timing was assessed using the Long Form Assessment (LFA) which evaluated timing and accuracy during fourteen movement tasks of the hands and feet. A wireless kinematic sensor system was utilized to measure pelvic acceleration in 3 axes (X, Y, Z) during the backswing and downswing. To determine the variation of pelvic movement during the golf swing in Parkinson’s disease. In light of these findings, future studies will also examine if MT training promotes improved motor timing and golf swing mechanics in individuals who show impaired range of motion. PD had a greater spread of SamEn in left hip abduction during tango movements than right hip abduction (p < 0.0001). A greater SamEn in right hip rotation during tango movements than left hip rotation (p < 0.0001) was seen during tango but no significant difference during foxtrot. Furthermore, PD group had no significant difference in left/right knee flexion SamEn during tango but left knee flexion SamEn was higher during foxtrot than right knee flexion SamEn (p = 0.006). OA participants saw a much smaller, but still significant, spread in SamEn in left hip abduction during Tango than right hip abduction during tango (p < 0.002), with no significant difference in hip rotation SamEn.

CONCLUSION: We interpret our entropy results as showing a decrease in PD left hip abduction compared to the right hip during tango. Our PD participants reported that the left side was more affected. These types of data could be used to optimize dance interventions in regards to dance type, music beat/rhythm in order to improve limb control.

3105 Board #7 May 29 3:15 PM - 5:15 PM Relationship Between Lower Extremity Muscle Function And Gait Variability In Individuals With PD Jared W. Skinner1, Chris J. Hass, FACSM1, Appalacian State University, Boone, NC. University of Florida, Gainesville, FL. (Sponsor: Scott Collier, FACSM) Email: skinnerjw@appstate.edu (No relevant relationships reported)

PURPOSE: Increased variability in motor function can significantly impair performing activities of daily living. The difficulty in performing daily motor tasks is increased in pathological populations, e.g., Parkinson’s disease (PD). The muscular capabilities, e.g., torque production and force control, in PD, are reduced compared to older adults. It is unclear if the reduced muscular capabilities in PD are related to increased difficulty performing regular movements, i.e., gait. This study examined the relationship between muscular capabilities of the lower extremity and gait variability in persons with PD.

METHODS: 12 PD and 11 age-matched controls underwent gait and lower extremity muscle testing. Gait was evaluated by having the subjects perform ten over-ground walking trials over a 9-m walkway at a self-selected speed using an 8-camera motion capture system. Linear measures of gait, including stride length, stride time, step width, and velocity, were calculated. Gait variability and force variability were examined using the coefficient of variation (CV = standard deviation/mean × 100%).

Lower extremity testing consisted of 1) maximal isometric torque production and 2) submaximal force control using a tracing paradigm at 5, 10, and 20% of their maximal torque production in multiple directions at the hip and ankle. Pearson’s correlations were applied to analyze associations between gait variability and force variability.

RESULTS: In the PD group, stride time was positively correlated with 20% of ankle dorsiflexion CV (r(21)=.67, p<.05) and velocity was positively correlated with 10 and 20% of ankle plantarflexion CV (r(21)=.59, p<.05) and 20% of hip extension CV (r(21)=.63, p<.05). Maximal torque production of the dorsiflexors (r(21)=.75, p<.05) and plantar flexors (r(21)=.67, p<.05) were positively correlated stride time variability in the PD group.

CONCLUSION: The results highlight an association between lower-extremity muscle function and gait function in PD. Interestingly, in those with PD, both maximal strength and control of muscle strength were found to be related to the temporal parameters of gait variability. These results suggest that joint dysfunction could be the result of specific pathological impairments and provide unique opportunities for specialized interventions.
overload, sleep deprivation, and caloric restriction are all factors of operational stress in the military. This study aims to investigate how Simulated Military Operational Stress (SMOS) affects performance on the operationally relevant tasks both in men and women. METHODS: As part of an ongoing study; Forty male soldiers (26±5 yrs, 176±8cm, 85±15kg, 20±7%Bf) and eleven female soldiers (25±5yrs, 167±12 cm, 63±6kg, 26±6%Bf) completed a SMOS protocol lasting 5 days (D) and nights (N). Days 3 & 4 (D3, D4), subjects consumed 50% of calorie demands. N1, 2, & 5 (D1, D2, and D5) subjects slept from 2300-0700. N3-4, subjects slept from 0100-0300 and 0500-0700. Familiarization was completed D1. During D2 & 5 participants underwent a Tactical Mobility Test (TMT), consisting of the following: 2-min water can carry (WCC) (20 kg each hand), fire & movement course, 20-m casualty drag (RM) (15 kg). Two-way mixed ANOVAs with Bonferroni Post Hoc (p<0.05) were used to identify if the difference in TMT performance form D2-5 was different between men and women. RESULTS: Regardless of sex a main effect for SRUt across days was found. SRUt increased by 6% from D2 to D4 and D5 (D2: 97.2±20, D4:103.3±22.8, p=0.047; D5: 103.5±18.8, p=0.011); additionally, D5 increased by 4% from D3 (D3: 103.5±18.8, D5: 99.3±20.2; p=0.047). CONCLUSION: Short-term exposure to military operational stress leads to a decline in anaerobic capacity; regardless of sex. Operational tasks involving muscular strength, endurance, and aerobic endurance such as the WCC, CD, and RM were well maintained over 5 days of during SMOS equally between men and women. The preliminary findings of this study suggest simulated military operational stress effects women and men equally. Further investigation will need a larger sample size is needed. This study was funded by the Department of Defense (Award #W81XWH-17-2-0070). The results and opinions herein are those of the authors and do not necessarily constitute endorsement of the Department of Defense.

PURPOSE: Females report greater sensitivity in cold compared to hot conditions. However, it is unclear how thermal sensitivity is affected when the change for internal focus (external environment) were measured every 10 minutes. A 2-way condition × sex; I: condition × sex; ME: condition × sex; P I: condition; P<0.008). Females reported greater external focus in cool compared to males (ME: sex; P<0.0002). CONCLUSIONS: These data indicate that sex differences exist for thermal stress. Females perceive thermal stress in hot and cool conditions to a greater extent than males exercising at similar metabolic heat production.
PURPOSE: Females have greater orthostatic intolerance and increased adrenergic sensitivity to passive heat stress compared to males. It is unknown how cerebral blood flow is affected during post-exercise heat stress. We tested the hypothesis that females would have lower middle cerebral artery blood flow velocity (MCAv)\textsuperscript{mean} during post-exercise hyperthermia.

METHODS: Twenty-two healthy active adult (7 day activity: 8620±2981 steps/day; VO\textsubscript{2max} 49.1±10 mL/kg/min) subjects (11M/11F; 22.4±4.9, 169±7.55cm, 68±1.13kg) exercised at a similar metabolic heat production (M: 7.1±1.5 W/kg and F: 6.9±1.4 W/kg, P=0.32) for 60 minutes (cycle ergometer) in cool (24±0.0°C; 14.4±3.6%RH) and hot (42.3±0.2°C; 27.9±5.5%RH) conditions in random order with a 7 day washout. During 1-hour post-exercise recovery, Transcranial Doppler examined MCAv\textsuperscript{mean}, pulsatility index (PI) and intracranial pressure (ICP). Systemic vascular responses for mean arterial pressure (MAP), augmentation index (Alx), pulse wave velocity (PWV), systemic vascular resistance (SVR), and change in intestinal temperature (ΔT\text{int}) and heart rate (ΔHR) and were measured during 1-hour recovery. Area under the curve (AUC) variables were analyzed using a mixed model 2-way repeated-measures analysis of variance for interaction (Sex, Condition; ME) and main effects (ME) for Condition x Sex. Alpha priori was set at P<0.05.

RESULTS: Exercise thermal (ΔT\text{int}, Cool: Δ0.5±0.1°C; ME: Condition, P=0.0011) and cardiovascular strain (ΔHR\text{int} 58±15 b/min; Hot: 71.1±15 b/min; ME: Condition, P=0.01) were identical between groups that used hot compared to cool condition. During recovery both sexes had a similar AUC MCAv\textsuperscript{mean}, however, MCAv\textsuperscript{mean} was lower in hot compared to cool (ME: Condition, P=0.03). Females also showed reduced stiffness (AUC PWV and Alx) compared to males (ME: Condition, P<0.0001; ME: Sex, P<0.0008). Females had greater AUC SVR compared to males in both conditions (ME: sex, P<0.01). There were no differences for MAP, PI, or ICP between the Condition or Sex. CONCLUSIONS: These data suggest that no sex difference exists for MCAv\textsuperscript{mean} during recovery. Both sexes have lower MCAv\textsuperscript{mean} in hot compared to cool conditions. However, the peripheral vascular mechanisms for this attenuation may differ as females have lower arterial stiffness and higher SVR.

F-37 Free Communication/Slide - Cardiometabolic Disease
May 29, 2020, 3:15 PM - 5:15 PM Room: CC-3014

3113 Chair: Steven K. Malin, FACSM. University of Virginia, Charlottesville, VA. (No relevant relationships reported)

3114 May 29 3:15 PM - 3:30 PM

Effect Of Pre-Operative Aerobic Exercise On Surgical Outcomes And Cardiometabolic Health In Bariatric Surgery Patients
Nicole M. Gilbertson\textsuperscript{1}, Natalie ZM Eichner\textsuperscript{1}, Elizabeth A. Rextrode\textsuperscript{2}, Sibhyle Krantz\textsuperscript{2}, Arthur Weltman, FACSM\textsuperscript{2}, Peter T. Halloway\textsuperscript{2}, Steven K. Malin, FACSM\textsuperscript{2}. \textsuperscript{1}Pennsylvania State University, Altoona, PA. \textsuperscript{2}University of Virginia, Charlottesville, VA. (Sponsor: Steven K. Malin, FACSM) Email: mm46@psu.edu (No relevant relationships reported)

PURPOSE: Examine if adding pre-operative aerobic exercise to standard medical care (EX+SC) improves surgical outcomes and enhances cardiometabolic health 30 d after surgery compared to SC only in bariatric surgery candidates. METHODS: Patients receiving bariatric surgery were matched pre to pre-operative SC (n=7) and EX+SC(n=7). VO\textsubscript{2max} was 44.2±5.0 (85% CI 39.0 to 49.5) and 41.8±2.3 (85% CI 37.8 to 45.8) mL/kg/min, respectively. Total body mass (82.2±16.9 vs. 90.1±4.1 kg), BMI (41.3±3.8 vs. 41.8±1.6), and waist circumference (115±7 vs. 117±7 cm) were similar (P>0.05) before surgery. Patients were post-op for 30 d. Patients were similar in age (52±12 vs. 52±12), sex (5 females vs. 5 females), length of stay (r=-0.58, P<0.04) and length of stay and increased VO\textsubscript{2peak} related to a shorter length of stay (r=-0.58, P=0.03). Increased VO\textsubscript{2peak} (r=0.78, P=0.001) and lean mass (r=-0.56, P=0.04) pre to post-intervention was also associated with decreased CRP 30 days post-operation.

CONCLUSIONS: EX+SC did not enhance the effect of SC on cardiometabolic risk factors. However, adding aerobic exercise to SC appears to benefit the bariatric patient as increased pre-operative VO\textsubscript{2max} related to a shorter length of stay and increased VO\textsubscript{2peak} and lean mass prior to surgery correlated to decreased systemic inflammation 30 d post-surgery.

Patients with hypertrophic cardiomyopathy (HCM) are excluded from high intensity activities due to perceived fear of sudden cardiac death though data from athletes with HCM suggest competitive sport may be safe for some. Low cardiorespiratory fitness in sedentary HCM patients may confer a greater lifetime cardiovascular event risk than exercise per se. While moderate intensity exercise training in patients with HCM modestly increases fitness, high intensity exercise may be superior. PURPOSE: To compare the efficacy of five months of moderate intensity exercise and high intensity exercise training to improve cardiorespiratory fitness (VO\textsubscript{2max}) in patients with HCM. METHODS: Eight patients with HCM (50 ± 7 years, 3 female) were assessed for maximal oxygen uptake (VO\textsubscript{2max}, Douglass Bag method), cardiac output (Q\text{oa}, acetylene rebreathing), and peripheral oxygen extraction (av-O\text{2}, diff, Fick equation) before randomization and after 5 months of moderate or high intensity exercise training. Patients completed 3-4 sessions of moderate intensity exercise each week, while the high intensity group also incorporated a weekly interval training session. RESULTS: Five months of moderate intensity exercise increased absolute VO\textsubscript{2max} by 3% and relative VO\textsubscript{2max} by 4%, while high intensity exercise consistently increased absolute VO\textsubscript{2max} by 6% and relative VO\textsubscript{2max} by 5% (Figure). Maximal Q\text{oa} did not change after moderate intensity exercise (+0.6L [95% CI 2.0 to 1.7]) but increased in all three patients after high intensity exercise (+1.2L [95% CI 1.4 to 3.5]), while maximal av-O\text{2} did not change after exercise (+0.2L [95% CI 1.0 to 2.6]); high intensity: -0.5mL/100mL [95% CI -3.6 to 2.7]). CONCLUSION: Preliminary findings show similar increases in cardiorespiratory fitness following five months of moderate and high intensity exercise training in patients with HCM, although improvements were more consistent after high intensity exercise.

Figure. Similar increases in absolute (A) and relative (B) cardiorespiratory fitness following five months of moderate intensity exercise (ME) and high intensity exercise (HE). The increase in VO\textsubscript{2max} was consistent in all three patients who completed high intensity exercise training whereas the training response to moderate intensity exercise was more variable.
Elevated fasting blood glucose is one of the five components of metabolic syndrome (MetS) which is a cluster of anthropometric, metabolic and cardiovascular derangements. Insulin resistance (IR) has been identified as an important risk factor to develop diabetes (i.e. T2D) and MetS. Both, aerobic (AT) and resistance training (RT) prevent the development of T2D although it is unclear which is most effective. It has been suggested that mechanisms to improve IR are different between AT and RT. Thus, we hypothesized that the combination of both modes of training could provide additive effects to treat IR.

**Purpose:** To determine whether the addition of resistance training (RT) to high-intensity interval training (HIIT) was able to improve glucose metabolism in patients with metabolic syndrome (MetS).

**Methods:** One hundred MetS patients (age, 56±18 years; weight, 92±17 kg; and MetS factors, 3.8±0.8 components) were randomized to undergo one of the following 16-wk program: (a) 4 x 4-min high-intensity interval training at 90% of HRpeak plus 3 sets of 8-12 rep at 60-85% 1RM of 3 legs free-weight exercises (HIIT+RT group; n=15), (b) 5 x 4-min high-intensity interval training at 90% of HRpeak (HIIT group; n=43) or (c) no exercise control group (CON group; n=22). We measured the evolution of all five MetS components (i.e. VO2peak, HOMA-IR, waist circumference, HDL, triglycerides) and insulin levels before and after intervention.

**Results:** After 16 weeks of training, HIIT+RT improved CMJ and 1RM leg press above HIIT and CON (P<0.01). After 16 weeks of training FG (P=0.046) and HOMA-IR (P=0.032) decreased only in HIIT+RT. However, both training groups improved similarly their VO2peak (HIIT+RT, 7%, P=0.001; HIIT, 11%, P=0.001) and Z-score (HIIT+RT, 43%, P<0.002; HIIT, 63%, P=0.004). Conclusion: Our findings suggest that in initially sedentary individuals with MetS, RT combined with HIIT further improves the insulin-sensitizing effects of exercise reducing glucose concentrations.
medication; AHM). Aerobic exercise training in hypertensive individuals has been shown to reduce their blood pressure. However, information is scarce on the effects of aerobic training and AHM on the control of hypertension. 

**PURPOSE:** To analyze the effects of AHM on 21-h ambulatory blood pressure (ABP) before and after an aerobic exercise training program in hypertensive individuals. 

**METHODS:** Twenty-seven participants chronically medicated with angiotensin receptor blockers or angiotensin-converting enzyme inhibitors antihypertensive medicine (AHM) underwent high-intensity interval training (HIIT; 3 sessions per week, 4x4 at 90 HRmax/3 at 70% HRmax) during 4-months. Before and after training, 21-h ABP was monitored under 2 conditions in a double-blind, placebo randomized design: a) PLAC trial substituting for 3 consecutive days antihypertensive medicine by placebo, and b) AHM trial, taking their prescribed antihypertensive medicine. 

**RESULTS:** AHM reduced daytime ambulatory mean arterial pressure by 4.5±1.1 mmHg, being that reduction enhanced to 7.4±1.1 mmHg after 4-months of training (P=0.047). However, at nighttime this difference faded out and the reductions of AHM before (6.1±1.5 mmHg) and after training (4.7±1.2 mmHg) remained similar (P=0.437). 

**CONCLUSIONS:** The present data show that 4 months of HIIT enhances the effects of antihypertensive medication on blood pressure during daytime. This effect fades out during the night, a time where BP naturally falls. These results demonstrate that aerobic training could be used as a strategy to improve pharmacological treatment in hypertensive individuals.

**F-38 Clinical Case Slide - Cardiovascular and Gastrointestinal**

**Chair:** Robert B. Kinningham, FACSM. University of Michigan, Ann Arbor, MI.  
(No relevant relationships reported)

**Discussant:** Meagan Wasyli. Massachusetts General Hospital, Boston, MA.  
(No relevant relationships reported)

**Discussant:** Barry A. Franklin, FACSM. Beaumont Health, Royal Oak, MI.  
(No relevant relationships reported)

**May 29 3:15 PM - 3:35 PM Cardiac-Football**

**Cardiac-Football**

Brady Fleshman. University of Kentucky, Lexington, KY.  
(Sponsor: Robert Hosey, FACSM)  
(No relevant relationships reported)

**May 29 3:35 PM - 3:55 PM**

**Abdominal Bloating - Cross Country**

Christine Linh Vuong. Kaiser Permanente, Fontana, CA.  
(Sponsor: Robert Sallis, FACSM, FACSAM)  
(No relevant relationships reported)
FRIDAY, MAY 29, 2020

Diarrhea (Infectious Disease)-Swimming And Diving
Jordan P. Hilgefort, Christina Murphy, Amy Miller, Keri Denay, FACSM.
University of Michigan, Ann Arbor, MI. (Sponsor: Keri Denay, FACSM)

Email: jordanhilgefort@gmail.com

(No relevant relationships reported)

History: 19-year-old men’s collegiate swimming athlete with PMH of anxiety & major depressive disorder presented with 3-days of nausea, vomiting & diarrhea. He reported several teammates with similar symptoms. He returned for reassessment 1 week following initial evaluation endorsing 2 days of symptom improvement followed by return of several episodes of emesis, diarrhea & fatigue.

Physical Examination:
General: Well-developed, Well-nourished, NAD
HENT:
- Head: NC, AT
- Eyes: conjunctiva clear, EOMI, PERRL, no discharge
- Ears: hearing normal on gross assessment, TMs normal
- Nose: nares clear, no deformity
- Throat: MMM, no erythema or exudate
NECK: normal
PULM/CHEST: CTAB, no wheezes, rales or rhonchi
CV: RRR, no MRG, CR < 2 sec
ABD: BS+, soft, non-tender, non-distended, no organomegaly
SKIN: no visualized rashes or skin lesions, skin is warm and dry
PSYCH: appropriate mood and affect

Differential Diagnosis:
1) Viral gastroenteritis
2) Bacterial gastroenteritis
3) Parasitic infection
4) Irritable bowel syndrome
5) Anxiety

Tests and Results: Initial CBC, BMP and TSH were remarkable only for mild thrombocytosis (447 K/mm3) and hypoglycemia (63 mg/dL). After incomplete resolution of symptoms, GI PCR panel was obtained and found to be positive for cryptosporidium.

Final Diagnosis: Cryptosporidiosis

Treatment and Outcomes:
1) He was treated with Nitazoxanide 500 mg PO BID x 3 days and held out of the pool for 2 weeks.
2) Athletes with exposure to university pools presenting with diarrhea were tested for cryptosporidium via PCR. 6 were positive and all were held out of the pool for 2 weeks.
3) The public health department and environmental health experts were consulted to assist with management.
4) Administrators from every university and local swimming clubs who shared a common pool with our athletes were notified of potential exposure to cryptosporidium.
5) University pools were shut down and treated twice with a high-concentration chlorine.

KUBs in 2016 and 2017 showed stool in the colon and nonspecific bowel gas pattern. LFTs, H.pylori, ESR, CRP were normal in 2017. She was diagnosed with constipation and irritable bowel syndrome. She tried a daily probiotic, the low FODMAP diet, and gave up dairy for months without improvement of her symptoms.

PHYSICAL EXAM: The abdomen appears distended. Decreased bowel sounds in all quadrants. Dull to percussion. The abdomen is firm, but no guarding or rebound. Prior to a run, abdominal girth measured at 90cm at the umbilicus. After a run, no change.

DIFFERENTIAL DIAGNOSES: Exercise induced bowel ischemia, Inflammatory Bowel Disease, ascites, organomegaly, abdominal mass, pregnancy, diastasis recti.

TEST AND RESULTS:
Stool calprotectin negative. WBC 11.6, hemoglobin 13.4, platelets 303. LFTs within normal limits. Serum HCG negative. Creatinine 0.81. CT abdomen and pelvis with contrast: Large cystic lesion in the abdomen and pelvis measuring 28 x 19 x 38 cm. The origin of this lesion is unclear. Secondary moderate to severe right and mild to moderate left hydropneumothorax.

FINAL WORKING DIAGNOSIS:
Large cystic abdominal mass, originating from the pelvis

TREATMENT AND OUTCOMES:
1. Emergent laparotomy showing large left ovarian cyst. 10L of fluid drained. Left salpingo-oophorectomy performed.
2. Pathology consistent with serous cystadenoma. Fallopian tube without significant abnormality. No malignant cells in the pelvic washing.
3. Medication compliance
4. Weekly immunotherapy injections
5. Anxiety
6. Water samples were collected serially before and after treatment cycles to ensure eradication prior to re-opening the pools.

HISTORY:
An 18-year-old NCAA D-1 football athlete developed emesis during exercise. During his freshman season, he had recurrent URIs and emesis during practice. The vomiting appeared to be post-tussive during intense exercise. The athlete has not experienced this before but has a history of asthma and allergies. Symptoms improved temporarily with a non-seated antihistamines and a H2 blocker. But, after one week, the vomiting returned. A PPI, fluticasone nasal spray and albuterol were then added, which appeared to help. Symptoms returned in the spring and montelukast was added to his regimen. He continued to complain of mucus accumulating in his throat that would cause him to gag which would occur with intense exercise and then even while trying to sleep. An EGD was performed which was normal. The athlete was then referred for allergy testing and immunotherapy.

PHYSICAL EXAMINATION:
- Afebrile. Pulse ox 98% on room air. NAD, A&O.
- Nasal mucosa is pale, boggy and swollen with clear d/c; TM clear bilaterally; OP with posterior cobblestoning; no tonsillar exudate or erythema. No cervical L&V.
- RRR. Lungs CTAB. Abdomen ND, BS (+), mild epigastric TTP, and no rebound or mass.

DIFFERENTIAL DIAGNOSIS:
1. Sinusitis
2. Allergic rhinitis
3. GERD
4. Gastritis
5. asthma

TESTS AND RESULTS:
Chest radiograph: normal
Spirometry Testing:
- normal FVC
- FEV1 max was decreased
- Increased RV/TLC
- diffusion 68% of predicted
EGD: normal

Allergy testing: (+) ragweed pollen, several weed pollens, tree pollens, several grasses, dust mites, cockroach, animal dander

FINAL WORKING DIAGNOSIS:
Allergic rhinitis accompanied by emesis due to hypersensitive gag reflex stimulated by postnasal drip

TREATMENT AND OUTCOMES:
1. Continue antihistamines and fluticasone nasal spray
2. Weekly immunotherapy injections
3. Dust mite bed covers to reduce exposure
4. Medication compliance

With the above measures, the athlete’s symptoms were controlled and he continues to play football without difficulty.

HISTORY:
31-year old male presents with left (L) groin pain. While cycling, he twisted rightward with sharp pull and “fullness” to L lateral abdomen and groin. This developed into new GI symptoms including constipation and acid reflux. In 4 months, his BMI decreased from 23 to 17 due to inability to tolerate food bolus. Additional urologic symptoms developed including perineal numbness and pain, incomplete void, and soreness with sexual activity.

PHYSICAL EXAMINATION:

TEST AND RESULTS:
Hipp ultrasound-rectus femoris transversalis fascia with invagination, herniating 0.2 cm at area of tenderness. Joint fluid at L anterior femoral recess. Iliopsoas bursa at L pelvic crest asymmetrically increased. Pubic symphysis
Final Diagnosis: Spontaneous pneumomediastinum

Testing:
Infection

Differential diagnosis:
subcutaneous crepitus to the chest or neck.

Chest: No TTP of ribs, sternum, costosternal joint, or intercostal spaces. No palpable

Resp: CTA bilaterally, good air entry, no wheeze, no accessory muscle use

CV: RRR, no M/R/G

spine or soft tissues.

ENT: no pharyngeal erythema or tonsillar swelling

Gen: NAD, nontoxic

Vitals: Ht 182 cm, Wt 77.1 kg, BP 119/74, HR 74 bpm, Temp 36.6 C
disease. He denied current or prior smoking, drug use, and vaping.

headache. He had no personal or family history of asthma, pneumothorax, or cardiac

symptom presentation, he performed baseline strength testing. He denied fevers, pain
rotation. He also reported feeling more out of breath than usual. Two days prior to

pain was constant and worse with swallowing, speaking, neck extension, and head

neck. He described it as a stiffness and as a weight pressing down on his chest. The

chest. He fell asleep without pain, but the next day noted pain in his upper chest and

Above the patient’s right anterior chest on palpation.

exertion or weight lifting.

Symptoms and X-ray findings resolved within two weeks.

He was cleared at 2 weeks with a gradual progression of activity and avoidance of full

exertion or weight lifting.

One week later, he was cleared to return to full activity with no restrictions. He was
advised to avoid breath-holding with activity. He has had no recurrence of symptoms.

HISTORY: 18 y/o male presents during review of incoming student-athlete health history documents with history of "severe hemophilia A", self-treated with Factor VIII infusions every other day & "extra doses" as needed. Letter from pediatric hematologist clearing him to participate: "there is no medical reason he cannot participate in competitive water polo." PMH: Two hospitalizations due to blood infection (2003 & 2005), ADHD diagnosis (2009), Type 2 SLAP lesion right shoulder (2016), Wisdom Teeth Extraction (3/2017).

PHYSICAL EXAMINATION: Visible keloid scarring present at two sites on the right and left side of patient’s chest consistent with port removals. BP: 129/92mmHG.
Pulse: 64bpm. Height 77in. Weight 225.2lbs. PE otherwise benign.

DIFFERENTIAL DIAGNOSIS: Hemophilia A
Venous Thromboembolism Disease
TEST AND RESULTS:
VWF profile: Normal
Random Factor VIII level: 12% (~30 hours after infusion)
Post-infusion Factor VIII level: 147% down to 77% at 6 hours.
Hepatitis A/B/C Immune Status, HIV Antibody: negative
Normal PT. Prolonged PTT which corrects with normal plasma mixing.
Unremarkable CBC, CMP
FINAL WORKING DIAGNOSIS: Severe Hemophilia A.

TREATMENT AND OUTCOMES: Prophylactic Treatment of Advate 5000units daily, during water polo season, just prior to participation in practice or game. If practice/games extend post-infusion 8 hours or beyond, patient to self-infuse additional 5000units. Self-infusion every other day when not participating in water polo. In case of an emergency/life-threatening bleeding, patient to infuse first and then, if stable, seek care at RWJ-Rutgers ER (or other regional Hemophilia Treatment Center while traveling). If clinically warranted, patient to seek care at closest ER and bring factor with him. Annual re-evaluations to be performed at Hemophilia Treatment Center Rutgers-RWJ. Patient has been fortunate to participate in competitive collegiate water polo for 2+ seasons with no adverse sequelae.

HISTORY: 29 yo male Brazilian jujitsu fighter with a history of Henoch-Schonlein purpura and eczema presents to clinic for 6 months of right anterolateral calf pain without a clear injury. He reports constant, dull, aching pain, worse with dorsiflexion and resisted plantar flexion. He notes associated purging edema, dry leathery skin, hypopigmentation, and hyperesthesia that began 3-4 months ago. He has stopped jujitsu due to symptoms. Tib-fib x-rays and venous duplex were negative. He tried acetaminophen, ibuprofen, physical therapy, topical clobetasol, and oral prednisone with short-term improvement. PHYSICAL EXAMINATION: Skin of the anterolateral calf is indurated with hair loss, a leathery appearance, and areas of depigmentation. The distal lateral calf is warm and erythematous, with swelling posterior to the lateral malleolus. Tinel’s sign is negative at the bimalleolar region. The malleoli region is tender to palpation.

TREATMENT/OUTCOME: Patient was held from activity until follow-up weekly X-rays demonstrated resolution of free air in the neck. Symptoms and X-ray findings resolved within two weeks.

One week later, he was cleared to return to full activity with no restrictions. He was advised to avoid breath-holding with activity. He has had no recurrence of symptoms.

HISTORY: 29 y/o male Brazilian jujitsu fighter with a history of Henoch-Schonlein purpura and eczema presents to clinic for 6 months of right anterolateral calf pain without a clear injury. He reports constant, dull, aching pain, worse with dorsiflexion and resisted plantar flexion. He notes associated purging edema, dry leathery skin, hypopigmentation, and hyperesthesia that began 3-4 months ago. He has stopped jujitsu due to symptoms. Tib-fib x-rays and venous duplex were negative. He tried acetaminophen, ibuprofen, physical therapy, topical clobetasol, and oral prednisone with short-term improvement. PHYSICAL EXAMINATION: Skin of the anterolateral calf is indurated with hair loss, a leathery appearance, and areas of depigmentation. The distal lateral calf is warm and erythematous, with swelling posterior to the lateral malleolus. Tinel’s sign is negative at the bimalleolar region. Pulses are normal bilaterally with ankle plantar and dorsiflexion. Ankle ROM is full. Light touch sensation is intact in L2-L5 dermatomes and strength is 5/5 in lower extremities.

DIFFERENTIAL DIAGNOSIS: Complex regional pain syndrome, Cellulitis, Scleroderma, Eosinophilic fasciitis, Chronic exertional compartment syndrome, Vascular insufficiency TEST AND RESULTS: Lab work: inflammatory markers and rheumatologic labs negative except for elevated CRP (356) of unknown significance. EMG/NCS: low amplitude right vs left sural sensory nerve suggesting sural neuropathy although within normal limits; no fibular neuropathy or radiculopathy. MRI right leg: nonspecific skin thickening of anterolateral shin with fascial edema and mild fibularis longus myositis. Skin biopsy: linear morphea versus eosinophilic fasciitis. FINAL WORKING DIAGNOSIS: Segmental Linear Morphea (localized scleroderma)
TREATMENT AND OUTCOMES: Dermatology referral led to biopsy; subsequently, treatment with PO methotrexate (MTX), high dose IV methylprednisolone for three cycles, and topical clobetasol ointment BID. UVa1 phototherapy was also started due to extensive disease and ankle and knee joint involvement. Subjective improvement in ROM, skin stiffness, and strength per patient after 2 cycles of methylprednisolone. Switched to SQ MTX for better absorption and lower cost. Patient continues to improve as he remains on the above treatment protocol.

3136 May 29 4:15 PM - 4:35 PM
An Unexpected Curveball Causing Fatigue In A Softball Player
Om Sam1, Stanley Hunter2, Nina Millet1, 1UHS, Johnson City, NY, 2UHS, Binghamton, NY.
Email: omsam3288@gmail.com
(No relevant relationships reported)

HISTORY: 19 year old caucasian female softball player with no past medical history presented to the office for fatigue and reduced exercise tolerance for a month. She also complained of muscle cramps in her calves, decreased appetite, intermittent headaches, nausea and one episode of non-bloody, non-bilious emesis. Her athletic performance had decreased despite no changes in her training regimen. She measured her glucose via a glucometer with readings in the 70s. She maintained proper fluids, electrolyte and nutrient intake. She denies any changes in her weight, menstrual cycle, depression and recent illness. 10 point ROS was negative. Social history is unremarkable except for occasional alcohol intake. Regular menstrual cycle.

PHYSICAL EXAMINATION: Vital signs within normal limits. No signs of acute distress. Normal mentation and affect. No jaundice or pallor. Regular rhythm and rate. No murmurs appreciated. Lungs clear to auscultation. Abdomen is soft, non-tender, with normal bowel sounds, no masses appreciated. 5/5 strength and sensation to light touch intact in all extremities. Biceps and knee jerk reflex 2+.


FINAL WORKING DIAGNOSIS: Beta-thalassemia trait

TREATMENT AND OUTCOMES: Initial treatment with iron supplementation for 3 weeks showed no improvement. Although it may take 6-8 weeks for Hgb levels to return to normal. Repeat Hgb after 3 weeks should have revealed a mild improvement. Iron panel was ordered to confirm diagnosis, which was normal. Further family history revealed thalassemia, which was then confirmed with Hgb electrophoresis. Folic acid 2 mg daily started, iron supplementation discontinued. Cessation of activity for 4 weeks to promote recovery, then gradual return to full activity. Follow-up in 2 months.

3137 May 29 4:35 PM - 4:55 PM
Almost Vaping Your Way To Medical Disqualification
Eric Emmanuel Coris, William Anderson, Yuli Chulskiy, Sanders Chae, Byron Moran. The University of South Florida, Tampa, FL.
Email: ecoris@usf.edu
(No relevant relationships reported)

HISTORY: 18 year old male freshman Division I football athlete with a history of abnormal pre-participation EKG. Initial EKG was significant for left axis deviation, incomplete right bundle branch block, prominent p wave, t wave inversion in V1 and V2. He had no symptoms, and denied significant past medical history. Echocardiogram revealed significantly enlarged right atrium, pulmonary hypertension.

PHYSICAL EXAMINATION: Normal, except CV: RRR without M/G/R; nl S1, prominent S2 in pulmonic area, Intermittent fixed split S2, normal PMI.

DIFFERENTIAL DIAGNOSIS: Pulmonary hypertension/Anomalous pulmonary return/Arthrythmogenic right ventricular dysplasia/Interstitial lung disease/Sarcoid/Intracardiac shunt/Artial septal defect/Ventricular septal defect/Obstructive sleep apnea/Obstructive lung disease/HIV/Granulomatous lung disease/Hypersensitivity Pneumonitis

TEST AND RESULTS: CT angiongraph of the chest revealed mild enlargement of the right atrium. Ill-defined opacites bilaterally with tiny focal luencies which may represent focal developing cavitation. Mixed solid and ground-glass opacites with focal internal luencies mainly located peripherally. Small lucent central regions are suggested within these regions.

Further significant history of two months prior to initial EKG and the day after initial EKG two vaping episodes. No tobacco, no THC reportedly contained but some type of flavored liquid was present. Believes he split one e cigarette with another person. Prior to that episode he vaped every other weekend, for a few weekends, two months prior to the initial EKG. No symptoms ever noted after vaping that he was aware of. Did have rhinorrea and sneezing for several months this summer, he felt related to seasonal allergic rhinitis.

FINAL WORKING DIAGNOSIS: Vaping induced hypersensitivity pneumonitis

TREATMENT AND OUTCOMES: Athlete refrained from further vaping. Held from competitive activity until completion of workup, athlete was gradually progressed through increasing cardiopulmonary exercise to return to play. Returned to full play over a 2 week progressive period with no symptoms. Follow-up CT of the chest and pulmonary function tests returned to normal.

F-40 Clinical Case Slide - Spine
Friday, May 29, 2020, 3:15 PM - 5:15 PM
Room: CC-3020

3138 Chair: Stanley Alan Herring, FACSM. University of Washington, Seattle, WA.
(No relevant relationships reported)

3139 Discussant: Samuel K. Chu. Shirley Ryan AbilityLab, Chicago, IL.
(No relevant relationships reported)

(No relevant relationships reported)

3141 May 29 3:15 PM - 3:35 PM
“ Tingling In The Scrum”: Paresthesias And Neck Pain - Rugby
Jonathan Smits1, Pierre Rouzier, FACSM2, John Herbert Stevenson1. 1University of Massachusetts Medical School, Worcester, MA, 2University of Massachusetts, Amherst, MA.
(No relevant relationships reported)

HISTORY: A 19 year old female college student “new to club rugby” presented to the campus health clinic for evaluation of neck stiffness and extremity tingling following last week’s practice. She was unable to recall a specific injury. However, she reported later feeling neck stiffness with associated soreness. She also reported paresthesias involving both hands, left worse than right, and her left foot. Her symptoms were improving but she had not resumed practice.

She reported being a multi-sport high school athlete with participation in varsity field hockey and lacrosse without prior concussion, head or neck pain, or extremity abnormalities. She had also been in an auto accident years prior without subsequent injury. History was notable for resolved low back pain, and a family history of back pain.

PHYSICAL EXAMINATION: Spine exam demonstrated FROM with no C/T/L spinous process tenderness. Spinal maneuver was negative. Tightness was appreciated in left trapezius muscle compared to right. Shoulders demonstrated FROM with no C/T/L pain.

1. Cervical spine x-rays: straightening without bony pathology
2. MRI brain & cervical spine:
   - Mild disc narrowing at C5-6
   - Chirial malformation with pointed tonsils herniated 1.1 cm from foramen magnum
   - Syrinx spanning C5-T4 with max diameter 3 mm in upper thoracic cord

**FINAL WORKING DIAGNOSIS:**
- Chiari I malformation with C5-T4 syringomyelia

**TREATMENT AND OUTCOMES:**
The athlete was initially restricted from rugby activities until follow-up evaluation. She noted interval improvement and wished to pursue strength training at season end. Her symptoms then recurred with overhead lifting, and later with chiropractic treatments. Upon return to campus, brain and cervical MRI were ordered as recommended by a neurologist. Due to the above MRI findings, she stopped recreational activity and was referred for urgent neurological evaluation. She will undergo decompression surgery.

**DIFFERENTIAL DIAGNOSIS:**
- Cervical Cord Compression
- Cervical Facet Radiculopathy
- Cervical XRAYS: No osseous abnormality.
- Cervical CT Scan: L neural foramen stenosis at C3/C4, R neural foramen stenosis at C6/7. Mild to moderate spinal canal stenosis at C6/7 and C7/T1. Thoracic CT Scan: Normal CT chest, abdomen, pelvic, and thoracic spine.
- MRI Cervical Spine: C6-7 where a right paracentral / foramina disc protrusion. Mild central canal stenosis at T1-2 level due to diffuse disc bulge.

**FINAL WORKING DIAGNOSIS:**
- C6-7 cervical disc herniation with mild to moderate cervical cord stenosis at C6/7 and T1-2.

**TREATMENT AND OUTCOMES:**
- R-sided weakness resolved after 4 weeks of supportive care, watchful waiting and physical therapy.

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**HISTORY:**
21-year-old senior high school football offensive line men sustained a neck injury while tackling. During the third quarter of a midseason game, he tackled an opponent player, and they both landed on the ground. The patient was facing down with opposing player just underneath his anterior torso. Shortly after the play, given he was near the ball, a pile up of players landed on his upper back. He sustained a hyperextension injury of his cervical neck since his head was laying on the player he tackled. Patient described an immediate “pop” sensation in his neck and had “complete weakness & numbness” of his R upper & lower extremities.

**PHYSICAL EXAMINATION:**
- After safely placing patient in supine position on spine board, examination demonstrated he was alert and orientated x 4, had spindled process tenderness from C4-C7. Sensory testing along both extremities revealed significantly decreased and almost absent sensation in R upper & lower extremities. He was unable to raise / move his R arm or leg. His distal pulses and breathing were within normal ranges.

**DIFFERENTIAL DIAGNOSIS:**
- Cervical Cord Compression
- Cervical Facet Radiculopathy

**TESTS AND RESULTS:**
- Cervical XRAYS: No osseous abnormality.
- Thoracic CT Scan: Normal CT chest, abdomen, pelvic, and thoracic spine.
- MRI Cervical Spine: C6-7 where a right paracentral / foramina disc protrusion. Mild central canal stenosis at T1-2 level due to diffuse disc bulge.

**FINAL WORKING DIAGNOSIS:**
- C6-7 cervical disc herniation with mild to moderate cervical cord stenosis at C6/7 and T1-2.

**TREATMENT AND OUTCOMES:**
- R-sided weakness resolved after 4 weeks of supportive care, watchful waiting and physical therapy.

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**HISTORY:**
A 15 year old male presented to the emergency department with back pain after Trampoline Training Trauma: A Diver’s Injury. Luting Eckeweskeiler1, Anne Doran2, Poomon Thaker, FACSM1. 1Resurrection Medical Center, Chicago, IL. 2Lutheran General Hospital, Park Ridge, IL. (Sponsor: Poomon Thaker, FACSM) (No relevant relationships reported)

**TRAMPOLINE TRAINING INJURY: A DIVER’S INJURY**

**Tests and Results:**
1. Spinal cord contusion
2. Lumbar vertebral fracture
3. Lumbar sprain
4. Acute spondylodlysis or spondyloolisthesis
5. LumboSacral Neuropathy

**Diagnoses:**
- Cervical spine: unremarkable
- MRI cervical-spine: unremarkable
- MRI cervical-thoracic-lumbar:
  - traumatic injury of the lumbar spine with disruption of the interspinous ligament at the L1-L2 level
  - small ventral extradural hematoma contained by the posterior longitudinal ligament at L2-L4
- MRI lumbar spine, hospital day #2:
  - decrease in size and craniocaudal extent of the ventral extradural collection
  - edema within psoas and paraspinous muscles at L2-L4

**Final diagnosis:**
- Extradural hematoma of lumbar spine at L2-L4
- Tear of interspinous ligament at L1-L2

**TREATMENT AND OUTCOMES:**
- Admission to PICU for close neurologic monitoring with neurosurgery and trauma on consult. He did not report further numbness or tingling in lower extremities.
- Physical therapy
- Stepped down to general pediatric floor on hospital day #2
- Discharged on hospital day #3 with lumbar sacral orthosis brace
- Experienced ongoing headaches for several weeks
- Back to activity as tolerated, continue to monitor recovery

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**HISTORY:**
A 21-year-old football player experienced low back pain and complete loss of sensory and motor function of his legs for about 30 seconds. All sensory and motor function subsequently returned and he was able to ambulate from the trampoline into the home. He denied ongoing sensory or motor deficits in his legs, loss of consciousness, neck pain, urinary or bowel incontinence, or upper extremity weakness.

**Physical examination:**
- Examination revealed a well appearing male who was able to ambulate slowly but independently with normal gait. He had midline tenderness in the upper lumbar vertebrae. There was normal alignment of the spine without step offs. His strength was 5/5 and reflexes were 2+ in lower extremities. He did not have deficits to touch sensation and did not have saddle anesthesia.

**DIFFERENTIAL DIAGNOSIS:**
- Cerebrovascular accident
- Brachial plexus stretch injury
- 3. Brachial plexus avulsion injury

**TESTS AND RESULTS:**
- MRI of cervical spine without contrast – small disc herniation.
- MRI of brachial plexus with and without contrast - edema involving right scalene and adjacent fascial planes extending into brachial plexus as well as into right C6/7 and C7/T1 neural foramen to confirm nerve root sleeve tears, CTA of neck – negative for artery involvement, EMG study showed that the brachial plexus was not avulsed, but not currently sending EMG signals to hand.

**FINAL WORKING DIAGNOSIS:**
- Brachial plexus stretch injury

**TREATMENT AND OUTCOMES:**

**Patient has been responding well to a treatment plan combining aspects of the above mentioned interventions. Has been showing greater activation of right hand and forearm muscles with ability to complete weak grip at this stage. Right upper extremity remains supported in sling.**

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**HISTORY:**
A 75 year old female tennis player was referred for bilateral elbow pain with suspected lateral epicondylitis. She noted 3 months of pain in her left more than right ventral forearms with radiation into her lateral elbows as well as posterior elbow pain.
bilateral shoulder pains. The forearm pain was constant and worsened by single
backhand with tennis, lifting weights. She reported reduced grip strength and her
racquet falling out of her hands.

PHYSICAL EXAMINATION:
Cervical range of motion was within functional limits. Elbow examination showed full
active and passive range of motion, minimal tenderness along lateral epicondyle and
just distal at tendinous origin, and no pain with resisted wrist extension and middle
finger extension. She had finger extension weakness without pain bilaterally 3.5 and
otherwise motor testing was 5/5 C5-T1 myotomes. Sensation was intact in C5-T1
dermatomes bilaterally. Reflexes were 2+ and symmetric of biceps and brachioradialis
and 3+ at the triceps bilaterally.

DIFFERENTIAL DIAGNOSIS:
1. Bilateral cervical spondylosis
2. Cervical spine stenosis with myelopathy
3. Posterior interosseous neuropathy

TEST AND RESULTS:
Cervical Spine anterior-posterior and lateral radiographs:
1. Grade 2 anterolisthesis of C7 on T1 is seen with bilateral pars fracture of C7.
   Moderate multilevel degenerative disc disease.

MRI of the Cervical Spine without Contrast:
- Advanced facet arthropathy at C7-T1. Anterolisthesis of C7 on T1 causing moderate/
  severe spinal stenosis with mild cord deformity. Severe bilateral foraminal stenosis
  at this level.

FINAL/WORKING DIAGNOSIS:
Cervical spine central stenosis with myelopathy

TREATMENT AND OUTCOMES:
1. Neurosurgery referred recommended urgent C7-T1 anterior cervical discectomy and
   fusion followed by C5-T2 posterior spinal fusion
2. She was placed in hard cervical collar at all times and surgery was performed 1
   week after neurosurgery evaluation
3. At 1 week postoperative, patient felt 80% improvement in pain in forearms and
   elbows along with subjectively improved grip strength
4. She continued the hard cervical collar until repeat radiographs at 6 weeks post
   surgery.
5. Patient was instructed to avoid playing tennis. She was also informed to avoid
   bending, twisting of her neck or lifting greater than 5 pounds until further evaluation
   in 6 week visit.

F-53 Free Communication/Poster - Body Composition
Friday, May 29, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

3180 Board #1 May 29 1:30 PM - 3:00 PM
Comparison Of DXA And Ultrasound For Measurement Of Body Composition In Physically Active College Students
Jeremy T. Barnes1, Jason D. Waggenar1, Jeremy P. Loenneke, FACSM1, Monica L. Kearney, William M. Miller3, Majid M. Syed-Abdul1, 2Southeast Missouri State University, Cape Girardeau, MO. 1The University of Missouri, University, MS. 3The University of Mississippi, Cape Girardeau, MS. 4The University of Missouri, Columbia, MO.

(No relevant relationships reported)

Body composition is a frequently assessed component of health-related fitness. Recently, a portable computer based A-mode ultrasound system has become commercially available for estimating percent body fat (%fat). If a single-site estimate of %fat is valid against the dual-energy X-ray absorptiometry, this would have immediate implications for assessing body composition in field based settings. However, little is known how these estimates compare with each other. PURPOSE: The aim of this study was to determine the accuracy of the A-mode ultrasound device as a way to estimate %fat. METHODS: Participants %fat was estimated using an A-mode ultrasound device biceps measurement and DXA, which served as the criterion estimate. Participants (75 males, 87 females) were physically active college students [age 21 (SD 3) yrs, height 1.73 (SD 0.10) m, body mass 76.0 (SD 15.74) kg and BMI 25.4 (SD 4.1) kg/m2]. Methods were compared using a Bland-Altman plot with DXA serving as the criterion method. The coefficient of determination and standard error of the estimate were assessed using linear regression. Total error was calculated to determine the average deviation of individual scores from the line of identity. RESULTS: DXA estimate %fat was 25.9 (SD 11.5)% and the A-mode ultrasound estimate was 22.6 (SD 10.9)%. The A-mode ultrasound device underestimated %fat by -3.3 (SD 8.0) % (p<0.0001). With a standard deviation of 8, the calculated 95% limits of agreement (SD x 1.96 ± mean difference) were -12.3 to 19.04%. The coefficient of determination was 0.55 with a standard error of the estimate of 7.6 %fat. The average deviation of individual scores from the line of identity was 8.6% (total error). CONCLUSIONS: The development of time efficient methods for estimating %fat are important for better screening large samples, particularly in field settings. Although a single site estimate of %fat is efficient, it did not provide valid estimates when compared to DXA in this population. The limits of agreement were wide, indicating poor agreement between the two assessments of %fat. Future studies may want to consider investigating multiple measures using sites A-mode ultrasound as this may better estimate overall %fat.

3180 Board #3 May 29 1:30 PM - 3:00 PM
Training Effects Of Alternated And Pulsed Currents On Body Mass Of Competitive Athletes
Pedro F A Oliveira1, Karrenna A G Modesto1, Bottaro Martim2, João L Q Durigan1, Nicolas Babault3, 1Federal Institute of Brasilia - IFR, Brasilia, Brazil. 2University of Brasilia - UnB, Brasilia, Brazil. 3Univestérité de Bourgogne - UB, Dijon, France.

Email: pedro.oliveira@ifb.edu.br

(No relevant relationships reported)

Neuromuscular electrical stimulation (NMES) is widely used for strength training in
healthy individuals and athletes. Previous studies have shown that alternating mid-
frequency currents (MF) and low-frequency pulsed currents (PC) have similar effects
on quadriiceps evoked strength and level of discomfort in this population. However,
little is known about the effects and best parameters of NMES to induce body mass
loss.

Purpose: To evaluate the effects of 6 weeks of training with 2 different NMES currents
- medium alternated and low frequency pulsed current - on body mass of competitive
athletes. METHODS: A double-blind controlled and randomized experimental study was
carried out with 33 athletes (22.2 ± 2.6 yrs, 74.7 ± 9.8 kg, 176.8 ± 6.0 cm), divided into
3 groups: mid-frequency current (MF, n=12), pulsed current (PC, n=11) and control
group (CG, n=10). Body mass was assessed before and after the intervention through
a body mass scale (BC-418, Tanita Corporation of America Inc., Illinois, USA). NMES
training was performed 3 times per week and consisted of 18 sessions, 15 min/
session (36 involuntary isometric quadriiceps contractions per session), 6s duration in
each contraction interspersed with 18s rest. Data were expressed as means ± standard
deviation (SD) and normality was checked using the Shapiro-Wilk test. A two-way analysis of variance (ANOVA) with repeated-measures and Tukey post-hoc test were used to analyze data for group and time effects. Statistical significance was accepted with p < 0.05. RESULTS: After the training period, body mass did not change in any group (PRE: PC = 76.1 ± 8.1 kg, MF = 74.7 ± 9.8 kg, CG = 73.5 ± 21.5 kg; POST: PC = 76.7 ± 8.9 kg, MF = 74.7 ± 9.4 kg, CG = 74.0 ± 11.3 kg; p > 0.05). All currents produced similar evoked torque and levels of discomfort (p > 0.05). Conclusion: Quadriceps NMES training applied through alternated or pulsed currents produced similar effects and did not change body mass in competitive athletes.

3183 Board #4 May 29 1:30 PM - 3:00 PM Changes In Body Composition Following A Competitive Season In Division I Collegiate Female Gymnasts Athletes
Monica L. Kearney, Jeremy T. Barnes, Jason D. Wagganer, Seth M. Sievers, Patryk P. Piekarczynski, Michelle L. McIntosh. Southeast Missouri State University, Cape Girardeau, MO. Email: mkearney@semo.edu (No relevant relationships reported)

A large muscle mass to total body mass ratio benefits power athletes such as gymnasts. While collegiate gymnastics athletes train strength and power in the pre-season but reduce training during the competitive season, the degree to which body composition changes during the competitive season is not known. PURPOSE: This study examined changes in body composition in a team of female Division I collegiate gymnastics athletes before and after their competitive season. It was hypothesized that percent body fat (%BF), total fat mass (TFM), and bone mineral content (BMC) would remain unchanged from pre- to post-season. METHODS: Fifteen female collegiate gymnasts (age = 19 ± 1 year, ht = 1.62 ± 0.05 m, wt = 62.7 ± 7.2 kg) volunteered to undergo measures of body composition assessment before and after their spring competitive season. During pre-season (PRE), participants were instructed to arrive to the laboratory in a euglycemic state. Following written informed consent, participants provided a mid-stream urine sample which was used to screen for pregnancy and to determine urine specific gravity (USG) using a handheld digital refractometer. Participants then performed a dual-energy x-ray absorptiometry (DXA) scan to determine TFM, %BF, and BMC. Immediately after the competitive season, participants returned to the laboratory and repeated all procedures (POST). Data were analyzed using paired-samples t-tests with significance set at p < 0.05. RESULTS: BMC significantly increased across the season (6.422 ± 0.206 g PRE vs. 6.485 ± 0.203 g POST; p < 0.05). While there was a downward trend in both TFM (34.158 ± 2.211 kg PRE vs. 32.905 ± 2.335 kg POST; p = 0.1) and %BF (25.68 ± 1.16 % PRE vs. 24.99 ± 1.23 % POST; p = 0.1), these were not significantly different at the a priori p < 0.05 level. There was no change in body weight. CONCLUSION: The significant increase in BMC, combined with the downward trend in TFM and %BF, with no change in body weight, suggests athletes maintained body composition in a favorable manner during the competitive season. The increase in BMC further suggests that stimuli during the competitive season were strong enough to elicit favorable changes in bone remodeling during in-season competition.

3184 Board #5 May 29 1:30 PM - 3:00 PM Correlation Between Visceral Fat Measured By Bioelectrical Impedance And Dual Energy X-ray Absorptiometry In Males Saori Braun, Morgan Goldammer, Tucker Goesch, Alexa Hayes, Garrett Stadler, Steven Fleck, FACSIM. University of Wisconsin-Eau Claire, Eau Claire, WI. Email: braunsi@uwec.edu (No relevant relationships reported)

Measurement of abdominal adiposity/visceral adipose tissue is clinically relevant in determining individuals’ risks of developing cardiometabolic conditions. Bioelectrical impedance (BIA) can be utilized to estimate visceral adipose tissue as an indicator for cardiometabolic dysregulation. PURPOSE: To determine the correlation between multi-frequency BIA-derived areal visceral fat (cm²) and dual energy x-ray absorptiometry (DXA)-derived volumetric visceral fat (cm³) in normal weight college-aged males. METHODS: Visceral fat was measured three times in the following order: 1) BIA, 2) DXA and 3) BIA in college aged males during the early morning. The mean of the two BIA measurements was used for statistical analyses. All three measurements were completed in the same session and at least 10 minutes apart. To ensure participants were normally hydrated [urine specific gravity (USG) range: 1.022-1.028], USG was determined immediately prior to the testing session. Correlations between BIA visceral fat and DXA volumetric visceral fat and correlation between BIA visceral fat level and DXA android/gynoid (A/G) percent fat ratio Pearson r correlations. RESULTS: Pearson correlations were calculated. RESULTS: Assessments were done on 102 males (mean age = 20.35 ± 1.38 years; mean body mass index = 25.40 ± 3.36 kg/m²). Correlation analysis indicated a moderately high direct correlation between BIA areal visceral fat (47.54 ± 32.78cm²) and DXA volumetric visceral fat (172.20 ± 274.36cm³), r = .678, p < .001. There was a moderately direct correlation between BIA visceral fat levels (4.26 ± 3.24) and DXA A/G percent fat ratio (0.83 ± 0.20), r = .570, p < .001. CONCLUSIONS: In normal weight adults, visceral adiposity and A/G percent fat ratio have much stronger associations with cardiometabolic dysregulation than android and gynoid percent fat. The results of this investigation indicate areal visceral fat and visceral fat level derived from BIA may be a set of useful and meaningful indicators of cardiometabolic disease risk when access to DXA is not available. Future research should explore the predictability of BIA-derived areal visceral fat and visceral fat levels, while controlling for factors such as sex, age, and BMI, on cardiometabolic risk.

3185 Board #6 May 29 1:30 PM - 3:00 PM Effects Of Compression Apparel On Body Composition Measurements By Air Displacement Plethysmography In College Males Scott Murr, Alexandra Hultstrom. Furman University, Greenville, SC. (Sponsor: Anthony Catersiano, FACSIM) Email: scott.murr@furman.edu (No relevant relationships reported)

Body composition measured by air displacement plethysmography (ADP) accounts for the effects of trapped isothermal air in hair by having the subject wear a swim cap to compress the hair on the head. It is recommended that even subjects with very little hair wear a swim cap. Currently, there are no recommendations that account for the effects of trapped isothermal air in body hair. PURPOSE: The purpose of this study was to investigate the impact of exposed body hair and the effect of wearing limb length single layer compression apparel on body composition measurements using ADP in college males. METHODS: Forty male college students (age 20.0±1.2 yrs; BMI 24.1±3.1 kg/m²) volunteered to participate in the study. Percentage of body fat was evaluated by ADP. To assess the impact of body hair on body composition measurements, ADP measurements were performed in two conditions: wearing single layer compression shorts (CS) with a swim cap (as recommended) and wearing limb length single layer compression (LC) apparel with the same swim cap. The order of apparel was conducted in random order to avoid any potential order effects. RESULTS: Wearing limb length single layer compression apparel to compress body hair increased body mass by an average of 0.3 kg (±0.02); however, there was no significant difference in body density between the CS condition (1.0580±0.014 g/cm³) and the LC condition (1.0629±0.015 g/cm³; p > 0.001). The mean percentage of body fat in the LC condition (15.9±6.5%) was significantly lower than the mean percentage of body fat in the CS condition (18.0±6.2%; p < 0.001). CONCLUSIONS: The effect of trapped isothermal air in body hair impacts body composition measurements by ADP. Covering exposed body hair in males when assessing body composition via ADP results in a significantly lower percentage of body fat compared to the minimal clothing recommendation. Attention should be paid to minimizing exposed body hair on males when assessing body composition by air displacement plethysmography. The present results suggest that this minimization may be achieved with males by wearing limb length single layer compression apparel.

3186 Board #7 May 29 1:30 PM - 3:00 PM Athlete-specific Prediction Equations For Appendicular Upper And Lower Body Lean Soft Tissue With BIA Megan Hetherington-Rauth, João P. Magalhães, Pedro B. Júdice, Inês R. Correia, Analiza M. Silva, Luís B. Sardinha. Faculdade de Motricidade Humana, Universidade de Lisboa, Lisbon, Portugal. (No relevant relationships reported)

Given sport specific physiological demands, knowing the distribution of lean soft tissue among the body segments is of relevance for optimizing athletic performance, monitoring response to specific training regimens, as well as for evaluating potential injury risk. Bioelectrical impedance (BIA) is a widely used portable, low cost, and easy technique to assess body composition. However, most equations used by BIA to predict lean body tissue are not specifically developed to optimize athletic performance.Purpose: The aim of this investigation was to develop and cross-validated prediction equations to estimate dual-energy X-ray absorptiometry (DXA)-derived appendicular lean soft tissue (LST) of the arms and legs based on whole body BIA in a population of athletes.

METHODS: Two-hundred sixty-five athletes (age 22.2±4.6 yrs) from a variety of sports had LST of the arms and legs assessed by DXA and whole-body reactance (Xc) and resistance (R) measured by BIA. Using measures of height, the resistance index (RI=height/R) was calculated. Prediction equations were established using a cross validation method where 177 athletes (2/3 of the sample) were used for equation development and the remaining 88 athletes (1/3 of the sample) were used for equation validation.

RESULTS: The developed prediction equations were as follows: arm LST=0.940*Xc +0.182*height – 0.043*R + 18.82; leg LST= 1.983*Xc +0.154*height – 0.024*R + 28.32; r= .91, p<.001. The developed prediction equations were as follows: arm LST=0.940*Xc +0.182*height – 0.043*R + 18.82; leg LST= 1.983*Xc +0.154*height – 0.024*R + 28.32; r= .91, p<.001.
Multi-compartment body composition assessment techniques are common in research and for assessing intervention success. Establishing the validity and reliability of assessment techniques help to ensure appropriate outcomes.

**METHODS:** Thirty-four healthy adults (53% female; 37.7 ± 15.5 y; 27.6 ± 7.0 kg∙m⁻²) were assessed using three body composition assessment methods: BIS FM and FFM, and ICC values suggesting good repeatability with the largest variation being observed for BIS FM and FFM.

**RESULTS:** Intra-test ICC, CV, and SEM values for all three measurement techniques are provided for each visit consisting of two consecutive rounds (four total measurements) of assessments including body weight, fasted (10 h) and after abstaining from exercise (24 h). Each visit consisted of two consecutive rounds (four total measurements) of assessments including body weight, FM, FFM, or percent fat) to have successful regular and post-seasons.

**CONCLUSIONS:** Multi-compartment models using DIR and IND nitrogen analysis to determine RLV demonstrated strong agreement. The more complex models (3C and 4C) were less affected by RLV method than the 2C model and produced limits of agreement for each model was assessed using paired t-tests and Bland-Altman analysis. Significance was accepted at p < 0.05.

**RESULTS:** Strong correlations (ICCs > 0.98) were observed for all %fat models between IND and DIR methods. Measures of %fat using IND were larger than DIR (mean differences, 0.7 to 1.6%, all p < 0.001). However, the magnitudes of the differences were small (Cohen’s d, 0.08 to 0.17). Additionally, the range of individual differences between IND and DIR was less than 4.0%, with 3C and 4C producing especially narrow limits of agreement (±1.4%fat and 1.9%fat) compared to 2C (±3.4%fat).

**CONCLUSIONS:** Multi-compartment models using DIR and IND nitrogen analysis to determine RLV demonstrated strong agreement. The more complex models (3C and 4C) were less affected by RLV method than the 2C model and produced limits of agreement less than ±2.0%fat. The results presented here indicate that DIR and IND nitrogen analysis may be used interchangeably for the assessment of body composition when using 3C and 4C models.

**Table 1:** ICC, CV, and SEM values for BIA, DXA, and BIS analysis

<table>
<thead>
<tr>
<th>Method</th>
<th>ICC (CV) (%)</th>
<th>SEM (grams)</th>
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<tbody>
<tr>
<td>BIA Fat Mass</td>
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<td>1.20</td>
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<tr>
<td></td>
<td>Inter 1.00</td>
<td>3.26</td>
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<tr>
<td>DXA Fat Mass</td>
<td>Intra 0.99</td>
<td>1.92</td>
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<td></td>
<td>Inter 0.99</td>
<td>1.26</td>
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<td>BIS Fat Mass</td>
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<td></td>
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<td></td>
<td>Inter 0.99</td>
<td>0.68</td>
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<td>DXA Fat-Free Mass</td>
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strongly related to soccer performance. PURPOSE: To examine body composition of NCAA Division I female soccer players by position and season. METHODS: One hundred seventy-five female collegiate soccer players from 4 NCAA Division I Universities participated in this study. Athletes were categorized by positions of forward (n=47), midfielder (n=51), defender (n=57), and goalkeeper (n=20). Seasons were defined as pre-season (Aug), in-season (Sep - Oct), post-season (Nov - Dec), winter off-season (Jan), spring season (Feb - Apr), and summer off-season (May - Jul). A whole body dual X-ray absorptiometry scan assessed percent body fat (%BF), total lean muscle mass (LM), total fat mass (FM), arm and leg LM and FM, and visceral adipose tissue (VAT). Separate ANOVAs with linear mixed-effects models to account for repeated measures assessed differences across positions and seasons. RESULTS: Goalkeepers had significantly higher height, body mass, FM, and arm and leg LM and FM compared to all other positions (p≤0.05). Goalkeepers (28.1 ± 4.3% had significantly higher %BF than defenders (24.4 ± 3.4%) and forwards (24.5 ± 4.0%); p<0.01), and midfielders (26.0 ± 3.9%) had significantly higher %BF than defenders (p <0.01) and forwards (p=0.04). Goalkeepers had significantly greater LM (50.5 ± 4.3 kg) than all other positions, and defenders (46.2 ± 4.7 kg) had greater LM than forwards (44.2 ± 3.7 kg) and midfielders (44.3 ± 4.0 kg; p<0.01). For all positions, %BF was significantly higher in winter off-season (26.7%) compared to summer off-season (25.7%) and pre-season (25.8%; p<0.01). For all positions, total LM and leg LM was significantly lower in winter off-season compared to all other seasons, and total LM was significantly higher in summer off-season than pre-season (p<0.01). CONCLUSIONS: Goalkeepers had higher body mass and FM but also had more LM compared to the other positions. In winter off-season, %BF increased and LM decreased indicating potential undesired changes in training and/or nutrition over the holiday break. In summer off-season, LM was the highest reflecting the emphasis on resistance training and increased volume of training.

**Abstracts were prepared by the authors and printed as submitted.**
CONCLUSIONS: Weight readings are more stable and BD and BF% are not significantly different when HW is performed without head submersion using predicted HV.

Simple, accurate, and cost-effective methods to estimate body composition in field settings are valuable to practitioners and clinicians. An automated smartphone- or tablet-based method of determining body composition from a single 2-dimensional (2D) digital image has recently been developed. However, the test-retest reliability has yet to be determined. PURPOSE: The purpose of this study was to evaluate the test-retest reliability of total body volume (BV) estimated from a single 2D digital image.

METHODS: A convenience sample was recruited for this study (n=30, 21.0±3.1 yr, 86.7% female, 24.8±3.6 kg/m²). Body mass was measured (to the nearest 0.1 kg) with a calibrated digital scale (Tanita BWB-800, Tanita Corporation, Tokyo, Japan). Standing height was measured (to the nearest 0.1 cm) with a stadiometer (SECA 213, Seca Ltd., Hamburg, Germany). Two digital images of each participant were taken from the rear/posterior view using a 12.9 inch, 64 Gig Pro. A paired sample T-test was used to examine the differences between BV obtained from the images (BV1, BV2). An Intraclass Correlations Coefficient (ICC) assessed the strength of the association between BV1 and BV2. RESULTS: No differences were observed between BV1 and BV2 (71.2±12.0 L versus 71.1±11.7 L, respectively, p>0.51), with excellent agreement between the two measures (ICC=0.99). CONCLUSIONS: This novel method of acquiring BV produced near-perfect reliability within our small sample. Given the excellent reliability, future research should examine the validity of acquiring body composition from a single 2D digital image using an automated smartphone- or tablet-based application.
Body Composition And Aerobic Fitness Levels In College Freshmen

Nicole Varone, Vipa Bernhardt. Texas A&M University Commerce, Commerce, TX. (Sponsor: Tony G. Babb, FACSM) (No relevant relationships reported)

Background: Research has shown that college students exhibit gains in fat mass that are up to 5.5 times greater than their peers of the same age who do not attend college (Mihalopoulos et al, 2008). Because of concerns over increasing rates of obesity, college campuses nationwide are engaging in campaigns designed to target college youth and educate them about the benefits of healthy lifestyle behaviors. In order to implement effective intervention strategies, a clear picture of current student fitness must be acquired.

Purpose: The purpose of this study was to examine objective measures of body composition and aerobic fitness levels in current first year students of a rural university. Methods: 24 participants (17F/7M, 18±1 yr, 167.5 ±72.0 cm, 67.9±17.1 kg, 24.5 ±5.2 kg/m² BMI) underwent dual energy x-ray absorptiometry for body fat determination and performed the Astrand submaximal bicycle ergometer test with metabolic measurements (e.g., VO₂), from which estimated VO₂ max was extrapolated. The International Physical Activity Questionnaire (IPAQ) was administered to gather subjective self-evaluation of weekly exercise volume.

Results: The majority of students (13F/4M) fell into the “very poor” category for subjective self-evaluation of weekly exercise. The International Physical Activity Questionnaire (IPAQ) was classified as “poor”, 1 (0F/1M) as “fair”, and 3 (1F/2M) as “good”. 13 participants were classified as “good” or better on VO₂ max and 11 as “fair” or worse (female: 42.5±11.2 ml/min/m² of height while male 39.0 ±15.7 ml/kg/m²). The majority (8F/7M) of participants claimed to engage in a “high” volume of physical activity per week as measured by the IPAQ, while 7 (7F/0M) scored “moderate” and 2 (2F/0M) “low” levels.

Conclusion: Although BMI average was normal, the majority of students failed to meet body fat standards. It is also interesting that all 7 males in the study scored themselves as “high” on the IPAQ, yet 6 of the 7 scored “poor” or “very poor” in the objective determination of VO₂ max. Follow-up studies will investigate these variables change within their first semester and over their entire college life.

Validity Of A 3-Compartment Body Composition Model Derived From A Single 2-Dimensional Digital Image

Katherine Sullivan, Clifton J. Holmes, Bjorn Hornikel, Shengtong Cao, Yu Gan, Michael R. Esco, Michael V. Fedewa. University of Alabama, Tuscaloosa, AL.


Laboratory-based methods for assessing body composition often require specialized equipment, trained administrators, and relatively complex, time-consuming protocols. Simple, accurate, and cost-effective methods to assess body composition in field settings are limited. PURPOSE: The purpose of this study was to evaluate the validity of a digital image derived 3-compartment model estimate of body composition (IMAGE-3C) when compared to a 3-compartment skinfold estimate of body composition (SKF-3C). METHODS: A convenience sample of female participants was recruited for this study (n=24, 24.0±1.0 yrs, 73.1±10.3 kg). Body mass was measured to the nearest 0.1 kg with a calibrated digital scale (Tanita BW800, Tanita Corporation, Tokyo, Japan), and a standing height was measured to the nearest 0.1 cm with a stadiometer (SECA 213, Seca Ltd., Hamburg, Germany). Double measurements (within 2 mm of each other), of skinfold thickness were taken using calibrated skinfold calipers (Lange Skinfold Caliper, Seko, USA) across 7 standard measurements (within 2 mm of each other), of skinfold thickness were taken using a 12.9 inch, 64g iPad Pro. A paired sample T-test was used to examine potential differences between body composition when measured via IMAGE-3C and SKF-3C. Intraclass Correlations Coefficient (ICC) was used to determine the strength of the association between the two methods. RESULTS: No differences in body composition were observed between IMAGE-3C and SKF-3C (17.9±5.1 versus 18.7±5.6, respectively, p<0.08), with excellent agreement between methods (ICC=96). CONCLUSIONS: The IMAGE-3C model appears to be a valid method of estimating body composition. The ability to evaluate body composition from a single digital image provides an accurate and efficient alternative to laboratory methods, which can be utilized by the general public. Data collection is ongoing. A larger and more diverse sample is needed to confirm these findings.

COMPARISON OF BODY COMPOSITION METHODOLOGIES BETWEEN SKINFOLD AND ULTRASOUND IN ELITE CROSSFIT ATHLETES: A PILOT STUDY.

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PURPOSE: The aim of the present work was to compare body composition methodologies between skinfold and ultrasound in elite CrossFit athletes.

METHODS: The sample consisted of 8 male CrossFit athletes with practice time (mean ± standard deviation) 58.66 ± 11.13 months, age 25.33 ± 4.38 years, height 181.11 ± 6.09 cm, weight 93.8 ± 8.41 kg and participating in national competitions, and international. The athletes were evaluated through skinfold (ST) (Cescof pliometer) and ultrasound (BodyMetrix - BX 2000) in triceps, subscapularis, biceps, middle axillary, iliac, supraspinatus, abdominal, mid thigh and middle calf. The circumferences were measured with a flexible and inelastic anthropometric tape measure. ISAK standardization was used to measure skin folds. Descriptive statistics data are expressed as mean and ± standard deviation (SD) of absolute values of skinfold thickness measured by pliometer and ultrasound. A t-test for paired measurements was used, the Shewhart-Wilk normality test. Wilcoxon for non-parametric data. The confidence interval (CI) is 95% and Cohen’s d was calculated for effect size. The existence of correlation was analyzed by Pearson’s test (Spearman for non-normal data).

RESULTS: The difference between the means generated by ultrasound and pliometer was statistically significant for: -1.67mm ST triceps; -4.15mm ST subscapular; -1.65mm ST Axillary; -0.21mm ST Iliac; -3.48mm ST Thigh; -1.61mm ST Calf. Comparing each skinfold and ultrasound result it was possible to perform a proportion, and it was noted that the triceps ST was 1.56 times higher, subscapular ST 1.95, axillary ST 1.49, iliac ST 1.67, abdominal ST 1.39, and thigh DC 1.15, 3.53, comparing pliometer with ultrasound, respectively. In addition, the variables with small correlation (r = 0 - 0.25) were: triceps (r = 0.177); subscapular (r = 0.109); axillary (r = 0.005); iliac (r = 0.222); thigh (r = 0.044); calf (r = 0.097); variables with weak correlation (r = 0.26 - 0.5) were: abdominal (r = 0.343).

CONCLUSIONS: We conclude that there is a significant reduction in the thickness of the anatomical point collected by ultrasound and the skinfold thickness collected by the pliometer. Thus, we suggest that these differences at each anatomical point be taken into account when using a predictive equation to estimate body fat.
CONCLUSIONS: In this study, we found that body composition, as well as somatotype, differs by sex. However, the sample was not divided by performing art (dance and theater), being able to find either similarities or differences with the existing literature.

**Table 1. Body composition and somatotype profile of the evaluated subjects**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total (n=264)</th>
<th>Males (n=95)</th>
<th>Females (n=169)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adipose tissue (%)</td>
<td>27 ± 7.4 (8-40)</td>
<td>20 ± 5.7 (8-32)</td>
<td>31 ± 4.4 (19-40)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Adipose tissue (kg)</td>
<td>16 ± 6.2 (3-36)</td>
<td>14 ± 6.2 (3-32)</td>
<td>18 ± 5.7 (3-36)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Muscle mass (%)</td>
<td>35 ± 5.1 (25-50)</td>
<td>40 ± 4.6 (29-50)</td>
<td>33 ± 3.4 (25-41)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Muscle mass (kg)</td>
<td>21 ± 5.4 (13-43)</td>
<td>26 ± 4.5 (16-43)</td>
<td>18 ± 3.5 (13-40)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Bone mass (%)</td>
<td>16 ± 2.1 (10-23)</td>
<td>17 ± 2.3 (10-23)</td>
<td>15 ± 1.8 (10-20)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Bone mass (kg)</td>
<td>9 ± 1.7 (7-15)</td>
<td>11 ± 1.5 (7-15)</td>
<td>9 ± 1.1 (7-12)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Endomorph</td>
<td>4 ± 1.6 (1-8)</td>
<td>4 ± 1.5 (1-8)</td>
<td>5 ± 1.4 (2-8)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mesomorph</td>
<td>4 ± 1.4 (1-11)</td>
<td>4 ± 1.3 (1-9)</td>
<td>4 ± 1.4 (1-11)</td>
<td>1.000</td>
</tr>
<tr>
<td>Ectomorph</td>
<td>2 ± 1.4 (0-8)</td>
<td>3 ± 1.5 (0-8)</td>
<td>2 ± 1.4 (0-6)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Data expressed as mean ± standard deviation (min-max)

**Table 1. Comparison of Regional Body Composition Between iDXA and Prodigy**

<table>
<thead>
<tr>
<th>Body Composition</th>
<th>iDXA</th>
<th>Prodigy</th>
<th>%Diff</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm BFLM (lbs)</td>
<td>12.3 ± 5.6</td>
<td>12.6 ± 5.8</td>
<td>-2.37</td>
<td>0.012</td>
</tr>
<tr>
<td>Arm FM (lbs)</td>
<td>5.3 ± 2.3</td>
<td>4.3 ± 2.3</td>
<td>22.68</td>
<td>0.000</td>
</tr>
<tr>
<td>Leg BFLM (lbs)</td>
<td>35.6 ± 9.4</td>
<td>34.8 ± 9.4</td>
<td>2.23</td>
<td>0.000</td>
</tr>
<tr>
<td>Leg FM (lbs)</td>
<td>17.5 ± 7.9</td>
<td>17.6 ± 9.1</td>
<td>-0.34</td>
<td>0.83</td>
</tr>
</tbody>
</table>

BFLM: Bone Free Lean Mass; FM: Fat Mass

Dual-energy X-ray absorptiometry (DXA) is one of the most accurate methods to measure body composition, and it has been widely used in both clinical and research settings such as the Appendicular Lean Mass (ALM) in sarcopenia. The body composition results on the same client may vary depending on the manufacturer, model and software version of the DXA. Therefore, it is important to compare the measurements between different systems in longitudinal research studies and clinical practice. **PURPOSE:** To properly cross calibrate the body composition measurements between the Prodigy and iDXA in young adults. **METHODS:** Thirty healthy college students, including ten males (23.7 ± 1.9 years; 171.9 ± 6.7 cm; 81.8 ± 11.4 kg) and twenty females (23.1 ± 1.9 years; 161.8 ± 6.1 cm; 64.9 ± 15.3 kg) participated in the study. Body composition was measured using two DXA systems: Prodigy and iDXA, and analyzed by enCORE version 13 and 17, respectively by the same licensed DXA technician on the same day. Paired sample t-tests and regression analyses were performed to compare the body composition variables between the two systems. **RESULTS:** No significant differences were found in total body and leg percent fat (%fat), total and leg Fat Mass (FM), and total Bone Free Lean Mass (BFLM) (p > 0.05). However, there were statistically significant differences in total body and leg Bone Mineral Content (BMC) (p < 0.001), arm %fat (p = 0.012), arm FM (p = 0.000), arm and leg BFLM (ALM, p = 0.000) between the two systems (Table 1). **Conclusion:** Our results suggest that calibration equations are needed for the appendicular lean mass when comparing body composition between the Prodigy and iDXA in young adults. Further study in older adults is needed for the comparison of sarcopenia assessment using the two models of DXA.
Accurate estimation of fitness from skinfolds is highly dependent on using the appropriate skinfold protocol, the methods of training and experience of the trainee. Purpose: To determine the effects of the type of training method and experience level on the accuracy of performing skinfold thickness measures at the triceps, subscapular and calf skinfold sites. Methods: This study was designed to test the experience of the trainee using three different methods of training in a 2 x 3 factorial plan with a manual (M), audiovisual (AV) and in person (IP) training approach. Half of the trainees had no experience and half had some or considerable experience as judged by the number of subjects they had measured previously assessed by self report. Thirty subjects were randomly assigned to each of three methods in instruction (n=10/method). Half of the trainees were inexperienced in each training method. Three skinfolds (triceps, subscapular and calf) were measured using standardized procedures. To be trained on the skinfold measurement method, the M group read a description of the skinfold method, the AV method group watched a training video, and the IP method group attended an IP workshop. All trainees measured the skinfolds of from 15 participants and were compared to an expert. An ANOVA was used to determine whether expert versus trainee systematic errors were different due to the method of training, experience level, or their interaction was significant. Results: The mean systematic errors for the tricep were 1.0 ± 0.9, 1.4 ± 1.0, 1.0 ± 0.6 for the M, AV and IP groups, respectively. For the calf, the mean errors were 1.4 ± 0.7, 1.6 ± 1.1, 0.7 ± 0.3 for the M, AV and IP groups, respectively. For the subscapular, the mean errors were 1.1 ± 1.0, 1.2 ± 0.7, 0.8 ± 0.7 for the M, AV and IP groups, respectively. There was no effect (p>0.05) of experience level or training method for all skinfolds except for the training method in the calf with the IP group trending toward the lowest error (p=0.09). The interaction between type of training and experience level was also not significant (p>0.05). Conclusion: The systematic errors in measuring skinfolds were not influenced by experience level of the trainee or the training method however, outliers were found in every treatment group which contributed to the variability in the measures. Approximately 60-70% of the adult population is classified as overweight or obese, and it is estimated by 2030 adulthood obesity will increase by 33%. As obesity rates increase, there are associated increases of comorbidities such as cardiovascular disease, cancer, and type-2 diabetes. This increasing pandemic stresses the importance for healthcare professionals to efficiently and accurately measure body composition (BC), and most importantly determine chronic disease risk (CDR). Quantifiable values are important for exercise testing; however, CDR classifications may be more understandable to patients. There are many validated ways of obtaining BC and anthropometric measures (AM). Direct-segmental bioelectrical impedance analysis (DSM-BIA) directly measures both body and visceral fat (VF). AM aims to yield CDR by estimating fat, mainly in the splanchnic region. Although commonly used, expensive, and easy to perform, AM accuracy has been questioned.

**PURPOSE:** To determine the effects of the type of training method and experience level on the accuracy of performing skinfold thickness measures at the triceps, subscapular and calf skinfold sites.

**METHODS:** This study was designed to test the experience of the trainee using three different methods of training in a 2 x 3 factorial plan with a manual (M), audiovisual (AV) and in person (IP) training approach. Half of the trainees had no experience and half had some or considerable experience as judged by the number of subjects they had measured previously assessed by self report. Thirty subjects were randomly assigned to each of three methods in instruction (n=10/method). Half of the trainees were inexperienced in each training method. Three skinfolds (triceps, subscapular and calf) were measured using standardized procedures. To be trained on the skinfold measurement method, the M group read a description of the skinfold method, the AV method group watched a training video, and the IP method group attended an IP workshop. All trainees measured the skinfolds of from 15 participants and were compared to an expert. An ANOVA was used to determine whether expert versus trainee systematic errors were different due to the method of training, experience level, or their interaction was significant.

**RESULTS:**

- The mean systematic errors for the triceps were 1.0 ± 0.9, 1.4 ± 1.0, 1.0 ± 0.6 for the M, AV and IP groups, respectively. For the calf, the mean errors were 1.4 ± 0.7, 1.6 ± 1.1, 0.7 ± 0.3 for the M, AV and IP groups, respectively. For the subscapular, the mean errors were 1.1 ± 1.0, 1.2 ± 0.7, 0.8 ± 0.7 for the M, AV and IP groups, respectively. There was no effect (p>0.05) of experience level or training method for all skinfolds except for the training method in the calf with the IP group trending toward the lowest error (p=0.09).

- The interaction between type of training and experience level was also not significant (p>0.05).

**CONCLUSION:** The systematic errors in measuring skinfolds were not influenced by experience level of the trainee or the training method however, outliers were found in every treatment group which contributed to the variability in the measures.
Coaches may find value in following track and field athletes’ anthropometrics as the extended competitive season may influence only certain sex-somatotype combinations. Influencing factors for the divergent changes in somatotype presently found should be identified to optimize training approaches.

**RESULTS**

Scores for endomorphy (range: 11.0-27.6). No differences in BF% between positions were identified (Attack=18.9±3.9%, Midfield=18.8±4.2%, Defense=18.9±3.7%, GK=20.5±2.9%; p=0.79). For the android region, no differences between positions were identified for fat mass (Attack=1.01±0.5kg, Midfield=1.00±0.5kg, Defense=0.90±0.4kg, GK=1.01±0.5kg; p=0.9), or lean mass (Attack=4.3±0.5kg, Midfield=4.3±0.5kg, Defense=4.1±0.3kg, GK=4.4±0.8kg; p=0.71). For the gynoid region, no differences between positions were noted for fat mass (Attack=2.6±0.8kg, Midfield=2.5±0.9kg, Defense=2.7±0.8kg, GK=0.3±1.1kg; p=0.48), or lean mass (Attack=10.3±1.6kg, Midfield=10.4±1.0kg, Defense=10.5±0.7kg, GK=10.4±1.4kg; p=0.79).

**CONCLUSION**

Total and regional body composition measures did not vary across positions in a group of men’s collegiate lacrosse players. These data suggest that the athletic demands across positions of men’s collegiate lacrosse are not related to differences in body composition. Therefore, training programs tailored to specific positions may not be needed in order to achieve athletic success.

**ANTHROPOMETRICS**

Anthropometrics (e.g. BMI, mass, limb lengths) have their place in the discussion of sports performance, but their unidimensional view prevents whole-player evaluation. Classical somatotyping categorizes the human build into ectomorph (ECTO), mesomorph (MESO), and endomorph (ENDO) according to stature and mass distribution. Somatotyping may offer clues as to desirable physique when investigating human performance in a diverse athletic group like field athletes. **PURPOSE** The aim was to compare the somatotype of Division II field athletes between sexes and among select events. **METHODS** Somatotyping data were collected on competitive female (n=9, age: 20.0±0.7 yrs., ht.: 173.4±6.5 cm, body fat: 18.8±5.2% and male (n=16, age: 19.9±1.1 yrs., ht.: 183.4±3.4 cm, body fat: 9.0±2.8%) field athletes nearing the conference championship; an assumption was made that athletes were in peak form. Raw data included stature (cm), mass (kg), skinfolds (mm), girths (cm), and breadths (cm) and were converted into ECTO, MESO, and ENDO scores. Independent t-tests were used to test significance. Data are represented as means and standard deviations.

**RESULTS**

Data for female athletes were: ECTO=2.76±1.30, MESO=3.32±1.64, and ENDO=8.02±1.04 and for males were: ECTO=2.78±0.74, MESO=4.48±0.75, and ENDO=5.00±0.96. Between the sexes, there was a difference for ECTO (t=7.33, p<.000), but not MESO (t=3.85, p=0.05) or ENDO (equal variance not assumed; n=9.91) scores. Among the multi-field athletes (female heptathletes=3 and male decathletes=5) there were not any differences for ECTO (2.99±1.56 vs. 3.08±0.54, p=0.97) or MESO (2.91±1.43 vs. 4.13±0.73, p=0.15) scores, but there was a difference for ENDO (7.81±1.10 vs. 4.79±0.71, p=0.003) scores. The jumpers (long, high, and triple; females=3 and males=7) were not different on ECTO (2.52±0.65 vs. 2.81±0.76, p=0.396), but they differed on both MESO (3.10±0.98 vs. 3.48±1.54, p=0.201) or ENDO (equal variance not assumed; n=3.01) scores. Evidence regarding somatotype among competitive athletes is interesting but
Body composition has a significant impact on athletic performance, as well as overall health and wellbeing. Athletes and coaches often attempt to optimize performance by changing body composition without sport specific guidelines. Several techniques for measuring body composition exist, but the validity compared to the DXA has not been fully elucidated in athletic populations in various sports. PURPOSE: The aim of this study is to examine the relationship of surrogate body composition methodologies in Division I NCAA men’s and women’s sports. METHODS: Student athletes from men’s (basketball, swim and dive, track and tennis) and women’s (softball, soccer, basketball, swim and dive, track and tennis) sports volunteered to participate in 3 measures of body composition including Dual Energy X-ray Absorptiometry (DXA), Bioimpedance Analysis (BIA), and 3D body contouring (FIT-3D). RESULTS: 108 men and 106 assessments were completed (age 19.7±1.4 y, mean±SD) with 84 athletes (61 Female, 17 African American athletes). The average weight, lean mass (LM), and % body fat (%BF) by DXA for men were 79.8±9.0 kg, 67.7±8.1 kg, and 15.9±1.5% and women were 69.6±9.5 kg, 54.5±7.3 kg, and 25.5±3.9%, resp. Matched pairs analysis showed that compared to DXA, BIA underestimated FFMI (men: t(43)=2.25, p=.030), and the spine, F(2, 65) = 13.391, p<.05, FFMI, F(2, 66)=37.06, p<.05. BMD of the total femur in the hockey players was 0.60±0.11 g/cm2 (0.29 to 0.95), but missed statistical significance in men (t(36)=1.61, p=.12). The total lean mass of synchronized swimmers (40.77±3.67 kg) was greater (p<.05) than the control group (36.65±3.30kg). CONCLUSION: BMD and FFMI of the control group compared to female athletes show how sports’ demands influence bone’s health in a female collegiate population. BMD and FFMI of hockey players compared to synchronized swimmers may validate the importance of measuring bone density in non-traditional female athletes. Differences in FFMI between female hockey players and synchronized swimmers suggest that establishing sport-specific norms in this new measure may help coaches and strength specialists better tailor training programs to optimize performance and bone health in varsity athletes.

Many studies have performed to examine the validity of those tools to measure body composition, including DEXA (Dual-energy X-ray absorptiometry), underwater weighing (UWW), Skin-fold thickness (SFT), and Bioelectrical impedance analysis (BIA). Technological advances now permit the use of the portable ultrasound device for the field measures. But no information is available regarding the validity of the Body Metrix™ ultrasound device for estimating percent body fat in a female collegiate population. PURPOSE: The purpose of the present study was to examine the validity of Body Metrix™ ultrasound device for estimating percent body fat in normal and obese college-aged male participants, compared to DEXA. METHODS: In total, ninety-eight (73 Normal, 25 Obese, 20.1±2.13 years, 175.15±6.00 cm, 73.63±13.92 kg) male collegiate students volunteered for this study. Height and weight were measured and participants’ percent body fat was measured twice; 1) the DEXA (Dual-energy X-ray absorptiometry; GE Lunar, Madison, WI, USA) and 2) the BodyMetrix BX2000 (IntelaMetrix, Livermore, CA, USA) using Pollock three site technique (P3). For data processing, the average and standard deviation of the data were calculated by using SPSS 25.0 program and MedCalc program. Correlation analysis (r) performed & Student’s t test was used to examine the validity of the portable ultrasound device. Mean absolute percentage errors (MAPEs) were used as measurement errors. RESULTS: There was a strong correlation between DEXA and Body Metrix™ ultrasound device (Normal; r = 0.84, p = 0.001; Obese; r = 0.80, p = 0.001). Bland-Altman analysis identified 95% relative limits of agreement for the portable ultrasound device were again clinically acceptable in participants with BMI <25 and BMI ≥25 <7.7% and 5.20% to 16.58%, respectively. MAPEs were 20.3% and 36.3% for normal BMI and Obese participants, respectively. Conclusion: We found that the Body Metrix™ ultrasound device appears to be an accurate and reliable method for measuring body composition, which allows coaches and athletes alike to monitor and improve their diabetes or patient's condition.
Children with intellectual disability (ID) have higher rates of obesity than children without ID, and the management of obesity might be facilitated through simple and accurate methods for estimating percent body fat (%BF) in children with ID. 

**PURPOSE:** To assess muscle and adipose tissue thickness in the calves while using the unconventional training methods of blood flow restriction (BFR) and neuromuscular electrical stimulation (NMES). 

**METHODS:** Six sedentary participants (4 males and 2 females; 20.5 ± 1.4 yrs, 73.5 ± 13.8 kg) underwent 6 weeks of calf training with each leg randomly assigned to one of three conditions: (a) BFR (n=4), (b) NMES (n=3), and (3) combined BFR-NMES (n=5). A control group of seven sedentary participants (4 males and 3 females; 23.1 ± 4.3 yrs, 75.1 ± 12.2 kg) were also used. Adipose tissue thickness was measured via ultrasound and skinfolds while muscle thickness of the gastrocnemius and soleus was assessed via ultrasound. Comparisons were made using separate two-way ANOVA's for each variable. 

**RESULTS:** A significant main effect of time was found for ultrasound measurements of the lateral gastrocnemius (p = 0.0021) and medial adipose tissue (p = 0.0047) adipose tissue. A significant interaction effect was found for medial adipose tissue (p = 0.0282) with post-hoc comparisons revealing a significant increase in medial adipose tissue thickness with the BFR (p = 0.0176). No differences were found in muscle thickness for both the medial and lateral gastrocnemius, however, there was a significant main effect of time (p = 0.0025) and interaction (p = 0.0013) for soleus muscle thickness. Post-hoc comparisons showed a significant increase in soleus muscle thickness with the BFR+NMES condition (p = 0.0029) only. 

**CONCLUSION:** These results suggest that a combined BFR+NMES training condition may be a feasible method for increasing soleus muscle thickness with 6 weeks of training. Additional research is warranted to elucidate the potential use of BFR and NMES for stimulating positive physiological change in the calves. 

Supported by National Institute of Health grants UL1GM118979; TL4GM118980; R15GM118978.
bioimpedance spectroscopy, and 3-dimensional optical scanning. Select DXA variables were also utilized as predictors. Ordinary least squares regression was conducted to predict the differences in total fat mass (FM) and total lean soft tissue (LST) between DXA and BIA. Standardized model coefficients (β), p-values for coefficients, and R² values were generated. RESULTS: For FM estimates, significant predictors (p ≤ 0.01) of the differences between DXA and BIA were hydration of LST (TBW:LST; β = -0.82), percentage of TBW as extracellular fluid (%ECF; β = -0.36), and the male sex (β = 0.26). For LST, significant predictors of the errors between DXA and BIA were TBW:LST (β = 0.85), height (β = 0.77), %ECF (β = 0.40), the male sex (β = -0.22), and racial identification as Black (β = -0.09). The R² values for regression models predicting differences between DXA and BIA were 0.80 to 0.86 for FM and 0.73 to 0.87 for LST. CONCLUSION: Hydration variables and height are primary predictors of discrepancies between DXA and BIA total body composition estimates.

3221 Board #42 May 29 1:30 PM - 3:00 PM Explaining Segmental Lean Soft Tissue Discrepancies Between Bioelectrical Impedance Analysis And Dual-Energy X-Ray Absorptiometry
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Interest in evaluating the composition of specific anatomical regions has become commonplace in a variety of settings. Appendicular lean soft tissue (A_LST) estimates are considered in the diagnosis of sarcopenia. While dual-energy x-ray absorptiometry (DXA) is viewed as a reference method for regional assessments, its availability is limited. Thus, explaining discrepancies in regional body composition estimates between DXA and the more accessible bioelectrical impedance analysis (BIA) is of utmost importance. PURPOSE: To assess the anthropometric and physiological predictors of variations between BIA and DXA segmental lean soft tissue (LST) estimates. METHODS: During a single visit, 179 participants (103 females, 76 males; Mean ± SD: 33.6 ± 15.3 years; 73.4 ± 16.2 kg; 171.2 ± 9.2 cm; 28.2 ± 8.9% DXA body fat %) underwent body composition assessments via DXA and 8-point single-frequency BIA. Potential predictors of discrepancies between DXA and BIA LST estimates were obtained from these methods and additional laboratory techniques. Specifically, air displacement plethysmography, 3-dimensional optical scanning, and bioimpedance spectroscopy were used to estimate body volume, anthropometrics, and hydration variables, respectively. Significant predictors (p ≤ 0.05) of the mean difference between DXA and BIA estimates of trunk LST (T_LST) and A_LST were established using ordinary least squares regression. Standardized model coefficients, p-values for coefficients, and R² values were generated. RESULTS: For both T_LST and A_LST, extracellular fluid percentage, LST hydration, height, total LST mass, the male sex, and racial identification as Black significantly predicted discrepancies between DXA and BIA. Additional predictors for T_LST discrepancies were DXA total fat mass (FM) to LST ratio and DXA T_LST, while additional predictors of A_LST discrepancies included DXA A_LST, DXA FM to LST ratio of the legs, DXA appendicular FM, and DXA-derived volume of the arms and legs. Regression models including these significant predictor variables produced R² values of 0.92 and 0.95 for T_LST and A_LST, respectively. CONCLUSIONS: Hydration variables, the quantity of LST in the region of interest, and height were the most influential predictor variables for discrepancies between DXA and BIA segmental LST estimates.

Blood flow restriction (BFR) training has been a breakthrough in both practice and equipment used in the field of exercise science and rehabilitation. However, previous literature showed inconsistent findings regarding the effects of BFR training on muscle strength. PURPOSE: The purpose of this study was to analyze how different types of BFR training influence muscle strength by means of a meta-analysis. METHODS: The review was conducted according to the Preferred Reporting Items for Systematic Review and Meta-Analyses guidelines. The following databases were used to conduct the research: Academic Search Complete, Medline, Web of Science, SPORT-Discus, HealthSource: Consumer, and HealthSource: Nursing. Search words used included “blood flow restriction” AND strength*. The following search limited to full text articles, peer-reviewed academic journals, and published in the English language. Out of 327 articles, 25 were eligible to be included where 47 ESs were calculated. Comprehensive meta-analysis v.3 software was used to examine a random effect model and moderator analysis of the collected data. RESULTS: The results showed that BFR training had positive effects on skeletal muscle strength. The overall effect size (Cohen’s d) was .558 (95% CI= .385, .731) which yielded a medium effect. The moderator analysis identified a group difference in workload (15~60% (ES= .423, SE=.900), >60% (ES=1.004, SE=.181), QE betweent=.008, df=2, p=.01). However, gender, intervention length, mode (upper body, lower body) and cuff type/pressure did not affect the muscular strength. CONCLUSION: This study confirmed that BFR training has a moderate impact on increase of skeletal muscle strength. Also, the study identified that more than 60% of workloads in exercise result in greater strength gain compared to 15 to 60% workloads. The results of this meta-analysis can help design optimal exercise interventions to maximize increases in muscle strength through BFR training.

3222 Board #43 May 29 1:30 PM - 3:00 PM Abstract Withdrawn

F-54 Free Communication/Poster - Training
Friday, May 29, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

3223 Board #44 May 29 1:30 PM - 3:00 PM Effects Of Training With Blood Flow Restriction On Muscular Strength: Meta-analysis
Kyungun R. Kim1, Katelyn G. Gear2, Kendra Masec, Cindy Thind1, Sukho Lee2, 1University of Central Missouri, Warrensburg, MO. 2Texas A&M-University San Antonio, San Antonio, TX. (Sponsor: Minsoo Kang, FACSM)
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Exposure to a microgravity environment removes the frequent loading of postural, or antagonistic muscles, as those found in the calf. Due to this reduced stimulation, muscle mass and strength are greatly reduced. Blood flow restriction (BFR) and neuromuscular electrical stimulation (NMES) are unconventional training methods that have been shown to elicit growth in thigh and wrist musculature. However, the effects of these methods on the calves are unknown.

PURPOSE: The purpose of this study was to explore the effectiveness of BFR and NMES individually and in combination for increasing calf strength.

METHODS: Thirteen participants (9 males and 4 females; 20.15 ± 1.72 yr, 69.95 ± 11.45 kg) were recruited from California State University, Long Beach with each leg being randomized to one of three training conditions: 1) BFR only, 2) NMES only, or 3) BFR and NMES, for six weeks of training. Calf strength was measured using an isokinetic dynamometer to assess peak and average torque during maximal plantar flexion contractions through a range of velocities (0-210 deg/s). Comparisons were made using separate two-way ANOVA’s for each variable.

RESULTS: Average isometric torque during five second maximal plantar flexion contractions increased in the NMES (P=0.019) and BFRNMES groups (P=0.01), while peak isometric torque only increased in the NMES group (P=0.031). Peak torque at 30 deg/sec and 90 deg/sec increased only with BFRNMES (P=0.001 and P=0.008, respectively). A significant main effect for time was found at 60 deg/sec (P=0.014) and 210 deg/sec (P=0.019), with no differences found during post-hoc comparisons. No significant differences were found at the other velocities.

CONCLUSION: NMES and BFRNMES conditions may have potential for increasing strength of the plantar flexors at slower velocities (<90 deg/sec). This study adds to the literature regarding the feasibility of these methods as alternative exercise countermeasures for promoting favorable adaptations in the calf musculature.
ELASTIC KNEE WRAPS ARE USED TO PRODUCE BLOOD FLOW RESTRICTION (BFR) BUT IT IS UNCLEAR HOW DISCOMFORT AND PERCEIVED EXERTION MAY COMPARE TO MORE TRADITIONAL WAYS OF PRODUCING BFR SUCH AS NYLON CUFFS WHERE THE PRESSURE IS KNOWN. PURPOSE: TO INVESTIGATE HOW ELASTIC KNEE WRAPS (PRACTICAL) COMPARE IN RATINGS OF PERCEIVED EXERTION (RPE) AND DISCOMFORT AFTER EXERCISE TO FAILURE WHEN COMPARED TO NYLON CUFFS (TRADITIONAL) OR LOW AND HIGH LOADS WITHOUT BFR.

METHODS: NINE PARTICIPANTS (MALE=7, FEMALE=2) COMPLETED THIS STUDY. THE AVERAGE AGE AND BODY MASS INDEX WERE 22 (4) YEARS AND 25.4 (1.5) KG/M2. EACH PARTICIPANT COMPLETED SIX CONDITIONS, IN A RANDOMIZED ORDER, OF UNILATERAL KNEE EXTENSION EXERCISE TO FAILURE FOR FOUR SETS. TWO CONDITIONS (30% ONE-REPETITION MAXIMUM, 1-RM) INCLUDED ELASTIC KNEE WRAPS THAT WERE EITHER STRETCHED TO TWO INCHES FROM RESTING LENGTH (PRACTICAL-LOW) OR TO A NEW LENGTH THAT WAS 85% OF THE THIGH CIRCUMFERENCE (PRACTICAL-HIGH). TWO MORE CONDITIONS (30%-1RM) USED NYLON CUFFS THAT WERE INFLATED TO EITHER 80% (BFR-HIGH) OR 40% (BFR-LOW) OF ARTERIOLE OCCLUSION PRESSURE. THE TWO CONDITIONS HAD NO RESTRICTION STIMULUS AND WERE 30% 1-RM (LL) OR 70% 1-RM (HL). DISCOMFORT (6-20) AND RPE (6-20) WERE MEASURED BEFORE AND AFTER EACH SET OF FOUR EXERCISES. THE CHANGE SCORES FROM BEFORE EXERCISE TO THE END OF SET 4 WERE USED FOR ANALYSIS. FRIEDMAN’S TEST AND CONOVER’S POST HOC TEST WERE USED TO IDENTIFY IF THERE WAS A DIFFERENCE IN DISCOMFORT AND RPE BETWEEN CONDITIONS. STATISTICAL SIGNIFICANCE WAS SET AT P<0.05.

RESULTS: PRACTICAL-HIGH HAD LARGER CHANGES IN DISCOMFORT COMPARED TO HL (8 VS 6, P=0.007) AND LL (8 VS 6, P=0.008). PRACTICAL-LOW HAD A SMALLER CHANGE IN DISCOMFORT COMPARED TO BFR-HIGH (7 VS 9, P=0.028) BUT IT WAS NOT DIFFERENT FROM BFR-LOW (7 VS 7, P=0.450). NO DIFFERENCES WERE FOUND BETWEEN PRACTICAL-HIGH VS. BFR-HIGH (8 VS 9, P=0.211) OR PRACTICAL-HIGH VS. BFR-LOW (8 VS 7, P=0.316). PRACTICAL-LOW HAD SMALLER CHANGES IN RPE COMPARED TO BFR-HIGH (12 VS 11, P=0.024) BUT THERE WAS NO DIFFERENCE IN RPE BETWEEN PRACTICAL-HIGH AND THE OTHER CONDITIONS (P=0.05).

CONCLUSIONS: WHEN EXERCISING TO FAILURE, BOTH DISCOMFORT AND RPE ARE IMPACTED BY THE PRESSURE USED AND ELASTIC KNEE WRAPS CAN PRODUCE CHANGES IN DISCOMFORT AND RPE LEVELS THAT ARE COMPARABLE TO HIGH BFR.

In competitive swimming, overload training is often used to elicit transient states of overreaching in the hopes that subsequent periods of taper will lead to performance supercompensation. However, if the overload stress is too great relative to the level of recovery, fatigue will accumulate and cause both a greater risk of injury and more prolonged decrements in performance. Measures of vagal control of heart rate (HR) have been shown to reflect the balance between training-induced fatigue and recovery, and so these measures can provide valuable feedback to help guide coaches as they develop and revise training plans. PURPOSE: The purpose of the present study was to use three different indicators of vagal control of HR to investigate the impact of overload training and tapering in collegiate female swimmers. Those indicators were the resting logarithm of the root mean square of successive R-R intervals (lnRMSSD_r), HR responses to forced breathing (HR_frf), and HR responses to one minute of sustained handgrip exercise (HR_HGR). METHODS: Thirteen female Division-I swimmers performed lnRMSSD_r, HR_frf, and HR_HGR assessments three times throughout their competitive season: 1. at the beginning of the season (BL), 2. eleven weeks later (lnRMSSD_r), and 3. at the end of the season (TP). RESULTS: Very large decreases in lnRMSSD_r (p<0.01) and increases in HR_frf (p<0.05) occurred during OL, but those values then returned to levels during TP (p<0.05 and p<0.01, respectively). By contrast, HR_HGR values fell progressively throughout the season, and there was a large difference between the BL and TP measurements (p<0.05).

CONCLUSION: Changes in all three variables demonstrated that OL impaired vagal stimulation of the heart, and the bulk of evidence indicated that vagal stimulation was fully restored during TP. This was one of only a few longitudinal studies that have investigated the control of HR over the course of an entire competitive swim season, and it was the first study to demonstrate that overload training and taper can alter HR responses to both forced breathing and sustained handgrip exercise.

Peripheral heart action (PHA) is a time-efficient and under-researched style of circuit training that alternates upper and lower body exercises with minimal rest between sets. PURPOSE: To compare the metabolic profile of PHA to traditional (TRAD) resistance training (RT) and report sex-specific responses during each. METHODS: In a repeated measures design, twenty resistance-trained individuals underwent two bouts of volume-matched RT: PHA and TRAD. For PHA, subjects executed 6 consecutive lifts (75% 10-RM, 12-15 repetitions) in circuit fashion with minimal rest between every set. Oxygen uptake (VO2), heart rate (HR), blood lactate concentration [La], rating of perceived exertion (RPE), and excess post-exercise oxygen consumption (EPOC) were measured. Summary of Results: PHA elicited significantly greater %VO2 Max (455±7.1 vs. 28±4.3%, p=0.0001), %HRMax (80±4.0 vs. 61±1.9%, p=0.0001), RPE (16±1.8 vs. 12±2.0, p=0.0001), and EPOC (0.6±2.4 vs. 0.7±1.4 ml/kg/min, p=0.0001) compared to TRAD. PHA was also completed in less time (30±3.2 vs. 46±3.8 min, p=0.0001).

Compared to TRAD, [La] was significantly higher at mid-exercise (8.1±1.5 vs. 5.6±1.9 mmol/L, p<0.0001), post-exercise (10.5±2.8 vs. 5.2±1.8 mmol/L, p<0.0001), and 5-min post-exercise (10.3±3.0 vs. 4.5±1.9 mmol/L, p<0.0001) during PHA. There were no between sex differences for [La] at any time-point for TRAD. During PHA, [La] was significantly higher for males at mid-exercise (9.6±2.0 vs. 6.6±2.4 mmol/L, p<0.008), post-exercise (12.1±2.0 vs. 9.8±2.5 mmol/L, p<0.006), and 5-min post-exercise (12.2±2.1 vs. 8.4±2.4 mmol/L, p<0.002). No between sex differences were detected for HR, VO2, or RPE for either style of RT. Conclusion: PHA is a time-efficient and metabolically demanding circuit that may be employed to stimulate musculoskeletal and cardiorespiratory adaptations. Males produced more lactate than females during PHA, and one may speculate this was caused by discrepancies in total-body lean mass, cross-sectional area per muscle fiber, or Type 1 fiber distribution.
RESULTS: All results show mean (SD). There was no main effect on peak oxygen consumption and no difference between training group (SB group: 33.1(0.6) ml/kg/min to 32.9(5.4) ml/kg/min, Bike Group: 32.7(6.7) ml/kg/min to 35.5(8.0) ml/kg/min). On the other hand, significantly interaction was found on some postural stability measurements: area in which the center of gravity (SB group: 2.3(0.4) cm² to 3.0(1.3) cm², Bike Group: 1.9(1.0) cm² to 2.4(1.4) cm²: no significantly interaction), total length of center of gravity displacement (SB group: 55.3(9.9) cm to 46.4(8.4) cm, Bike Group: 39.9(1.6) cm to 43.3(1.3) cm: interaction p<0.05), velocity of center of pressure (SB group: 1.8(0.3) cm/sec to 1.6(0.3) cm/sec, Bike Group: 1.3(0.4) cm/ sec to 1.4(0.4) cm/sec: interaction p<0.05). CONCLUSIONS: SB training showed no significant effect on peak oxygen consumption. On the other hand, SB training improved postural stability compared with bicycle ergometer training.

PURPOSE: While the number of overweight and obese Americans increases, fewer people meet recommended physical activity levels. Among Americans, 32 - 56% of Christian clergy have obesity and associated chronic diseases. Seminarians are an optimal group to introduce interventions to decrease the prevalence of obesity, as they have the power to improve both their own health as well as the health of those in their congregation. This study aims to determine whether a physical activity intervention in a seminary population is an effective way to improve physical fitness and body composition, in an effort to decrease obesity and related diseases.

METHODS: 59 male seminary students (age range 22 - 66 years; mean age 30.12 years) participated in a 10-week physical activity intervention, attending two trained- exercise sessions per week for 10 weeks, which including cardiorespiratory and resistance training components. Pre- and post-intervention anthropometric measures included weight, BMI, waist-to-hip ratio, and body fat (%). Physical fitness assessments included the Rockport Walk test, cardiorespiratory endurance, and flexibility. Blood panels included a lipid and glucose panel.

RESULTS: Results are shown in Table 1 (not all data shown). Body weight, BMI, triglycerides and LDL cholesterol did not change as a result of the intervention. Mean waist circumference decreased 3 cm (p = 0.001). Significant improvements were observed in all physical fitness assessments (all p < 0.05). Mean total cholesterol increased 8.7 mg/dL, HDL cholesterol increased 5 mg/dl, and blood glucose decreased 10 mg/dl (all p < 0.05).

CONCLUSIONS: The results of this study show that a 10-week physical activity intervention in seminary students was effective in improving body composition, physical fitness and blood cholesterol and glucose measures. Results of this study suggest that seminarians may be an optimal group for future interventions to improve overall health and fitness.

Table 1. Pre- and post-intervention anthropometric, fitness and blood panel outcomes

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Pre-TestMean (±SD)</th>
<th>Post-TestMean (±SD)</th>
<th>p-value</th>
</tr>
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<tbody>
<tr>
<td><strong>Anthropometrics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Weight (kg)</td>
<td>51</td>
<td>89.7 (±17.9)</td>
<td>89.2 (±17.8)</td>
<td>0.161</td>
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<tr>
<td>Waist Circumference (cm)</td>
<td>51</td>
<td>94.5(±13.1)</td>
<td>91.5 (±11.3)</td>
<td>0.000</td>
</tr>
<tr>
<td>Hip Circumference (cm)</td>
<td>50</td>
<td>106.2 (±8.9)</td>
<td>104.9 (±8.7)</td>
<td>0.041</td>
</tr>
<tr>
<td><strong>Physical Fitness Tests</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Push-up Test (n)</td>
<td>51</td>
<td>20.1 (±12.0)</td>
<td>23.9 (±11.1)</td>
<td>0.000</td>
</tr>
<tr>
<td>Curl-up Test (n)</td>
<td>51</td>
<td>33.9 (±19.5)</td>
<td>47.1 (±22.6)</td>
<td>0.000</td>
</tr>
<tr>
<td>Trunk Flexion (cm)</td>
<td>51</td>
<td>25.4 (±9.9)</td>
<td>26.8 (±10.6)</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Blood Panel</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glucose (mg/dL)</td>
<td>43</td>
<td>94.7 (±31.1)</td>
<td>84.7 (±13.2)</td>
<td>0.005</td>
</tr>
<tr>
<td>Total Cholesterol (mg/dL)</td>
<td>44</td>
<td>175.9 (±32.2)</td>
<td>184.6 (±29.3)</td>
<td>0.018</td>
</tr>
<tr>
<td>HDL (mg/dL)</td>
<td>44</td>
<td>48.1 (±13.1)</td>
<td>53.2 (±14.5)</td>
<td>0.000</td>
</tr>
<tr>
<td>LDL (mg/dL)</td>
<td>44</td>
<td>105.7 (±25.9)</td>
<td>110.3 (±24.2)</td>
<td>0.109</td>
</tr>
</tbody>
</table>
CrossFit® is a strength and conditioning program recognized as one of the most popular and practiced types of high-intensity functional training today. The goal of participants is to optimize physical conditions in some fitness domains: strength, flexibility, power, cardiovascular or respiratory endurance, coordination, and agility. The exercises are executed quickly, repetitively in a high intensity with little or no recovery time between sets. PURPOSE: This study aimed to verify muscle damage and immune markers parameters in the response of the CrossFit® training session. METHODS: Sixteen male recreational CrossFit® practitioners (Mean±SE: SD: 29.4±5.3 years old) performed a single session of AMRAP (means as many rounds as possible) for 12 minutes. This session followed a sequence of 12 box jumps, 6 thrusters and 6 burpees facing bar. After the rest of 3 minutes, participants were instructed to complete a Wingate test on a cycle ergometer in the fastest time possible. Blood samples were collected immediately before the session of AMRAP (PRE) and after Wingate test (POST). They were analyzed white blood cells and platelet count in EDTA samples. Creatine kinase, C-reactive protein and uric acid were quantified in serum samples. The paired t test was applied to verify PRE and POST statistical differences. Values of $p < 0.05$ were considered significant. RESULTS: The data are presented as mean and SE. There was significant increases in leukocytes (PRE 7.6 ± 0.4 and POST 15.0 ± 0.8x10$^6$/L, $p < 0.001$); lymphocytes (PRE 2.5 ± 0.1 and POST 6.9 ± 0.4x10$^6$/L, $p < 0.001$); lymphocytes (PRE 2.5 ± 0.1 and POST 6.9 ± 0.4x10$^6$/L, $p < 0.001$); and platelets counts (PRE 271 ± 6 and POST 344 ± 12 x10$^6$/L, $p < 0.001$); Creatine Kinase (PRE 363 ± 94 and POST 452 ± 114 U/L, $p < 0.001$) and C-reactive Protein (PRE 7.1 ± 0.9 and POST 8.0 ± 1.1 mg/L, $p < 0.001$). Uric acid concentrations were not different (PRE 4.7 ± 0.3 and POST 5.0 ± 0.2 mg/L, $p = 0.184$). CONCLUSION: In conclusion, these results indicate that the AMRAP session associated with the Wingate test elicits an acute immune response, including neutrophils, lymphocytes, and platelets. Besides, this protocol acutely increase muscle damage and inflammatory markers. These blood parameters could be analyzed in the recovery strategies in CrossFit® practitioners.

CrossFit programs focus on performance of aerobic and strengthening exercises which incorporate multi-joint, functional movements. These variables combine to enhance athletic performance and improve an individual’s ability to perform daily functional movement. A limited amount of research has compared CrossFit® with other training groups regarding aerobic capacity, muscular strength, and body composition. A smaller percentage of research has compared functional movement variables. PURPOSE: Current research supports that CrossFit® athletes demonstrate high symmetry of functional movement patterns. The primary aim of this study was to determine if CrossFit® training was more beneficial to functional movement as compared to a standard exercise regimen. METHODS: This investigation was an exploratory cross-sectional study. Sixty (28 males, 32 females) healthy adults (age, 25±5 yr; ht, 170.5±10.3 cm; wt, 79.2±20.0 kg; BIA 23.10±8.44%) participated. Participants were recruited from the community and assigned to three groups based on their reported exercise lifestyle: CrossFit® trained (CF), recreationally trained (RT), and sedentary (SD). The 60 participants underwent a series of tests including a maximal strength test (Deadlift 1-Rep Max assessment; kg deadlift/kg body wt), and an estimated aerobic capacity assessment (Astrand-Rhyming Cycle Ergometer Test; L02/min). Exclusion criteria, anthropometric data and vital signs were assessed in all patients. RESULTS: The CF group (6.97±1.13) was significantly higher than the sedentary group (5.73±1.41) in the FMS components score. The CF group deadlift score (1.90±0.40) was significantly higher than both the SD (1.18±0.36) and RT groups (1.47±0.51). For aerobic capacity, both the CF (3.09±1.00) and RT (2.84±0.67) groups were significantly higher than the SD group (1.96±1.17). All testing significance was set at $p < 0.05$. CONCLUSION: CrossFit® training provided improved fitness and functional performance parameters as compared to sedentary counterparts. For muscular strength, CrossFit® was associated with higher scores as compared to recreationally trained individuals. CrossFit® and recreationally trained groups scored evenly for aerobic fitness and components of functional movement patterns.
Previous investigation has noted that neither body build nor initial strength level appear to influence upper-body strength gains resulting from a short-term resistance training (RT) program in young men. Such information is lacking in young women. With increasing interest of women in RT, it would be beneficial to determine if the same outcome as noted in men is operating in women. PURPOSE: To determine the influence of body build on changes in upper-body strength resulting from different modes of RT in college women.

METHODS: College women (n = 708; age = 19.0 ± 0.9 yrs; Ht = 165.0 ± 6.0 cm; Wt = 62.6 ± 10.7 kg) self-selected to train with free weights or mechanical weights during 12 weeks of periodized RT 3 days/week. 1RM press was measured with free weights (FW, n = 170), supine vertical machine weight (SVP, n = 284), and seated horizontal machine weight (n = 232) before and after training. Fat mass (FM) and fat-free mass (FFM) were determined from a gender-specific skinfold %fat equation. Body build was determined by ret地标izing FFM/Ht^2 on FM/Ht2. Body build was partitioned into thirds as slender (SL, n = 231), average (AV, n = 239), and solid (SO, n = 232) groups.

RESULTS: The SVP group had a significantly greater initial 1RM (37.8 ± 8.5 kg) than the FW (35.6 ± 7.8 kg) and SVP (35.6 ± 7.8 kg) groups. SO body type (36.6 ± 8.3 kg) had a greater initial 1RM than SL (35.8 ± 8.0 kg) and AV (35.1 ± 8.4 kg) body types. Mode by body type ANOVA indicated that SVP (9.5 kg ± 6.2 kg) and SVP (8.8 ± 5.1 kg) classes made significantly greater 1RM gains than FW (4.9 ± 3.9 kg), while SO (9.3 ± 6.2 kg) and AV (8.8 ± 5.1 kg) body types made significantly greater gains than SL (6.9 ± 5.0 kg), with no significant interaction. Absolute strength gains had low correlations with initial strength in all modes (r = 0.08 to -0.26), accounting for no more than 7% of the common variance. Body type also had low correlations with absolute strength gains (r = -0.11 to 0.23). CONCLUSIONS: Young women appear to make similar initial strength gains using mechanical weights compared to FW. Body build does not appear to influence training potential to gain strength in women from RT using either mode. Thus, when beginning RT, young women of any body size or initial strength level can make significant gains using either free weights or mechanical weights.

Abstracts were prepared by the authors and printed as submitted.
suggest that a pool bottom mirror is an effective tool in coaching for correction of front crawl stroke. Both verbal and visual instruction is valuable in correcting stroke of recreational swimmers and it can be achieved by the mirror.

### 3238 Board #59 May 29 1:30 PM - 3:00 PM Effects Of Unilateral Resistance Training On Muscular Strength, Power, And Measures Of Core Stability In Trained Individuals

Anthony Duong, Andrew J. Carnes, Thomas Wójcicki. Bellarmine University, Louisville, KY. (Sponsor: Sara E. Mahoney, FACSFM)

Email: aduong01@bellarmine.edu

(No relevant relationships reported)

**PURPOSE:** This study examined the effects of unilateral resistance training on lower body muscular strength and power, and measures of core stability in resistance-trained college students.

**METHODS:** Participants (N=22) underwent either 10 sessions of lower body unilateral (URT) or bilateral (BRT) resistance training on three non-consecutive days per week for three weeks. Training sessions consisted of three sets of five repetitions at 80% 1-RM for each exercise. URT exercises included the barbell back squat, deadlift, and weighted jump squat. URT exercises included the Bulgarian split squat, single leg of Romanian deadlift, and single leg weighted jump squat. Outcome measures were a one repetition maximum (1-RM) leg press for lower body strength, standing vertical jump (VJ) for lower body power, and double leg lowering (DLL) hip abdution isometric strength (H AIS), and Sorensen (SOR) tests for core stability.

**RESULTS:** Training elicited a positive main effect of time for all variables (p < 0.05). Both groups improved pre to post training in 1-RM (297±95.4 to 373±114 kg), VJ (56±15.0 to 62±18.0 cm), DLL (33±14.9 to 45±3.6±13.2 deg), H AIS (29.6±8.8 vs. 32.6±10.1 kg), and SOR (91.4±33.1 to 112±36.7 sec). The magnitude of change was similar between groups for all variables except H AIS, which in the URT group demonstrated significantly (p=0.0155) greater improvement (14.3% vs. 5.3%). However, the effect size was larger in URT for all variables except VJ (Cohen’s d = 0.86 vs. 0.61 for 1-RM, 0.92 vs. 0.55 for DLL, 0.64 vs. 0.19 for H AIS, 0.90 vs. 0.36 for SOR).

**CONCLUSIONS:** Relative to bilateral training, unilateral resistance training produced similar improvements in measures of lower body strength and power in trained subjects. Additionally, these data suggest that unilateral training may potentially offer the benefit of enhanced core stability.

### 3239 Board #60 May 29 1:30 PM - 3:00 PM Effect Of Core Strength Exercise On Colon Transit Time In Female University Students

Yeon Soo Kim1, Dongsus Han1, Angelique G. Brellenthin2, Bong Kil Song2. Sports science, Seoul, Korea, Republic of; Physical activity epidemiology lab, ame, IA.

Email: ky0101@skku.ac.kr

(No relevant relationships reported)

**PURPOSE:** To evaluate the benefit of core strength exercise (CSE) on colonic transit time (CTT) for female university students.

**METHODS:** Participants (N=22) underwent either 10 sessions of lower body unilateral (URT) or bilateral (BRT) resistance training on three non-consecutive days per week for three weeks. Training sessions consisted of three sets of five repetitions at 80% 1-RM for each exercise. URT exercises included the barbell back squat, deadlift, and weighted jump squat. URT exercises included the Bulgarian split squat, single leg of Romanian deadlift, and single leg weighted jump squat. Outcome measures were a one repetition maximum (1-RM) leg press for lower body strength, standing vertical jump (VJ) for lower body power, and double leg lowering (DLL) hip abdution isometric strength (H AIS), and Sorensen (SOR) tests for core stability.

**RESULTS:** Training elicited a positive main effect of time for all variables (p < 0.05). Both groups improved pre to post training in 1-RM (297±95.4 to 373±114 kg), VJ (56±15.0 to 62±18.0 cm), DLL (33±14.9 to 45±3.6±13.2 deg), H AIS (29.6±8.8 vs. 32.6±10.1 kg), and SOR (91.4±33.1 to 112±36.7 sec). The magnitude of change was similar between groups for all variables except H AIS, which in the URT group demonstrated significantly (p=0.0155) greater improvement (14.3% vs. 5.3%). However, the effect size was larger in URT for all variables except VJ (Cohen’s d = 0.86 vs. 0.61 for 1-RM, 0.92 vs. 0.55 for DLL, 0.64 vs. 0.19 for H AIS, 0.90 vs. 0.36 for SOR).

**CONCLUSIONS:** Relative to bilateral training, unilateral resistance training produced similar improvements in measures of lower body strength and power in trained subjects. Additionally, these data suggest that unilateral training may potentially offer the benefit of enhanced core stability.

### 3240 Board #61 May 29 1:30 PM - 3:00 PM Chronic Influence Of Inspiratory Muscle Training At Different Intensities On The Serum Metabolome

Etore Signini1, Camila Sakaguchi1, Raphael Abreu1, Claudio Silva1, Patricia Rehder-Santos1, Carla Dato1, Maria Carosio1, Roberta Maria1, David Nieman3, Tiago Venâncio2, Antônio Ferreira1, Aparecida Catt1. 1Federal University of São Carlos, São Carlos, Brazil. 2Central Paulista University Center, São Carlos, Brazil. 3North Carolina Research Campus, Appalachian State University, Kannapolis, NC.

(No relevant relationships reported)

**PURPOSE:** To investigate the chronic effect of inspiratory muscle training (IMT) on the human serum metabolome in healthy male recreational cyclists. **METHODS:** This study employed a randomized, parallel group design. Recreational male cyclists (n=23, 20-40 y, BMI=30 kg/m²) were randomized to three IMT groups: low intensity (6 cm H2O) (LI, n=7); moderate intensity or 60% of maximal inspiratory pressure (MI, n=10) and high intensity, the critical inspiratory pressure (~85-90% of maximal inspiratory pressure) (HI, N=1). The IMT was performed for 11 weeks, 3 times per week (3 sets of 15 minutes/session). Another group of participants under the same conditions, who did not perform the IMT but participated in all assessments and procedures, was included as controls (CG, N=6). Blood samples were collected one week before and one week after 11 weeks of IMT and analyzed using 1H NMR spectroscopy. Statistical analysis included a 4 (group) x 2 (time) repeated measures ANOVA using the general linear model (GLM), and multivariate Principal Component Analysis (PCA).

**RESULTS:** The targeted metabolomics analysis of serum samples identified 23 metabolites, including amino acids, lipids, and tricarboxylic acid cycle intermediates. No significant interaction effects from GLM were found for the 23 metabolites, and this was confirmed by PCA. **CONCLUSION:** These data indicate that IMT at three intensity levels did not alter the serum metabolome relative to the control group. These results are consistent with other exercise training studies showing negligible alterations in the serum metabolome compared to the large but transient perturbations linked to prolonged and intensive exercise.

### 3241 Board #62 May 29 1:30 PM - 3:00 PM Cardiorespiratory And Metabolic Responses Of High Intensity Yoga-surya Namaskar Session

Angela Tsopanidou, Fotini Venetsanou, George Dallas, Ioannis Stavridis, Elias Zacharogiannis, National and Kapedonian University of Athens, Greece, ATHENS, Greece.

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(No relevant relationships reported)

The recent global rise in obesity appears to be a threat to public health as it is connected with various cardiovascular and metabolic diseases. Surya Namaskar (SN), a component of Vinyasa yoga, consisted of a specific sequence of 12 yoga postures performed with controlled breath, is often used as an alternative of a typical fitness program to improve overall health, including body weight management. However, research data studying high intensity SN (HSN) is limited. **PURPOSE:** The aim of the present study was to assess cardiorespiratory and metabolic demands of HSN performed with 3 s/pose. **METHODS:** Heart rate (HR) response of twenty-four moderately trained subjects (n=12 males and 12 females; mean ± sd age: 39 ±7.33 years, body stature: 167.38±9.32 cm, body mass: 66.60±14.07 kg, % body fat: 23.30±5.86; VO2peak: 45.48±7.12 ml.kg-1.min-1 and HRmax: 183.54±10.13 bpm) was recorded during two-15 min sessions HSN practice 7 days apart. Maximal oxygen uptake (VO2peak) and maximum HR (HRmax) had been estimated earlier, after an incremental test to exhaustion. VO2, during HSN was estimated from individual regression equations using the relationship of VO2 and HR values derived from VO2 peak test, while the metabolic rate (kcal.min-1 ) was calculated from the relationship of HR and kcal.min-1. Total HSN energy consumption was the average value of the two-15 min sessions.

**RESULTS:** Mean ± sd values of the %HRmax, %VO2peak, and VO2max and rate of energy expenditure during HSN were 71.7 ± 7.5%, 59.9 ± 10.3 and 8.9 ± 3.3 kcal.min-1 (7.9 ± 2.0 METs) respectively. Total session energy expenditure was 133.04 ± 50.14 kcal. **CONCLUSIONS:** The results of the present study confirm that an HSN session may produce a sufficient training stimulus to promote cardiorespiratory fitness and favor weight loss in moderate trained adults.
Brief vigorous exercise training can improve cardiorespiratory fitness. Few studies, however, have examined the efficacy of basic bodyweight exercises that can be performed in a small space, without the need for specialized equipment. Practical, time-efficient approaches of this sort have been advocated for decades, including the 11-minute “Five Basic Exercises” (5BX) program developed by the Canadian government in the 1960s. PURPOSE: We determined the effect of a 5BX-style program on peak oxygen uptake (VO$_2$peak) in inactive but healthy young men and women (20±1 y; body mass index: 20.5±3 kg/m$^2$; mean±SD). METHODS: Participants were randomized to a training group that performed 18 sessions over six weeks (n=9), or a non-training control group (n=10). Each session involved a 1-minute warm-up (jumping jacks), followed by 1-minute bouts of five exercises (burpees, high knees, split squat jumps, high knees, squat jumps), each interspersed with 1-minute of active recovery (walking around the room). Participants were instructed to complete as many repetitions per bout as possible, at a self-determined “challenging” pace. All sessions were supervised and compliance was 100%. RESULTS: Mean intensity during training was 82.5% of maximal heart rate. Borg Scale ratings of perceived exertion for the five exercises ranged from 12±2 to 15±3 out of 20. ANCOVA revealed a significant difference between groups after the intervention, such that VO$_2$peak was higher in the training group compared to control (34.2±6.4 vs 30.3±11.1 ml/kg/min; P=0.03). Peak power output during the VO$_2$peak test was also higher after training compared to control (211±43 vs 191±50 W, p=0.004). There were no changes in leg muscular endurance, handgrip strength or vertical jump height in either group. CONCLUSIONS: A simple bodyweight interval training program, requiring 11 minutes per session, increased cardiorespiratory fitness in previously sedentary young adults when performed three times per week for six weeks. Supported by NSERC.
Tracking and monitoring bilateral limb asymmetries is an increasingly common practice to provide information associated with athlete performance, injury risk, as well as guiding return-to-play or return-to-performance protocols following injury. It is speculated external training loads (eTL) during sport specific practice may influence subsequent jump changes in inter-limb asymmetries, and, repeat block jump test while wearing velocity and height measuring devices. Participants were split into a control group (CON) and a plyometric group (PLYO), which completed a 3 day a week/ 8 week program consisting of dot drill and box drop jump exercise variations. After 8 weeks, participants were retested. Fatigue Index for the repeat tests were analyzed for differences between genders or SL and B. CONCLUSION: To our knowledge, this was the first study to quantify training volume and modalities in a sample of advanced and elite climbers. RESULTS. Of 595 initial participants, 92 boulderers distributed through various climbing-related social media platforms. Questions included demographics, climbing ability and style, training modalities, and weekly volumes of training. RESULTS. Of 595 initial participants, 92 boulderers (B) (63 men, 29 women) and 71 sport-lead (SL) climbers (49 men, 22 women) were identified as advanced or elite (A/E) using the IRCRA (International Rock Climbing Research Association) Red Point Scale of which 69% had entered at least one competition. Among A/E women and men SL climbers there was a moderate inverse relationship between BMI and SL climbing ability (r = -0.56 and r = -0.39, respectively), both with p<0.01. CONCLUSIONS: Utilization of plyometric training may help offset fatigue as seen in kayak specific core instability training intervention, produced a positive effect on kayaking performance.
Balance is defined as the ability to maintain a stable position while remaining steady. Balance is extremely important to dancers to help prevent injury and to maximize aesthetic and athletic performance. While other studies support the improvement of balance among dancers following a core exercise training program, the effects immediately following one core exercise session are less clear. PURPOSE: The purpose of this study was to examine the immediate effects of a core and abdominal exercise program on balance for dancers, with the hypothesis that a core exercise program would cause an immediate improvement in balance for college-aged dancers.

METHODS: Eighteen female collegiate dancers (19.83 ± 1.58 years, 7-18 years of dance experience) completed two sets of eight exercises, engaging the upper and lower abdominal, obliques, gluteals, and erector spinae muscles. Two static balance tests, the Balance Error Scoring System (BESS) test and the Stork Balance Standing test, and two dynamic balance tests, the Y Balance test and the Pirouette test, were included. The core exercise program included the following exercises: Plank (mainly core activation), Russian twist (targeting the obliques), and glute bridge (targeting the gluteals and erector spinae). The abdominal exercise program included the following exercises: Bicycle (targeting the lower abdominal), seated leg curl (targeting the hamstring), and supine crunch (targeting the lower abdominal, obliques, gluteals, and erector spinae). The core and abdominal exercise program was performed on the same day, with the core exercise program occurring first, followed by the abdominal exercise program.

RESULTS: The core exercise program significantly improved balance results for the Y Balance Test composite score (86.0 ± 6.3% pre vs 88.4 ± 5.3% post, p < 0.05) and the BESS Test (22.7 ± 8.0 errors pre vs 16.1 ± 7.0 errors post, p < 0.05). There were no significant differences between pre and post intervention scores of the Stork Balance Standing test or the Pirouette test.

CONCLUSIONS: Including core exercises in a dancer’s warm-up before practices and performances may have an acute positive effect on balance for dancers, which could translate to improvements in performance. It is unclear if a core exercise program can acutely improve dance skill-specific balance, such as during pirouettes.

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Success in baseball batting relies on a union of swing power and accuracy. Off the field, training commonly employs weighted loads replicating hitting mechanics. On the field, immediately prior to a plate appearance, batters sometimes place a weighted ring on the bat to warm up their swing. Although common, these traditional training methods lack investigation. PURPOSE: To observe differences of baseball swing characteristics in response to applied bat resistance. METHODS: We tested 14 NCAA baseball athletes using Proteus technology (Proteus Motion, USA). Participants completed 5 sets of 6 swings at increasing loads of magnetic resistance. Each set increased in weight by 2 lbs, ranging from 1-9 lbs. Measurements computed by Proteus were peak power, peak force development rate (PFDR), braking, consistency, endurance, velocity, and range of motion (ROM). Paired-samples t-tests compared swing characteristics of the 1 lb resistance to the mean of 3, 5, 7, and 9 lb.

RESULTS: The 1 lb resistance differed from the mean resistance in peak power (p < 0.001), PFDR (p < 0.001), braking (p < 0.001), Rom (p < 0.017), and velocity (p < 0.063), but not in consistency (p = 0.110) or endurance (p = 0.375). The mean values of consistency (p = 0.985) and endurance (p = 0.530) could not predict outcomes for 1 lb performance, but did predict ROM (p = 0.002) and braking, power, PFDR, and velocity (p < 0.001). As resistance levels increased, there were significant differences in swing power (F(3, 179) = 27.9, p < 0.001), PFDR (F(3, 179) = 141.797, p < 0.001), braking (F(3, 179) = 91.011, p < 0.001), ROM (F(3, 179) = 90.067, p < 0.013), and velocity (F(3, 179) = 51.522, p < 0.039), but not measurements of consistency (F(3, 179) = 0.111, p = 0.480) or endurance (F(3, 179) = 2.156, p = 0.070). CONCLUSIONS: As bat resistance increased, players made acute responses that compromised recruitment characteristics (consistency and endurance). Training and warm-up techniques that employ loaded swings may alter mechanics accordingly.
APPENDIX A:

The cardiovascular response induced by resistance exercise with blood flow restriction (BFR) seems to be lower or comparable to traditional exercise in healthy individuals. However, the potential for BFR to be used for at-risk populations highlights a need to further attenuate the cardiovascular response, potentially via the modality of exercise.

PURPOSE: To compare the cardiovascular response to unilateral (UN), bilateral (BI), and alternating (AL) BFR exercise.

METHODS: Thirteen males and 7 females performed four sets (30 seconds rest) of UN, BI, and AL knee-extensions to failure with 30% one-repetition maximum and 40% arterial occlusion pressure. Pulse wave analysis was measured before and after exercise. Data, presented as mean (SD), were analyzed using Bayesian RMANOVA. RESULTS: AL caused greater changes in: aortic systolic [AmHlg: AL=21(8); UN=13(10); BI=15(7); BF=29.63], diastolic [AmHlg: AL=13(8); UN=7(10); BI=8(7); BF=5.53], and mean arterial [AmHlg: AL=19(8); UN=11(10); BI=13(7); BF=48.30] blood pressures. Brachial [AmHlg/bpm: AL=4945(2340); UN=1218(1412); BI=3461(1430); BF=31.74] and aortic [AmHlg/bpm: AL=6134(2479); UN=4200(1722); BI=4152(1664); BF=114.83] rate pressure product as well as heart rate [AmHlg: AL=26(14); UN=18(8); BI=19(11); BF=5.82] were also greatest with AL. Augmentation pressure [AmHlg: UN=3(5); BI=2(6); AL=4(6); BF=0.19], pulse pressure [AmHlg: UN=6(6); BI=7(7); AL=8(5); BF=0.27], augmentation index [Δ%: UN=6(12); BI=7(11); AL=6(16); BF=0.16], reflection magnitude [Δ%: UN=5(8); BI=5(7); AL=4(7); BF=0.15], forward wave height [AmHlg: UN=8(6); BI=8(6); AL=8(4); BF=0.15], and reflected wave height [AmHlg: UN=1(3); BI=2(4); AL=3(3); BF=0.31] were not different between conditions. Exercise volume was greater in AL [kg: AL=1835(1725); UN=915(312); BI=893(313); BF=29.17]. Ratings of perceived exertion (BF10: AL=19(8); UN=11(10); BI=13(7); BF=0.15) were also greatest with AL. CONCLUSION: The greater cardiovascular response induced by alternating alternating BFR exercise suggests those at risk of a cardiovascular event should choose unilateral or bilateral BFR exercise until further work determines the degree to which this modality can be tolerated.

CONCLUSIONS: This study suggests that the addition of intermittent BFR to LIIE may result in greater EE but similar substrate utilization and enjoyment as HIIE, albeit at a lower work rate.
CONCLUSIONS: The SonoTrax measured LOP equivalently to the MD6. Physical therapists wanting to use BFR therapy should feel comfortable using either vascular doppler in their clinic.

3258 Board #79 May 29 2:30 PM - 4:00 PM
Effect of a Single Bout of Remote Ischemic Preconditioning on 48-Hour Skin Blood Flow Responses
Jahyun Kim, Sydney Barlow, Warren Franke, FACSM, James Lang. Iowa State University, Ames, IA. (Sponsor: Warren D. Franke, FACSM)
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Remote ischemic preconditioning (RIPC) protects against ischemia reperfusion injury in two phases. Initial protection occurs in the first 1 to 2 h post-RIPC and dissipates after 4 h. Delayed protection occurs ~24 h after RIPC and lasts for 2 to 3 days in human conduit arteries. The extent to which this timeline occurs in human cutaneous microcirculation is not clear. Purpose: To assess the timeline of skin microvascular functional changes after a single bout of RIPC.

Methods: Sixteen participants (23±4 yrs; 7 males, 9 females) underwent a single bout of RIPC. Using laser speckle contrast imaging, acetylcholine (Ach)-mediated skin blood flow responses were assessed immediately prior to RIPC as well as 24 h, 48 h, 72 h, and a week afterwards. RIPC consisted of 4 repetitions of 5 min of arm blood flow occlusion interspersed by 5 min reperfusion. Ach was prepared with saline 48 hr, 72 hr, and a week afterwards. RIPC and lasts for 2-3 days in human conduit arteries. The extent to which this timeline occurs in human cutaneous microcirculation is not clear. Purpose: To assess the timeline of skin microvascular functional changes after a single bout of RIPC.

Results: Skin blood flow responses to Ach infusion were assessed immediately prior to RIPC as well as 24 h, 48 h, 72 h, and a week afterwards. RIPC consisted of 4 repetitions of 5 min of arm blood flow occlusion interspersed by 5 min reperfusion. Ach was prepared with saline 48 hr, 72 hr, and a week afterwards. RIPC and lasts for 2-3 days in human conduit arteries. The extent to which this timeline occurs in human cutaneous microcirculation is not clear. Purpose: To assess the timeline of skin microvascular functional changes after a single bout of RIPC.

Responses to Ach infusion are an indicator of global endothelial function and reflect endothelial dependent vasodilation. These data suggest that a single bout of RIPC induces a response to Ach-induced endothelial dependent-vasodilation that peaks at 48 h post-RIPC. This response to a single bout of RIPC does not persist a week afterwards. Thus, a single bout of RIPC elicits a delayed window response of endothelial dependent vasodilation in human skin microvasculature.

3259 Board #80 May 29 2:30 PM - 4:00 PM
Feasibility and Effectiveness of High-intensity Interval Training With Blood Flow Restriction in Heart Failure
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Reduced aerobic capacity (VO_{2peak}) is a key characteristic of heart failure with reduced ejection fraction (HFrEF). Peripheral vascular dysfunction, the result of an imbalance between endothelial damage and endogenous repair mechanisms, is both a precursor to and a consequence of HFrEF. This may contribute to the reduction in VO_{2peak} by increasing peripheral vascular resistance, impairing blood flow distribution and reducing O_2 delivery to locomotor muscles. High-intensity interval training (HIIT) can ameliorate vascular dysfunction and increase VO_{2peak} in HFrEF. Whether the effectiveness of HIIT can be increased by combining it with leg blood flow restriction (BFR), a novel technique that alters peripheral vascular shear stress and augments the intramuscular metabolic stress of a given exercise protocol, is unknown.

Purpose: To investigate the feasibility and effectiveness of HIIT vs. BFR to improve VO_{2peak} in HFrEF patients with T2DM.

Methods: 13 males with HFrEF (72 ± 11 y; LVEF ≤ 50% or completed HIIT (5 x 2 min cycling bouts at 80% ramp-incremental peak power, separated by 2 min recovery) twice per week for 4 weeks, either with BFR (HIIT+BFR; n = 7; thigh cuff pressure 100 mmHg) or without BFR (HIIT; n = 6; thigh cuff pressure 10 mmHg). CD34+/KDR+ number (flow cytometry), exercise tolerance and VO_{2peak} (ramp-incremental exercise test) were measured pre- and post-training.

Results: All HIIT+BFR participants tolerated 100 mmHg cuff pressure. There was a pre- to post training increase in CD34+/KDR+ number (HIIT: 78 ± 11 vs. 88 ± 28 per 10^6 total events; HIIT+BFR: 67 ± 21 vs. 102 ± 44 per 10^6 total events; time effect, p < 0.05) and ramp-incremental exercise tolerance (HIIT: 494 ± 160 vs. 537 ± 162 s; HIIT+BFR: 469 ± 136 vs. 529 ± 108 s; time effect, p < 0.05). However, the effect of training was not different for HIIT vs. HIIT+BFR. VO_{2peak} was unchanged with training (HIIT: 16.7 ± 8.5 vs. 18.7 ± 9.8 ml/min/kg; HIIT+BFR: 17.0 ± 3.8 vs. 16.4 ± 3.7 ml/min/kg; time effect, p > 0.05). QoL was also unchanged with training.

Conclusions: HIIT+BFR is feasible in HFrEF. However, the increases in CD34+/KDR+ progenitor cell number and exercise tolerance following HIIT+BFR are not greater than the increases conferred by HIIT alone in HFrEF.
research reporting blood flow characteristics in the dominant and non-dominant limb in both males and females is lacking. PURPOSE: This study compared femoral artery occlusion pressure (AOP) and femoral artery blood flow characteristics at different percentages of AOP between both legs in males and females. METHODS: Participants in this study included 31 physically active and healthy males (n=18) and females (n=13) years of age. Blood flow in the superficial femoral artery (SFA) was measured using Doppler ultrasound and BFR was controlled using a Hokason E20 Rapid® Cuff Inflator with a 10 cm cuff placed on the upper thigh. After measuring the AOP of the SFA, blood flow was measured in a random order at 0%, 20%, 40%, 60%, 80%, and 100% of AOP. This was repeated in the opposite leg. Blood flow was recorded in absolute (mL/min) and relative terms (% unoccluded bloodflow).

RESULTS: There was significant difference (p<0.008) in the AOP in the dominant leg (234 vs 188 mmHg) and nondominant leg (206 vs 177 mmHg) between males and females, respectively. After accounting for differences in leg circumference (p<0.001), sex remained a significant (p=0.0001) factor in accounting for differences in AOP. The difference in AOP between the dominant and nondominant leg in males (234 vs 206 mmHg) and females (188 vs 177) were not significant (p=0.123). At each of the occlusion pressures (0%, 20%, 40%, 60%, 80%, 100% of AOP), there were no differences in absolute or relative blood flow between males and females. The relationship between SFA blood flow at occlusion pressures between 0% and 100% of the AOP was curvilinear in both males and females. Blood flow at occlusion pressures between 40% and 80% of AOP was relatively constant. CONCLUSIONS: Significant differences in AOP in males and females can be attributed, in part, to differences in leg circumference and sex. The curvilinear relationship between blood flow and occlusion pressure indicates that BFR during exercise can be effectively a lower pressures (40% AOP) as at higher pressures (80% AOP).

F-56  Free Communication/Poster - Vascular Function II
FRIDAY, MAY 29, 2020, 1:30 PM - 4:00 PM Room: CC-Exhibit Hall

3262  Board #83  May 29 2:30 PM - 4:00 PM
The Effect Of The Somatosensory Afferent On Hemodynamic Transmission From The Aorta To The Brain
Marina Fukuie. Tuskuba university, Ibaraki, Japan.
(No relevant relationships reported)

PURPOSE: This study aimed to reveal whether the somatosensory input from lower extremities can affect hemodynamic transmission from the aorta to the brain during orthostatic stimulation.

METHODS: Thirty young adults (5 women, mean age 25±5 yrs.) underwent two consecutive 6-min orthostatic stimulations with lower body negative pressure (LBNP) (-30 mmHg and -50 mmHg) under following two conditions in random order: (1) placing feet on the wood board with slight knee flexion (RESISTED) and (2) feet untouched using a harness (FREE) inside the LBPN chamber. Heart rate (HR), aortic pressure, stroke volume (SV), cardiac output (CO), and cerebral blood flow velocity (CBFV) from the middle cerebral artery were continuously recorded. Hemodynamic transmission (i.e., admittance) from the aorta to the brain was evaluated by transfer function analysis.

RESULTS: HR was significantly higher, and SV and CO were significantly lower during -50 mmHg LBNP stimulation than baseline values irrespective of foot conditions. Aortic mean pressure and mean CBFV were not affected by the leg-condition. In contrast, aortic pulse pressure and pulsatile CBFV were significantly reduced during -50 mmHg LBNP with the degree of reduction (from baseline to -50 mmHg LBNP) smaller in the RESISTED condition than in the FREE condition (aortic pulse pressure: -17 % vs. -35 %, P=0.047; CBFV: -15 % vs. -26 % vs. P=0.09, respectively). Transfer function gain at the first harmonic from the aortic pressure to the CBFV was not affected significantly by LBNP stimulation or the somatosensory input. The transfer function normalized gain by mean CBFV was significantly increased with LBNP (1.3±0.1 vs. 1.5±0.1 cm/s/mmHg, P=0.048) but did not differ by the somatosensory input.

CONCLUSIONS: These results suggest that the aorta-brain admittance at the first harmonic is augmented with the LBPN stimulation but not altered by the somatosensory input from the lower limbs.
Arterial stiffness is an independent risk factor for cardiovascular disease. Different measures of arterial stiffness have been used to assess the impacts of exercise training interventions. One of the primary problems faced by investigators conducting systematic reviews and meta-analyses is the lack of standardized methodology to evaluate and compare efficacies of the existing and newly conducted exercise interventions on arterial stiffness. The reference standard measure of arterial stiffness is pulse wave velocity (PWV) while other commonly-used methodologies are ultrasound-derived arterial compliance and distensibility. PURPOSE: To describe standardized equations to convert common ultrasound-based measures of arterial stiffness (arterial compliance, distensibility, β-stiffness index, elastic modulus) to local PWV. METHODS: We first conducted a literature search to derive conversion equations. For measures of arterial stiffness that conversion equations cannot be used, we generated regression equations using the accumulated dataset available in the laboratory. Subsequently, these equations were cross-validated in a well-controlled laboratory-based study, in which all measures of arterial stiffness were collected in 49 apparently healthy participants. RESULTS: The literature search revealed that some measures of arterial stiffness such as distensibility coefficient (DC) can be converted to local PWV using the Bramwell-Hill model (PWV = PR/DC) with an assumption of P = 1059 kg/m². Ultrasound-based measures of arterial stiffness were strongly and significantly associated with local PWV with Pearson r ranging from 0.74 to 0.99 (p < 0.01). Converted local PWV using regression models were correlated with each other (r = 0.73 to 0.99, p < 0.01). The correlations between converted local PWV and directly measured carotid-femoral PWV ranged from weak to moderate correlations with the range of r from 0.08 to 0.41. CONCLUSION: Our findings indicate that commonly-used measures of ultrasound-based arterial stiffness can be converted to local PWV and can be compared with a reference standard measure. These conversions can be used in systematic reviews and meta-analyses to synthesize evidence across studies to detect effects.

BACKGROUND: Greater time spent in sedentary behaviour is associated with an increased risk of cardiovascular disease, type-2 diabetes, and mortality. Regularly interrupting prolonged sitting with 2-min light-intensity and 2-min moderate-intensity walking every 20 minutes without matching for energy expenditure has been shown to reduce resting blood pressure. However, little is known whether interrupting prolonged sitting with 3-min light-intensity walking and 1.5-min brisk walking every 30 min when the energy expenditure of these trials is matched provides similar benefits on resting blood pressure. PURPOSE: To compare the effects of 1.5-min moderate-intensity walking every 30 minutes and 3-min light-intensity walking every 30 minutes on resting blood pressure in young men with central obesity when the energy expenditure of these trials is matched. METHODS: Thirty-four healthy adults (21 males) residing in Scotland (55.8°N, 4.1°W) were monitored for 7 days in the summer (June - August) and winter (December - February) in a randomised order. Participants wore a personal UV monitor on the wrist throughout each monitoring phase before visiting the laboratory to provide a venous blood sample and to have blood pressure measured. Serum levels of 25(OH)D were measured using an enzyme-linked immunosorbent assay and plasma nitrate and nitrite analysed using gas-phase chemiluminescence. RESULTS: Total UV-A exposure was higher in summer (17 ± 21 cm²) compared to winter (2.5 ± 3.0 cm², P < 0.001). Plasma nitrite did not differ between seasons (P = 0.57) but nitrite (137 ± 31 nm) and serum 25(OH)D (22 ± 8 ng/ml) were lower (both P = 0.001) in the winter compared to summer (200 ± 56 nm and 35 ± 13 ng/ml, respectively). Blood pressure was higher in winter (systolic 126 ± 13 mmHg; diastolic 76 ± 9 mmHg) than in summer (systolic 119 ± 11 mmHg; diastolic 67 ± 8 mmHg; both P < 0.001). UV-A exposure was positively associated with plasma nitrite (R = 0.41, P = 0.01) and 25(OH)D (R = 0.43, P = 0.01). Plasma nitrite was negatively associated with systolic (R = 0.5, P = 0.01) and diastolic blood pressure (R = -0.4, P = 0.01). CONCLUSIONS: In a similar fashion to 25(OH)D, circulating levels of plasma nitrite, a marker of NO bioavailability, appear to be influenced by seasonal variations in UV exposure. The negative association between nitrite and blood pressure suggest that a reduced level of NO may increase cardiovascular risk factors in the winter months.

Glibenclamide (GLI), prescribed to Type II diabetes patients, enhances insulin release by inhibiting pancreatic K<sup>ATP</sup> channels. K<sup>ATP</sup> channels support maximal aerobic capacity (VO<sub>2max</sub>) and blood flow during treadmill running in male rats. Whether high-intensity exercise tolerance (i.e. critical speed, CS) and muscle O<sub>2</sub> delivery-utilization matching (interstitial PO<sub>2</sub>, PO<sub>2</sub>is) is impaired, and whether sex differences exist in K<sup>ATP</sup> function, are unknown. PURPOSE We hypothesized that systemic inhibition of K<sup>ATP</sup> channels via GLI would decrease VO<sub>2</sub>max and CS, while local inhibition would decrease contracting PO<sub>2</sub>is and blood flow within fast-twitch oxidative (mixed gastrocnemius (MG)) and slow-twitch oxidative (soleus (SOL)) muscles with females (F) and F+OVX expressing the greatest reduction. METHODS: Male (n=12), female (n=10) rats were ovariectomized (F) and then fed a high-fat diet (F) for 12 weeks. VO<sub>2</sub>max and CS were assessed using state-of-the-art treadmill testing. Intraperitoneal PO<sub>2</sub>is was determined before and after GLI superfusion (5 mg/kg), via phosphorescence quenching (G4) in the exposed MG and SOL muscles during electrically-induced contractions and blood flow by fluorescent-labeled microspheres (15 μm). RESULTS: GLI decreased VO<sub>2</sub>max in male (71.5 ± 1.0 vs 67.9 ± 1.5) and F+OVX (76.8 ± 1.4 vs 74.4 ± 1.4; p = 0.05 for both) but not in female rats (8.9 ± 1.0 vs 8.9 ± 1.0, p = 0.65). CS was reduced equivalently in all groups (8-11%; p < 0.05). GLI reduced MG blood flow (female: 49 ± 9 vs 34 ± 5; male: 50 ± 5 vs 35 ± 4) and PO<sub>2</sub>is in female (7.3 ± 0.5 vs 6.1 ± 0.5; male: 8.9 ± 1.1 vs 7.2 ± 0.5, but not SOL, of female and male rats (p = 0.05). Conversely, in F+OVX, PO<sub>2</sub>is was reduced in the SOL (14.5 ± 1.5 vs 10.2 ± 1.2).
Arterial stiffness (AS) has been shown to underpin the development and progression of many cardiovascular diseases. Regular exercise promotes favorable changes in arterial health; however, investigations on the impact of resistance training (RT) alone on AS have shown mixed results. Moreover, the frequency design in which an RT program is completed on a weekly basis (i.e., the "weekend warrior" approach) may impact overall changes to arterial health.

**PURPOSE:** We sought to examine the dose response impact of RT frequency over a 4-week period on arterial stiffness and blood pressure in college-aged resistance trained individuals.

**METHODS:** Twenty-seven resistance trained males (n=16) and females (n=11) were randomized into three training groups differing in weekly RT frequency: a) 1-day (1D) per week (n=9), b) 2-days (2D) per week (n=9), and c) 3-days (3D) per week (n=9). Resistance training exercises included: dumbbell chest press, seated cable row, leg press, calf raise, lateral pulldown, seated shoulder press, seated leg extension, and prone leg curl. Exercises were completed either two (3D), three (2D), or six (1D) sets of 10 repetitions at 65% 1-repetition max, depending on group. Arterial stiffness indices (augmentation index (AIx75), pulse pressure (PP), and augmentation pressure index (API)) were measured at baseline, midpoint, and after completing the 4-weeks using the Sphygmocor Xcel. A two-way (group x time) ANOVA with repeated measures was employed to examine differences in AS indices between groups.

**RESULTS:** Total weekly load volumes were similar (p = 0.996) across groups. There were no differences between 1D, 2D, and 3D for AIx75 (p = 0.429), PP (p = 0.646), and API (p = 0.247). **CONCLUSION:** Given no differences between groups, a total weekly load volume of RT can be completed in a single weekly session or across multiple sessions without any negative or favorable impact on AS.

**PULSE WAVE VELOCITY AND PULMONARY FUNCTION TESTING AS MARKERS OF CARDIOVASCULAR DISEASE IN FEMALES**

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**PURPOSE:** To assess the association of dynamic lung function, namely forced vital capacity (FVC) and forced expiratory volume in 1 sec (FEV1) and diffusing capacity for carbon monoxide with markers of cardiovascular disease in a cohort of asymptomatic female smokers. Cardiovascular disease is a major health problem worldwide, poor lung function has been associated with increased mortality in cardiovascular disease patients. Both are linked to smoking. Poor scores in arterial stiffness have been linked to restrictive pattern on spirometry. Relatively little is known about the association of other pulmonary function test scores to arterial stiffness.

**RESULTS:** These data support the role of vascular KATP channel expression in exercise tolerance (i.e. CS) by matching O2 delivery- utilization with ovariectomy shifting KATP channel expression from fast- to slow-twitch muscles. Supported by NIH Grants: HL108323 and F31HL145981

**MEDICINE & SCIENCE IN SPORTS & EXERCISE®**

**Board #93**
May 29 2:30 PM - 4:00 PM
**EXERCISE TRAINING AMELIORATES CEREBROVASCULAR DYSFUNCTION IN ALZHEIMER’S DISEASE; A ROLE OF P2Y2 RECEPTOR AND ENDOPOLYMBLAMIC RETICULUM STRESS**


**PURPOSE:** To determine the protective effect of exercise training on P2Y2 receptor-mediated and ER stress-associated cerebrovascular dysfunction in AD.

**METHODS:** We used the control mice (C57BL/6), CON with exercise training (CON+EX), AD mice (AD; APP/PS1) and AD with EX (AD+EX). At 7 to 9 months of age, CON+EX and AD+EX mice underwent 10-12 weeks of aerobic exercise training on the treadmill, running for an hour at 15m/min at a 5% grade for 5 days a week. To test the purinergic receptor-dependent vasoreactivity, a posterior cerebral artery (PCA) was isolated and pressurized, and then ATP (2-MeS-ATP, 1 mmol/L to 10 mmol/L)-induced dose-dependent vasoreactivities were determined at 10-12 months of age. Human brain micro endothelial cells (HBMECs) were exposed to laminar shear stress (LSS) at 20 dyn/cm² for 30 mins, 2 hrs, and 24 hrs. Western blotting was utilized to analyze the expression of P2Y2 receptors, endothelial nitric oxide synthesis (eNOS), and ER stress signaling to define the effect of exercise training on cerebrovascular dysfunction.

**RESULTS:** ATP-induced vasodilation in PCA from CON mice, but it caused vasostenosis in PCA from AD mice. Notably, exercise training reversed ATP-induced vasostenosis in PCA from AD mice to vasodilation (AD+EX) comparable to CON mice. Exercise training reduced the elevation of APP expression and increased P2Y2 receptor and Akt/eNOS expression in HBMECs, but these increases were blunted by P2Y2 receptor inhibitor (AR-C) in HBMECs. Exercise training normalized the abnormal expression of ER stress markers; p-IRE1, p/eIF2α, CHOP, and ER stress-associated apoptosis; Bax and Bcl-2 in AD mice brain.

**CONCLUSION:** Exercise training improves the cerebrovascular dysfunction in AD possibly through P2Y2 receptor and ER stress-dependent endothelial dysfunction.
Peripheral artery disease (PAD) is an atherosclerotic disease that is associated with poor vascular function, walking impairment, and reduced quality of life. Walking is frequently recommended to improve vascular function and reduce symptoms; however, the efficacy of land-based walking training (LET) versus heated-water walking training (HWET) in PAD patients had not been elucidated. **Purpose**: We sought to compare effects of LET to HWET on vascular function, resting heart rate (RHR), exercise tolerance (6-min walking distance (6MWD), time to onset of claudication (COT)), muscular strength, physical function, body composition, and resting metabolic rate (RMR) in PAD patients. **METHODS**: PAD patients (n=53) were recruited and randomly assigned to a LET group (n=25) or HWET group (n=28). The LET group performed a treadmill walking program while the HWET group performed a heated-water walking program for 12-weeks. Leg arterial stiffness (femoral-to-ankle pulse-wave velocity, legPWV, blood pressure (BP), ankle-brachial index (ABI), RHR, 6MWD, COAT, muscular strength, physical function, body composition, and RMR were assessed before and after 12-weeks. **RESULTS**: There were significant group by time interactions for systolic BP (p<0.05), central diastolic BP (p=0.06), and central pulse pressure (p<0.05). There were no changes in RHR, decreteration time, max dp/dt, carotid-to-radial PWV, carotid-to-femoral PWV, carotid-to-ankle PWV, ABI, or COAT (p>0.05). **CONCLUSIONS**: These results indicate that a dose of nitrate (~0.11 mmol nitrate/kg) seems to be an effective dose for improving BP, vascular function, and walking capacity in patients with PAD.

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**Introduction**: Obesity is a serious health concern worldwide and it is a common health condition in Hispanic population. High body fat percentage is inversely related to aerobic fitness and increased arterial stiffness, which is an independent CVD risk factor. However, there is limited data about the effects of body fat percentage on arterial stiffness in Hispanic population. High body fat percentage is inversely related to aerobic fitness and increased arterial stiffness, which is an independent CVD risk factor. However, there is limited data about the effects of body fat percentage on arterial stiffness in Hispanic population. **Purpose**: We sought to compare effects of LET to HWET on vascular function, resting heart rate (RHR), exercise tolerance (6-min walking distance (6MWD), time to onset of claudication (COT)), muscular strength, physical function, body composition, and resting metabolic rate (RMR) in PAD patients. **METHODS**: PAD patients (n=53) were recruited and randomly assigned to a LET group (n=25) or HWET group (n=28). The LET group performed a treadmill walking program while the HWET group performed a heated-water walking program for 12-weeks. Leg arterial stiffness (femoral-to-ankle pulse-wave velocity, legPWV, blood pressure (BP), ankle-brachial index (ABI), RHR, 6MWD, COAT, muscular strength, physical function, body composition, and RMR were assessed before and after 12-weeks. **RESULTS**: There were significant group by time interactions for systolic BP (p<0.05), central diastolic BP (p=0.06), and central pulse pressure (p<0.05). There were no changes in RHR, decreteration time, max dp/dt, carotid-to-radial PWV, carotid-to-femoral PWV, carotid-to-ankle PWV, ABI, or COAT (p>0.05). **CONCLUSIONS**: These results indicate that a dose of nitrate (~0.11 mmol nitrate/kg) seems to be an effective dose for improving BP, vascular function, and walking capacity in patients with PAD.

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**Background**: Post-occlusive reactive hyperemia (PORH) is often used as a test of microvascular function. However, the method of PORH measurement and the reporting of PORH values varies widely between studies, from measurements on the skin or whole-femur to reporting peak or cumulative PORH values. As such, the optimal measurement and reporting of PORH values remains unclear. **Purpose**: To compare whole-femur and skin PORH between older adults with conditions typically associated with microvascular dysfunction (type 2 diabetes, T2D), macrovascular dysfunction (non-diabetic coronary artery disease, CAD) and healthy control participants (HC). **Methods**: We retrospectively analyzed data obtained from 13 T2D patients (61 ± 9 years, 6 M ; 7 W), 21 CAD patients (65 ± 9 years, 18 M ; 3 W) and 13 CTRL (65 ± 7 years, 9 M ; 4 W). Forearm vascular conductance (FVC, duplex ultrasound) and cutaneous vascular conductance (CVC, laser-Doppler) were measured simultaneously before and for 3 minutes after 5 minutes of forearm ischemia. PORH was quantified as: area-under-the-peak (Peak), change from baseline to peak (Δ) and area under the curve above baseline (AUC). **Results**: Baseline FVC (P=0.84) and CVC (P=0.31) were similar between groups. Peak FVC was similar between groups (P=0.24), while ΔFVC tended to be reduced in T2D compared to CAD (P=0.06) and CTRL (P=0.07). FVC AUC was reduced in T2D compared to CTRL (P=0.03), while values in CAD did not differ from T2D or CTRL. Peak CVC (T2D: P=0.04, CAD: P=0.02) and ΔCVC (T2D: P=0.03, CAD: P=0.01) were reduced in T2D and CAD. There was a trend for CVC AUC to differ between groups (P=0.06). The different indices of PORH for a given measurement (forearm vs skin) were strongly correlated (r=0.755 to 0.906 between FVC descriptors, r=0.768 to 0.991 between CVC descriptors, all P<0.001). However, FVC indices of PORH weakly correlated with CVC indices (r=0.23 to 0.374, P<0.01 to 0.11). **Conclusions**: Whole-femur and skin PORH provide different information on microvascular function in older adults. A decreased PORH in the whole-femur appears to be a feature of T2D and not CAD, while a decreased PORH in forearm skin seems to be detectable in both T2D and CAD.
difference in hemodynamic variables including systolic BP, diastolic BP and HR (p > 0.05 for all). In addition, PWV (HF vs. LF: 5.3 ± 0.5 vs. 5.3 ± 0.4 m/s) and AIX(75) (HF vs. LF: 13.8 ± 8.8% vs. 5.3%) were not statistically different between groups (p = 0.05 for both) Conclusion: Although HF group exhibited significantly lower aerobic capacity, BF does not affect arterial stiffness in young casually active Hispanic males. Future study with more participants will be needed.

**3278**  Board #99  May 29 2:30 PM - 4:00 PM  Impact Of Smoke Exposure On Vo2max And Arterial Stiffness In Wildland Firefighters: A Pilot Study

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(No relevant relationships reported)

**Purpose:** Inhalation of wildfire smoke can cause reduced lung function, chest pain, fatigue, and depressed respiratory immune defenses. Those at increased risk for these adverse effects would be wildland firefighters (WLFF). Aerobic fitness is a key component of WLFF performance. Additionally, it is known that higher levels of aerobic fitness correlate with lower levels of cardiovascular (CV) morbidity and mortality. The impact of wildland smoke exposure on CV health among WLFF is unknown.

**Methods:** WLFF from the Arizona high country were recruited for this study. WLFF were asked to come to the lab at Grand Canyon University before and after fire season. Wildfire smoke exposure was measured using personal real-time particle mass monitors. Following anthropometric measurements, subjects had carotid-femoral Pulse Wave Velocity (cPWV) and VO2max measured. Identical measurements were taken before and after fire season. Hierarchical regression was completed to assess the relationship between the number of fire seasons completed and VO2peak. Paired t-test was completed for pre-post testing.

**Results:** Twenty-eight subjects completed initial testing while 22 returned for post-testing. Subjects were 31.0±5.7 yrs., with a BMI of 25.7±3.0 kg/m², VO2max of 55.4±6.6 mL/kg/min and completed on average 10.6±5.8 seasons of wildland firefighting. Regression analysis was completed with age in model one and number of seasons in model two. VO2max was the criterion variable. Model one was not a significant predictor of VO2max. Model two significantly explained 23% of the variance in VO2max (P=0.044). Significant reduction in absolute VO2peak (43.7±2.8 vs. 32.1±1.9 L/min, P<0.004) and significant increases in cPWV (6.0±1 vs. 6.6±0.7 m/s, P<0.042) were seen following fire season.

**Conclusion:** This pilot study suggests that the duration of a WLFF career may negatively impact CV health.

**3279**  Board #100  May 29 2:30 PM - 4:00 PM  Exercise Mediates Epigenetic Suppression Of LTCC And BKCa Channel In Mesenteric Arteries Of Hypertensive Rats

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(No relevant relationships reported)

Regular exercise is a lifestyle intervention for controlling hypertension and has an improving effect on vascular function. Voltage-gated L-type Ca2+ (LTCC) and large-conductance Ca2+-activated K+ (BKCa) channels are two principal mediators of vascular smooth muscle contractility and arterial tone. Exercise-induced LTCC and BKCa channel alterations in arterial myocytes may contribute to the improvement of vascular function in pathological conditions. However, the mechanism underlying the functional changes of these ion channels is still unclear but critical for understanding the mechanistic basis of reliable arterial performance. **Purpose:** To investigate the role of DNA methylation in exercise-induced reprogramming of LTCC and BKCa channel in mesenteric arteries from spontaneously hypertensive rats (SHRs).

**METHODS:** Two-week-old male SHRs and normotensive Wistar-Kyoto rats (WKYs) were assigned into sedentary and exercise groups. Exercise groups were performed a moderate-intensity treadmill running (about 55-65% of maximal aerobic velocity, 20 min/min, 0% grade, 60 min, 5 days/week). After 12 weeks, patch clamp study, Western blot, qPCR and bisulfite sequencing PCR were performed to detect the LTCC and BKCa channel currents, protein expression and mRNA levels of LTCC α1c and BKCa β1 subunits. DNA methylation level of α1c and β1 gene promoter region.

**RESULTS:** Exercise training significantly decreased the systolic blood pressure in both WKYS (139.5±0.48 vs. 132.3±0.56 mmHg, P<0.05) and SHRs (199.4±0.45 vs. 191.2±0.71 mmHg, P<0.05). Exercise inhibited hypertension-induced upregulation of LTCC (-16.0±1.6 vs. -11.4±1.5 pA/pF, P<0.05) and BKCa (43.7±2.8 vs. 23.3±1.6 pA/pF, P<0.05) and significantly downregulated mRNA levels of mesenteric arterial myocytes by repressing LTCC α1c (2.8±0.3 vs. 1.7±0.2, P<0.05) and BKCa β1 (1.7±0.3 vs. 0.8±0.2, P<0.05) expression. DNA bisulfite sequencing PCR showed that chronic exercise increased CpG methylation at α1c (81.3±1.6 vs. 87.9±0.8%, P<0.05) and β1 (17.7±0.4 vs. 25.2±2.0%, P<0.05) gene promoter in SHR mesenteric arteries. **Conclusion:** Exercise suppresses LTCC and BKCa channel function via hypermethylation of α1c and β1 subunits, which contributes to the restoration of mesenteric arterial function and vasodilation during hypertension.

**3280**  Board #101  May 29 2:30 PM - 4:00 PM  Evaluation Of Functional Sympatholysis Occurring Within Contracting Skeletal Muscle Microvasculature In Humans

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(No relevant relationships reported)

The ability of contracting skeletal muscle to blunt sympathetic vasoconstriction, termed functional sympatholysis, is thought to contribute to supplying adequate blood to the exercising muscle despite increased sympathetic tone. However, previous studies in humans primarily investigated vascular responses of exercising limb as a whole that reflects not only responses of contracting skeletal muscles but also responses of inactive tissues such as skin, adipose and bones. **Purpose:** We aimed to more directly investigate the functional sympatholysis occurring within exercising skeletal muscle in humans. **METHODS:** In 26 healthy male volunteers, we examined the effects of acute sympathoexcitation by 90-s forehead cooling at rest and during dynamic handgrip exercise at 10% and 30% of maximum voluntary contraction (10%Ex and 30%Ex), respectively. The handgrip exercises were continued 3 min and forehead cooling was applied at latter half of the exercise period. The subjects also performed handgrip exercises without forehead cooling as control conditions. We employed near-infrared diffuse correlation spectroscopy, an emerging optical technique for noninvasive measurement of deep tissue hemodynamics, to continuously measure the microcirculatory blood flow index (BFI) within the flexor digitorum superficialis muscle, the muscle primarily responsible for handgrip. **RESULTS:** The acute sympahtoexcitation induced significant decrease in vascular conductance (BFI/mean arterial pressure) at rest (baseline vs. forehead cooling: 1.00±0.75 vs. 0.89±0.03 AU, P<0.05) and during 10%Ex (control vs. forehead cooling: 1.66±0.08 vs. 1.32±0.10 AU, P<0.05), but not during 30%Ex (control vs. forehead cooling: 4.00±0.56 vs. 3.66±0.50 AU, P>0.05). In addition, the percentage reduction in vascular conductance by forehead cooling was significantly decreased during 30%Ex compared to rest (−25.2±2.5 vs. −4.9±5.1%, P<0.05). **CONCLUSIONS:** Our study demonstrated the functional sympatholysis occurring within the contracting skeletal muscle microvasculature in humans. Furthermore, our results revealed the clear intensity-dependent response such that mild exercise hardly interferes with sympathetic vasoconstriction, whereas moderate exercise substantially attenuates it.

**3281**  Board #102  May 29 2:30 PM - 4:00 PM  Continuous Physical Activity Modulates Arterial Stiffening In Young People: A Prospective Longitudinal Observational Study

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(No relevant relationships reported)

**PURPOSE:** Higher physical activity is well known to prevent age-related increases in arterial stiffness in middle-aged and older people. However, no data are available concerning prospective longitudinal studies between physical activity and arterial stiffness, especially in young people. Therefore, this prospective longitudinal observational study aimed to examine the effects of continuous physical activity on arterial stiffening in young people.

**METHODS:** The data of the longitudinal study analyzed from 79 normal healthy young men and women (19.2±0.2 years at baseline). At baseline (pre) and after 4-year follow-up (post), arterial stiffness, which was measured by using Cardio-Angle Vascular Index (CAVI) and regular physical activity levels, which were measured by using International Physical Activity Questionnaire (IPAQ), were assessed. At each time point, participants were classified as having high (H) or low (L) physical activity based on the Physical Activity Reference for Health Promotion 2013 in Japan (23 Metabolic Equivalent Tasks/h/week), and then were finally divided into LL, HL, or HH groups.

**RESULTS:** After follow-up period, in addition to body weight, body mass index, and blood pressure, CAVI values of all participants significantly increased (Pre, 5.7±0.1 unit; Post, 6.1±0.1 unit). There were no significant differences in baseline CAVI values across the groups (LL, 5.7±0.1 unit; HL, 5.7±0.1 unit; HH, 5.8±0.1 unit). However, the changes in CAVI were more significantly larger in HH group than in LL group (P<0.05). With the status of continuous physical activity increasing, significant decreasing trends were observed in CAVI (LL, 0.6±0.1 unit; HL, 0.4±0.1 unit; HH, 0.1±0.1 unit; P<0.05).
CONCLUSIONS: These findings indicate that age-related increase in arterial stiffness is observed even in young healthy people. However, continuous higher physical activity can prevent this age-related arterial stiffening in young people.

PURPOSE: Increased incidences of cardiovascular disorder and metabolic syndrome particularly in postmenopausal women have set curiosity for the underlying factors. One potential mechanism by which endothelial dysfunction may promote early arterial stiffness is by causing estrogen deficiency. It is reported that physical exercise counteracts the occurrence of above disorders, while a few others show no change. The training response differs among individuals partly due to genetic composition. Angiotensin-converting enzyme (ACE) insertion/deletion (D/I) polymorphism related to physical performance in athletes has been well-reported. The present study was to observe the effects of 12 weeks exercise (aerobic exercise and resistance training) on endothelial function in postmenopausal women with different D/I polymorphism of ACE gene.

METHODS: 122 postmenopausal women aged 45-75 years were randomly divided into aerobic exercise group (D/I=65, DD=6) and resistance training group (D/I=42, DD=9). Body composition, TC, HDL, LDL, endothelial function, endothelium-derived relaxing factor and contracting factor were analyzed.

RESULTS: TC, blood lipid abnormality rate, blood glucose and visceral fat in DI/II type were decreased more significantly after aerobic exercise compared with DD type. Aerobic exercise showed markedly positive effects in LDL, hyperglycemia, overweight/obesity, high blood fat rate, abnormal waist-hip ratio and visceral fat in DI/II, while resistance training in DD carriers to resistance exercise.

CONCLUSIONS: Exercise positively influences endothelial functions, independent of ACE D/I polymorphism; and DI/II carriers show a better response to aerobic exercise, while DD carriers to resistance exercise.

The physiological manifestations of posttraumatic stress disorder (PTSD) have been associated with an increase in risk of cardiovascular disease (CVD) independent of negative lifestyle factors. Peripheral vascular dysfunction may be a mechanism by which PTSD increases CVD risk. PURPOSE: This study sought to determine if blood flow regulation and peripheral vascular function are altered during exercise in individuals PTSD when compared to age-matched controls. METHODS: Sixteen individuals with PTSD (10 women, 6 men; age 24 ± 4 years), and twenty-four age, and sex-matched healthy controls (CTRL); 15 women, 9 men, 24 ± 4 years), participated in the study. Upper limb vascular function and blood flow was assessed during resting, anaerobic handgrip exercise (at rest, 3 and 6 kilograms (kg)) with Doppler ultrasound. Exercise-induced changes in arterial diameter and blood flow were analyzed. RESULTS: Although no significance was noted in MAP, BA flow mediated dilation, or blood flow between groups, the PTSD group reported significantly lower VC at the highest exercise workload (6 kg - PTSD: 2.04 ± 0.9; CTRL: 2.87 ± 1.0 ml/min-1 x 100 mmHg-1, p < 0.05) when compared to the CTRL group. CONCLUSION: Individuals with PTSD increases lower vascular conductance during upper limb arm exercise when compared to healthy controls. Further research is needed to determine if this finding translates to larger muscle mass exercise, potentially leading to exercise intolerance, as well as the potential mechanisms may be driving this dysfunction in individuals with PTSD, such augmented sympathetic activity during exercise and/or microvascular dysfunction.

Endothelial dysfunction is a risk factor for cardiovascular disease (CVD) and is predictive of adverse events. However, endothelial function is rarely measured in young adults reporting histories of chronic resistance activity and minimal CRE. Endothelial function in postmenopausal women with different D/I polymorphism of ACE gene.

CONCLUSIONS: The present study was to observe the effects of 12 weeks exercise (aerobic exercise and resistance training) on endothelial function in postmenopausal women with different D/I polymorphism of ACE gene.

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RESULTS: TC, blood lipid abnormality rate, blood glucose and visceral fat in DI/II type were decreased more significantly after aerobic exercise compared with DD type. Aerobic exercise showed markedly positive effects in LDL, hyperglycemia, overweight/obesity, high blood fat rate, abnormal waist-hip ratio and visceral fat in DI/II, while resistance training in DD carriers to resistance exercise.

CONCLUSIONS: Exercise positively influences endothelial functions, independent of ACE D/I polymorphism; and DI/II carriers show a better response to aerobic exercise, while DD carriers to resistance exercise.

Cerebral palasy (CP) is a non-progressive and permanent neurological disorder leading to musculoskeletal dysfunction and immobility. A major clinical problem with CP is early development of cardiovascular diseases with increased rates of mortality. Due to the inevitability of motor dysfunction adults with CP can develop health risk factors, such as obesity and hypertension, at a higher rate compared to the general population. To date, the physiological basis for CP has not been established; how cardiovascular dynamics, such as heart rate (HR), blood pressure (BP), and blood flow (BF), are controlled in individuals with CP has never been identified. PURPOSE: To determine differential cardiovascular responses to acute dynamic exercise in adults with CP. METHODS: Total of ten adults with and without CP participated in the study. HR from ECG, beat-to-beat arterial BP from Finapres and brachial BP, and respiration via pneumotach was continuously measured before, during and after 2 minutes of dynamic handgrip exercise at 35% and 50% of maximal voluntary contraction. In addition, diameter, blood velocity, and flow of the brachial artery were measured using Doppler ultrasound on the contracting arm throughout the experiment. RESULTS: HR was significantly increased to exercise from rest in both groups with no group difference (Δ7=+1.2 control vs. Δ7=+1.8 CP; p<0.05). Both control and CP groups had increases in BF during exercise compared to at rest (Δ11=+22 control vs. Δ11=+32 CP; p<0.05). Mean BP was significantly increased to exercise from rest in control; however, there were only minor changes in BP to exercise from rest in CP group (Δ7=+1.6 control, Δ7=+0.1 CP, mmHg). CONCLUSION: While HR and BP increased to exercise from rest in similar fashion, BP did not change to exercise in CP with our preliminary data show that other mechanisms, possibly vascular contribution from non-contracting limbs, may contribute to impaired BP response during exercise in CP. Supported by CASA RSCA Infusion, Central RSCA, and Undergraduate Research Grant, SJSU
It is well-established that hypertensive individuals have an exaggerated systolic blood pressure in response to exercise. Leg muscle weakness is related to greater left ventricular (LV) mass in hypertensive individuals via exaggerated increases in blood pressure during aerobic exercise. Pulse pressure (PP) is an indicator of LV pulsatile ventricular (LV) mass in hypertensive individuals via exaggerated increases in blood pressure in response to exercise. Pulse pressure (PP) is an indicator of LV pulsatile ventricular (LV) mass in hypertensive individuals (HTN) versus normotensive older adults (NTN). PP response at 30% of 1RM was significantly greater in the HTN (15 ± 1 mmHg) compared to the NTN (5.00 ± 1.0 kg/kg, p = .05). Leg muscle strength was not significantly different between groups. PP response at 30% was negatively correlated with leg strength (r = -.570, p = .009) and leg strength (r = -.465, p = .039).

CONCLUSIONS: The current findings indicate that cfPWV and hfPWV are strongly associated, and that change in cfPWV is strongly associated with change in hfPWV.

BACKGROUND: Central Pulse Wave Velocity (PWV) is the gold-standard measure of arterial stiffness and an important clinical parameter for evaluating cardiovascular risk. The most frequently used measure of central PWV is carotid-femoral PWV (cfPWV); however, cfPWV may be unsuitable for use in patients who are obese, have had an ischemic stroke, or those with advanced carotid artery atherosclerosis. A potential alternative is heart-femoral PWV (hfPWV), which is simpler to conduct as the measurement does not require assessment of the carotid artery. The aim of this study was to determine (1) the strength of the association between cfPWV and hfPWV, and (2) determine whether change in cfPWV is associated with change in hfPWV.

METHODS: Thirty healthy participants (23.5 ± 2.9 y, 53.5% F, BMI 24.1 ± 2.3) were recruited for Aim 1, and 20 participants (24.1 ± 3.1, 55% F, BMI 23.9 ± 2.5) for Aim 2. Using Doppler ultrasound, cfPWV was measured using the foot-foot method on ECG-gated doppler waveforms captured from the common carotid and superficial femoral arteries. hfPWV was measured using the R wave to the foot of the superficial femoral artery doppler waveform. To induce change in cfPWV (Aim 2) the upper leg was occluded to 60 mm Hg. To estimate intra-individual associations between cfPWV and hfPWV (Aim 1), Pearson’s product moment correlation was used. To estimate intra-individual associations between change (cfPWV – baseline) in cfPWV and change in hfPWV, the repeated measures correlation package for R was used. RESULTS: There was a large positive correlation (r = 0.72, 95% CI 0.48-0.86, P < 0.001.) between hfPWV and cfPWV (Aim 1). There was also a large positive correlation between change in cfPWV and change in hfPWV (r = 0.83, 95% CI 0.61-0.93, P < 0.001). CONCLUSION: The current findings indicate that cfPWV and hfPWV are strongly associated, and that change in cfPWV is strongly associated with change in hfPWV.

BACKGROUND: Pulse-wave velocity (PWV) can potentially be used to assess acute change in endothelial function. Previous studies have reported that increasing or decreasing nitric oxide bioavailability results in reciprocal changes to PWV. However, nitric oxide is not the only molecule regulating endothelial function and at this time, no in-vivo studies have examined whether PWV changes in acute, non-specific endothelial dysfunction. PURPOSE: Determine effects of acute endothelial dysfunction on PWV. In this study, retrograde shear stress was induced by increasing retrograde flow for 30 minutes. Our hypothesis is that acute endothelial dysfunction will result in decreased PWV. METHODS: Twenty-two young, healthy adults (23.8 years [SD 4.1], 16 F, BMI 22.8 kg/m² [SD 2.8]) were recruited. PWV and flow-mediated dilation (FMD) were measured at baseline and immediately following the endothelial dysfunction protocol. FMD was measured to confirm the presence of endothelial dysfunction. PWV was measured between the upper arm and wrist using an oscilometric device, and brachial FMD using ultrasound. The association between PWV and FMD was assessed using Pearson’s product moment correlation. Linear mixed models were used to assess baseline versus endothelial dysfunction protocol changes in PWV and FMD, controlling for within-subject changes in mean arterial pressure and the shear rate area under the curve, respectively. RESULTS: At baseline, there was a large association between FMD and PWV (r = 0.60, 95%CI: 0.23, 0.81). Following the endothelial dysfunction protocol, there was a moderate significant increase in PWV (Δ = 0.38 m/s, 95%CI: 0.07, 0.69, ES = 0.5) and a large significant decrease (Δ = 3.10, 95%CI: -4.13, -2.05, ES = -1.3) in FMD. CONCLUSIONS: Acute change in PWV is at least partially driven by changes in endothelial function, indicating that PWV could be a useful tool for assessing endothelial function changes.
increase in PWV (Δ = 0.16, 95% CI: 0.05, 0.28, ES = 0.6). There was a moderate inter-individual association between FMD and PWV (r = 0.46), and a large intra-individual association between FMD and PWV (r = 0.63). CONCLUSIONS: Acute changes in PWV may be a user-objective, automate, and viable tool for monitoring acute changes in endothelial function.

3291 Board #112 May 29 2:30 PM - 4:00 PM Can Racial Differences In Endothelial Dysfunction Be Explained By Mirnas? Dulce H. Gomez, Maitha Aldokhayıyl, Adelola Adeyemo, Michael D. Brown, FACSM. Auburn University, Auburn, AL. (Sponsor: Michael D. Brown, FACSM) Email: dhg0008@auburn.edu (No relevant relationships reported)

MicroRNAs (miRs) are short noncoding RNAs that regulate gene expression post-transcriptionally. It is well documented that exercise improves endothelial function, possibly, by modifying flow-responsive miR expression (e.q. miRs-126*, -92a and -21). MiR-126* is an anti-atherogenic miR that regulates vascular integrity, angiogenesis, and inflammation. Whereas, miR-92a and -21 are pro-atherogenic miRs that result in a reduction in endothelial nitric oxide synthase (eNOS) activity. MiR-92a targets the transcription factor Kruppel-like factor 4 (KLF4) leading to a decrease in endothelial nitric oxide activity and the reduction in blood pressure (BP) (S killers). Therefore, KLF4 and eNOS are key factors controlling blood pressure (BP) regulation during acute hypotension. Acute decreases in BP via a shortened occlusion time for 3 min without a change in BP (SR) was attenuated in the hypotension trial (Δ = 0.16, 95% CI: 0.05, 0.28, ES = 0.6). CONCLUSIONS: Acute changes in PWV may be a user-objective, automate, and viable tool for monitoring acute changes in endothelial function.

3292 Board #113 May 29 2:30 PM - 4:00 PM Acute Hypotension Blunts Brachial Flow-mediated Dilation In Young Healthy Men Yutaka Yamada1, Erika Iwamoto1, Rintaro Sakamoto1, Toru Neki1, Jun Sugawara2, Masaki Katayose3, Shigehiko Ogoh, FACSM3, Sapporo Medical University, Sapporo, Japan. 1National Institute of Advanced Industrial Science and Technology, Tsukuba, Japan. 2Toyo University, Kawagoe, Japan. Email: yutaka.y.swim.8842@outlook.jp (No relevant relationships reported)

Recent clinical studies using a vasovagal syncope suggest that endothelial function is a key factor controlling blood pressure (BP) regulation during acute hypotension. Acute increase in BP is known to attenuate brachial flow-mediated dilation (FMD). However, the influence of acute hypotension on peripheral FMD remains unclear.

PURPOSE: To test the hypothesis that acute hypotension blunts brachial FMD, an index of endothelial function, in young healthy humans.

METHODS: Twelve healthy young men (21.8±1.6 yrs; body mass index: 22.2±1.6 kg/m2) were cultured under two conditions: Control or TNF-α (10 ng/mL) for 4 hours. Protein expression was measured for PTEN, KLF4, p-eNOS=117 and eNOS. Total RNA was harvested to measure miR-21, miR-126*, and miR92a. A two-way ANOVA was used to assess the effects of race and condition.

RESULTS: No racial differences were found in protein expression of PTEN, KLF4, and eNOS at baseline or with TNF-α stimulation. AA had lower p-eNOS expression (p=0.008) compared to CA ECs under both conditions. No racial differences were found in miR-21, miR-126*, and miR92a. A two-way ANOVA was used to assess the effect of race and condition.

CONCLUSIONS: Although we show significantly lower levels of p-eNOS and higher miR-92a expression in activated ECs of AA compared to CA, KLF4 protein levels were not significantly different. Therefore, the specific miRs studied do not explain the racial differences observed in endothelial dysfunction in an inflammation model. Future research should investigate potential racial differences in how miRs respond to high laminar shear stress, as an exercise metric.

3293 Board #114 May 29 2:30 PM - 4:00 PM The Association Between Physical Inactivity And Vascular Dysfunction May Be Related To Low Testosterone Concentrations Matthew C. Babcock, Jennifer M. Blankenship, Ashley Brubaker, Teresa L. Witten, Kerry L. Hildreth, Kerrie L. Moreau. University of Colorado Anschutz Medical Campus, Aurora, CO. (Sponsor: William Farquhar, FACSM) Email: matthew.babcock@cuanschutz.edu (No relevant relationships reported)

Increased sitting time is associated with increased arterial stiffness, poor cardiometabolic health outcomes, increased risk of developing cardiovascular disease, and all-cause mortality. Further, excess sitting time likely reduces aerobic capacity and increases adiposity, which have been shown to be related to low testosterone (T) in young men. Low T has been linked to increased arterial stiffness, however, it remains unclear how T may contribute to the association between physical inactivity, adiposity, aerobic capacity, and vascular health.

PURPOSE: To determine the influence of T on the relationships between VO2max, body composition, physical activity, endothelial function, and arterial stiffness.

METHODS: 87 healthy males aged 18-75 years (mean±SD; 25±14 years, BMI=27.0±4.4 kg/m2) underwent VO2max testing, physical activity monitoring (accelerometry), body composition (DXA), and vascular (endothelial function via brachial artery flow-mediated dilation, FMD; arterial stiffness via pulse wave velocity, PWV) testing. Serum T was measured under fasted conditions in the morning.

RESULTS: Bivariate correlation analysis indicated that VO2max (p=0.001, R=0.42), body fat (p=0.001, R=-0.42), sitting time (p=0.020, R=-0.28), PWV (p=0.018, R=-0.22), and BMI (p=0.046, R=0.24) were related to T concentrations. Body fat (p=0.001, R=-0.39), VO2max (p=0.001, R=0.41), and sitting time (p=0.029, R=0.24) were correlated with PWV. Body fat (p=0.001, R=-0.44) and VO2max (p=0.001, R=-0.41), but not sitting time (p=0.185, R=0.17), were related to FMD.

CONCLUSIONS: T using partial correlation analysis, sitting time was no longer significantly related to PWV (p=0.297, R=0.141), however correlation coefficients between PWV and VO2max or body fat were unchanged.

CONCLUSIONS: These data indicate that the association between physical inactivity may be related to low T concentrations.

3294 Board #115 May 29 2:30 PM - 4:00 PM Preliminary Study Of Ethnic Differences In Hemodynamic Responses Following High Intensity Exercise: Wave Separation Analysis Sang Ouk Wee, Rachel C. Reyes, Zhaojing Chen, Jason Ng. California State University San Bernardino, SAN BERNARDINO, CA. Email: sangouk.wee@csusb.edu (No relevant relationships reported)

The Hispanic population is at a high risk of developing cardiovascular disease (CVD), especially cerebrovascular disease. High blood pressure (BP) and inadequate BP regulation are related to future CVD events. Sympathetic stimulation through high intensity exercise temporarily increases risk of cardiovascular events and alters hemodynamics. It is unknown whether there is an ethnic difference in the regulation of BP and pulse wave characteristics—including forward or reflected pressure waves—between Hispanic and White populations.

PURPOSE: To investigate the ethnic differences in BP and pulse wave characteristics measured with wave separation analysis in response to high intensity exercise.

METHODS: 10 male volunteers (9 Hispanic; 23 ± 3 yr, 1 White; 21 yr) completed the study. Aerobic capacity was measured by indirect calorimetry and a treadmill graded exercise test (GXT). Brachial BP was measured by an automated BP monitor. Central hemodynamic variables and forward waves were obtained by tonometer at baseline, 15-minute, and 30-minute after high intensity treadmill exercise (GXT). Pulse waves were further separated into forward pulse height (FH) and reflected pulse height (RH) for analysis. A 2 x 3 repeated measure analysis of variance was performed to investigate ethnic differences in BP and pulse wave responses to high intensity exercise.

RESULTS: See table 1. There were not significant ethnic differences in brachial systolic BP, brachial diastolic BP, aortic systolic BP, aortic diastolic BP, BP pressure and mean arterial pressure (p > 0.05 for all).

FURTHER, FH and RH were not statistically different between Hispanic and White males at rest and following high intensity exercise (p > 0.05). CONCLUSION: The Association Between Physical Inactivity And Vascular Dysfunction May Be Related To Low Testosterone Concentrations

Sang Ouk Wee, Rachel C. Reyes, Zhaojing Chen, Jason Ng. California State University San Bernardino, SAN BERNARDINO, CA. Email: sangouk.wee@csusb.edu (No relevant relationships reported)

Abstracts were prepared by the authors and printed as submitted.
3295  
**Board #116**  
**May 29 2:30 PM - 4:00 PM**  
**Age- And Sex-related Differences In Skeletal Muscle Oxygen Consumption Rate And Microvascular Reactivity**  
Hannah F. Bryan, Nile F. Banks, Emily M. Rogers, Claire M. Smith. -Oklahoma State University, Stillwater, OK.  

—No relevant relationships reported—

**Purpose:** To examine the influence of age and sex on non-invasive measurements of oxygen consumption rate and microvascular reactivity. **Methods:** Seven young females (YF; mean ± SD, age = 20.9±2 y), 6 older females (OF; 57.5±10 y), 14 younger males (YM; 22.2±2 y), and 8 older males (OM; 59.5±5 y) visited the laboratory on one occasion during which skeletal muscle oxygen utilization and microvascular function were assessed following a 10 s fast using near-infrared spectroscopy with vascular occlusion test (NIRS-VOT). During the NIRS-VOT, tissue saturation (StO2) was monitored, and the rate of decrease in StO2 (Slope 1) during cuff inflation (i.e., ischemia) was quantified, as were the reperfusion magnitude (Rep1-AUC, rate of increase in StO2 (Slopes 2 and 2), and the reperfusion area under the curve (SI2AUC0-1) following cuff deflation. Two-way (age × sex) ANOVAs were used to examine the differences in Slope 1, Rep1-AUC, Slope 2, and SI2AUC0-1 among the YW, OW, YM, and OM. Means ± 95% CIs are reported. **Results:** There were significant age and sex effects for Slope 1 (p = 0.01 and 0.02, respectively), which was more negative (i.e., steeper) in males versus females (-0.132±0.12 vs. -0.108±0.15 %/s) and in the young versus older adults (-0.133±0.13 vs. -0.107±0.14 %/s). There was an age effect for Rep1-AUC (p < 0.001), which was greater in the younger than older adults (50.7±4.0 vs. 38.5±4.6%). While there was no effect of age on Slope 2, Slope 2 was steeper (p = 0.002) in males than females (1.71±0.24 vs. 1.06±0.34 %/s). Finally, there were age (p = 0.02) and sex (p = 0.03) main effects for SI2AUC0-1, which was greater in males versus females (1228.5±148.8 vs. 960.1±178.9 %/s) and in the young versus older adults (1240.7±148.8 vs. 947.9±178.9 %/s). **Conclusions:** Overall, our results suggest that there are age and sex-related differences in skeletal muscle oxygen consumption rate and microvascular reactivity, as assessed using the NIRS-VOT technique. However, because the degree of tissue desaturation is the stimulus for subsequent reperfusion responses and the rate of desaturation was greater in the younger than older adults and in males than females, it is not clear if the differences in Slope 2 and SI2AUC0-1 reflect differences in microvascular reactivity, per se. Additional studies are needed to more fully explore this interplay.

3296  
**Board #117**  
**May 29 2:30 PM - 4:00 PM**  
**Altered Microvascular Reactivity In Young Healthy Adults With A Family History Of Hypertension**  
Evon L. Matthews, 1 John J. Guers, 2 Peter A. Hosick. 1 Montclair State University, Montclair, NJ; 2 Rider University, Lawrenceville, NJ.  
Email: matthewse@montclair.edu  

—No relevant relationships reported—

Young healthy adults with a family history of hypertension (+FHH) display some of the phenotypic characteristics of adults with established hypertension. These similarities may serve as early warning signs for the development of hypertension, and therefore, should be examined. **PURPOSE:** To determine if, like hypertensives, normotensive +FHH adults display lower conduit artery function and microvascular reactivity than normotensive adults without a family history of hypertension (-FHH). **METHODS:** Healthy normotensive adults self-reported if a first degree relative had been diagnosed with hypertension. A forearm vascular occlusion test was performed while resting in the supine position. An ultrasound probe placed on the brachial artery above the occlusion cuff was used to assess flow mediated dilation (FMD); a test of conduit artery function. Simultaneously, a near infrared spectroscopy (NIRS) sensor placed on the anterior forearm measured skeletal muscle oxygen saturation (SmO2). SmO2 kinetics were examined to evaluate microvascular function. **RESULTS:** Twenty-one participants were included in this investigation (+FHH n=12, -FHH n=9). Groups were young (+FHH 24.1±5, +FHH 24.6±6yr; p=0.756), with a non-significant trend towards higher mean arterial pressure in the +FHH group (+FHH 82±10, +FHH 89±8mmHg; p=0.082). There were no group differences in baseline brachial arterial diameter (+FHH 0.24±0.164, +FHH 0.325±0.19mm; p=0.234), total shear (+FHH 5324±35326, +FHH 34430±368756AUC; p=0.384), and vessel dilation (-FHH 6.92±4.55, +FHH 6.97±6.65%/s p=0.984). Baseline SmO2 (+FHH 69.9, +FHH 64±13%; p=0.271), and the 30s peak desaturation slope obtained during vascular occlusion (-FHH -0.38±0.12, +FHH -0.42±0.14%; p=0.393), were also not different between groups. Following cuff release the reperfusion slope (1° 10s, -FHH 2.90±1.06, +FHH 5.00±2.51%/s p=0.046), and the SmO2 overshoot (+FHH 1177±719, +FHH 2024±974AUC; p=0.029) were greater in the +FHH group. **CONCLUSIONS:** Contrary to our hypothesis, the +FHH group displayed greater NIRS reperfusion microvascular reactivity than the -FHH group. This may be due to a greater perfusion pressure in the +FHH group as evidenced by a trend for greater mean arterial pressure.

3297  
**Board #118**  
**May 29 2:30 PM - 4:00 PM**  
**Abstract Withdrawn**

3298  
**Board #119**  
**May 29 2:30 PM - 4:00 PM**  
**Self-reported Sleep Habits Are Related To Arterial Stiffness In Apparently Healthy Individuals**  
Meral N. Culver, Sean P. Langan, Bryan L. Riemann, Andrew A. Flatt, Gregory J. Grosicki. Georgia Southern University-Armstrong Campus, Savannah, GA.  
Email: mc28967@georgiasouthern.edu  

—No relevant relationships reported—

Insufficient sleep is associated with cardiovascular disease. Whether this relationship is mediated through decrements in vascular function has yet to be fully elucidated. **PURPOSE:** This study investigated relationships between self-reported sleep habits and vascular health in apparently healthy individuals. **METHODS:** Thirty-one individuals (14 females/17 males, 30±10 yrs, 24.7±3.2 kg/m²) free of cardiovascular disease, diabetes, and not using medications were enrolled. Subjective sleep habits were characterized using the Pittsburgh Sleep Quality Index to generate a composite score (PSQI score) ranging from 0 (better) to 21 (worse). Vascular health including brachial and aortic pressures, pulse pressure, and augmentation pressure (a measure of arterial stiffness) was quantified via arterial pressure waveforms. **RESULTS:** Mean PSQI score was 4±3, where a score >5 is deemed to be “poor” sleep quality. Initial regression models for age, gender, body mass index, and PSQI score predicted (P<0.01) pulse pressure (31.2±5.9 mmHg) and augmentation pressure (24.3±7.3 mmHg). The final model including only significant predictors for pulse pressure (P<0.01, R²=0.38) included PSQI score (β=0.47, P<0.01) and BMI (β=0.38, P=0.02). Meanwhile, the final model for augmentation pressure (P<0.01, R²=0.31) included PSQI score (β=0.34, P=0.04), BMI (β=0.36, P=0.03), and gender (β=0.46, P=0.01). PSQI score was not associated (P>0.05) with brachial or aortic systolic (123±11 and 108±10 mmHg) or diastolic (76±9 and 77±9 mmHg) pressures. **CONCLUSIONS:** These data demonstrate that self-reported sleep habits, quantified via PSQI score, are related to indices of arterial stiffness (i.e., pulse pressure and augmentation pressure) in apparently healthy individuals. Large artery stiffening resulting from sleep deficiency may play a role in the development of hypertension and cardiovascular disease.

3299  
**Board #120**  
**May 29 2:30 PM - 4:00 PM**  
**Mitochondrial Targeted Antioxidant Intake Improves Vascular Function And Exercise Tolerance In Peripheral Artery Disease Patients**  
Elizabeth J. Pekas, Won-Mok Son, Ronald J. Headld, III, TeSean K. Wooden, Song-Young Park. The University of Nebraska at Omaha, Omaha, NE.  
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—No relevant relationships reported—

Peripheral artery disease (PAD) is a manifestation of atherosclerosis in the lower leg arteries, which causes reduced blood flow and leg pain. This may be in part due to excessive mitochondria-produced reactive oxygen species (ROS) and attenuated mitochondrial respiratory function. Mitoquinol mesylate, a mitochondrial-targeted antioxidant, has been shown to scavenge ROS and improve vascular function in older adults and animal models. However, the impacts of mitochondrial antioxidant supplementation in patients with PAD are unknown. **PURPOSE:** To examine the impacts of acute mitoquinol intake (80mg) on endothelial function (flow mediated dilation, FMD), resting heart rate (RHR), blood pressure (BP), arterial stiffness (pulse wave velocity, PWV), and exercise tolerance in patients with PAD. **METHODS:** 10 patients with
PAD (stage II-III) received either mitoquinol or placebo in a randomized crossover design. At each visit, measurements of RHR, central and peripheral BP, brachial and popliteal artery FMD, PWV, augmentation index (AIx), maximal walking capacity, and time to claudication (TTC) were measured before and after mitoquinol and placebo.

RESULTS: There were significant group by time interactions (p<0.05) for brachial FMD, popliteal FMD, and CO, which significantly increased (p<0.05). There were trends for decreases in diastolic BP (p=0.10), carotid-toankle PWV (p=0.08), and increases in total peripheral resistance (p=0.06), and maximal walking distance (p=0.06). There were no changes in RHR, systolic central BP, brachial carotid artery, wall, or brachial-to-radial PWV, carotid-to-femoral PWV, or AIx (p>0.05).

CONCLUSIONS: Mitoquinol intake may be an effective strategy for targeting mitochondrial ROS, which may be useful for treating endothelial dysfunction, leg pain, and improving walking time in patients with PAD.

3300 Board #121 May 29 2:30 PM - 4:00 PM AUTONOMIC AND CARDIOVASCULAR RESPONSES TO ACUTE EXERCISES IN CHILDREN WITH AUTISM SPECTRUM DISORDER Allison T. Bui, Gustavo Aldama, Ashley J. Castle, Kauinalani P. Kekuawela, Jacob A. Manriquez, Areum K. Jensen. San Jose State University, San Jose, CA. (No relevant relationships reported)

Autism Spectrum Disorder (ASD) is a complex neurological disorder identified in early childhood and is characterized by impaired social interaction and atypical behaviors. Limited studies reported that children with ASD tend to have higher heart rate (HR) and blood pressure (BP) at rest compared to typically developing children (TDC). Previously, we reported that HR and blood flow (BF) did not alter after while BP increased from rest to acute exercise in ASD. Thus, we thought that ASD may have impaired autonomic nervous system activity to differentially control HR and stroke volume (SV) to regulate BP through changes in cardiac output. PURPOSE: To determine autonomic and cardiovascular responses to acute dynamic exercise in children with ASD. METHODS: 36 adults, TDC and children with ASD participated in the study. HR from ECG, beat to beat arterial BP from Finapres and brachial BP, and SV from Modelflow, were continuously measured before, during and after 2 minutes of dynamic handgrip exercise at 35% and 50% of maximal voluntary contraction. Diameter, blood velocity, and flow of the brachial artery were measured using Doppler ultrasound on the contracting arm throughout the experiment. Time and frequency domains of HR variability indexes were used. RESULTS: Mean BP was significantly increased to exercise from rest in all groups with no group differences (A9.8±1.8 adults, A8.3±1.2 TDC, and A6.9±1.8 ASD, mmHg). HR was significantly increased to exercise from rest in adults and TDC; however, there was no change in HR to exercise from rest in ASD (A11±1 adults, A7±1 TDC, and A1±1 ASD, bpm). SV was unaltered from rest to exercise in all groups. Both adults and TDC had similar increase in BP during exercise compared to rest (A17±3 adults vs. A14±2 TDC cm/s); however, BP did not change from rest to exercise (A5.6±2.2 ASD cm/s) in ASD. The nMSD and high frequency of HR were similar in all groups while very low frequency HR was significantly lower in ASD. CONCLUSION: While HR and BF were altered to exercise in both adults and TDC groups in similar fashion, HR and BF did not change in ASD children indicating impaired autonomic and vascular function. Higher total peripheral resistance may contribute to increase BP during exercise in ASD children without a significant contribution of cardiac output.

3301 Board #122 May 29 2:30 PM - 4:00 PM ETₐ Receptor Responses In Young Women With A Family History Of Hypertension Shane J. McGinty, Laura M. Welti, Andrew V. Kuczmarski, Sangeetha Nathaniel, Megan M. Wenner. University of Delaware, Newark, DE. (No relevant relationships reported)

Endothelin-1 (ET-1) contributes to endothelial dysfunction, a primary driver of hypertension and cardiovascular disease. Young women with a family history of hypertension (+FH), a group at risk for developing hypertension, display elevated resting plasma ET-1. Our lab has previously shown that in healthy young women, the ETₐ receptor mediates vasodilation. However, the function of ETₐ receptors has yet to be determined in young women +FH. PURPOSE: The purpose of this study was to test the hypothesis that +FH women display attenuated ETₐ mediated vasodilation. METHODS: Eight young women without a family history of hypertension (+FH, 23±2 yrs, 24±1 kg/m²) and 8 women +FH (23±2 yrs, 22±1 kg/m²) completed the study. Family history status was self-reported on a medical history questionnaire. Causative vasodilatory responses to local heat were measured using laser doppler flowmetry during microdialysis perfusions of lactated Ringer’s (Control) and ETₐ receptor blockade (BO-788, 300µM). Causative vascular conductance (CVC) was calculated during the plateau phase of local heating (42°C), and normalized to maximal vasodilation achieved by perfusion of sodium nitroprusside (28µM) and heating to 43°C. A two-way ANOVA was performed to compare the impact of familial history of hypertension on vasodilatory responses. Threshold for significance was set a priori at P<0.05. Data are presented as mean ± SEM. RESULTS: Resting mean arterial pressure (+FH: 80±3 vs. +FH: 85±2 mmHg, P=0.25), and plasma ET₁ (−FH, n=5: 1.2±0.2 vs. +FH, n=6: 1.5±0.2 pg/mL, P=0.43) were similar between groups. There was no trend for a significant group x time interaction for causative vasodilatory responses (Drug: P=0.33, Group: P=0.63, Interaction: P=0.09); vasodilatory responses to Control tended to be lower in +FH (−FH: 95±1 vs. +FH: 89±4% CVC max). Furthermore, a trend in blockade of ETₐ receptors tended to be present (ETₐ: −FH: 95±1 vs. 87±3% CVC max) but not +FH (Control: 93±4 vs. 91±2 %CVC max). CONCLUSION: These preliminary data suggest that in young, otherwise healthy women, ETₐ receptor function may be altered based on hypertensive family history status; however additional data are needed. Furthermore, data in +FH young men are needed given the known sex differences in the ET₁-system. Supported by: NIH R01 HL 146558, P20 GM 113125.

3302 Board #123 May 29 2:30 PM - 4:00 PM Higher Aortic Stiffness Is Related With Lower Physical Fitness In Older Adults Lucimere Bohn, Alinne Nascimento, Duarte Barros, Joana Carvalho, José Oliveira. Faculty of Sports, University of Porto, Porto, Portugal.

Email: lucimerebohn@fde.up.pt (No relevant relationships reported)

PURPOSE: To compare physical fitness levels according to arterial stiffness reference values in older adults. METHODS: This is a cross-sectional study comprising 156 (75.24 ± 6.5 years; 69.2% female) apparently healthy older adults. Carotid-femoral pulse wave velocity (cfPWV) was assessed through applanation tonometry and classified as < or ≥ 10 meters per second (m/s). Physical fitness was assessed through the Senior Fitness Test [cardiorespiratory fitness (6-Min Walk), agility (8-foot Up and Go), upper (30-second Arm Curl) and lower body strength (30-second Chair Stand), and flexibility tests (Chair Sit & Reach and Back Scratch)]. A z-score including all physical fitness components was computed as a global index of physical fitness. Total physical activity was objectively measured and recorded as counts per minute. Between-group comparisons were performed through ANCOVA. RESULTS: Eighty-five (59.1%) of the subjects had cfPWV ≥ 10 m/s. After adjusting for age and total physical activity, compared to the cfPWV < 10m/s group, the cfPWV ≥ 10 m/s group exhibited significantly lower physical fitness scores (0.355 ± 0.074 vs. 0.076 ± 0.077, respectively; p = 0.017). CONCLUSION: Seniors with higher levels of arterial stiffness present lower values of physical fitness. Strategies to improve physical fitness might be important to prevent the rapid augmentation of arterial stiffness.

3303 Board #124 May 29 2:30 PM - 4:00 PM Test-Reliability Of Blood Pressure Criteria For Defining An Exaggerated Blood Pressure Response To Exercise Kayla M. Soave, Katharine D. Currie. Michigan State University, East Lansing, MI. (No relevant relationships reported)

Exaggerated blood pressure responses (EBPR) during exercise are associated with increased risk of mortality. Due to the prognostic value of EBPR, it is important to evaluate the reliability of criteria used to define this response. PURPOSE: This study assessed the test-retest reliability of two different criteria used to define EBPR: the maximal systolic blood pressure (SBP) and the SBP/METs-slope which is the ratio of the change in SBP to the change in the metabolic equivalents of task (METs). METHODS: Twenty healthy, normotensive adults (8 males: 21±1 years, 12 females: 21±1 years) completed two identical modified Bruce treadmill tests on separate days. Blood pressure was measured using an automated motion-tolerant auscultatory device at rest (i.e., standing on treadmill) and during the last minute of each exercise stage. For each test, maximal SBP was identified, METs were estimated, and the change in these indices (i.e., maximal – rest) were calculated to determine the SBP/METs-slope. Test-retest reliability of the two criteria were assessed using intraclass correlation coefficients (ICC), with an ICC ≥ 0.60 considered reliable. RESULTS: Total exercise time was similar between visits (1000±123 vs. 1005±128, P=0.33). Reliability of the EBPR criteria are presented as (ICC; 95% confident intervals). Maximal SBP (0.45; 0.02-0.74) and SBP/METs-slope (0.29; 0.16-0.64) were not reliable. Furthermore, they were then separated based on sex. In males, maximal SBP (0.85; 0.44-0.97) was reliable while the SBP/METs-slope only demonstrated moderate reliability (0.59; -0.13-0.90). In females, both maximal SBP and the SBP/METs-slope were not reliable (ICCs <0.17). Using the criteria of a maximal SBP 210 and 190 mmHg for males and females respectively, 50% of males and 33% of females had EBPR on both visits. CONCLUSION: Criteria used to define EBPR are only reliable in males. Further investigation is warranted to understand the potential sex effects on the SBP responses to maximal exercise testing.
PURPOSE: Menopause is often accompanied by decreased estradiol, growth hormone (GH), insulin-like growth factor-1 (IGF-1) and dehydroepiandrosterone sulfate (DHEA-s) and increased blood pressure (BP), which may collectively increase risks for cardiovascular disease (CVD). It is important to combat the negative effects on estradiol, GH, IGF-1, DHEA-s, and BP by incorporating appropriate lifestyle interventions, such as exercise. We sought to examine the effects of resistance exercise training program on estradiol, GH, IGF-1, DHEA-s, and BP in postmenopausal women with stage 1 hypertension.

METHODS: Postmenopausal women (n=20) were recruited and randomly assigned to a resistance exercise group (EX, n=10) or control group (CON, n=10). The EX group performed a total-body resistance band exercise training program for 12 weeks. Levels of estradiol, GH, IGF-1, DHEA-s, as well as BP were assessed before and after 12 weeks.

RESULTS: There were significant group by time interactions (p<0.05) for estradiol (F(1,850.01), IGF-1 (F(1,5.71), 2), and DHEA-s (F(1,10,45.5) which significantly increased (p<0.05), and systolic BP (F(3,0.1) which significantly decreased (p<0.05) after exercise training compared to no changes in CON. There were no significant differences (p>0.05) in diastolic BP after 12 weeks.

CONCLUSIONS: These results indicate that resistance exercise training may be an effective, easily-accessible, and cost efficient intervention for improving estradiol, GH, IGF-1 and DHEA-s and decline BP in postmenopausal women with stage 1 hypertension.

3305 Board #126 May 29 2:30 PM - 4:00 PM Blood Flow And Arterial Stiffness In Amputated Subjects.

Anna Pedrinolla, Valentina Cavedon, Chiara Milanese, Massimo Venturelli. University of Verona, Verona, Italy.
Email: anna.pedrinolla@univr.it

(No relevant relationships reported)

PURPOSE: To investigate arterial adaptations in amputated soccer players of the Italian National Amputated team. METHODS: Basal blood flow (BF, corrected for muscle volume), and pulse wave velocity (PWV) were measured in 11 amputated soccer players (35±13 years; 141±8 years from the amputation) of the Italian National Amputated team. BF and PWV were measured right and left-hand at carotid arteries, brachial arteries, radial arteries, common femoral arteries, and superficial femoral arteries. Basal BF and PWV of amputated limbs were compared with the non-amputated limbs. RESULTS: Basal BF was found to be reduced in amputated limbs compared with the contralateral non-amputated limbs (~30%, p<0.05). However, PWV was not found to be statistically different between amputated and non-amputated limbs (3%, p=0.32). CONCLUSIONS: Although an adaptation of basal BF seems to take place in amputated limbs, PWV seems to be unaltered in the amputated side in national soccer players. Since PWV reflects cardiovascular risk and vascular adaptation, based on this results we can speculate that soccer training served as a good stimulus to maintain vascular health even in amputated subjects.

3306 Board #127 May 29 2:30 PM - 4:00 PM Reliability Of Non-invasive Vascular Function Tests And Their Responsiveness To A High-fat Meal In Females

Emily M. Rogers, Nile F. Banks, Hannah F. Bryan, Claire M. Smith, Nathaniel D.M. Jenkins. Oklahoma State University, Stillwater, OK.

(No relevant relationships reported)

PURPOSE: To examine the reliability of non-invasive assessments of micro- and macrovascular function and their responsiveness to a high-fat meal (HFM) in females. METHODS: During 2 visits (T1 and T2) separated by 28 ± 2 days, 11 women (age = 30.7 ± 2.3, BMI = 24.4 ± 3.1 kg/m²) consumed a standardized HFM (12 kcal/kg body weight; 63% fat) after a 10-h fast. Before (BL) and 3-h after the HFM, blood triglyceride (TG) levels were measured to quantify the lipemic response, and micro- and macrovascular function were assessed using the NIRS-VOT and FMD technique, respectively. During the NIRS-VOT assessment, the occlusion slope (Slope 1), the minimum tissue saturation (StO2AUC) the repuffusion slope (Slope 2), and the repuffusion area under the curve (StO2AUC) were calculated. Reliability was assessed on BL values using one-way ANOVAs, intraclass correlation coefficients, and standard errors of measurement reported as coefficients of variation (CV). We also examined the responsiveness of each of the assessments to a HFM, as well as repeatability of the response by examining differences and relationships between the 3-h values at T1 and T2 for each of the variables. RESULTS: The reliability of each of the variables is reported in Table 1. All variables demonstrated moderate to strong relative reliability, although the CVs for TG, StO2AUC, and FMD were moderately high. Interestingly, only TG responded to the HFM at 3-h. There were also no differences between the 3-h values at T1 versus T2 for any of the dependent variables (all p>0.05), which were moderately to strongly (r = 0.66 - 0.72, p<0.04) related, except for StO2AUC and FMD (r = 0.46-0.47, p<0.16).

CONCLUSION: Each of the variables assessed displayed sufficient repeatability and were similarly (non-responsive) to a HFM before and after a 28-day period. Further, it appears that StO2AUC and FMD may display lower absolute reliability and studies may require greater sample sizes when using these as outcomes in intervention studies.
Our laboratory recently reported a significant decline in muscle-resident pericyte quantity following hindlimb immobilization, and subsequently demonstrated the capacity for pericyte transplantation to accelerate recovery of skeletal muscle mass during the rehabilitation period. PURPOSE: The purpose of this study was to determine the extent to which pericyte-derived extracellular vesicles (EVs) effectively recover skeletal muscle mass following hindlimb immobilization. METHODS: Two groups of donor mice were used to isolate serum EVs before ("Pre") and after ("Post") an acute bout of contraction using a sciatic nerve stimulation procedure. Serum EVs were isolated using ultracentrifugation followed by magnetic bead sorting to isolate CD146+ EVs and CD146- EVs. Five groups of mice (n=4/group) underwent unilateral hindlimb immobilization for 14 days. At 14 days, the mice were intramuscularly (tibialis anterior) injected with 1 PBS, 2 CD146+ Pre EVs, 3 CD146+ Post EVs, 4 CD146- Pre EVs, or 5 CD146- Post EVs (in 40 µL of PBS), then remobilized for 2 weeks to determine therapeutic capacity. RESULTS: A significant decrease in serum CD146+ EVs was observed following 14 days of hindlimb immobilization (p<0.05). CD146-Post EVs demonstrated significant recovery of myofiber cross-sectional area compared to PBS control (p<0.05). CD146-Pre and CD146-Post EVs significantly restored capillary density compared to PBS control (p<0.05). CD146-Pre EVs recovered capacity for collagen remodeling compared to PBS control (p<0.05). CONCLUSIONS: The results from this study suggest that CD146- serum EVs positively benefit regrowth of skeletal muscle following a period of disuse. Additionally, CD146+ serum EVs enhance skeletal muscle capillarization. Overall, a combination of both EV fractions may optimize recovery of skeletal muscle mass following disuse.

Skeletal muscle (SKM) is an important regulator of metabolism and adaptations from exercise training influences mitochondrial function. Thyroid hormone (TH) is a regulator of SKM processes, including mitochondrial biogenesis. PURPOSE: To use an in vitro model of hypothyroidism to test the hypothesis that SKM cells will have dysregulated mitochondrial function. Additionally, the exercise mimetic, formoterol, was used to determine the effects of exercise signaling on mitochondrial function. METHODS: Human SKM myoblasts (n = 6 per group) were cultured and differentiated until mature myotube formation (Day 6). Groups included control cells (CON), TH depleted cells (ThD), and TH depleted cells plus formoterol stimulation (ThD+F; 30nM for 3h). Total RNA was extracted during mid-myogenesis (Day 4) and at terminal differentiation (Day 6). Gene expression for Peroxisome

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Proliferator-Activated Receptor Gamma Coactivator-1 Alpha (PGC-1α), Mitochondrial Transcription Factor A (TFAM), and Nuclear Respiratory Factor 1 (NRF1) was determined by qPCR. Data was analyzed by repeated measures ANOVA. **RESULTS:** Significant differences between conditions and time points are detailed in Table 1. **CONCLUSION:** ThD media resulted in reduced NRF1 signaling in both D4 and D6 with a subsequent decrease in D6 only for TFAM. Formoterol resulted in the expected stimulation of PGC-1α at both D4 and D6, but subsequent signaling for genes associated with mitochondrial biogenesis common to PGC-1α stimulation were lost as a result of TH depletion at D6 only for TFAM and both D4 and D6 for NRF1. This work was supported by a Texas ACSM SRDA grant. **Table 1.**

<table>
<thead>
<tr>
<th>Gene</th>
<th>Comparison</th>
<th>Fold Change</th>
<th>P Value</th>
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<td></td>
<td>D6 ThD+F &lt; D6 CON</td>
<td>-0.42</td>
<td>&lt;0.001</td>
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**Purpose:** Recently, a training-retraining (TRT) paradigm in which 3 month old rodents underwent an initial cycle of SSC RTET followed by another bout at 6 months led to increases in isometric/dynamic peak force and muscle mass relative to naïve 6 month old rats, thus augmenting the trainability of muscle into adulthood. However, the molecular underpinnings of this response are unknown. Therefore, we sought to determine whether this TRT paradigm has positive effects on transcription factor (TF) methylation and expression in adult skeletal muscle. **Methods:** F344xBN hybrid rats were SSC RTET on an in vivo dynamometer 3 days/week for 1 month at 3 months and again at 6 months of age (TRT), or just at 6 months (T). Gene expression and DNA methylation were quantified via PCR Arrays (Qiagen®). **Results:** TRT group had 17 significantly differentially expressed genes (SDEGs) in the TF pathway, including Myf5; T expressed only 3 SDEGs. TRT had decreased TF methylation compared to sham (Placebo: 13 ±0.5 vs. 26 ± 2 pg/mg protein and ARB: 13 ± 0.6 vs. 21 ± 1 pg/mg protein, respectively; p<0.05). Maximal force relative to body mass was unchanged with FO, independent of ARB. However, force tended to decrease only in placebo group with FO compared to sham. Fatigue resistance was increased with FO compared to sham, independent of treatment (Placebo: 53 ± 6 vs. 65 ± 5% and ARB: 48 ± 4 vs. 61 ± 4%, for sham and FO, respectively, p<0.05). Plantaris IGF-1 levels were increased with FO, with a significantly greater response in ARB than placebo (Placebo: 51 ± 7 vs. 109 ± 12 pg/mg protein and ARB: 36 ± 3 vs. 148 ± 17 pg/mg protein, for sham and FO, respectively, p<0.05). Plantaris FGF levels were increased in ARB group only (Placebo: 788 ± 88 vs. 901 ± 88 pg/mg protein and ARB: 649 ± 31 vs. 1075 ± 104 pg/mg protein, for sham and FO, respectively, p<0.05).

**Conclusions:** The hypertrophic response to FO was attenuated with ARB in spite of greater IGF-1 and FGF responses compared to placebo. Comparing FO-associated changes in muscle force between treatments suggests ARB may positively impact muscle specific tension which could be associated with the augmented growth factor responses with ARB. Supported by Iowa Space Grant Collaborative Research Grant to KH and RV

**Purpose:** Atrophy and reduced growth hormone levels while ANG II Receptor Blockers (ARBs) may protect against atrophy and restore insulin-like growth factor 1 (IGF-1) signaling. However, the effects of ARB during muscle growth is unclear. **Purpose:** It was hypothesized that ARB treatment would positively impact skeletal muscle growth as evidenced by greater hypertrophy, increased growth factor levels, and improved contractile function compared to placebo. **Methods:** Mice underwent FO of the plantaris or sham surgery. *In vivo* plantaris force and fatigue resistance (5% of max force after 10 contractions) were measured 14 days after FO or sham in mice receiving daily candesartan (6 mg/kg body mass) or placebo (n=7-9/group). IGF-1 and fibroblast growth factor (FGF) were measured in the plantaris by ELISA. Data were analyzed with 2-way ANOVAs. **Results:** FO increased plantaris mass in both groups; however, ARB attenuated hypertrophy compared to placebo (Placebo: 13 ±0.5 vs. 26 ± 2 mg and ARB: 13 ± 0.6 vs. 20 ± 1 mg, for sham and FO, respectively; p<0.05). Maximal force relative to body mass was unchanged with FO, independent of ARB. However, force tended to decrease only in placebo group with FO compared to sham. Fatigue resistance was increased with FO compared to sham, independent of treatment (Placebo: 53 ± 6 vs. 65 ± 5% and ARB: 48 ± 4 vs. 61 ± 4%, for sham and FO, respectively, p<0.05). Plantaris IGF-1 levels were increased with FO, with a significantly greater response in ARB than placebo (Placebo: 51 ± 7 vs. 109 ± 12 pg/mg protein and ARB: 36 ± 3 vs. 148 ± 17 pg/mg protein, for sham and FO, respectively, p<0.05). Plantaris FGF levels were increased with FO in ARB group only (Placebo: 788 ± 88 vs. 901 ± 88 pg/mg protein and ARB: 649 ± 31 vs. 1075 ± 104 pg/mg protein, for sham and FO, respectively, p<0.05). **Conclusions:** The hypertrophic response to FO was attenuated with ARB in spite of greater IGF-1 and FGF responses compared to placebo. Comparing FO-associated changes in muscle force between treatments suggests ARB may positively impact muscle specific tension which could be associated with the augmented growth factor responses with ARB. Supported by Iowa Space Grant Collaborative Research Grant to KH and RV

**Purpose:** Nearly 80% of cancer patients are afflicted with cachexia, which is defined by wasting of lean body mass and associated with increased morbidity and mortality. The amino acid leucine has been shown to promote muscle growth by augmenting protein synthesis through mTOR activation. Therefore, supplementation of leucine could prove beneficial for mitigating skeletal muscle wasting during cancer cachexia. **Purpose:** To determine the effect of leucine supplementation on cancer cachexia in APC(−/−) mice. **Methods:** 18 male APC (n=9) and wildtype (WT, n=9) littermate mice were used in this study. Within each of these two groups, 4 were given water (NL) and 5 were given 1.5% leucine-supplemented water (Ll), with ad libitum access to food and water. Gastrocnemius (GA) muscle and tibias (TL) were extracted at ~14-21 weeks...
of age—when mice became moribund. Muscle tissue was homogenized and analyzed for gene expression via RT-qPCR. Gene expression data were analyzed via Two-Way ANOVA, followed by a Fisher’s LSD post-hoc to determine between group differences when significant F-ratios were found. The relative frequency of tumor polyp size was analyzed via a Student’s t-test. Significance set at p<0.05. RESULTS: Body weight for APC-NL mice was ~14% lower than both WT-NL and WT-L (p<0.05). Body weight for APC-L mice was ~25% lower than all WT, and ~13% lower than APC-NL (p<0.05). There were main effects of APC genotype and L supplementation for lower GA mass and GA/TL (p<0.05). In APC mice, there was a ~20% increase in the relative frequency of polyps >1mm in diameter, and a ~15% decrease in the relative frequency of polyps 1-2mm in diameter due to L supplementation (p<0.05). There was no difference in the relative frequency of polyps >2mm. There was a main effect for APC mice to have elevated expression of IL-6, IL-1β, Atrogen-1, and MuRF-1 when compared to WT mice (p<0.05). CONCLUSION: Surprisingly, leucine supplementation appeared to exacerbate cancer cachexia. Cancer cachexia has previously shown marked increases in skeletal muscle atrophy, commonly through atrophy and inflammatory related markers such as Atrogen-1, MuRF-1, IL-6 and IL-1β. Leucine supplementation may not influence these markers directly, but may alter the cachectic environment to induce greater overall wasting.

Table 1.

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<tr>
<th>Gene</th>
<th>Comparison</th>
<th>Fold Change</th>
<th>P Value</th>
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In skeletal muscle (SKM), signal transduction of thyroid hormone (TH) exerts subcellular downstream effects by influencing mechanisms of gene expression. People with hypothyroidism commonly experience SKM pain, fatigue, and intolerance to exercise, which may be driven by dysregulated TH metabolism.

Purpose: To use an in vitro model of hypothyroidism to test the hypothesis that SKM cells will have dysregulated TH metabolism. Additionally, the exercise mimetic, formoterol, was used to determine the effects of exercise signaling on TH depleted cells.

Methods: Human SKM myoblasts (n = 6 per group) were cultured and differentiated into immature myoblasts (Day 0) until mature myogenesis (Day 4) and at terminal differentiation (Day 6). Gene expression for Thyroid Hormone Receptor Alpha (THRα), Deiodinase 2 (DIO2), and Deiodinase 3 (DIO3) was determined by RT-qPCR. Data were analyzed by repeated measures ANOVA.

Results: Significant differences between conditions and time points are detailed in Table 1. Conclusion: THRα was reduced by ThD and further decreased by ThD+F; suggesting that the combination of ThD+F is highly suppressive of this receptor. Intracellular activation of TH (T3) by DIO2 stimulates nuclear transcripts leading multiple cellular functions. Formoterol stimulation increased DIO2 but was decreased in the ThD group, indicating a potential lower availability of T3. Interestingly, DIO3 was also increased by formoterol stimulation, which could counteract availability of T3 via conversion to reverse T3. More research addressing hypothyroidism and exercise is warranted as there may be negative consequences regarding exercise mode and intensity. This work was supported by a Texas ACSM SRDA grant.

3316 Board #137 May 29 1:30 PM - 3:00 PM
Abstract Withdrawn

3317 Board #138 May 29 1:30 PM - 3:00 PM
Dysregulated Thyroid Hormone Metabolism Following Formoterol Stimulation In Thyroid Hormone Depleted Skeletal Muscle
Gena D. Guerin, Emily L. Zumbro, Ryan A. Gordon, Chase M. White, Dreanna M. McAdams, Matthew L. Sokoloski, David L. Nichols, FACSM, Anthony A. Duplanty. (No relevant relationships reported)

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Purpose: To use an in vitro model of hypothyroidism to test the hypothesis that SKM cells will have dysregulated TH metabolism. Additionally, the exercise mimetic, formoterol, was used to determine the effects of exercise signaling on TH depleted cells.

Methods: Human SKM myoblasts (n = 6 per group) were cultured and differentiated until mature myotube formation (Day 0). Groups included control cells (CON), TH depleted cells (THD), and TH depleted cells plus formoterol stimulation (THD+F; 30nM for 3h). Total RNA was extracted during mid-myogenesis (Day 4) and at terminal differentiation (Day 6). Gene expression for Thyroid Hormone Receptor Alpha (THRα), Deiodinase 2 (DIO2), and Deiodinase 3 (DIO3) was determined by RT-qPCR. Data were analyzed by repeated measures ANOVA.

Results: Significant differences between conditions and time points are detailed in Table 1. Conclusion: THRα was reduced by ThD and further decreased by ThD+F; suggesting that the combination of ThD+F is highly suppressive of this receptor. Intracellular activation of TH (T3) by DIO2 stimulates nuclear transcripts leading multiple cellular functions. Formoterol stimulation increased DIO2 but was decreased in the ThD group, indicating a potential lower availability of T3. Interestingly, DIO3 was also increased by formoterol stimulation, which could counteract availability of T3 via conversion to reverse T3. More research addressing hypothyroidism and exercise is warranted as there may be negative consequences regarding exercise mode and intensity. This work was supported by a Texas ACSM SRDA grant.

3318 Board #139 May 29 1:30 PM - 3:00 PM
Mitochondrial Health During The Development Of Cancer Cachexia In Female Mice
Lauren C. Westervelt1, Seongkyun Lim1, Megan E. Rosa-Caldwell1, Wesley S. Haynie1, Kirsten R. Dunlap1, Lisa T. Jansen1, Michael P. Wiggs2, Tyrone A. Washington1, Nicholas P. Greene, FACSM1, 1University of Arkansas, Fayetteville, AR, 2University of Texas at Tyler, Tyler, TX. (Sponsor: Dr. Nicholas Greene, FACSM)

Email: lwester@uark.edu
(No relevant relationships reported)

Cancer cachexia is a syndrome characterized by weight loss, anemia, and skeletal muscle wasting. Muscle mass in males and females is a strong predictor of quality of life and morbidity during cancer treatment. Mitochondrial dysfunction during cancer cachexia has been well described in males, specifically our laboratory has found mitochondrial deteriorations to precede muscle loss in male models of cachexia. However, if these aberrations are conserved between biological sexes has yet to be investigated. PURPOSE: To investigate muscle mitochondrial health during cancer cachexia development in female mice. METHODS: ~40 female C57BL/6 mice were implanted with ~1X106 Lewis Lung Carcinoma (LLC) cells in the right hind flank. Tumors were allowed to develop up to 4 weeks. After 3-4 weeks of tumor development, a clear dichotomy was noted in tumor burden. As such, tumor injected females were divided into high tumor (HT, tumor size > 2000 mg) and low tumor groups (LT, tumor size < 1300 mg). CON animals were age-matched to tumor mice and injected with phosphate buffered saline (PBS); therefore creating 3 experimental groups (LT, tumor size < 1300 mg). CON animals were age-matched to tumor mice and injected with phosphate buffered saline (PBS); therefore creating 3 experimental groups HT, LT, and CON (n=12-14/group). Mitochondrial health was measured by fluorescent histology of pMitoTimer. Results were analyzed by one-way ANOVA with Tukey’s post hoc when significant F ratios were found (p<0.05). RESULTS: Tibialis anterior, plantaris and gastrocnemius muscle masses were ~10%, ~11% and ~5% lower in HT compared to LT and CON. Analysis of pMitoTimer demonstrated no differences between groups. Circulating progesterone and estrogen were ~42% and ~60% lower in HT and LT animals compared to CON with no differences between HT and LT. CONCLUSION: LT had negligible muscle wasting when compared to HT, these differences in muscle loss did not correspond to alterations in mitochondrial health. This directly contrasts prior literature in male models of cancer-cachexia suggesting divergent mechanisms between males and females in the development of cancer cachexia. As such, further examination of why females had a dichotomy in tumor development and subsequent wasting mechanisms are necessary in order to further understand mechanisms contributing to development of cancer cachexia. This study was funded by the National Institutes of Health, Award: R15 AR069913/AR/NIAMS.
**Purpose:** Physical inactivity and subsequent skeletal muscle disuse may cause muscle atrophy, which is associated with a reduction in muscle function, physical performance, quality of life, and loss of independence, particularly in elderly. Traditionally, 2D muscle cell cultures (e.g., C2C12) have been used to study biological processes and identify and validate pharmacological and/or nutritional compounds to treat skeletal muscle disease including muscle atrophy. However, cell culture studies basically use a pharmacological method to induce muscle atrophy, and not an actual muscle disuse induced by a reduction of mechanical stress (i.e., mechanical unloading). Previously Nakamura et al. (2017) developed 3D engineered muscle (OITem: Osaka institute technology engineered muscle) with artificial tendons at both ends of the muscle, which is removable, thereby allowing us to mechanically release muscle tension by taking off (removing) one side of the muscle. Therefore, the purpose of the present study was to investigate whether removable tissue-engineering muscle cells effectively induced muscle disuse atrophy.

**Methods:** OITem was made from C2C12 skeletal muscle cells and a collagen gel and placed between two artificial tendons (Nakamura et al., 2017). OITem was differentiated for 2 weeks and then divided into two groups: 1-week stretched on control group (CON; n=6) in which the both ends of the muscle fixed with tendons, and 1-week stretched and unloaded group (OFF; n=6) in which the one side of the muscle was removed. We analyzed expressions of muscle atrophy-related proteins MuRF-1 and Atrogin-1, and myogenic-related protein myogenin using Western blotting. As well, we analyzed expression of MHC-fast or -slow (fast- or slow-twitch muscle fiber specific myosin heavy chain (MHC), respectively).

**Results:** The protein expression of MuRF-1 and myogenin was significantly lower in the OFF than those in the CON (P<0.05). Moreover, the protein expression of MHC-fast and -slow was significantly lower in the OFF than those in the CON (P<0.01). However, the protein expression of Atrogin-1 did not differ between two groups.

**Conclusions:** The present findings suggest that OITem may be useful model for muscle disuse.

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**Purpose:** To test the hypothesis that skeletal muscle ECM remodeling associated with linking obesity with metabolic dysfunction. It is also a constructive feature of skeletal muscle ECM remodeling may play a significant role in mediating the metabolic benefits of exercise training. This study was supported by National Nature Science Foundation of China (31470600).

**Purpose:** To investigate the effects of different exercise interventions on disuse atrophy and atrophy-related proteins in rat gastrocnemius muscle.

**Methods:** Male Sprague-Dawley rats were randomly divided into a control group (C), HF group, and a suspension group (T, n=40). Rats in the T group were suspended by a tail suspension system for two weeks. Rats in the C group were further divided into a post-suspension blank group (C1) and a post-exercise blank group (C2), and rats in the T group were further divided into a post-suspension control group (T1), a post-exercise control group (T2), an endurance exercise group (TA), a resistance exercise group (TR) and a combined endurance and resistance exercise group (TAR). In the TA, TR, and TAR groups were subjected to exercise training for four weeks. Body weight and wet weight of gastrocnemius muscle were measured immediately after suspension or at 24 hours after the last training session. Protein expression levels of Muscle Ring Finger 1 (MURF1), Muscle Atrophy F-Box (MAFbx), Insulin-Like Growth Factor-1 (IGF-1) and Cysteinyl Aspartate Specific Protease-3 (Caspase-3) in gastrocnemius muscle were determined by western blot. Student t-tests and one-way ANOVAs were used for data analysis.

**Results:** After suspension, body weight and wet weight of gastrocnemius muscle in the T1 group were significantly lower than those in the C1 group (p=0.05 to p<0.01). After exercise intervention, body weight, wet weight of gastrocnemius muscle, and the protein expression levels of MAFbx in the TA, TR, and TAR groups were significantly higher than those in the TA and C2 groups, and the protein expression levels of MURF1 in the TA and TR groups were significantly lower than those in the T2 group (p<0.05 to p<0.01). After exercise intervention, the autophagic response was evaluated. Exercise interventions, such as endurance exercise, exercise resistance, exercise combined, and resistance exercise and exercise can effectively reverse disuse atrophy of gastrocnemius muscle in rats, which might be through altering the expression levels of several atrophy-related proteins.
time effect was found for FOXO3A. FOXO3A expression decreased at +12h (0.33 ± 0.07-fold) and +24h (0.25 ± 0.07-fold) from PRE. A trend was found for BECN1 (p=0.055) towards an increased in expression from PRE to +12h (1.94 ± 0.65-fold). A significant time effect was found for the AUC of cortisol with a greater AUC of cortisol for EX than CON.

Conclusion: These results suggest that the RE-induced hormone response can be important to the initiation of the phagophore after muscle damage in untrained young women.

3324 Board #145 May 29 1:30 PM - 3:00 PM
Myogenic Regulatory Factor Expression Is Downregulated Following Formoterol Stimulation In Thyroid Hormone Depleted Skeletal Muscle

No relevant relationships reported

In skeletal muscle (SKM), gene expression of transcription factors regulating myogenesis are dependent on thyroid hormone (TH) signal transduction. Expression of myogenic regulatory factors may be altered due to dysregulated TH metabolism, which may result in SKM dysfunction and intolerance to exercise in individuals with hypothyroidism.

PURPOSE: To use an in vitro model of hypothyroidism to test the hypothesis that SKM cells will have dysregulation in transcription factors regulating myogenesis. Additionally, the exercise mimetic, formoterol, was used to determine the effects of exercise signaling during myogenesis.

METHODS: Human SKM myoblasts (n = 6 per group) were cultured and differentiated until mature myotube formation (Day 6). Groups included control cells (CON), TH depleted cells (ThD), and TH depleted cells plus formoterol stimulation (ThD+F; 30nM for 3h). Total RNA was extracted during mid-myogenesis (Day 4) and at terminal differentiation (Day 6). Gene expression for myogenic regulatory factors (Myf5, MyoD, MyoG) was determined by qPCR. Data were analyzed by repeated measures ANOVA. Data were analyzed by repeated measures ANOVA.

RESULTS: Significant differences between conditions and time points are detailed in Table 1.

Table 1

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3325 Board #146 May 29 1:30 PM - 3:00 PM
The Immunoproteasome, A Potential Link To The Loss Of Muscle Mass In Diet-induced Obesity
Emma Fletcher, Paul M. Gordon, FACSM. Baylor University, Waco, TX. Email: Emma_Fletcher1@Baylor.edu

No relevant relationships reported

PURPOSE: Obesity is associated with reductions in muscle mass and regeneration. Although chronic inflammation and oxidative stress may play a role, a way in which these processes regulate cachexia in obese muscle is unclear. Since the catalytic subunit of the immunoproteasome (LMP7) is increased in muscle of other atrophic conditions (如 DIO), we sought to determine the impact of diet-induced obesity (DIO) on muscle mass, LMP7 protein content, and regeneration in response to exercise-induced muscle damage (EIMD) in mice. Intramuscular levels of pro-(CD11b and CD38) and anti-(CD206 and EGR2) inflammatory macrophages and oxidative stress (8-iso-prostanate) were also assessed.

METHODS: Sixty male C57BL/6J mice (4 weeks old) were randomly assigned to either a high-fat diet (HFD, 45% fat) or lean diet (LD, 10% fat). After 12 weeks of feeding, the mice were randomly subdivided into EIMD or non-exercise, no muscle damage (NMD) control groups. EIMD was achieved via a downhill treadmill run at 13-14m/min for 68min. The gastrocnemius muscle (GS) was excised 1 or 5d after EIMD, resulting in 6 experimental groups (n = 10/group) at study completion.

RESULTS: Total body mass was greater (HFD 43.3 ± 6.6 g vs LD 30.5 ± 6.6 g, p < 0.000), however, GS mass relative to body mass was lower (HFD 4.1 ± 1.1 mg/g vs LD 5.3 ± 1.1 mg/g, p < 0.000) in mice with DIO. Despite no change in pro- or anti-inflammatory macrophages (p > 0.5), GS oxidative stress was increased in mice with DIO (HFD 46.0 ± 5.1 pg/ml vs LD 29.2 ± 4.6 pg/ml, p < 0.029). Oxidative stress was enhanced 1 d post-EIMD, but only in DIO mice (HFD 77.9 ± 8.6 pg/ml vs LD 31.4 ± 3.3 pg/ml, p = 0.015). Muscle LMP7 was also elevated with DIO (HFD 3.5 ± 0.2 ng/ml vs LD 2.6 ± 1 ng/ml, p < 0.000), and increased 5 d post-EIMD (3.5 ± 0.2 ng/ml) compared to NMD (2.7 ± 1 ng/ml, p < 0.000). However, the response of LMP7 to EIMD did not differ between obese or lean mice (p = 0.504). When controlling for muscle damage group assignment, LMP7 was correlated with 8-iso-prostanate (r = 0.39, p = 0.027) and both markers were inversely correlated with relative GS mass (r = -0.48 (LMP7), - 0.62 (8-iso-prostanate), p < 0.000). Muscle regeneration (myofiber differentiation protein) was unaltered by DIO (p = 0.741) or EIMD (p = 0.455).

CONCLUSIONS: The immunoproteasome may be a critical link between obesity-induced oxidative stress and diminished muscle mass.

3326 Board #147 May 29 1:30 PM - 3:00 PM
An Evaluation Of Skeletal Muscle Aging Using A Novel Guinea Pig Model
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No relevant relationships reported

Maintenance of the musculoskeletal system is critical to prevent falls and loss of mobility with aging. Sarcopenia, the age-related loss of muscle mass and function, affects 10% of those over 65 years and as much as 50% of people over 80 years of age. Aging is a major risk factor for osteoarthritis (OA) which is characterized by a concomitant loss of skeletal muscle, further contributing to decreased mobility. The “inflammaging” phenotype, (i.e., age-related increases in low-grade inflammation and oxidative stress) is common to both OA and sarcopenia. While progress has been made in understanding the mechanisms of sarcopenia a preclinical model that captures human conditions is lacking. Dunkin Hartley (DH) guinea pigs rapidly and spontaneously develop primary knee OA beginning at about 4 months of age. Thus, we speculate that DH guinea pigs may also be a valuable model of sarcopenia.

PURPOSE: To determine if DH guinea pigs can serve as a model to understand human skeletal muscle aging. METHODS: We compared skeletal muscle age-related changes in the gastrocnemius (GAS) and soleus (SOL) from 5, 9, and 15-mo DH guinea pigs. We also compared these changes to a strain of guinea pig, strain 13, that does not develop knee OA at an early age. Magnetic resonance imaging was used to examine volume and then used to calculate muscle density. Immunofluorescent histostaining was used to assess myofiber size distribution. Formalin fixed muscles were stained in India ink to measure pennation angle. Fibrosis was assessed using muscles paraffin embedded and stained with Masson’s Trichrome to quantify % collagen. Analyses are ongoing to identify if DH pigs are characterized by an inflammation phenotype similar to aging human muscle.

RESULTS: DH guinea pigs had a significant decrease in GAS density between 5 and 15-mo that was not present in the SOL (p<0.05). Both in the GAS and SOL, DH guinea pigs also demonstrated a shift towards a smaller average myofiber size with age. However, there were no age-related changes in pennation angle or fibrosis. CONCLUSION: Based on these analyses, the DH guinea pig appears to be a potentially valuable model.
The regulation of gene transcription is essential for muscle adaptations resulting from endurance exercise training. Recent findings implicate hypoxia inducible factor 1α (HIF-1α) in this adaptive process as it regulates genes involved in O2 substrate utilization. Athletes have greater resting levels of muscle HIF-1α inhibitors than untrained individuals, suggesting that suppression of HIF-1α underlies skeletal muscle adaptations to exercise training. However, it is unknown if exercise-induced expression of HIF-1α and its inhibitors differs between trained and untrained individuals. Further, differences in expression of HIF-1α target genes following acute exercise between trained (ET) and untrained (UT) individuals have yet to be examined.

**PURPOSE:** To characterise the transcriptional changes associated with time-dependent changes in glucose metabolism following muscle contraction.

**METHODS:** C2C12 myotubes were exposed to either 24 h of contractile activity (electrical pulse stimulation; EPS) or rest (no EPS), followed by a further 0, 6, 18 or 24 h rest (no EPS). Temporal profiling of the contraction-mediated responses in functional (basal and insulin-stimulated glucose uptake) and transcriptional (RNA sequencing and bioinformatics) outcomes was evaluated at all time points. Data are presented as mean ± SEM.

**RESULTS:** Compared to time-matched control cells (no EPS), contraction-mediated glucose uptake (i.e. without insulin) was increased 0 h post-EPS only (162 ± 28 % relative to control, P<0.05), whereas insulin sensitivity was increased at 24 h post-EPS only (163 ± 35 % relative to control, P<0.05). This distinct temporal profile for contraction-induced changes in muscle glucose metabolism was associated with a similarly distinct temporal transcriptional profile. Firstly, EPS-induced improvements in contraction-mediated glucose uptake (0 h post-EPS) and insulin sensitivity (24 h post-EPS) coincided with differential expression of 143 (76 up-regulated; 67 down-regulated) and 145 transcripts (71 up-regulated; 74 down-regulated), respectively. Notably, only 35 were differentially regulated at both 0 and 24 h post-EPS. Of these, only 20 were regulated in the same direction (e.g. miR-206, miR-207), with the remaining 15 oppositely regulated (e.g. miR-99b, miR-6790).

**CONCLUSION:** Similar to exercise in vivo, our model of in vitro skeletal muscle contraction induced distinct temporal profiles for contraction-mediated glucose uptake and insulin sensitivity. These time-dependent changes in skeletal muscle glucose metabolism are associated with an equally distinct contraction-specific transcriptional profile. Supported: By The Physiological Society.
The effect of high intensity interval exercise (HIIT) combined with Vitamin E (VE) in the intervention of aging degeneration of skeletal muscle is still unclear.

**PURPOSE:** In this study, the effects of 16-week HIIT intervention and VE supplementation on the mitochondrial autophagy-related Ros-NFκB-Bnip3 pathway and the number of mitochondria in aged rat skeletal muscle were observed. To provide theoretical basis for delaying sarcopenia by means of exercise and nutrition.

**METHODS:** 60 male Wistar rats aged 8 months were randomly divided into the control group (C, n=20), the HIIT intervention group (H, n=20) and the HIIT group supplemented with VE (EH, n=20) according to the random number table. H and EH adjusted the exercise intensity with the results of the VO₂max test every two weeks. The EH was given VE gavage according to 50 mg/kg body weight everyday at 1 hour before each training. Rats were taken from each group randomly at the basic state, week 8 and 16 for sampling. During sampling, the soleus muscle of rats was removed.

The mitochondria were photographed using a transmission electron microscope, the fluorescence intensity of ROS was measured by Multifunctional enzyme marker, The EH was given VE gavage according to 50 mg/kg body weight everyday at 1 hour before each training. The mitochondria were photographed using a transmission electron microscope, the fluorescence intensity of ROS was measured by Multifunctional enzyme marker.

**RESULTS:**

At 8 weeks, the number of mitochondria in H and EH increased (P=0.001, P=0.001), and was higher in H than in EH (P=0.010). Although the content of NF-κB changed in each group, no significant difference occurred. At week 16, beclin-1 expression of soleus muscle in H increased (P=0.036). EH was lower than H and C (P=0.004, P=0.002). The expression of Bnip3 in soleus muscle in C increased at 8 weeks and 16 weeks (P=0.030, P=0.001). H increased at 8 and 16 weeks (P=0.001, P=0.001), and was higher in H than in EH (P=0.006, P=0.020).

**CONCLUSIONS:** The 16 week HIIT intervention and the combined effect of HIIT and VE to alleviate the reduction of mitochondrial number caused by aging may be due to the delayed protein expression of the Ros-NfκB-Bnip3 pathway in the soleus muscle of rats.
Dynamin-related protein 1 (Drp1) is a critical mediator of mitochondrial fission. Recent studies have reported increased Drp1 activation in obese skeletal muscle, which is associated with reduced mitochondrial function and insulin sensitivity. **Purpose:** To determine if inhibiting Drp1-mediated mitochondrial fission by a pharmacologic inhibitor attenuates skeletal muscle insulin resistance induced by a high-fat diet (HFD) in mice. **Methods:** 6-week old male C57BL/6J mice (n=9/group) were assigned to either a HFD (45% Fat) or low-fat diet (LFD, 10% Fat) group for a total of 5-weeks. A subgroup of HFD-fed mice received intraperitoneal injections of Mitochondrial Division Inhibitor 1 (MDIVI-1) (20 mg/kg) while the other mice received saline every other day for the last week of diet intervention. A glucose tolerance test was performed after 4 hours of fasting. Twenty-four hours after the final injection, quadriceps and gastrocnemius muscles were collected for further analysis. **Results:** H2O2 levels were detected using Amplex Red Hydrogen Peroxide kit. Insulin signaling and protein markers of mitochondrial dynamics were measured by immunoblot analysis. Results: HFD significantly increased glucose area under the curve (AUC) than LFD mice (19074 ± 651 vs. 16054 ± 624, p < 0.05). Insulin-stimulated AktSer473 phosphorylation was reduced in insulin-stimulated skeletal muscle of HFD-fed mice compared to LFD-fed mice (0.351 ± 0.046 vs. 0.301 ± 0.046, p < 0.05). Moreover, MDIVI-1 reduced mitochondrial fission and improved whole-body glucose homeostasis in mice fed by HFD. **Conclusion:** Inhibiting Drp1-mediated mitochondrial fission attenuates skeletal muscle insulin resistance and improves whole-body glucose homeostasis in mice fed by HFD.

**References:**

RESULTS: (1) Compared with group C, the change rate of skeletal muscle protein expression in rats showed that ① CRT (2.080 ± 0.096* 1.525 ± 0.105* 1.395 ± 0.142** 1.315 ± 0.096* 0.990 ± 0.052**) in Group E increased by 1.08 times at 0 h after exercise, showing significant difference ② FAM134B (1.301 ± 0.076* 1.967 ± 0.119** 1.379 ± 0.112* 1.500 ± 0.073* 1.277 ± 0.09611); in Group E, it was significantly increased at 12 h and 48 h after exercise, 96.7% and 50% respectively. ③ LCN1 (1.376 ± 0.132* 1.799 ± 0.063* 0.562 ± 0.063* 1.659 ± 0.084* 1.300 ± 0.067*); it was significantly increased in Group E from 0 h to 72 h after exercise. (2) The results of CO location of fam134b and CRT, and co-location of LC3 and CRT showed that compared with group C, group E significantly increased from 0 h to 48 h after exercise.

CONCLUSIONS: The expression of FAM134B and CRT in ER increased and co-located with CRT after heavy load exercise, indicating that FAM134B may be involved in the occurrence of ER autophagy after heavy load exercise.

Differential expression of Myosin Heavy Chain (MHC) isoforms in skeletal muscle determines its metabolic and functional characteristics. Endurance exercise training is associated with fast-to-slow MHC isoform transition, and which is considered to mediate the beneficial effects of exercise on metabolic health. Rats genetically bred for low-capacity running (LCR) and high-capacity running (HCR) were characterized by the health benefits typically described after exercise training. LCR and HCR rats differed in maximal running capacity 14 fold.

PURPOSE: To quantify mRNA expression for slow (MHC-I), fast (MHC-IIa, MHC-IIb) MHC isoforms in soleus, gastrocnemius and vastus skeletal muscle of LCR and HCR male adult rats, and determine if HCR rats have higher mRNA expression for slow, and lower mRNA expression for fast, MHC isoforms.

METHODS: Muscle tissue from 5 HCR and 5 LCR rats was homogenized and mRNA was isolated. The mRNA content of MHC isoforms in muscle was quantified using reverse transcriptase polymerase chain reaction (RT-PCR), and standardized to the 18s mRNA content in muscle.

Differences between groups were calculated using the comparative Ct method (2-ΔΔCt). LCR were the control group.

RESULTS: Expression of mRNA of the MHC isoforms differed between groups and the type of skeletal muscle analyzed. MHC-I mRNA expression was lower in the HCR compared to LCR across all muscle groups, but this difference was more pronounced for the gastrocnemius muscle.

CONCLUSION: Genetic differences linked to the MHC transcriptome (i.e., decrease in MHC-I mRNA) in muscle do not explain the exercise performance observed in HCR rats. Changes in the muscle MHC transcriptome may not directly be responsible for the health benefits associated with exercise training. It remains to be determined on whether the differences we observed at the mRNA level are translated to the MHC proteome level.
PO = 

\[
\text{GROUP C} \quad \text{GROUP M} \\
1 \text{ day} \quad 1.00 \pm 0.00 \quad 1.50 \pm 0.26 \quad 1.38 \pm 0.32 \\
3 \text{ days} \quad 1.47 \pm 0.42 \quad 1.32 \pm 0.018 \\
7 \text{ days} \quad 1.25 \pm 0.26 \quad 1.26 \pm 0.45 \\
10 \text{ days} \quad 1.03 \pm 0.23 \quad 1.18 \pm 0.48
\]

The content of AMPK (related)

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<th>Stop training time</th>
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The content of PGC-1α (related)

<table>
<thead>
<tr>
<th>Stop training time</th>
<th>Group C</th>
<th>Group H</th>
<th>Group M</th>
</tr>
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<tbody>
<tr>
<td>1 day</td>
<td>1.00±00</td>
<td>1.52±0.28</td>
<td>1.28±0.15</td>
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<tr>
<td>3 days</td>
<td>1.43±0.15</td>
<td>1.16±0.18</td>
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<tr>
<td>7 days</td>
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<td>1.19±0.17</td>
<td></td>
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<tr>
<td>10 days</td>
<td>0.84±0.24</td>
<td>1.02±0.26</td>
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**Purpose**: Notch signaling is a prominent pathway necessary for repair of injured muscle. The interactions of Notch with other signaling pathways, specifically mechanistic/mammalian target of rapamycin (mTOR), in regulating myogenesis is not well known. Studies have been conducted on Notch inhibition, but little research has been performed on activated Notch and the interactions with mTOR. This study was implemented to develop a Notch force activation protocol and to measure the effect of overexpressed Notch on C2C12 proliferation, differentiation and mTOR signaling.

**Methods**: Notch signaling was force activated via suspension or adhesion. For suspension, Notch-1 antibody was introduced to a 12-well plate with C2C12 cells at a concentration of 1:10. For adhesion, Notch ligand, Delta-like Ligand 1 (DLL1), was mixed with Extracellular Matrix (ECM) and coated on a 12-well plate at different concentrations (control, 2.5ug, 5ug, and 10 ug) for 12 hours. C2C12 cells were seeded at a concentration of 15,000 cells/well and differentiated for 96 hours. Following designated time period, lysates were collected for Western Blots. Primary antibodies probed for Notch (Hes1), total mTOR signaling (TmTOR), and ß-actin.

**Results**: Preliminary data shows a stronger effect of suspension over adhesion for force activating Notch. A concentration of 2.5ug of ligand is possibly sufficient to force activate Notch, any higher appears too concentrated to activate Notch. Preliminary data also suggests that force activating Notch does not affect mTOR signaling. Experiments are currently testing the ideal DLL1 to activate Notch signaling, as well as examining the effect of force activating Notch on proliferation, differentiation and other markers of mTOR signaling. Different time points for differentiation should be tested in future research.

Recent research suggests that genes encoding micro RNA (miRNA) molecules are differentially expressed in response to training.

**Purpose**: To determine whether specific miRNAs serve as possible predictors for training efficacy.

**Methods**: In healthy, sedentary female subjects (mean ± SD: age 23.2 ± 3.1 years, peak oxygen uptake (VO₂peak) 31.7 ± 1.6 mL·kg⁻¹·min⁻¹, body mass index 23.0 ± 1.2 kg·m⁻²), aged between 20 and 27 years, performed exercise training on a cycle ergometer, three times a week, for 6 weeks. Participants were randomly assigned to either moderate intensity continuous training (MICT, n=3) or high intensity interval training (HIIT, n=3). The MICT group performed 60 min of continuous cycling at the power output (PO) calculated as corresponding to 90% of the first lactate threshold (LT). The HIIT group performed a warm-up for 10 min at the PO calculated as corresponding to 70% of the maximal heart rate (HRmax), followed by four 4-min intervals at the PO calculated as corresponding to 90% of HRmax, with 4-min recovery periods at 30 W in between. Muscle biopsies were taken pre- and post-training from the vastus lateralis muscle, followed by isolation of total RNA. Samples were then analyzed using a commercial miRNA array.

**Results**: Participants increased their VO₂peak after 6 weeks of training by 4.2 mL·kg⁻¹·min⁻¹ in mean (SD: 0.9). MICT and HIIT induced significant changes in miRNA expression patterns, part of which were specific for one of the two training regimens. For instance, there was a significant (p<0.006), 5.5-fold upregulation of the anti-apoptotic miRNA 21-5p in both training groups. Furthermore, we could identify distinct shift in miRNA patterns that correlated with exercise-induced changes in physiological parameters, such as changes in VO₂peak (delta VO₂peak vs delta expression of miRNA 503, r=-0.9, p=0.01) or microvascular properties.

**Conclusions**: Our data suggest that MICT and HIIT exert distinct, but also overlapping effects on miRNA expression patterns. In addition, basal miRNA expression patterns might be associated with the individual response to training. Furthermore, the data are currently reproduced using semi-quantitative RT-PCR (qPCR). Our results might have important implications for the development of personalized exercise recommendations and therapeutic strategies.

**Purpose**: To assess the effect of regular exercise on mRNA expression of the K⁺ₐᵢ channel Kir6.x subunits in (Kir6.1 and Kir6.2) in slow-twitch and fast-twitch muscles of streptozotocin-induced diabetic rats.

**Methods**: Male Wistar rats (25 days old) were randomly divided into four groups: sedentary control, trained control, sedentary diabetic, trained diabetic. Diabetes was induced by a single streptozotocin injection (100 mg/kg body weight), animals with fasting blood glucose levels ≥ 300 mg/dL were considered as diabetic. Groups with training program performed exercise on a treadmill (30 minutes daily, 5 days/week) for 8 weeks. At the end of the intervention, gastrocnemius (fast-twitch) and soleus (slow-twitch) muscles were dissected and real-time quantitative PCR experiments were performed to quantify Kir6.1 and Kir6.2 expression.

**Results**: In control conditions, the regular exercise increased Kir6.2 subunit mRNA levels significantly in slow and fast muscle (60 ± 13.49% and 132±43.81%, respectively), while Kir6.1 mRNA levels did not differ, respect to sedentary control group. In diabetes, relative mRNA expression of the subunit Kir6.1 were significantly higher in both muscles (229.7% and 152%), whereas the mRNA levels of Kir6.2 were downregulated only in slow muscle by 66.8%. These effects were counteracted by the exercise, Kir6.1 expression was decreased in slow and fast muscle (47.28 and 47.57%, respectively), instead the expression of kir6.2 was increased in both muscles.

**Conclusion**: Our results indicate that regular exercise modifies the gene expression patterns of Kir6.x subunits during diabetes, by increases the expression of Kir 6.2 subunits and regularizes Kir6.1. These effects are dependent on muscle fiber type.

**Purpose**: At present, diabetics have significantly increased prevalence of diabetes, which includes diabetes as a common disease. In the skeletal muscle, ATP sensitive potassium (K⁺ₐᵢ) channels link metabolic cell state and electrical excitability. It has been reported that DM is associated with a K⁺ₐᵢ channel dysfunction, reducing their protecting role in preventing fiber damage and contractile dysfunction. While regular exercise can improve hyperglycemic state in DM, its impact on the expression of K⁺ₐᵢ channels subunits is unknown, and could vary in different types of muscle.

**Methods**: Male Wistar rats (25 days old) were randomly divided into four groups: sedentary control, trained control, sedentary diabetic, trained diabetic. Diabetes was induced by a single streptozotocin injection (100 mg/kg body weight), animals with fasting blood glucose levels ≥ 300 mg/dL were considered as diabetic. Groups with training program performed exercise on a treadmill (30 minutes daily, 5 days/week) for 8 weeks. At the end of the intervention, gastrocnemius (fast-twitch) and soleus (slow-twitch) muscles were dissected and real-time quantitative PCR experiments were performed to quantify Kir6.1 and Kir6.2 expression.

**Results**: In control conditions, the regular exercise increased Kir6.2 subunit mRNA levels significantly in slow and fast muscle (60 ± 13.49% and 132±43.81%, respectively), while Kir6.1 mRNA levels did not differ, respect to sedentary control group. In diabetes, relative mRNA expression of the subunit Kir6.1 were significantly higher in both muscles (229.7% and 152%), whereas the mRNA levels of Kir6.2 were downregulated only in slow muscle by 66.8%. These effects were counteracted by the exercise, Kir6.1 expression was decreased in slow and fast muscle (47.28 and 47.57%, respectively), instead the expression of kir6.2 was increased in both muscles.

**Conclusion**: Our results indicate that regular exercise modifies the gene expression patterns of Kir6.x subunits during diabetes, by increases the expression of Kir 6.2 subunits and regularizes Kir6.1. These effects are dependent on muscle fiber type.
3344  Board #165  May 29 1:30 PM - 3:00 PM  
**The Role Of Collagen Composition And Orientation In Lateral Force Transmission With Aging**

Jed Keenan Lim Obra1, Henning T. Langer1, Agata A. Mossakowski1, Vadim Malis2, Edward Smitaman2, Usha Sinha2, Shantanu Sinha2, Keith Baar, FACSM3, UC Davis, Davis, CA. UC San Diego, San Diego, CA. (Sponsor: Keith Baar, FACSM) 
Email: jlbobra@ucdavis.edu 
(No relevant relationships reported)

**PURPOSE:** Collagen is the most abundant protein in the body and functions to provide the mechanical strength of connective tissues. In muscle, collagen fibrils function both to hold muscle fibers together and transmit force laterally between fibers. With aging, force transmission is reduced; however, how changes to specific collagen isoforms or the matrix orientation contribute to this force loss is currently unclear. The current study was designed to compare lateral force transmission in the gastrocnemius muscle of young and old people with changes in specific collagen proteins and the orientation of the matrix.

**METHODS:** The calf strength of 12 subjects, 5 between 18 and 30 years old and 7 over the age of 65, was measured within an MRI. Images were taken to determine lateral force transmission. Following strength testing, biopsies were obtained under local anesthetic from the gastrocnemius muscle. Biopsies were pinned to cork at resting length and frozen in isopentane cooled in liquid nitrogen. Cross-sections were taken to determine collagen I, III, IV, and V content, whereas longitudinal sections were stained with picrosirius red to determine matrix orientation. The collagen IV image was also used to determine muscle fiber cross-sectional area (CSA).

**RESULTS:** Collagen I and V were evenly dispersed throughout the cross-sections, whereas Collagen IV and VI were denser around individual muscle fibers. Collagen IV content was similar in young and old. As expected, fiber CSA tended (p = 0.6) to decrease in the old subjects. Picrosirius red staining showed that the collagen matrix is oriented at a 22.3±3.1% angle to the fibers in young and 30.2±8.7% in old subjects.

**CONCLUSIONS:** Preliminary data suggests that, in the old, fiber CSA decreases and the extracellular matrix becomes less aligned. By establishing the role of specific collagen proteins during aging, we hope to better understand the relationship between the extracellular matrix and force transmission in muscle and how this relationship is modified by age.

3345  Board #166  May 29 1:30 PM - 3:00 PM  
**Human Medial Gastrocnemius Conversion To Adipose Tissue, A Histological Analysis**

Kailley M. Omstead, Matthew C. Kostek. Duquesne University, Pittsburgh, PA. (Sponsor: Trent Hargens, FACSM) 
Email: omsteadk@duq.edu 
(No relevant relationships reported)

There are very rare reports in the biomedical literature of entire human skeletal muscles being replaced by adipose tissue and thereby affecting lower limb function and ambulation. The causes are unknown. A fully preserved example was discovered in a Medical Anatomy course. **PURPOSE:** To examine the histological characteristics of a bilateral conversion of the medial gastrocnemius, presumably from skeletal muscle to adipose tissue. **METHODS:** Small specimens were collected for preservation, wax embedding, and the histological analysis of the affected muscle, unaffected lateral head of the muscle, nerve, and a control muscle. **RESULTS:** Hematoxylin and Eosin staining revealed an 88% decrease in the number of skeletal muscle fibers with a corresponding increase in the number of adipocytes. Connective tissue was similar between samples; however, the lateral gastrocnemius exhibited signs of inflammation with no necrosis. **CONCLUSIONS:** This is to our knowledge the first full histological analysis of a seeming conversion of the bilateral gastrocnemius medial heads into adipose tissue. The cause is unknown but could be related to the immune cell infiltration.

3346  Board #167  May 29 1:30 PM - 3:00 PM  
**PGC-1α mRNA Isoform-specific Response To Exercise And Cold**

Ben Meister, Camille Larson, Dustin Slivka, FACSM. University of Nebraska at Omaha, Omaha, NE. (Sponsor: Dustin Slivka, FACSM) 
(No relevant relationships reported)

**PGC-1α mRNA Isoform Specific Response to Exercise and Cold**

Ben Meister, Camille Larson and Dustin Slivka 
University of Nebraska at Omaha. 

Cold exposure in conjunction with aerobic exercise has been shown to increase the gene expression of PGC-1α, the master regulator of mitochondrial biogenesis. PGC-1α can be expressed as multiple different isoforms due to alternative splicing mechanisms. The isoforms have differing structures and functions but relatively little about the specificity and response is known.

**PURPOSE:** Determine the difference of PGC-1α isoform expression following an acute bout of cycling in cold and room temperature conditions. **METHODS:** 8 male participants cycled for 1 hour at 65% Wmax at -2°C and 20°C. A muscle biopsy was taken from the vastus lateralis before, 3 h post, and 6 h post exercise. qRT-PCR was used to analyze gene expression of total PGC-1α and NT-PGC-1α expression.

**RESULTS:** Gene expression of both total PGC-1α and NT-PGC-1α increased due to the exercise intervention at both 3 h and 6 h time points (p<0.05), with mRNA expression peaking at 3 h (p<0.05). At 3 h total PGC-1α was higher in the cold (13.2 ± 6.3 fold increase) compared to room temperature (7.4 ± 2.0 fold increase, p = 0.03). NT-PGC-1α was also higher in cold (20.8 ± 12.5 fold increase) compared to room temperature at 6 h (10.7 ± 3.7 fold increase, p<0.029). Total PGC-1α and NT-PGC-1α were similar in cold and room temperature at 6 h (p=0.05). **CONCLUSION:** Exercise and cold exposure induced alterations in gene expression for total-PGC-1α and its truncated isoform, NT-PGC-1α. It appears that NT-PGC-1α contributes to the reported alterations in the cold-induced PGC-1α exercise response.

3347  Board #168  May 29 1:30 PM - 3:00 PM  
**Formoterol Stimulation In Vitro Influences Myogenic Regulatory Factors During Myogenesis In Human Skeletal Muscle Cells**

Chase M. White, Gena D. Guerin, Emily L. Zumbro, Ryan A. Gordon, Drewanna M. McAdams, Matthew L. Sokoloski, David L. Nichols, FACSM, Anthony A. Duplanty. Texas Woman’s University, Denton, TX. (Sponsor: David L. Nichols, FACSM) 
(No relevant relationships reported)

The process of myogenesis within skeletal muscle (SKM) is essential for growth and repair and is coordinated via the expression of myogenic regulatory genes. Previous animal studies have reported that formoterol, a beta-adrenergic receptor agonist, has stimulating effects on genes related to SKM mitochondrial function and biogenesis, similar to effects found for exercise. Lesser known is the potential “exercise mimetic” influence that formoterol stimulation may have during the stages of myogenesis, especially in human SKM cells. **Purpose:** To investigate the effects of formoterol stimulation on expression of myogenic regulatory genes during myogenesis in human SKM cells. **Methods:** Human SKM myoblasts (n = 6 per group) were cultured and differentiated until mature myotube formation (Day 6). Groups included control cells (CON) and cells stimulated by 30nM formoterol for 3h prior to RNA extraction points (FORM). Total RNA was extracted during mid-myogenesis (Day 4) and at terminal differentiation (Day 6) (a cell culture model of investigating myogenesis). Gene expression for Myogenic factor 5 (Myf5), Myogenic differentiation 1(Myod), and Myogenin (Myog) was determined by qPCR. Data were analyzed using repeated measures ANOVA. **Results:** Significant differences between conditions and time points are detailed in Table 1. **Conclusions:** For the FORM group, Myf5 expression was elevated at D6 compared to CON while MyoG and Myod expression was lower than CON for D4 and D6. The interpretation is that FORM stimulation increased stimulus of D4 myoblast proliferation and, thus, delayed initiation of differentiation. These results, coupled with other preliminary data from our lab showing increased mitochondrial biogenesis with this model of investigation, suggests that this exercise mimetic stimulation may cause shift in the cell towards biomechanic preference rather than fusion of myotubes. **Table 1.**

<table>
<thead>
<tr>
<th>Gene</th>
<th>Comparison</th>
<th>Fold Change</th>
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<td>D6 FORM &gt; D4 FORM</td>
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<td>D6 FORM &gt; D6 CON</td>
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### 3348 Board #169 May 29 1:30 PM - 3:00 PM

Diurnal Regulation Of Exercise-induced Anabolic And Catabolic Signaling In White Adipose Tissue


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(No relevant relationships reported)

**Purpose:** Autophagy is a degradation system where damaged cellular components can be recycled, resulting in higher cellular efficiency. White adipose tissue has been shown to have a catabolic response to exercise where autophagy will increase immediately after exercise. mTOR is an anabolic signaling pathway that inhibits autophagy, and plays a key role regulating cell size. Autophagy is sensitive to bioenergetic stressors such as exercise and has been shown to be regulated in a circadian fashion. However, it is currently unknown if exercise-induced autophagy is sensitive to the time-of-day at which exercise occurs. The purpose was to assess anabolic and catabolic signaling in white adipose tissue following exercise at two times of day: Zeitgeber time (ZT) 0 (light phase) and ZT12 (dark phase).

**Methods:** 21 week old male C57BL/6 mice (n=38) were habituated to treadmill exercise for 5 days under red light during the active phase, and allowed to recover for 2 days. Following a single 60-minute bout of treadmill exercise at 10 m/min, mice were sacrificed at 3 time points, pre exercise (SED), immediately post exercise (POST), and 1-hour post exercise (1HR). Tissue was analyzed for anabolic (p-mTOR (Ser2448) and p-S6) and catabolic (LC3II/I) signaling pathways via western blotting. Results were analyzed with a 2x3 ANOVA and significance was accepted at p<0.05.

**Results:** Following exercise, there was a significant repression of p-mTOR (SED=0.990±0.17 vs POST=0.747±0.14, p<0.05) and p-S6 (SED=0.702±0.39 vs POST=0.186±0.14, p<0.05) activation (Main Effect (ME) Exercise; p<0.05, both), which was significantly following exercise performed at ZT12 (Interaction Effect for p-p60; p<0.05). Autophagy signaling (LC3II/I) was increased at ZT12 (ZTO=1.22±0.33 vs ZT2=2.28±0.19, p<0.05), which appeared to be driven by changes in LC3I expression. LC3II (normalized to total protein) was increased following exercise (SED=0.81±0.26 vs POST=1.28±0.43 and 1HR=1.22±0.28, p<0.05, both) and was higher at ZTO (ZTO-3.33±0.33 vs ZT2=2.91±0.33, p<0.05), although no interaction was present.

**Conclusion:** Anabolic and catabolic signaling in adipose tissue may be differentially impacted by exercise performed at different times of day.
MicroRNAs (miRNAs) are increasingly being studied as regulators for biological processes in skeletal muscle. However, little information relating to biological process regulated by aerobic exercise-affected miRNA is available. Bioinformatics analysis provides a perspective on the direction of future research.

**PURPOSE:** To analyze the functions of miRNAs which were affected by 8-week aerobic exercise in skeletal muscle of mice. 

**METHODS:** Twenty C57BL/6J mice (WT mice) were randomly divided into two groups: the quiet group and the training group, with 10 mice in each group. In the training group, 6 days a week, aerobic training was conducted on the running platform with a gradient of 0 and a speed of 12 m/min for 1 hour every day for 4 weeks. The level of ROS in skeletal muscle was detected using fluorescence colorimetry. Real-time PCR was used to detect the expression of MSTN, ACVR2B, FST miRNA in skeletal muscle. The expression of MSTN, ACVR2B, FST, p-Smad2/3 were detected by Western Blot.

**RESULTS:** Compared with group PBS, adipose mesenchymal stem cells injection significantly promoted the repair of muscle fibers. Compared with group D1, the level of CK in group W2 was significantly decreased, the content of sTnT level in group D3 and group W1 were remarkably increased, the serum MnSOD contents in group W1 were significantly decreased, which in group W2 was remarkably increased. Compared with group PBS, the expression of MSTN protein were significantly decreased at time point D3, D1 and W1, however, which was significantly decreased at time point W2. Compared with group PBS, the expression of MSTN protein were significantly decreased at time point D3, D1 and W1, however, which was significantly decreased at time point W2. Compared with group PBS, the expression of MSTN protein were significantly decreased at time point D3, D1 and W1, however, which was significantly decreased at time point W2.

**CONCLUSIONS:** Aerobic exercise, allogeneic adipose mesenchymal stem cells injected intramuscularly can decrease the transcription of MSTN in skeletal muscle. Adipose mesenchymal stem cells injected intramuscularly may improve the regeneration and repair of skeletal muscle after eccentric exercise through affecting the downstream signaling pathway of MSTN.

**Abstracts were prepared by the authors and printed as submitted.**
control(NC),moderate intensity exercise(MIE) and acute exhaustive exercise(AEE) groups. NC and AEE:traditionally used. MIE:Rats were run at 15m/min per day for 60min until the end of the 8th week. Slope:10% AEE: The rats were subjected to acute exhaustive exercise after 8 weeks. They were sacrificed 48h after the last experiment. PHB1 expression, ATP content, FO-F1-ATPase, oxidative stress (ROS), cellular oxygen consumption rate (OCR), and mitochondrial respiratory function (RCR) in skeletal muscle were measured by animal and cell experiments. RESULTS: Compared with NC, MIE group RCR decreased (-0.005, p<0.01), ATP content (49RL, p<0.01), FO-F1-ATPase activity (79p<0.05), PHB1 expression (42%, p<0.01), ROS level (-75%, p<0.001) decreased; AEE group RCR (-58%, p<0.05), ATP content (-55%, p<0.05), FO-F1-ATPase activity (-56%, p<0.01), PHB1 expression (-31%, p<0.01) decreased and ROS (-79%, p<0.05) increased. In C2C12 cells, PHB1 overexpression group, ATP content (+86%, p<0.01), FO-F1-ATPase mRNA level (+59%, p<0.05), FO-F1-ATPase protein expression (+306%, p<0.01), OCR (+256%, p<0.01), ROS level (-74%, p<0.01) significantly enhanced the cellular respiratory function. In the low expression group of PHB1, ATP content (-21%, p<0.01), FO-F1-ATPase mRNA level (-64%, p<0.05), FO-F1-ATPase protein expression (-89%, p<0.05), FO-F1-ATPase activity (-93%, p<0.01) and OCR (-190%, p<0.01) ROS production was significantly increased (+104%, p<0.01), and cellular respiratory function was significantly reduced. CONCLUSION: In energy metabolism, PHB1 may play a role in stabilizing the mitochondrial structure and positively regulating FO-F1-ATPase activity, thereby enhancing mitochondrial function and promoting energy metabolism. Supported by NSFC(No.31470601)

In preparation for upcoming space missions to the Moon and Mars, there is a need to understand how space stressors (e.g., microgravity, radiation) affect different physiological systems. As skeletal muscle is a critical organ, not only for locomotion but also for overall body homeostasis, defining the molecular impact of microgravity and radiation on this tissue will help developing new, or fine-tuning current countermeasures to maintain health and physiological function of space travellers.

PURPOSE: To investigate the effects of combined radiation and unloading on anabolic/catabolic and immune/inflammatory processes on skeletal muscle in mice.

METHODS: Ten C57/B6J mice were subjected to 14-d hind-limb unloading by horizontal unloading (HILUR). Ten mice were used as controls (CTRL), similar cages, sham radiation. Mice were sacrificed and soleus muscle was immediately dissected, weighed and frozen. Then, RNA was extracted and converted to cDNA. Gene expression of anabolic/catabolic (i.e., myostatin, Myr1F-1, Arog1-1, PGC1-1) and immune/inflammatory markers (i.e., CD4, CD8, IFNγ, CD11b, MHCII, TNFα, IL-6) was assessed by RT-PCR. Independent t-tests were used to compare HILUR vs. CTRL. RESULTS: Soleus muscle weight was ~30% lower in HILUR vs. CTRL (P<0.001). Myostatin expression was greater in HILUR vs. CTRL (1.8-fold, P=0.014). MHCII expression was greater in HLUR vs. CTRL (2.4-fold, P<0.001). There was a trend for group differences (P=0.08) in CD11b and TNFα mRNA content with HILUR showing greater values than CTRL. Gene expression of CD4, CD8, and IFNγ was barely detected in either group.

CONCLUSIONS: The combination of unloading and radiation has a major impact on skeletal muscle. Apart from inducing muscle atrophy, as indicated by the decreased muscle weight and increased myostatin levels, these two space stressors altered the immune profile within the muscle. The increased gene expression of MHCII and CD11b indicates that the myoid component of the immune system is activated upon unloading and radiation in skeletal muscle. In contrast, the almost undetected mRNA levels of CD4, CD8 and IFNγ may imply that unloading and acute radiation have little impact on the lymphoid component. These findings should be followed up with immunohistochemical analysis.

POURPOSE: The purpose of this investigation was to examine the role of the MCT-1 in the T1470A polymorphism on blood lactate clearance rates in females following a 30 second Wingate test.

METHODS: Lactate was measured before the test, immediately following the test and -10, -20, -30 and -40 minutes post. Lactate decreases were calculated for each 10-minute period. Participants were divided into three groups based on their T1470A genotype (TT, TA, AA). RESULTS: There was no significant interaction between genotype and lactate clearance (p=0.12), however the TT genotype group had significantly higher clearance rates when collapsed across time points (p=0.003). Lactate clearance was higher in the TT genotype when compared to both the TA genotype (p=0.002) and the AA genotype (p=0.009). This effect was caused by significantly higher lactate accumulation in TT genotype subjects immediately following the Wingate test compared to TA (p=0.001) and AA (p=0.003) subjects. CONCLUSION: To our knowledge, our investigation is the first that demonstrates that the MCT-1 genotype effects lactate clearance in women. Our findings differ from the body of literature carried out using male participants, which suggests that the T allele adversely effects lactate clearance. Further, our findings indicate that peak lactate clearance occurs earlier in the TT group compared to the TA and AA group in resistance trained females. Future research should continue to examine the MCT-1 polymorphism in women and how this genetic information can be integrated into exercise prescription protocols.

Purpose: BFR during RT has been reported clinically to rehabilitate/prevent injury in healthy people and people with orthopedic conditions. Further, subjective accounts of minimal muscle soreness post-training suggest a reduction in exercise induced muscle damage compared to traditional RT. We sought to compare the effects of BFR eccentric RT at low loads on muscle performance to traditional RT. As skeletal muscle is a critical organ, not only for locomotion but also for overall body homeostasis, defining the molecular impact of microgravity and radiation on this tissue will help developing new, or fine-tuning current countermeasures to maintain health and physiological function of space travellers. As skeletal muscle is a critical organ, not only for locomotion but also for overall body homeostasis, defining the molecular impact of microgravity and radiation on this tissue will help developing new, or fine-tuning current countermeasures to maintain health and physiological function of space travellers.
the BFR and control conditions demonstrated a decrease in torque immediately following exercise [mean change = 4.5 (4.5) and 1.82 (4.5) Nm for BFR and control conditions respectively], which remained decreased below baseline 15 minutes post exercise [mean change = 2.39 (5.5) and 2.28 (3.19) Nm for BFR and control conditions respectively]. For muscle thickness, there was a main effect for time (p < 0.001). Muscle thickness increased from pre [3.52 (7.8 cm) to post [3.68 (8.1 cm) exercise and remained increased above baseline 15 min post exercise [3.6 (8.0) cm]. For AOP, there was a main effect for condition (p = 0.027). The difference in AOP was greater in the BFR group [16.6 (13.42) mmHg] compared to the control group [11.1 (11.84) mmHg].

CONCLUSIONS: NO LOAD exercise with the application of BFR led to greater reductions in isometric torque compared to NO LOAD exercise without the application of BFR. In addition, the application of BFR led to an exaggerated cardiovascular response compared to NO LOAD exercise alone. There were no differences in acute muscle swelling between NO LOAD exercise with and without BFR. These results suggest that the application of BFR to NO LOAD exercise may lead to a greater level of muscle fatigued when performing four sets of twenty maximal repetitions. This is accompanied with an exaggerated cardiovascular response.

In immobilized patients, passive movement (PM) with blood flow restriction (BFR) reduces atrophy over PM alone; whether these effects are greater than BFR alone is uncertain. PURPOSE: To determine if acute muscular responses are unique when combining BFR and PM compared to PM alone or BFR alone. METHODS: 20 participants performed four conditions (randomized order): time control (TC), PM, BFR, and PM combined with BFR (PM+BFR) over two visits (one condition each leg, per visit). For PM, a dynamometer moved (45°/second) the leg through 3 sets of 15 knee extension/isolations (90°). For BFR, a cuff was inflated to 80% arterial occlusion pressure on the proximal portion of the leg. Muscle thickness (MT) was measured at 60% and 70% of the anterior upper leg before, immediately after, five minutes after, and ten minutes after each condition. Oxygenated, deoxygenated (HHb), and total (tHb) hemoglobin of the vastus lateralis were monitored throughout conditions via near-infrared spectroscopy. Ratings of perceived effort (RPE-E) and discomfort (RPE-D) were reported before and after each condition and after each set. Data [presented as mean (SD)] were analyzed using Bayesian RMANOVA. RESULTS: 60% MT [A before to immediately after: TC: 0.04 (0.09), PM: -0.01 (0.15), BFR: -0.00 (0.11), PM+BFR: -0.01 (0.11)] and 70% MT [A before to immediately after: TC: -0.01 (0.09), PM: -0.01 (0.15), BFR: -0.02 (0.11), PM+BFR: -0.03 (0.22)] did not change (BF vs. 0.014 and 0.015, respectively). HHb and tHb changes were generally greater with BFR compared to PM and PM+BFR [i.e. channel 2 HHb: Δ start set 1 to end set 3: TC = 1.07 (1.21), PM: -1.23 (1.86), BFR = 9.58 (2.81), PM+BFR = 10.11 (3.16) μm]. RPE-E increased with time and condition (BF = 5.88±2.18, [A before to end set 3: TC = 3.10±0.2, PM = 0.7 (1.0), BFR = 0.9 (2.1), PM+BFR = 1.3 (1.7)]. RPE-D changes were greater for BFR and PM+BFR [BF = 9.87±13], [A before to end set 3: TC = 0.0 (0.2), PM = 0.4 (1.1), BFR = 3.2 (1.8), PM+BFR = 2.6 (1.5)]. CONCLUSION: PM and/or BFR alone are not sufficient to acutely increase MT (generally associated with a hypertrophic stimulus) in healthy people. Changes in tissue oxygenation seem to be driven by BFR rather than a unique effect of combining PM with BFR. The extent of this effect and what it would mean for adaptation in either healthy or bed-ridden patients warrants further investigation.

Conclusions: Muscular strength gains following blood flow restricted (BFR) resistance training are consistently lower than those observed after HL training and this may be due to differences in neuromuscular activation. Integrating high-velocity muscle contractions and BFR resistance exercise may increase neuromuscular activation. PURPOSE: To compare torque and neuromuscular activation before and after sessions of HL knee extension exercise and high-velocity BFR knee extension exercise in young and older adults. METHODS: Ten young males and females (20-31.5 years, 1.73±0.6 m, 69.2±10.4 kg) and 10 older males and females (72.6±4.7 years, 1.70±0.2 m, 74.3±14.6 kg) performed randomized sessions of HL (80% 1-RM for 3 sets of 10 isotonic knee extension repetitions) and low-load, high-velocity BFR (30% 1-RM coupled with a vascular restriction for one set of 30 knee extension repetitions and 3 sets of 15 repetitions completed as quickly as possible). Knee extension isometric torque was assessed before and after each session of exercise and neuromuscular activation of the vastus lateralis (VL) was quantified with surface electromyography (EMG). RESULTS: The young participants had higher isometric torque than the older participants (213.4±54.8 vs 160.1±52.5 Nm; P<.01). There was an average decrement in torque of 31.4±9.2% among all participants from baseline to post exercise (P<.01). The magnitude of this decrement was similar between conditions (P=.19), age (P=.12), and the interaction of time, condition and age (P=.16). EMG amplitude normalized to pre isometric torque in the first 5 knee extension repetitions of the HL condition averaged 106±57% and 90±33% in the BFR high-velocity condition. In the last 5 repetitions, EMG amplitude averaged 117±56% and 113±46% in the HL and BFR conditions respectively. This was a significant increase in EMG amplitude (P<.01) but there were no interactions or main effects of condition or age (P>.05). CONCLUSION: Combining high-velocity contractions with BFR resistance exercise results in decrements in torque and heightened neuromuscular activation similar to HL exercise in both young and older adults. Future studies should evaluate the training adaptations from high-velocity BFR resistance training. Supported by University of New Hampshire Grimes Family Fund.
**Proposed A New In Vitro Exercise Model For Cartilage Regeneration**
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**Background**

Tissue Engineering and Regenerative Medicine are promising interdisciplinary fields regarding tissue and/or organ repair and regeneration. Due to the extremely high incidence of osteoarthritis in such an aging population, it is critical to put all efforts into developing a successful implant for osteochondral tissue regeneration; although there has been a huge amount of work aiming to regenerate it, a tailored construct has not been achieved yet. **Purpose**: to develop a 3D in vitro model and bioreactor system to evaluate osteochondral regeneration, as well as cell-material interaction and material induced cell migration and differentiation, under physiological conditions in a bioreactor system with the ability of providing mechanical and electrical stimuli. **Methods**: Multiphysics computer simulations were performed to explore which combination of stimulus facilitate cells adhesion, proliferation, viability and differentiation. A suite of new mathematical models were developed and validated, together with robust and efficient computational tools that allow simulation of chondral regeneration in vitro and in vivo. **Results**: An automated integrated smart system for the assembly and in vitro culture process of the osteochondral constructs was designed. The platform integrates two distinct zones: the multi-material bioprinter and the custom-designed bioreactor. Due to different environmental conditions (temperature, humidity and PCO2) that must be ensured in the fabrication and culture areas, a custom-made incubator with two separate areas and differential environmental control were developed. **Conclusion**: The integrated assembly system was validated by comparing the biological and mechanical properties of the produced constructs. Preliminary results have demonstrated both adequate mechanical and biological properties of the 3D constructs, using Poly(glycerol-sebacate) and graphene.

**Therapeutic Potential Of Different Pericyte Populations In The Recovery Of Skeletal Muscle Mass Following Disuse**
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**Background**

Dysfunctional pericyte function has been linked to the progression of muscle atrophy and the extent of recovery was assessed. One-way ANOVA was used to compare the extent of recovery. RESULTS: There was no significant improvement in TA muscle weight or myofiber CSA with pericyte transplantation following a period of disease. METHODS: Twenty-four 4-month old C57BL/6 mice were randomly divided into four groups (n=6/group). Mice hindlimbs were immobilized in full dorsiflexion via a surgical staple. 4-month old fast-twitch white skeletal fibers ranging 2000-3000 μm² in mice receiving CD146+Lin, CD146+ NG2 Lin, NG2 Lin or saline (control) were injected into the tibialis anterior (TA) muscle. TA muscles were excised for analysis after 2 weeks of remobilization and the extent of recovery was assessed. One way ANOVA was used to compare the extent of improvement between treatment groups. RESULTS: There was no significant improvement in TA muscle weight or myofiber CSA with pericyte transplantation in the current study (p>0.05). However, a trend toward significant improvement in myofiber CSA was noted for fibers ranging 2000-3000 μm² in mice receiving CD146+NG2 Lin pericytes (p=0.072). Significant improvements in capillarization and collagen remodeling were detected in mice receiving CD146+NG2 Lin pericytes (p<0.05) and CD146+Lin (p<0.05) pericyte compared to controls. **Conclusion**: CD146+ Lin pericyte transplantation effectively recovered capillary quantity and collagen remodeling following a period disease compared to controls, whereas NG2-Lin pericytes did not demonstrate similar capacity for recovery. Supported by NIH Grant NIAAMS R01 AR027375 to MBB.

**A Novel Umbilical Cord Derived Wharton's Jelly Formulation For Regenerative Medicine Applications**

**Background**

Musculoskeletal injuries have traditionally been treated with activity-modification, physical therapy, pharmacological agents and surgical procedures. These modalities have limitations, as well as potential side-effects. Over the last decade, there has been an increased interest in the use of biologics for regenerative medicine applications (RMA), including umbilical cord (UC) derived Wharton’s Jelly (WJ). Despite this increase, there is insufficient literature assessing the amount of growth factors, cytokines, hyaluronic acid (HA) and extracellular vesicles (EV) including exosomes in these products. The purpose of this study was to develop a novel WJ formulation and evaluate the presence of growth factors, cytokines, HA and EV including exosomes.

**Methods**: WJ was isolated from human-UC obtained from consenting C-section donors and formulated into an injectable form. Randomly selected samples from different batches were analyzed for sterility testing and quantified for presence of growth factors, cytokines, HA and EV in size range. **Results**: The results showed all samples passed the sterility test. Growth factors including IGF1, 1, 2, 3, and 6, TGF-a, PDGF-AA were detected. Expression of several immunomodulatory cytokines, RANTES, IL-6R, IL-6, IL-16, were also detected. Expression of pro-inflammatory cytokines MCSF, MIP-1 alpha, anti-inflammatory cytokines TNF-R, INF-γ, IL-1RA; and homeostatic cytokines TIMP-1 and TIMP-2 were observed. Cytokines associated with wound-healing, ICAM-1, G-CSF, GDF-15, and regenerative properties, GH were also expressed. High concentrations of HA were observed. Particles in the EV size range (30-150nm) were detected and were enclosed by the membrane, indicative of true EV. **Conclusions**: Our results confirmed the presence of numerous growth factors, cytokines, HA and EV in the WJ formulation. More studies are underway to confirm the presence of exosomes detected in EV using exosome-specific markers. We believe the presence of multiple factors within one WJ formulation may play a role in reducing inflammation, pain and augment healing of musculoskeletal injuries. This offers a potential expanded use for RMA.

**Overexpression Of PGC-1α In Human Primary Myotubes Increases Regulators Of Exosome Biogenesis And Secretion**
Derek Middleton1, Christopher Kargl2, Jeffery Brautl3, Timothy Gavrin, FACSM1. 1Purdue University, West Lafayette, IN. 2Indiana University, Indianapolis, IN. (Sponsor: Timothy P. Gavrin, FACSM)

**Background**

Peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC-1α) is a key driver of mitochondrial biogenesis, a characteristic of oxidative compared to glycolytic muscle. It was hypothesized that PGC-1α regulates exosome biogenesis and secretion in skeletal muscle. **Purpose**: To determine if PGC-1α regulates skeletal muscle exosome biogenesis and secretion. METHODS: Twenty-four 4-month old C57BL/6 mice were randomly divided into four groups (n=6/group). Mice hindlimbs were immobilized in full dorsiflexion via a surgical staple. 4-month old fast-twitch white skeletal fibers ranging 2000-3000 μm² in mice receiving CD146+Lin, CD146+ NG2 Lin, NG2 Lin or saline (control) were injected into the tibialis anterior (TA) muscle. TA muscles were excised for analysis after 2 weeks of remobilization and the extent of recovery was assessed. One way ANOVA was used to compare the extent of improvement between treatment groups. RESULTS: There was no significant improvement in TA muscle weight or myofiber CSA with pericyte transplantation following a period of disease. METHODS: Twenty-four 4-month old C57BL/6 mice were randomly divided into four groups (n=6/group). Mice hindlimbs were immobilized in full dorsiflexion via a surgical staple inserted through the center of the foot and body of the gastrocnemius for 2 weeks. At 2 weeks post immobilization, staples were removed and either pericytes (CD146+Lin, CD146+ NG2 Lin, NG2 Lin) or saline (control) were injected into the tibialis anterior (TA) muscle. TA muscles were excised for analysis after 2 weeks of remobilization and the extent of recovery was assessed. One way ANOVA was used to compare the extent of improvement between treatment groups. RESULTS: There was no significant improvement in TA muscle weight or myofiber CSA with pericyte transplantation in the current study (p>0.05). However, a trend toward significant improvement in myofiber CSA was noted for fibers ranging 2000-3000 μm² in mice receiving CD146+NG2 Lin pericytes (p=0.072). Significant improvements in capillarization and collagen remodeling were detected in mice receiving CD146+NG2 Lin pericytes (p<0.05) and CD146+Lin (p<0.05) pericytes compared to controls. **Conclusion**: CD146+ Lin pericyte transplantation effectively recovered capillary quantity and collagen remodeling following a period disease compared to controls, whereas NG2-Lin pericytes did not demonstrate similar capacity for recovery. Supported by NIH Grant NIAAMS R01 AR027375 to MBB.

**Overexpression Of PGC-1α In Human Primary Myotubes Increases Regulators Of Exosome Biogenesis And Secretion**
Derek Middleton1, Christopher Kargl2, Jeffery Brautl3, Timothy Gavrin, FACSM1. 1Purdue University, West Lafayette, IN. 2Indiana University, Indianapolis, IN. (Sponsor: Timothy P. Gavrin, FACSM)

**Background**

Peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC-1α) is a key driver of mitochondrial biogenesis, a characteristic of oxidative compared to glycolytic muscle. It was hypothesized that PGC-1α regulates exosome biogenesis and secretion in skeletal muscle. **Purpose**: To determine if PGC-1α regulates skeletal muscle exosome biogenesis and secretion. METHODS: On day 4 of differentiation, primary myotubes from vastus lateralis biopsies from lean donors (BMI < 25.0 kg/m²) were exposed to adenovirus encoding human PGC-1α or GFP control. On day 6 of differentiation, culture media was replaced with exosome-free media. On day 8, cells were collected for mRNA and protein analysis. **Results**: Overexpression of PGC-1α increases regulators of exosome biogenesis in the endosomal sorting complexes required for transport (ESCRT) pathway: Alix (GFP: 2.9 ± 1.0 vs. PGC-1α: 7.6 ± 1.4), TSG-101 (GFP: 2.6 ± 0.7 vs. PGC-1α: 7.3 ± 2.1), CD63 (GFP: 2.6 ± 0.3 vs. PGC-1α: 3.7 ± 0.4), Clathrin (GFP: 3.5 ± 0.1 vs. PGC-1α: 11.6 ± 2.5), and the secretion pathway: Rab7 (GFP: 2.6 ± 0.7 vs. PGC-1α: 3.2 ± 0.3). **Conclusion**: Overexpression of PGC-1α increases gene expression of regulators of exosome biogenesis and secretion in human primary myotubes.
Obesity increases the susceptibility of skeletal muscle to damage and impairs the regenerative response following muscle damage. Obesity is associated with an increase in ectopic lipid accumulation and inflammatory cell infiltration in skeletal muscle. It is unclear if the impairments in skeletal muscle regeneration and increased susceptibility to damage is due to these factors or if defects in integrity and repair are inherent to muscle of obese subjects. PURPOSE: To investigate if myotubes isolated from obese donors are (1) more susceptible to damage and (2) have a blunted regeneration response. METHODS: Differentiated myotubes from lean (LN) and obese (OB) donors were treated with 0.5 μM of cardiotoxin (CTX) for 1 h. Cells were allowed to recover in skeletal muscle growth media for 3 days and then differentiation media for 2 days. Cells were isolated immediately (ImPost), 3 and 5 days following CTX treatment. RESULTS: CTX significantly reduced the fusion index of differentiated cells, but there were no differences between LN and OB at ImPost (no-CTX: LN 78% vs. OB 28%; CTX: LN 15% vs. OB 12%), 3 Days (no-CTX: LN 38% vs. OB 38%; CTX: LN 30% vs. OB 29%), or 5 Days (no-CTX: LN 41% vs. OB 39%; CTX: LN 37% vs. OB 34%). CTX significantly reduced cell viability assessed via MITT but no differences were observed between LN and OB at ImPost (no-CTX: LN 0.20 au vs. OB 0.21 au; CTX LN 0.11 au vs. OB 0.14 au), 3 days (no-CTX: LN 0.37 au vs. OB 0.37 au; CTX LN 0.08 au vs. OB 0.12 au), 5 days (no-CTX: LN 0.34 au vs. OB 0.34 au; CTX LN 0.19 au vs. OB 0.22 au). No differences were observed in the expression of key metabolic proteins PFK-1, Citrate Synthase, or β-Had following CTX administration in LN or OB. CONCLUSION: When cultured under identical conditions, myotubes isolated from young, healthy obese donors demonstrate similar damage following CTX treatment and similar regenerative responses compared to myotubes from lean donors.

INTRODUCTION: Skeletal muscle contains numerous stem and progenitor cell populations that reside within the interstitium between myofibres. These cells directly and indirectly support muscle repair; however, the identities and functions of these cells remain poorly characterized in human muscle. PURPOSE: To identify progenitor cell populations within uninjured human skeletal muscle. METHODS: Total mononuclear cells were isolated from the hamstrings of n=5 orthopedic surgery patients (2 males, 3 females, mean age ~23.4 ± 1.1 years) and employed unsupervised graph-based clustering using uniform manifold approximation and projection (UMAP). RESULTS: Following quality control, a total of 2736 cells were analyzed at a read depth of ~41,000 reads per cell with an average approximation and projection (UMAP) of 1255 genes detected per cell. Analysis of differentially expressed genes identified 8 sub-clusters of cells providing insight into previously undescribed cellular populations within human skeletal muscle. Ongoing analysis is examining the function of SMCAMS and Twist-2-positive cells in response to exercise.

Physical exercise (PE) is a well-known non-pharmacological intervention to overcome chronic low-grade inflammation-induced sarcopenia through humoral factors. However, it is not fully elucidated whether PE-induced maintenance of muscle homeostasis against inflammation is associated with muscle cell-derived myokines and extracellular vesicles. PURPOSE: To determine the effects of inflammation of muscle cell on the myokine expression in exosome-like vesicles (EVs), and the effects of electric pulse stimulation (EPS), as an exercise mimetic on the myokine expression using C2C12 myotubes. METHODS: Inflammation of C2C12 was induced by treatment of a cytokine mixture (CM, TNF-α, IFN-γ), and insulin resistance was induced by palmitate (0.75 mM) for 24 hrs. ELVs were enriched from conditioned media by differential ultracentrifugation. EPS was set as 11.5 V, 2 ms, 2Hz for 24 hrs. We considered P < 0.05 as significant, using GraphPad Prism ver 2.0 program. RESULTS: Treatment of C2C12 by CM significantly inhibited the expression of myogenic regulators (myoblast transcription factors, myogenic myokine, and signaling proteins), while induced the expression of atrophic factors (atrogin-1, myostatin and signaling proteins). In addition, the inflamed C2C12 myotubes released anti-myogenic EVs which contain abundant myostatin and scanty level of decorin, comparing with control ELVs. When we stimulated C2C12 myotubes by EPS, the system, levels of myogenic regulators (MyoD and myogenin), myogenic myokines (FDNC5, decorin, FGF21 and cathepsin B), and metabolic function of myotubes were significantly increased, however the levels of myostatin and atrogin-1 were down-regulated. Furthermore, EPS increased the mitochondrial activity and activated mitochondrial biogenesis pathways. CONCLUSIONS: Inflammation, expression of anti-myogenic regulators and mitochondrial dysfunction are major contributors in metabolic diseases- or aging-induced sarcopenia. Therefore, our results suggested that activation of anti-myogenic activity in muscle cells by contraction (i.e., EPS in vitro and skeletal muscle contraction during PE in vivo) through myokine-containing ELVs may be a mechanism of beneficial effects of PE against sarcopenic factors.
protein Drp1 ser616 phosphorylation was significantly reduced following EPS in both groups (1.09 ± 0.07 vs. 0.95 ± 0.06, P<0.05). No differences of mitochondrial fusion proteins were found between study groups.

CONCLUSIONS: Our data reveal that EPS induces similar intrinsic adaptations in mitochondrial dynamics in cultured myotubes derived from lean and severely obese humans.

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3373 Board #193 May 29 1:30 PM - 3:00 PM

Gene Expression Responses Of Skeletal Myotubes To Mechanical Loading In Vitro


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(No relevant relationships reported)

Skeletal muscle can adapt to mechanical loading by changing its mass and overall contractile phenotype via the activation of mechanotransduction and intracellular signaling mechanisms. In vitro mechanical loading of differentiated myoblasts (myotubes) has been utilized for mimicking the mechanical loading conditions of skeletal muscle in vivo. PURPOSE: This study investigated the effects of mechanical loading of myotubes on their gene expression responses associated with various aspects of cellular function, such as differentiation, hypertrophy and apoptosis.

METHODS: C2C12 myoblasts were cultured on elastic membranes up to day 9 of their differentiation and then underwent a passive, cyclic stretching protocol (at a frequency of 0.25 Hz, for 12 hours). Myotubes were harvested and lyzed 12 hours after the completion of the stretching protocol. Real-Time PCR was utilized to measure changes in mRNA expression levels of myogenic regulatory factors (MRFs: MyoD, Myogenin, MRF4), as well as growth (IGF-1 isomers: IGF-1Ea, IGF-1Eb), atrophy (Murf1, Atrogin, Myostatin), apoptotic (Foxo, Fuca, p53) and inflammatory factors (Myogenin, MRF4), as well as growth (IGF-1 isoforms: IGF-1Ea, IGF-1Eb), atrophy (Murf1, Atrogin, Myostatin), apoptotic (Foxo, Fuca, p53) and inflammatory factors (Myogenin, MRF4) while Myogenin expression

RESULTS: Mechanical loading of the myotubes resulted in increased expression of MyoD (1.5-fold; p<0.05) and MRF4 (2.0-fold; p<0.05) while Myogenin expression decreased by 0.4-fold (p>0.05). Expression of muscle atrophy factors Atrogin (0.5-fold), Myostatin (0.4-fold), and Murf1 (0.4-fold), and of the inflammatory factor IL-1b (0.5-fold) was significantly decreased (p<0.05). No significant changes were revealed in the expression levels of IGF-1 isomers (IGF-1Ea: 0.9-fold, IGF-1Eb: 1.1-fold) and apoptotic factors (Foxo: 0.8-fold, Fuca: 1.1-fold, p53: 1.0-fold), as well as of IL-6 (0.8-fold) in response to the selected stretching protocol of the differentiated myotubes.

CONCLUSIONS: These findings suggest that the specific mechanical loading protocol can further affect the myogenic differentiation program and protein synthesis of skeletal myotubes by influencing the expression of myogenic factors and downregulating muscular atrophy genes.

3373 Board #194 May 29 1:30 PM - 3:00 PM

Novel Method To Visualize AMPK Protein Localization In Single Human Muscle Fibers Via Confocal Microscopy

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(No relevant relationships reported)

Purpose: AMP-activated protein kinase (AMPK) is the energy regulator of skeletal muscle cells. Current methods can identify the magnitude of AMPK expression in single muscle cells via Western blotting and Capillary Nano-Immunoassay (CNIA); however, these methods lack the ability to visually identify AMPK localization within muscle cells. Identifying AMPK in human muscle is important because it is involved in various exercise training adaptations such as mitochondrial biogenesis and glucose transport. Therefore, we aimed to develop a novel confocal microscopy method to identify AMPK protein expression (relative intensity) and localization within human single muscle fibers. Methods: A vuxus lateralis muscle biopsy was obtained from a healthy male and immediately fixed (4% PFA). Twenty fibers were isolated, placed on microscope slides, incubated in 0.1% Triton (15min), then incubated in 5% normal goat serum (blocking solution; 4h). This was followed by exposure to a 1 antibody (Ab) (anti-AMPKα2) in 5% bovine serum albumin (1h at 4ºC). Fibers then exposed to a 2 Ab (anti-rabbit IgG conjugated w/ AlexaFlour 488) and phalloidin (AlexaFlour 568) to label actin (2h). Finally, fibers were mounted under coverslips with AntiFade Gold w/DAPI for myonuclei detection. Confocal microscopy imaging was conducted using a Zeiss LSM 710 with 63x plan apochromatic objective (oil emersion). Images were processed via ImageJ. Results: Muscle fiber contractile proteins (actin; red), myonuclei (blue), and AMPK proteins (green) were successfully visually identified at rest (AMPK fluorescence intensity ~ 1199.64 ± 630 AU). To ensure that no auto-fluorescence or non-specific binding was observed, images were compared to control slides: 1) DAPI only, 2) 1 Ab only, 3) Ab only and 4) no staining. Conclusion: These methods allow for the successful visualization (relative intensity) and localization of AMPK proteins within single human muscle fibers. This method could be used in future research to investigate the response and myonuclear co-localization of AMPK following exercise in human skeletal muscle to elucidate how they may play a role in these physiological processes.

3375 Board #196 May 29 1:30 PM - 3:00 PM

Hyperbaric Oxygen Therapy Promotes Muscle Recovery After Contusion Injury Via Angiogenesis By Reactive Nitrogen Species

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(No relevant relationships reported)

Background: Muscle contusion is a common sports injury, but delayed return to competition may negatively influence athlete’s careers. Recently, hyperbaric oxygen (HBO) treatment promoted early recovery from muscle injury with reduction of soft tissue swelling. Increased reactive oxygen species (ROS) and reactive nitrogen oxide species (RNS) is a key mechanism of HBO, which supplies abundant oxygen due to increased dissolved oxygen at high pressure, and a high O2 content in tissues. RNS generally stimulate vascular endothelial growth factor (VEGF) secretion from endothelial cells, which then induces angiogenesis. Purpose: To investigate whether HBO could promote angiogenesis with induction of ROS /RNS and induce muscle regeneration after contusion injury in rats. Methods: Muscle contusion was induced 2 Ab only, and 4) no staining. Conclusion: These methods allow for the successful visualization (relative intensity) and localization of AMPK proteins within single human muscle fibers. This method could be used in future research to investigate the response and myonuclear co-localization of AMPK following exercise in human skeletal muscle to elucidate how they may play a role in these physiological processes.

3373 Board #195 May 29 1:30 PM - 3:00 PM

An Examination Of The Nonlocal Repeated Bout Effect Of The Elbow Flexor Muscles

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Unacustomed eccentric exercises usually result in muscle damage. It has been well documented that the magnitude of muscle damage can be attenuated in the subsequent bouts of the similar exercise, which is known as the repeated bout effect (RBE). The potential nonlocal RBE (e.g., from the upper limb to lower limb or vice versa), however, has not been examined yet.

PURPOSE: To examine whether performing an initial bout of eccentric damaging exercise (EDE) on the elbow flexors muscles could induce any RBE against the muscle damage from the subsequent identical EDE performed on the knee flexors.

METHODS: Six healthy male (Age: 24 ± 4 yrs; Weight: 84.3 ± 15.2 kg; Height: 174.3 ± 9.2 cm) and nine women (Age: 21.1 ± 1 yrs; Weight: 65.5 ± 13.4 kg; Height: 162.8 ± 3.5 cm) participated in this study. The participants performed the baseline bout of knee flexion (KF) EDE on one randomly chosen thigh. After a washout period, the participants performed the elbow flexion (EF) EDE on a randomly chosen arm. Lastly, the second bout of EDE was performed on the contralateral leg one week after the EF EDE. All EDE protocols consisted of six sets of 10 eccentric contractions with the load equivalent to 150% of the concentric 1-repetition maximum of the leg curl or arm curl exercise. Range of motion (ROM) at the knee joint, muscle soreness, and the relative KF isometric strength were taken before, after, one day (1D), two days (2D), and seven days (7D) after the EDE protocols. Separate three-way (bout [baseline, second] × group [dominant, non-dominant] × time [Pre, Post, 1D, 2D, 7D]) repeated measures ANOVAs were used to examine the changes in dependent variables.

RESULTS: The ROM did not show any 3-way or 2-way interactions, but a main effect for time (p < 0.001). There was a significant bout × time interaction (p = 0.042) for the relative isometric strength, and the follow-up paired t-tests indicated a significant difference at the EDE testing time (baseline bout vs. second bout: 80.5 ± 10.4% vs. 87.5 ± 13.0%, p = 0.046). The muscle soreness only showed significant main effects for bout (p = 0.034) and time (p < 0.001), with the pairwise comparison showing significantly smaller value for the second bout when compared to that for the baseline bout.

CONCLUSIONS: This preliminary study showed potential nonlocal RBE between the upper and lower body muscles.
by the mass-drop method on the right calf muscle of rats. After the injury, the rats were divided into non-treated (NT) and HBO-treated groups. The HBO protocol consisted of 100% oxygen inhalation at 2.5ATA for 120 minutes once a day for 5 consecutive days. We measured VEGF levels and histologically evaluated broad vessel formation and muscle regeneration in the contused muscles. In a functional analysis, we measured the tensile strength of the calf muscles at the final observation point. We also evaluated the effects of a (ROS)/RNS inhibitor (NAC) or RNS specific inhibitor (L-NAME) in the HBO group. An ANOVA test was performed to significantly increase the total muscle performance (NT group: 311.2 ± 58.2 pg/ml, HBO group: 827.5 ± 83.8 pg/ml) and promoted broad vessel formation at 3-7 days after contusion (3 days: NT group: 0.04 ± 0.02 /HPF, HBO group: 0.4 ± 0.1 /HPF, 5 days: NT group: 0.82 ± 0.2 /HPF, HBO group: 2.14 ± 0.7 /HPF, 7 days: NT group: 2.8 ± 0.8 /HPF, HBO group: 5.9 ± 0.9 /HPF). Administration of both NAC and L-NAME before HBO suppressed angiogenesis (7 days: NAC group: 3.4 ± 0.8 /HPF, L-NAME = HBO group: 2.9 ± 0.6 /HPF) and muscle regeneration (NT group: 20.2 ± 2.2 /HPF, HBO group: 34.6 ± 3.2 /HPF, NAC + HBO group: 20.0 ± 2.4 /HPF, LNAME + HBO group: 19.4 ± 1.5 /HPF) even after HBO. RNS inhibition is more important for the effects of HBO. CONCLUSIONS: HBO increased angiogenesis mainly through generation of RNS in the early phase and promoted muscle regeneration after muscle contusion injury.

### METHODS

To analyze ECC exercise-induced muscle damage in lumbar paraspinal muscles assessed via MRI.

**METHODS:** Ten participants (167±33.6y; 174±8.7m; 71±12kg) were included in the study. Quantitative paraspinal muscle constitution of M. erector spinae and M. multifidus was assessed in supine position before and 72h after an intense eccentric trunk exercise bout in a mobile 1.5 tesla MRI device. MRI scans were recorded on spinal level L3 (T2-weighted TSE: echo sequences, 11 slices, 2mm slice thickness, 3mm gap, echo times: 20, 40, 60, 80, 100ms, TR time: 2500ms). Muscle T2 times were calculated for manually traced regions of interest of the respective muscles with an imaging software. The exercise protocol was performed in an isokinetic device and consisted of 120sec alternating ECC trunk flexion-extension with maximal effort. Venous blood samples were taken before and 72h after the ECC exercise. Descriptive statistics (mean±SD) were performed. Statistical analyses were performed with level of significance set at 0.05.* RESULTS: T2 times increased from pre- to post-ECC MRI measurements from 55±3ms to 79±28ms in M. erector spinae and from 80±3ms to 116±27ms in M. multifidus. In comparison, the remaining participants showed increases of 11±12% in M. erector spinae and 7±9% in M. multifidus, respectively. Mean CK increased 9.5-fold in the 3 HR subjects compared with the remaining 7 subjects.

**CONCLUSIONS:** The 120sec maximal ECC trunk flexion-extension protocol induced high amounts of muscle damage in 3 participants. Moderate to low responses were found in the remaining 7 subjects, assuming that inter-individual predictors play a role regarding physiological responses to ECC workload.

### RESULTS

Muscle stiffness in elbow flexors.

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(No relevant relationships reported)

We recently demonstrated body fat% , fast ball velocity, and RPE were significant predictors of valgus torque in NCAA baseball pitchers. Even though changes in hyperemic-induced limb volume are associated with acute, repetitive pitching performance, possibly indicating approaching dominant elbow soft-tissue risk, no investigation, to our knowledge, has examined relationships between performance, biomechanics, and hyperemic-induced changes in collegiate baseball pitchers during game-simulated pitching sessions of 40, 80, or 120 pitches.

**METHODS:** Following informed consent, 5 male subjects (age = 18.8 ± 0.8 years; BMI = 27.6 ± 1.5; 6 body density ± 1.8; 6 body fat ± 10%) performed ECC pitching at 72 pitches (0-20 rpm) block-assigned to groups of 40, 80, or 120 pitches. Bouts consisted of 10 pitches (-20-10 pitches) between deliveries from an artificial mound with a 1-2 mns rest between bouts. HR and RPE were recorded immediately following each 10-pitch bout. A MOTUS sensor and compression sleeve measured elbow valgus torque. A Stalker Star II Radar Gun measured fastball velocity. Pre-test and post-test upper- and lower-extremity limb girths were measured, signifying reactive hyperemia. Wilcoxon non-parametric testing determined pre- to post-test differences. Pearson correlation identified relationships between variables. Alpha was set at p ≤ 0.05.

**RESULTS:** No group differences were found on any performance, biomeetric, demographic, or hemodynamic variable. HR (72.6 ± 8.9rpm vs. 97.6 ± 10.0rpm, p = 0.02) and dominant forearm limb girth (29.4 ± 1.5cm vs. 30.9 ± 1.5cm, p = 0.04) increased from pre-test to post-test for subjects combined. Significant correlations were found for: pitching volume & post-test HR (r = 0.90, p = 0.039); post-test dominant upper arm circumference & RPE (r = 0.89, p = 0.042); and, valgus torque % change & pitching volume (r = 0.91, p = 0.031).

**CONCLUSIONS:** Forearm limb girth increased for subjects combined, and; given this metric’s indication of reactive hyperemia, future research focused on elucidating and interpreting the biological components of the tissue (compartments), as well as their contribution to performance- and/or injury-specific outcomes, is warranted.

### RESULTS

Skeletal muscle and exercise performance adapt to high intensity interval training (HIIT). Downhill running is an eccentric-biased exercise modality whereas uphill running is concentric-biased and flat running has aspects of both. Therefore, variation in adaptation may differ with HIIT done on flat (F) or uphill (UH) or downhill (DH) gradients. PURPOSE: To compare the training effect of three modes of HIIT on laboratory and outdoor performance and muscle cross-sectional area (CSA) and satellite cell number per fiber (SC). **METHODS:** 17 fit, but not elite, young adult male runners volunteered for HIIT: 6 sets of 3 minutes and 1-minute rest between, for 10 sessions over 4 weeks. Gradients were: flat (F: 0%), uphill (UH: -4.5%), downhill (DH: -10%). Performance tests included pre- and post-tests, where the HIIT protocols were performed on the respective gradients.

**RESULTS:** No group differences were found on any performance, biomeetric, demographic, or hemodynamic variable. (No relevant relationships reported)

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We measured VEGF levels and histologically evaluated blood vessel formation and muscle regeneration in the contused muscles. In a functional analysis, we measured the tensile strength of the calf muscles at the final observation point. We also evaluated the effects of a (ROS)/RNS inhibitor (NAC) or RNS specific inhibitor (L-NAME) in the HBO group. An ANOVA test was performed to significantly increase the total muscle performance (NT group: 311.2 ± 58.2 pg/ml, HBO group: 827.5 ± 83.8 pg/ml) and promoted broad vessel formation at 3-7 days after contusion (3 days: NT group: 0.04 ± 0.02 /HPF, HBO group: 0.4 ± 0.1 /HPF, 5 days: NT group: 0.82 ± 0.2 /HPF, HBO group: 2.14 ± 0.7 /HPF, 7 days: NT group: 2.8 ± 0.8 /HPF, HBO group: 5.9 ± 0.9 /HPF). Administration of both NAC and L-NAME before HBO suppressed angiogenesis (7 days: NAC group: 3.4 ± 0.8 /HPF, L-NAME = HBO group: 2.9 ± 0.6 /HPF) and muscle regeneration (NT group: 20.2 ± 2.2 /HPF, HBO group: 34.6 ± 3.2 /HPF, NAC + HBO group: 20.0 ± 2.4 /HPF, LNAME + HBO group: 19.4 ± 1.5 /HPF) even after HBO. RNS inhibition is more important for the effects of HBO. CONCLUSIONS: HBO increased angiogenesis mainly through generation of RNS in the early phase and promoted muscle regeneration after muscle contusion injury.

### RESULTS

Eccentric (ECC) exercises might cause muscle damage, characterized by delayed-onset muscle soreness, elevated creatine kinase (CK) levels and local muscle oedema, shown by elevated T2 times in magnet resonance imaging (MRI) scans. Previous research suggests a high inter-individual difference regarding these systemic and local responses to ECC workload. PURPOSE: To analyze ECC exercise-induced muscle damage in lumbar paraspinal muscles assessed via MRI.

**METHODS:** Ten participants (167±33.6y; 174±8.7m; 71±12kg) were included in the study. Quantitative paraspinal muscle constitution of M. erector spinae and M. multifidus was assessed in supine position before and 72h after an intense eccentric trunk exercise bout in a mobile 1.5 tesla MRI device. MRI scans were recorded on spinal level L3 (T2-weighted TSE: echo sequences, 11 slices, 2mm slice thickness, 3mm gap, echo times: 20, 40, 60, 80, 100ms, TR time: 2500ms). Muscle T2 times were calculated for manually traced regions of interest of the respective muscles with an imaging software. The exercise protocol was performed in an isokinetic device and consisted of 120sec alternating ECC trunk flexion-extension with maximal effort. Venous blood samples were taken before and 72h after the ECC exercise. Descriptive statistics (mean±SD) were performed. Statistical analyses were performed with level of significance set at 0.05.* RESULTS: T2 times increased from pre- to post-ECC MRI measurements from 55±3ms to 79±28ms in M. erector spinae and from 80±3ms to 116±27ms in M. multifidus. In comparison, the remaining participants showed increases of 11±12% in M. erector spinae and 7±9% in M. multifidus, respectively. Mean CK increased 9.5-fold in the 3 HR subjects compared with the remaining 7 subjects.

**CONCLUSIONS:** The 120sec maximal ECC trunk flexion-extension protocol induced high amounts of muscle damage in 3 participants. Moderate to low responses were found in the remaining 7 subjects, assuming that inter-individual predictors play a role regarding physiological responses to ECC workload.
POSSIBLE causes of these changes include muscle damage and oxidative stress on muscle injury markers and oxidative stress.

Methods: Thirteen healthy males were randomized into three groups: 

1. Control group (K, n = 7) 
2. Maximal eccentric exercise group (M, n = 8) 
3. Maximal eccentric exercise performed before maximal eccentric exercise which causes muscle damage (DY+M, n = 7)

All participants performed 6 x 5 sets of maximal EC at 90°/sec angular velocity on non-dominant elbow flexors and had no previous experience with eccentric exercise. EIMD symptoms, MVIC, ROM, muscle swelling, soreness, and serum CK activity were measured.

RESULTS: There were significant differences from those of baseline in MVIC, ROM, muscle swelling, soreness, fatigue, and stiffness at each session. Muscle swelling and stiffness in biceps brachii m. had statistical differences between sessions. Although CK and EI had no significant differences in ECC2, there were significant differences from those of baseline in ECC1. Additionally, there were statistical differences between sessions in CK and EI. Maximal eccentric exercise per maximal eccentric exercise which causes muscle damage and oxidative stress on muscle injury markers and oxidative stress.

CONCLUSIONS: Tetracosactidin before and immediately after EC decreased the magnitude of muscle damage and oxidative stress on muscle injury markers and oxidative stress.
**PURPOSE:** The purpose of this study was to examine the acute androgen receptor (AR) and glucocorticoid receptor (GR) response to a moderate intensity resistance exercise bout in resistance trained (RT) and untrained men (UT).

**METHODS:** RT men (n = 10; X ± SD, age = 21.3 ± 1.7 yrs, height = 175.8 ± 6.8 cm, body mass = 84.5 ± 13.5 kg, back squat 1RM = 154.3 ± 19.3 kg, training history = 5.4 ± 2.0 yrs) and UT men (n = 9; X ± SD, age = 20.8 ± 3.1 yrs, height = 178.7 ± 8.9 cm, body mass = 81.0 ± 14.0 kg, squat 1RM = 108.1 ± 13.7 kg, training history = 0.7 ± 1.7 yrs) volunteered for this study. Prior to the RT bout, subjects were strength tested for back squat (BS) and leg extension (LE). Subjects returned 4-7 days later between 10am-2pm, and completed a RT bout consisting of 6 sets of 10 repetitions of BS at 75% 1RM, immediately followed by 4 sets of 10 repetitions of LE at 75% 1RM with a 1.7 min rest between all sets. Muscle samples were collected from the vastus lateralis prior to exercise (PRE) and 10 min (10P), 30 min (30P), 60 min (60P), and 180 min (180P) post exercise. Total AR and GR expression was determined via western blotting. Receptor data were not normally distributed, thus all receptor data were log transformed. Results were not normally distributed, thus all receptor data were analyzed using Mann-Whitney U test, Friedman test, and Wilcoxon signed-rank text. **RESULTS:** For total AR expression, there were no differences between time points within the RT group (p > .05); however, there were differences between time points within the UT group (p < .01). In the UT group, total AR expression significantly decreased at 30P (-19%, z = -2.192, p = .027) and 60P (-11%, z = -2.192, p = .027) post exercise, but returned to baseline values by 180P (z = -1.78, p > .05). For total GR content, there were no differences between time points within the RT or UT groups (p > .05). Total GR content was significantly greater in the RT group compared to the UT group at 10P (Mann-Whitney U = 19, z = 2.123, p = .035).

**CONCLUSIONS:** While no changes were observed for AR expression in the RT group, the UT subjects experienced a significant decrease in AR expression at 30P and 60P suggesting acute AR responses vary depending on training status. No differences were seen across time for the GR in each group; however, RT and UT subjects were different from each other at 10P. It is unclear if these responses are related to the acute hormonal response; therefore, future research will address this.

**RESULTS:** There were significant group differences for all MHC isoforms, where PL had a higher proportion of MHC I (p < .001) and Ila (p < .010) content relative to CON. Conversely, PL had a significantly lower proportion of MHC Ix content versus CON (p < .001). There was a significant gender effect for MHC Ila fibers, where females had a higher proportion versus males (p < .021). Lastly, Pearson correlation analysis revealed a non-significant, low correlation between MHC Ila content and Wilks coefficient (r = -0.288, p = .364).

**CONCLUSIONS:** These results illustrate that powerlifting-style training may result in higher proportions of MHC I and Ila fibers, as well as losses in MHC Ix content. Contrary to previous literature, our data also show a higher proportion of fast-twitch MHC Ila fibers in females versus males. Overall, MHC Ila content is not a significant predictor of powerlifting performance as per Wilks coefficient, suggesting other biochemical markers and/or neural efficiency underlie variations in skill.

**Muscular fatigue has been reported to have varying effects depending on sex. Both males and females incur deficits in strength resulting from strenuous activity but males suffer greater relative deficits. Similarly, in a fatigued state, males may be relatively less able to activate muscles. PURPOSE: We sought to determine whether the decrease in strength that males and females suffer is related to changes in their voluntary activation (%VA). METHODS: Twenty-two untrained, college-aged, males (11) and females (11) participated. Subject’s dominant lower leg was strapped to an attachment set at an angle of 110° (180° = full extension) for isometric knee extensions. At pretesting, subjects performed maximal voluntary contractions (MVC) and the interpolated twich technique was applied to assess %VA. Following initial testing, a fatiguing protocol was performed which consisted of 20 six-second MVCs with 3 seconds in between. In the fatigued state, subjects again performed an MVC and %VA was assessed. Linear regression was performed to determine if the variance in fatigability, as measured by change in MVC, can be accounted for by changes in %VA for each sex. RESULTS: Regression showed that 15.3% and 1.1% of the variance in force loss could be explained by changes in %VA in males and females, respectively. However, neither of these models were significant (p = 0.233 and p = 0.760). The results are shown in the figure below for both males (circles) and females (triangles). A 2-way mixed-factorial ANOVA showed neither a group x time interaction (p = 0.296), nor a main effect for time (p = 0.288) for %VA. CONCLUSIONS: The findings suggest that voluntary activation was not responsible for the force loss with fatigue observed in either males or females. For the females, this could be partially due to the fact that many of them had minimal changes in MVC from the fatigue protocol, whereas all of the males showed at least a 10% deficit. However, there were no differences in %VA between males and females.**
Eight young healthy males were recruited for this study. After completing an incremental test to exhaustion on a single-leg knee extensor ergometer, the subjects performed two tests on separate days. On the first day, they performed a time-to-exhaustion test at 85% of their maximal power output (No-PreF trial). Exercise-induced quadriceps muscle fatigue was assessed by supramaximal electrical femoral nerve stimulation evaluating changes in the potentiated resting twitch force ($Q_{0.5rest}$), maximal voluntary contraction (MVC) and voluntary activation (VA) from pre to post exercise. On the second day, the same exercise bout was preceded by the induction of fatigue in the contralateral quadriceps through electrical stimulation (PreF trial). The pre-fatiguing protocol was terminated once the subjects reached the maximum tolerated torque during a 1-310 voluntary contraction. To overcome these limitations, in the present study we present the effects of prolonged running on quadriceps strength and plasma calprotectin levels and examine the relationship between these two factors.

**Methods:** Trained men and women ($n=11$) age 39 ± 7 years participated in a 50-kilometer(t) trail run consisting of 15 lap 10ks. Seated knee extensor force was measured before the race, after each lap, immediately post-race and 24h post-race using a hand-held dynamometer. Quadriceps torque (Nm) was calculated by multiplying tibial length by force. Blood was drawn 30 minutes after participants finished eating their pre-race meal, after the first lap (10k), within 60 minutes of finishing the race and 24h post-race. Plasma calprotectin was measured using an enzyme-linked immunosorbent assay (ELISA). Results: Quadriceps torque did not significantly change from pre-race to lap 1 (P=0.64), but significantly declined post-race (l=10%, P=0.047) and returned to pre-race values by 24h post-race (P=0.1). Compared with lap 1, quadriceps torque declined significantly by lap 2 (-9%; P=0.024) but remained unchanged from lap 2 through post-race (between -10% and -8%) from lap 2 through post-race; P=0.05 for each timepoint). Plasma calprotectin increased 63% at lap 1 (P=0.001), and returned to pre-race levels by 24h post-race (P=0.66). Pre-race calprotectin levels directly correlated with quadriceps torque at lap 1 (r=0.627, P=0.023), post-race (r=0.771, P=0.005) and 24h post-race (r=0.767, P=0.006). Plasma calprotectin levels 24h post-race directly correlated with 24h post-race quadriceps torque ($r=0.604, P=0.04$). Conclusion: Athletes participating in a 50k ultramarathon experienced an acute decline in quadriceps torque that coincided with an acute increase in plasma calprotectin concentrations. Both torque and plasma calprotectin returned to pre-race values after 24h. The relationships between calprotectin levels and muscle torque before, during, and after the race suggest a potential novel role for calprotectin in muscle recovery from an ultramarathon.

**Funding:** No funding was received for this study

**No relevant relationships reported**

**Ultrasim marathon running has increased in popularity over the past decade. However, the effects of prolonged running on novel circulating inflammatory factors, such as calprotectin, and their relationship to muscle strength are not completely understood. Purpose:** Determine the effects of prolonged running on quadriceps strength and plasma calprotectin levels and examine the relationship between these two factors.

**Methods:** Trained men and women ($n=11$) age 39 ± 7 years participated in a 50-kilometer(t) trail run consisting of 15 lap 10ks. Seated knee extensor force was measured before the race, after each lap, immediately post-race and 24h post-race using a hand-held dynamometer. Quadriceps torque (Nm) was calculated by multiplying tibial length by force. Blood was drawn 30 minutes after participants finished eating their pre-race meal, after the first lap (10k), within 60 minutes of finishing the race and 24h post-race. Plasma calprotectin was measured using an enzyme-linked immunosorbent assay (ELISA). Results: Quadriceps torque did not significantly change from pre-race to lap 1 (P=0.64), but significantly declined post-race (l=10%, P=0.047) and returned to pre-race values by 24h post-race (P=0.1). Compared with lap 1, quadriceps torque declined significantly by lap 2 (-9%; P=0.024) but remained unchanged from lap 2 through post-race (between -10% and -8%) from lap 2 through post-race; P=0.05 for each timepoint). Plasma calprotectin increased 63% at lap 1 (P=0.001), and returned to pre-race levels by 24h post-race (P=0.66). Pre-race calprotectin levels directly correlated with quadriceps torque at lap 1 (r=0.627, P=0.023), post-race (r=0.771, P=0.005) and 24h post-race (r=0.767, P=0.006). Plasma calprotectin levels 24h post-race directly correlated with 24h post-race quadriceps torque ($r=0.604, P=0.04$). Conclusion: Athletes participating in a 50k ultramarathon experienced an acute decline in quadriceps torque that coincided with an acute increase in plasma calprotectin concentrations. Both torque and plasma calprotectin returned to pre-race values after 24h. The relationships between calprotectin levels and muscle torque before, during, and after the race suggest a potential novel role for calprotectin in muscle recovery from an ultramarathon.
Fatigue-induced Changes In Neuromuscular Responses During Maximal Bilateral Leg Extensions
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Purpose: The purpose of the present study was to compare the fatigue-induced changes in neuromuscular responses from both vastus lateralis (VL) muscles during maximal, bilateral isokinetic leg extensions. Methods: Fourteen men (22.6 ± 4 yr) performed consecutive, maximal, bilateral, concentric isokinetic leg extensions at 180 °·s⁻¹ until their peak torque was reduced by 70% (67 ± 19 repetitions). The amplitude (root mean square = RMS) and frequency (mean power frequency = MPF) contents of the electromyographic (EMG) and mechanomyographic (MMG) signals from the VL muscles of both legs were recorded simultaneously during each repetition of the fatiguing bout. The EMG RMS, EMG MPF, MMG RMS, MMG MPF and torque values were normalized to the values corresponding to 10% of the total number of repetitions completed and statistically compared at 5% intervals. Four (2 right and left VL) x 19-100% of the total repetitions) repeated measures ANOVAs were used to determine mean differences for each neuromuscular parameter. A 1 x 19 repeated measures ANOVA was used to analyze torque changes across repetitions. Pair-wise comparisons were used to identify when the neuromuscular and torque values changed from the values at 10% of the total repetitions. Results: The results indicated no significant interactions involving the right and left VL of any of the neuromuscular parameters. There were, however, significant main effects for repetitions collapsed across the muscles for both MMG RMS (p = 0.03; n² = 0.147) and EMG MPF (p < 0.01; n² = 0.376). Bilateral peak torque (271.1 ± 44.6 N·m) decreased significantly (p < 0.01; n² = 0.695) from 100% to 40-100% of the total repetitions. Conclusion: The results of this study revealed no differences between the right and left VL muscles for the patterns of neuromuscular responses during the fatiguing bilateral leg extensions. Peak torque decreased by 40.3% across all repetitions and was dissociated from the patterns of responses for EMG RMS and MMG MPF. The decreases across repetitions for EMG MPF and MMG RMS suggested that the fatigued-induced decrease in torque was due to excitation-contraction coupling failure secondary to an increase in metabolic byproducts.

Method: Fifteen adults (Age: 25.2 ± 4.4 years; Weight: 76.0 ± 11.4 kg; Height: 171.1 ± 7.3 cm) participated in this study. Participants were randomly assigned to either arm (n = 8) or leg group (n = 7). After the first visit as the familiarization, Visit 2 was the eccentric exercise visit, during which the participants performed 6 sets of 10 repetitions eccentric exercise at 50% maximal voluntary isometric contraction (MVIC) in the designated muscle group (randomly chosen between dominant and non-dominant sides). Before (pre) and after (post) exercise, MVIC, submaximal isometric trapezoid contraction task, ramped MVC (R-VIC), but not VMAX (R-MVIC), DOMS were measured. Specifically, the trapezoid contraction task required the participants to gradually increase the force from 0 to 30% MVIC in 3 seconds, held it for 10 seconds, and then gradually decreased the force to 0% in 3 seconds. During the Visits 3 and 4 (24-hour post- and 48-hour post-exercise), all measurements were collected. One week after Visit 2, the exact same exercise was performed and the measurements were obtained for the contralateral muscle. The EMG signals from the biceps brachii or FDI muscles were collected, and separate three-way [group (arm vs. hand) × bout (bout 1 vs. 2) × time (pre vs. post vs. 24 post vs. 48 post)] repeated measures analysis of variances (ANOVAs) were used to examine the mean differences in dependent variables.

Results: For the biceps brachii muscle, the pre to 24 post change (delta) in ROM showed a significant difference between first bout and second bout (first vs. second bout: 27.01 ± 11.84 vs. 16.81 ± 9.88, p = 0.042). There were significant differences between first bout and second bout at 24 post (55.06 ± 11.44 vs. 37.38 ± 12.67, p = 0.006) and 48 post (65.38 ± 10.00 vs. 47.44 ± 14.99, p = 0.007) for DOMS. In addition, normalized EMG amplitude showed a significant difference between first bout and second bout at post (69.87 ± 25.41% vs. 41.37 ± 17.13%, p = 0.009). However, there was no conRBE in all dependent variables on FDI muscle.

Conclusion: The elbow flexor muscles showed conRBE, but hand muscle did not have any protective effect. Therefore, conRBE seems to be muscle specific.
The number of jumps figure skaters perform daily has never been formally quantified, though it has been suggested that skaters perform 50-100 jumps per training day. The magnitude of force, high loading rates, and frequent repetitions likely contribute to the high injury rate of competitive skaters. Monitoring the number of jumps performed may help decrease risk of injury, similar to the institution of pitch counts in youth baseball.

Activity monitors that are commonly used for activities such as walking and running record many false positives during figure skating jump quantification due to the variety of skating movements that generate similar acceleration profiles. Previously, we developed an algorithm that successfully counted 39 of 40 jumps performed during the competitive routines of 7 local skaters whose isolated jumps were used to create the algorithm.

**Purpose:** To test the performance of the algorithm on an independent sample of skaters of varying skill levels.

**Methods:** 18 healthy competitive figure skaters participated in this study (ages 8-26y, 12 female). Each skater wore an IMU affixed to the lower back while they performed a variety of jumps, spins, and footwork. A high speed video camera recorded all trials for validation purposes. Custom software was used to analyze the IMU data to quantify the number of jumps performed with ≥1 rotation.

**Results:** Analysis of the videos showed that we recorded a total of 200 jumps with ≥1 rotation. The algorithm correctly quantified 94.3% of the jumps in this dataset (189 successful jumps). It also identified 11 jumps with ≤1 rotation.

**Conclusions:** These results show that this algorithm can be successfully applied to a unique dataset. Many of the jumps with ≤1 rotation that were counted were “popped” jumps, where a skater intends to perform a multi-revolution jump prior to take-off, but perform a single instead. Multi-revolution jumps that were not counted included falls and those with too much rotation that occurs on the ice prior to take-off. Finally, this dataset showed that the algorithm may need to be customized for smaller and/or low-level skaters as it failed to identify 7 of 12 jumps performed by a small, beginning level skater (8y, 122cm, 23.6 kg). Further improvements may be made by using machine learning algorithms to differentiate types of jumps as well as jump count.

In-shoe pressure sensor systems have been used to measure vertical ground reaction forces (GRFs) during functional tasks in clinical settings. However, no study has evaluated their reliability and validity during functional tasks in healthy soccer players.

**Purpose:** To determine the test-retest reliability of the peak plantar pressure measured by an in-shoe pressure system during landing from long-jump (LLJ) and landing from heading-jump (LHJ) performed by healthy soccer players. A second purpose was to evaluate the concurrent validity of the peak plantar pressure in relation to the peak vertical GRFs obtained using a force plates system as a criterion reference during both landing maneuvers.

**Methods:** Ten healthy soccer players (age: 25.6 ± 2.67; BMI: 22.74 ± 2.33) participated in this study. LLJ included jumping forward and landing on the force plates, whereas LHJ included jumping forward to head a soccer ball and landing on the force plates. Each participant performed five trials of each landing maneuver. Within each day of initial testing, participants were asked to perform five trials of each landing task. Peak plantar pressure and peak vertical GRFs were measured during the landing phase (from initial contact to maximum bilateral knee flexion).

In-tra-class correlation coefficients [ICC (3,2)] were used to determine test-retest reliability. Pearson product-moment coefficient of correlations (r) were calculated to compare the peak plantar pressure with the peak vertical GRFs.

**Results:** Test-retest reliability exhibited good reliability: ICC values ranged from 0.916 to 0.981 for left limb peak acceleration and 0.903 to 0.978 for right limb peak acceleration. ICCs for RMS of left and right limb ranged from 0.908 to 0.979 and 0.899 to 0.977 respectively. Conclusions: The IMUs showed good to excellent reliability for both peak and RMS total acceleration across both limbs during the forward lunge. This demonstrated the potential for their integration as a clinical tool to provide quantified measures of an individual’s forward lunge performance.

The integration of inertial sensor data into the clinical environment and beyond, demonstrates the potential of improved clinical interpretation of an individual’s functional movement capacity. Previously this has only been possible through the use of expensive laboratory-based motion capture systems. The forward lunge, a lower limb functional movement which exaggerates the gait cycle is commonly used by clinicians to assess lower limb strength, flexibility and balance. Combining Inertial measurement units with the forward lunge exercise could provide a quantified measure which was previously not possible in the clinical setting. **Purpose:** To determine the intra-session-reliability of kinetic measures derived from shank based inertial sensors during a forward lunge. **Methods:** Twenty-three healthy participants took part in the study (12 Male, 11 Female, 30.8 ± 0.6yrs, 1.7 ± 0.09m, 65.3 ± 10.8kg). Each participant performed 3 sets of 5 lunges bilaterally, each with a 10 min rest period to establish intra-session reliability. Each lunge was segmented into initiation, initial contact, mid-point, and termination. Peak & root mean squared (RMS) of total acceleration signals of the shank based IMU were taken for all lunges. Intra-class correlation coefficients (ICCs) were calculated based on a mean rating (k=3), absolute agreement two-way mixed effects model. Intero-session reliability was defined as poor (ICC<0.5), moderate (0.5-0.75), good (0.75-0.9) and excellent (≥0.9). Results: ICC values ranged from 0.916 to 0.981 for left limb peak acceleration and 0.903 to 0.978 for right limb peak acceleration. ICCs for RMS of left and right limb ranged from 0.908 to 0.979 and 0.899 to 0.977 respectively. Conclusions: The IMUs showed good to excellent reliability for both peak and RMS total acceleration across both limbs during the forward lunge. This demonstrated the potential for their integration as a clinical tool to provide quantified measures of an individual’s forward lunge performance.

In-shoe pressure sensor systems have been used to measure vertical ground reaction forces (GRFs) during functional tasks in clinical settings. However, no study has evaluated their reliability and validity during functional tasks in healthy soccer players. **Purpose:** To determine the test-retest reliability of the peak plantar pressure measured by an in-shoe pressure system during landing from long-jump (LLJ) and landing from heading-jump (LHJ) performed by healthy soccer players. A second purpose was to evaluate the concurrent validity of the peak plantar pressure in relation to the peak vertical GRFs obtained using a force plates system as a criterion reference during both landing maneuvers.

**Methods:** Ten healthy soccer players (age: 25.6 ± 2.67; BMI: 22.74 ± 2.33) participated in this study. LLJ included jumping forward and landing on the force plates, whereas LHJ included jumping forward to head a soccer ball and landing on the force plates. Each participant performed five trials of each landing maneuver. Within each day of initial testing, participants were asked to perform five trials of each landing task. Peak plantar pressure and peak vertical GRFs were measured during the landing phase (from initial contact to maximum bilateral knee flexion).

In-tra-class correlation coefficients [ICC (3,2)] were used to determine test-retest reliability. Pearson product-moment coefficient of correlations (r) were calculated to compare the peak plantar pressure with the peak vertical GRFs.

**Results:** Test-retest reliability exhibited good reliability: ICC values ranged from 0.916 to 0.981 for left limb peak acceleration and 0.903 to 0.978 for right limb peak acceleration. ICCs for RMS of left and right limb ranged from 0.908 to 0.979 and 0.899 to 0.977 respectively. Conclusions: The IMUs showed good to excellent reliability for both peak and RMS total acceleration across both limbs during the forward lunge. This demonstrated the potential for their integration as a clinical tool to provide quantified measures of an individual’s forward lunge performance.

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Incorporating inertial measurement units (IMU) into screening tools affords the ability to ‘quantify’ commonly used functional tasks using angular velocity and acceleration as an outcome variable. These ‘quantified’ tasks have may have greater depth, accuracy and sensitivity than that achieved with standard clinical evaluation tools. Angular velocity can quantify how fast a segment or joint rotates, and provide a preliminary understanding of neuromuscular control during dynamic tasks including a forward lunge.

**PURPOSE:** To determine the validity of IMU-derived knee joint angular velocity during a forward lunge.  

**METHODS:** Twenty-three healthy individuals participated in this study (12M/11F, 30.8 ± 8.6yrs, 1.7 ±0.9 cm, 65.3 ±10.8 kg). Participants performed a set of 5 lunges on the right limb and 5 on the left limb, repeated 3 times separated by 10 minute rest periods. Lunge distance was normalized to 100% (±5%) of leg length. IMUs were worn on the lateral thigh and shank of each limb. The following anchor points were defined for segmentation: initiation, initial contact 1 (IC1), midpoint and initial contact 2 (IC2), termination. Peak and average thigh and shank angular velocities were extracted from the 2-axis gyroscope signal for each lunge segment and for a 50ms window either side of IC1. Peak and average knee joint angular velocity in each segment was calculated from thigh and shank data. Intraclass correlation coefficients (ICCs) were calculated based on a mean rating (k=3), absolute agreement, 2-way mixed-effects model. Intra-session reliability was defined as poor (ICC<0.5), moderate (0.5-0.75), good (0.75-0.9) or excellent (>0.9). RESULTS: ICC values ranged from 0.841 to 0.911 for peak left knee joint angular velocity and 0.760 to 0.939 for peak right knee joint angular velocity. Average left knee joint velocity had ICCs ranging from 0.912 to 0.972, and 0.922 to 0.965 for average right knee joint angular velocity. CONCLUSIONS: IMU-derived knee joint angular velocity had good to excellent intra-session reliability during a forward lunge and demonstrate good potential for providing quantified data on forward lunge performance. IMUs may provide a more accessible alternative to 3D motion analysis or screening tools for lower limb function and neuromuscular control in a clinical setting.

Individuals who rely on wheeled mobility have unique fall risk factors (e.g. seated postural control) but recommended fall risk screening tools are predominately designed for ambulatory individuals. Consequently, most non-ambulatory adults do not undergo comprehensive full fall risk screening or receive targeted fall prevention strategies.

**PURPOSE:** To examine the validity of smartphone-based postural control assessments in non-ambulatory adults.  

**METHODS:** Eleven participants (age: 55.4 ± 17.9) completed three clinical tests: The Trunk Control Test, Function in Sitting Test (FIST), and Tee-Shirt Test, as well as, four instrumented balance tasks in a standardized order: eyes open, eyes closed, functional reach, and functional stability boundary. During the balance tasks, participants held a smartphone and research-grade accelerometer to their chest. These devices measured root mean square (RMS) acceleration in the medio-lateral (ML), anterior-posterior, and vertical axes during all tasks. A median split of FIST scores differentiated participants with better and worse postural control. Spearman rank-order correlations between the two devices’ measurements were conducted, and receiver operating characteristic (ROC) and the area under the curves (AUC) were constructed to distinguish participants with better and worse postural control. RESULTS: Participant scores from the FIST differed between those with better and worse postural control (p = 0.020). There were significant moderate to strong correlations between measures derived from the smartphone and measures derived from the research-grade accelerometer during the balance tasks (p = 0.636-1.000, p = 0.001-0.035). The AUC ROC plots were significant for RMS ML sway during the eyes open test and functional stability boundary (p = 0.045 and 0.018, respectively). CONCLUSION: This pilot study illustrated that smartphone technology may be able to provide a valid assessment of seated postural control and have the ability to distinguish between those with better and worse postural control in the ML direction. Leveraging this functionality, technology could prove to be easily accessible and objective fall risk assessments for non-ambulatory adults.

**Funded by:** The National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR)

Current postural control tests for baseline concussion analysis and return to play decision making are of moderate reliability, attributed to subjective scoring. A recently developed inertial measurement unit (IMU) may offer clinicians a feasible, objective tool for postural control assessment during a concussive event. **PURPOSE:** To assess the validity of a wearable IMU against a force platform (FP) during postural control tasks in adults. **METHODS:** Twenty-four participants completed three trials of four stance conditions (double-leg, tandem, left leg, and right leg) with eyes open (EO) and eyes closed (EC). Concurrent measures of postural control (anterior-posterior and medio-lateral sway, path length, and sway area) during each stance were collected as participants stood on a single FP while wearing the IMU on the sternum. Statistical analyses were conducted on mean percentage change (MPC) from EO to EC for sway parameters from the FP and IMU during the four stance conditions. Multiple multivariate analyses of variances were conducted to determine whether statistical differences existed between instruments (p < 0.05). **RESULTS:** The differences in MPC when comparing the IMU to the FP were 5-33% for double-leg stance, 8-130% for tandem stance, 0-82% for left leg stance, and 12-178% for right leg stance across postural control measures. Significant multivariate differences were found for double-leg [F = 12.233, p < 0.001], tandem [F = 15.927, p < 0.001], left leg [F = 3.725, p = 0.011], and right leg [F = 4.031, p = 0.007] stance. Pairwise comparisons indicated significant differences for anterior-posterior sway (p = 0.010) and path length (p < 0.001) during double-leg stance and path length (p = 0.005) during tandem stance. **CONCLUSIONS:** Preliminary results indicate large differences in postural control when utilizing this IMU versus a FP for assessing sway in direct comparisons. It must be noted that sway from this IMU is projected from its center of mass. Thus, direct comparison may be misleading. Further study is suggested to incorporate the IMU projection algorithm, in order to make more appropriate direct comparisons between instruments. It is important for researchers to understand algorithms that are implemented in IMU software to determine reliability of measurement, prior to stating experimental outcomes.

**Board #223**  
**May 29 2:30 PM - 4:00 PM**  
**Validity And Reliability Of A Mobile App For Measuring Bar Velocity In The Bench Press Exercise**  
Daniel Boulosa, Alejandro Pérez-Castilla,2 Amador García-Ramos,1 Federal University of Mato Grosso do Sul, Campo Grande, Brazil.  
1University of Granada, Granada, Spain.  
2Universidad Católica de la Santísima Concepción, Concepción, Chile.  
(Sponsor: Carl Foster, FACSIM).  
**Email:** daniel.boulosa@gmail.com

**Reported Relationships:** D. Boulosa: Ownership/interest/stock; CEO and Founder of iLOAD Solutions.

**Board #224**  
**May 29 2:30 PM - 4:00 PM**  
**The Validity Of A Smartphone-based Seated Postural Control Assessment In Non-ambulatory Adults**  
Mikaela L. Frechette, Libak Abou, Laura A. Rice, Jacob J. Nossoff. University of Illinois at Urbana-Champaign, Champaign, IL.  
**Email:** mikaelal5@illinois.edu

(No relevant relationships reported)

**Board #225**  
**May 29 2:30 PM - 4:00 PM**  
**Validation Of A Wearable Inertial Sensor Unit To Measure Balance And Stay During Postural Tasks**  
Jason M. Avedesian, Mathew Sunil Varre, Ryan Tingle, Janet S. Duček, FACSIM. University of Nevada, Las Vegas, Las Vegas, NV.  
(Sponsor: Janet S. Duček, FACSIM)  
**Email:** Jason.avedesian@unlv.edu

(No relevant relationships reported)
Lower body positive pressure treadmills (LBPT) allow patients to walk in a gravity reduced environment of their total body weight with new embedded gait analysis module capable of documenting gait outcomes. PURPOSE: To validate step length (SL) measurement calculated by the LBPT against a two-dimensional camera system. METHODS: Nine participants (5 male and 4 females; mean age 30.8 years) walked and ran for five minutes at 3mph, 4mph, 5mph, and 6mph on a lower body positive pressure treadmill (LBPT). At each speed the subjects were unweighted at 80%, 60%, 40% and 20% of their total body weight (BW). A side camera view was employed to record step length. Five SL measurements from the middle minute were taken from each video from heel to heel and averaged to represent SL for each BW and speed. The right and left SL measurements from the treadmill were averaged as a composite SL measurement for analysis. Intraclass correlation coefficients were estimated for the average of five trials of the video data. Pearson correlations were calculated between step length from the treadmill and video. Correlations were considered significant at alpha .05. RESULTS: All speeds and body weight conditions exhibited excellent reliability (ICC > 0.90) for the average of five trials for the video analysis. The correlations between the treadmill and video analysis for the speeds of 3 and 4 mph showed varied correlations fluctuating from poor to good (r=-21.98) with correlations greater than r=0.85 showing statistical significance. The correlations between treadmill and cameras for the 5 and 6 mph speeds showed no statistically significant correlations ranging from r=0.02-0.69. CONCLUSIONS: The gait analysis module of the LBPT does not measure direct step length from the instrumented belt after the transition from walking to running. The LBPT might be using an algorithm to extrapolate the anticipated step length if the goal is to use that model to estimate a particular quantity (i.e. GRFvert).
### Table 1. Comparison of ground reaction forces from force plate and motion-capture system (MCS) during counter-movement vertical jumps

<table>
<thead>
<tr>
<th>Force Plate (N)</th>
<th>MCS (N)</th>
<th>t</th>
<th>t²</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Force</td>
<td>887.9±131.0</td>
<td>0.97</td>
<td>0.93</td>
<td>13.99</td>
</tr>
<tr>
<td>Peak Force</td>
<td>1662.0±368.6</td>
<td>0.92</td>
<td>0.84</td>
<td>35.72</td>
</tr>
</tbody>
</table>

(n=50); (X ± SD); * indicates significant difference (p<0.01)

Instantaneous power output measured at the cranks when cycling in a non-seated posture is not equivalent to the instantaneous joint power produced by the rider. This discrepancy is due to additional power that is generated on, and by, the rider’s centre of mass (CoM). Capturing CoM motion in a laboratory setting is relatively straightforward; however, an accurate and reliable method for measuring this in the field remains elusive.

**PURPOSE:** To test whether a single Inertial Measurement Unit (IMU) placed on the torso of the rider at L4-5 can provide an accurate and precise measure of vertical CoM displacement during non-seated cycling.

**METHODS:** We first assessed whether the IMU could track its own vertical displacement by comparing it to an attached marker cluster tracked using three-dimensional motion capture. We then compared vertical displacement of the IMU to a kinematic estimate of vertical CoM displacement using a full body musculoskeletal model. IMU (100 Hz) and motion capture (200 Hz) data was collected synchronously for 10-s on seven participants while they cycled on an ergometer in a non-seated model. IMU (100 Hz) and motion capture (200 Hz) data was collected synchronously for 10-s on seven participants while they cycled on an ergometer in a non-seated position.

**RESULTS:** In all trials, the IMU performed well with a dynamic RMS error of 0.17 ± 0.04 radians/s across all orientation components. The agreement analysis corrected for repeated measures was also performed, which encompassed the limits of agreement, accuracy, precision, average error, and maximum error between each method.

**CONCLUSIONS:** These results suggest that a single IMU can provide a highly accurate and precise measure of its own orientation and amplitude of vertical displacement. Further research is required to test whether agreement between the IMU and the model’s CoM can be improved by placing the IMU in different positions on the torso.
was normalized (n-EMG) to the MVC for the current visit. Separate paired samples similar increases in muscle activation when completing the ensuing contraction. Muscle activation when completing a contraction at pre-training torque levels and amplitudes in relation to recruitment thresholds for the VL were unchanged. Although

**CONCLUSIONS**

time and repetition.

was no significant two-way interaction (P = 0.035) and rep (41.2 ± 11.9 vs. 43.7 ± 12.7%; P = 0.039). nRTD<sub>50</sub> (433.2 ± 175.4 %MVIC/s) was related to MUNE (r = 0.531, p = 0.028) and nEMG<sub>50</sub> (r = 0.604, p = 0.010). nEMG<sub>50</sub> and TT were significant determinants (p < 0.001) that accounted for 45.3% and 15.5% of the variance in nRTD<sub>50</sub>, respectively. nEMG<sub>50</sub> was the only significant predictor (p = 0.01), explaining 36.4% of the variance in nRTD<sub>50</sub>.

**CONCLUSIONS:** These pilot data support the notion that early phase RTD is primarily determined by neural factors, even in older adults. These data also suggest that possessing a higher number of viable MUs may influence early phase absolute RTD in older men.

**METHODS:** Nine males completed 40 supervised training sessions. Pre- and post-intervention, participants performed a cycling VO<sub>2</sub>MAX test and MVCs on an isokinetic intervention, participants performed a cycling VO<sub>2</sub>MAX test and MVCs on an isokinetic

**PURPOSE**

relationships. Alpha was 0.05.

**RESULTS:** Ten weeks of training resulted in significant increases in VO<sub>2</sub>max (5.4 ± 0.6 vs. 3.8 ± 0.5 L/min; P = 0.005) while MVC was unchanged (212.7 ± 43.4 vs. 201.4 ± 32.1 Nm; P = 0.056). For the slopes and y-intercepts from the MFR and MUAP<sub>AMP</sub> vs. RT relationships, there were no significant two-way interactions (P = 0.152 - 0.669) or main effects for time (P = 0.213 - 0.653) or repetition (P = 0.131 - 0.653). For n-EMG, there was no significant two-way interaction (P = 0.485). There were main effects for time (37.3 ± 7.0 vs. 47.6 ± 12.4%; P < 0.05) and rep (41.2 ± 11.9 vs. 43.7 ± 12.7%; P = 0.044). n-EMG was greater for post-training and repetition 2 when collapsed across time and repetition.

**CONCLUSIONS:** Continuous cycling increased maximal aerobic capacity, whereas maximum strength of the knee extensors and motor unit firing rates and action potential amplitudes in relation to recruitment thresholds for the VL were unchanged. Although aerobic training is believed to improve endurance, participants exhibited greater muscle activation when completing a contraction at pre-training torque levels and similar increases in muscle activation when completing the ensuing contraction.

**RESULTS**

In young, healthy adults, early phase (i.e., 0-50 ms) rate of torque development (RTD) is primarily determined by neural characteristics. However, it is unclear if this remains the case in older adults. **PURPOSE:** To examine the physiological characteristics of early phase RTD in older men. **METHODS:** Seventeen older males (age = 73 ± 6 y) completed 2 maximal (MVIC) and 2 rapid (nMVIC) isometric knee extensions. Early phase RTD values were calculated from the first 50 ms (aRTD<sub>50</sub>) of the rapid contractions and normalized (nRTD<sub>50</sub>) to maximal torque (%MVIC/s). Muscle activation amplitude (EMG) was calculated during the first 50 ms (nEMG<sub>50</sub>) of EMG onset and was normalized to the peak-to-peak M-wave amplitude (%M<sub>P</sub>) of the vastus lateralis (VL), vastus medialis (VM), and rectus femoris (RF). Evoked peak twitch torque (TT) was determined as the maximal torque (Nm) produced from a single electrical stimulus. Motor unit number estimation (MUNE) was calculated as a ratio of the ensemble average of the single MU potential amplitude to the compound muscle action potential amplitude and was corrected for alteration. Muscle quality (MQ) was determined by examining the average muscle cross-sectional area as a ratio of the ensemble average of the single MU potential amplitude to the compound muscle action potential amplitude and was corrected for alteration. Muscle quality (MQ) was determined by examining the average muscle cross-sectional area

**RESULTS**

Individuals diagnosed with human immunodeficiency virus (HIV) are often present with impaired postural control as a consequence of proprioceptive alteration, due to secondary effects of prescription medication. **PURPOSE:** This study seeks to evaluate lower extremity neuromuscular activation during dual postural control tasks in individuals living with HIV.

**METHODS:** Twenty-three participants of Hispanic-latino origin diagnosed with HIV (18 male and 5 female, average age 55± 1.7 years) with an average CD4 count of 698.8 (22 years of HIV diagnosis) enrolled in this study. Surface electromyography (EMG) on the tibialis anterior (TA) and gastrocnemius (GA) muscles was used on the participant’s dominant leg. Each task took approximately 15 seconds to finish. Each participant was instructed to quietly stand in a bi-pedal posture on a balance foam. Four single balance and dual cognitive-balance tasks (count backwards from 100 in 5 sec, close eyes) were performed on the balance foam. **RESULTS:** The variables of interest in this study were 1) time to peak, 2) decay and, 3) duration of muscle activation for TA and GA. A repeated measure ANOVA analysis was used to compare all variables of interest. No significant difference is indicated between duration and decay of muscle activation for TA and GA across the various tasks assessed. Throughout the cognitive balance task, GA time to peak activation was slower (P < 0.001) during eyes closed (EC) head movements (HMD) (7.7 ± 0.7 seconds) when compared to HUQ with eyes open (EO) (3.0/3.1 ± 0.2 secs) and, eyes open (EO) (3.1/3.2 secs).

**CONCLUSIONS:** As the GA plays a major role in static balance, an increased fall risk could be resultant of this delay in time to peak onset. As such, our research recommends lower extremity electromyography and strength assessment in this population to forestall or decrease fall hazards.

| Table 1. Mean slope and intercept coefficients for relationships between motor unit firing properties |
|---------------------------------|-----------------|--------|
| **Mean Firing Rate vs. Recruitment Threshold** | **p-value** |        |
| **Regression Equation** | **Slope** | **Intercept** |
| VL | Proximal | $y = -0.667x + 23.49$ | 0.46 | 0.77 |
| Distal | $y = -0.753x + 22.90$ | 0.59 | 0.51 |
| RF | Proximal | $y = -0.384x + 22.34$ | 0.59 | 0.51 |
| Distal | $y = -0.343x + 32.85$ | 0.59 | 0.51 |

| **Mean Firing Rate vs. Action Potential Size** |        |
|---------------------------------|-----------------|--------|
| **Action Potential Size vs. Recruitment Threshold** | **p-value** |        |
| **Regression Equation** | **Slope** | **Intercept** |
| VL | Proximal | $y = -95.79x + 25.54$ | 0.08 | 0.25 |
| Distal | $y = -72.28x + 23.51$ | 0.77 | 0.20 |
| RF | Proximal | $y = -74.62x + 22.92$ | 0.77 | 0.20 |
| Distal | $y = -78.68x + 24.57$ | 0.77 | 0.20 |

**Board #233** May 29 2:30 PM - 4:00 PM

**EFFECTS OF CONTINUOUS CYCLING TRAINING ON MOTOR UNIT BEHAVIOR AND MUSCLE ACTIVATION DURING REPETITIVE CONTRACTIONS**

Michael A. Trevino<sup>1</sup>, Adam J. Sterczala<sup>2</sup>, Jonathan D. Miller<sup>2</sup>, Mandy E. Parra<sup>1</sup>, Hannah L. Dimmick<sup>4</sup>, Trent J. Herda<sup>1</sup>.

<sup>1</sup>University of South Alabama, Mobile, AL. <sup>2</sup>Oklahoma State University, Stillwater, OK. <sup>3</sup>Oklahoma State University, Stillwater, OK. (Sponsor: Joan Eckerson, FACSM)

**PURPOSE:** To examine the effects of 10 weeks of continuous cycling training on maximal aerobic capacity (VO<sub>2</sub>max), maximal strength (MVIC) of the knee extensors, and motor unit (MU) behavior of the vastus lateralis (VL) in sedentary males.

**RESULTS**

There were main effects for time and repetition.

was no significant two-way interaction (P = 0.485). There were main effects for time (37.3 ± 7.0 vs. 47.6 ± 12.4%; P = 0.035) and rep (41.2 ± 11.9 vs. 43.7 ± 12.7%; P = 0.044). n-EMG was greater for post-training and repetition 2 when collapsed across time and repetition.

**CONCLUSIONS:** Continuous cycling increased maximal aerobic capacity, whereas maximum strength of the knee extensors and motor unit firing rates and action potential amplitudes in relation to recruitment thresholds for the VL were unchanged. Although aerobic training is believed to improve endurance, participants exhibited greater muscle activation when completing a contraction at pre-training torque levels and similar increases in muscle activation when completing the ensuing contraction.

<sup>1</sup>Creighton University, Omaha, NE. <sup>2</sup>University of South Alabama, Mobile, AL. <sup>3</sup>Oklahoma State University, Stillwater, OK. (Sponsor: Joan Eckerson, FACSM)

**MEDICINE & SCIENCE IN SPORTS & EXERCISE®**

Board #234 May 29 2:30 PM - 4:00 PM

**PHYSIOLOGICAL DETERMINANTS OF THE RATE OF TORQUE DEVELOPMENT IN OLDER MEN: A PILOT STUDY**

Mitchel Magrini<sup>1</sup>, Ryan J. Colquhoun<sup>1</sup>, Sydnie Fleming<sup>2</sup>, Matthew C. Ferrell<sup>1</sup>, Nathaniel D.M. Jenkins<sup>1</sup>, Jason M. DeFreitas<sup>1</sup>.

<sup>1</sup>Cruigton University, Omaha, NE. <sup>2</sup>University of South Alabama, Mobile, AL. (No relevant relationships reported)
Anterior cruciate ligament (ACL) injuries are common in female athletes. Performance-based feedback (FB) may alter landing mechanics. PURPOSE: To provide peak vertical ground reaction force (PvGRF), loading asymmetry (LA), and frontal-plane (FP) video as post-landing FB to evaluate and train female collegiate athletes during single- and dual-task (ST and DT) drop landing. METHODS: 88 athletes performed both ST and DT (with/without jumping for a suspended ball) landings onto custom, portable force plates sampled at 2000 Hz. FP video showing knee-to-ankle (K:A) ratio, a surrogate for knee valgus, was recorded at 100 Hz. Performance trials were conducted in blocks of 3 ST and 6 DT pre-tests, 6 ST and 6 DT with post-visual feedback (PVGF) in body weight (BW), LA, and FP video), and 3 ST and 3 DT post-tests. RESULTS: Quartiles were determined from PVGF

**CONCLUSIONS:** PostST Grp 3 = 4.1%, Grp 4 = 11.0%, PostST to PostDT Grp 3 = 0%, Grp 4 = 1.0%). Follow-up tests revealed that Grp 3 and 4 improved PvGRF and K:A ratio from PreST to PostST that were maintained in PostDT (PVGF: PreST to PostST Grp 3 = -20.6%, Grp 4 = -32.2%, PostST to PostDT Grp 3 = 3.0%, Grp 4 = 5.2%; K:A ratio: PreST to PostST Grp 3 = 4.1%, Grp 4 = 11.0%, PostST to PostDT Grp 3 = 0%, Grp 4 = 1.0%). Grp 1 and 2 demonstrated no change in K:A ratio despite the decrease in PVGF from PreST to PostST. These changes were not maintained during PostDT (PreST to PostST Grp 1 = -11.2%, Grp 2 = -18.3%, PostST to PostDT Grp 1 = 7.8%, Grp 2 = 2.3%). CONCLUSIONS: Collegiate athletes with PreST PVGF > 4.01 BW may benefit more from performance-based landing FB that are maintained during DT scenarios.

A responsive equine simulator therapy (REST) system is a sitting device replicating motions experienced during horse riding. The mild motion induced by the REST could promote a more active sitting experience to users. Although the REST system could potentially provide the benefits associated with active sitting, the effect of a REST system on trunk motion, trunk and leg muscle activations over that of sitting on a normal chair is yet to be examined. Purpose: To quantify trunk motion patterns and trunk and leg muscle activity during sitting on a REST system compared to an office chair. Methods: 20 healthy participants (22±2 yr, 75:150 kg, 1.71:7.9 m) sat on an office chair and an office chair replicating the human motor cortex (HabO) changes in the ipsilateral motor cortex during a fatiguing task. Methods: Eleven subjects (Men:SD 20.8±1.14 yrs.) performed two maximal voluntary isometric knee extensions of the left leg before (MVCleft) and after fatigue protocol (MVCfatigue). The fatigue protocol consisted of repeated, 50-second long isometric knee extensions with the leg held at 30% MVC until failure. During the fatigue protocol, hemodynamic responses of the motor cortex were recorded at a sampling rate of 5.81 Hz using a continuous-wave functional near infrared spectroscopy system (fNIRS). Raw fNIRS signals were processed and converted to hemoglobin concentrations using an open-source software (HomER2), and the peak HbO (HbOpeak) was obtained from the final contraction before failure. MVCpeak and MVCfatigue were used to calculate the percentage of change in maximal force from the fatigue task (MVCfatigue). A Pearson’s correlation between HbOpeak and MVCfatigue was calculated using a commercial software. Results: For any given 10-sec sitting interval, the trunk center of mass traveled a greater distance during the REST condition (25.4±7.9 cm) over that of the Chair condition (3.6±1.5 cm) (p<0.001). Mean, also mean angular speeds of the trunk during sitting on the REST was greater in the sagittal plane (0.20±0.12 deg/s vs. 0.07±0.06 deg/s) (p<0.001) and in the transverse plane (0.11±0.04 deg/s vs. 0.05±0.09 deg/s) (p<0.01) than those of the Chair condition. Furthermore, average RMS EMGs of the external oblique (6.13±0.34 mv vs. 5.95±0.30 mv) (p<0.037), tibialis anterior (18.96±0.37 mv vs. 18.73±0.30 mv) (p=0.007), and soleus (9.58±0.65 mv vs. 8.70±1.10 mv) (p=0.018) were significantly higher in the REST condition than those in the Chair condition during a 10-sec interval. Conclusion: Using a REST device resulted in a significant increase in trunk motion. The elevated activities in trunk and leg muscles serve to maintain and control upper body posture. These biomechanical responses imply that people could assist in helping to establish an active lifestyle by using the REST device on a regular basis.

Performing unilateral contractions to exhaustion has been shown to lead to force deficits of both the exercised and unexercised limbs. Although limb muscles are controlled by the contralateral hemisphere of the brain, neuroimaging studies have also shown slight activation of the ipsilateral motor cortex during unilateral tasks. However, whether cortical activity of the ipsilateral hemisphere might, in part, be responsible for the force decrements in the non-fatigued limb remains unknown. Purpose: To quantify the relationship between resting state functional connectivity (rsFC) and intracortical inhibition through the duration of the cortical silent period (CSP). Results: Glutamate and GABA concentrations in the primary motor cortex were obtained using proton magnetic resonance spectroscopy (1H-MRS). Transcranial magnetic stimulation (TMS) was used to assess corticomotor excitability with the amplitude of the motor evoked potential (MEP), and intracortical inhibition through the duration of the cortical silent period (CSP). Results: Glutamate (p=0.55) and GABA (p=0.73) concentrations in M1, as well as MEPpeak (p=0.20) and CSP duration (p=0.47), did not differ between mTBI groups. There were no differences in these measures between carriers and non-carriers (p>0.50) and no significant interactions between mTBI group and ε4 carrier status for any of the four measures (p>0.07). CONCLUSION: The lack of differences in glutamate, GABA, and corticomotor excitability and inhibition across groups suggests that motor cortex function may not explain the physiology underlying differences in symptom recovery post-mTBI. While the apol allele has been associated with differences in outcome following mTBI, it did not seem to affect the function of the human motor cortex in this group of participants.

Abstracts were prepared by the authors and printed as submitted.
**Stiffness** (MVC AMP) than the UL condition. These findings suggested the greater performance fatigability during UL muscle actions may be attributable to peripheral mechanisms of fatigue.

**Methods:** Nineteen participants (10 female) performed one 10-s isometric dorsiflexion contraction at 20 and 50% maximum voluntary contraction (MVC) before and after completing 20 min of the psychomotor vigilance task (PVT). The PVT is a sustained attention reaction time (RT) task known to induce MF. Force, indwellling and surface electromyography (sEMG) of the tibialis anterior were measured prior to and immediately following the PVT. **Results:** Mean values for all variables can be found in Table 1. PVT RT and subjective fatigue increased similarly in males and females over time, indicating successful induction of MF. Mean absolute force produced at 20% and 50% MVC increased in males and females from pre- to post-PVT. However, there were no significant changes in the root mean square error of force at either contraction intensity. sEMG amplitude declined after the PVT in the 20% MVC condition with a trend towards declining at 50% MVC in both males and females. This was accompanied by a slowing of motor unit discharge rate after the PVT at 20% MVC in both sexes, but only in males at 50% MVC. **Conclusion:** Inducing MF led to changes in mean force of submaximal isometric contractions. This was accompanied by a decline in agonist muscle activity, suggesting alterations to motor control in the presence of MF.

### Table 1. Impact of PVT

<table>
<thead>
<tr>
<th></th>
<th>Pre-PVT</th>
<th>Post-PVT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Reaction time (ms)*</td>
<td>281.31 ± 32.07</td>
<td>270.40 ± 31.79</td>
</tr>
<tr>
<td>Subjective fatigue*</td>
<td>5.50 ± 1.18</td>
<td>2.44 ± 1.01</td>
</tr>
<tr>
<td>Mean force (N)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20% MVC*</td>
<td>41.37 ± 7.62</td>
<td>45.76 ± 13.19</td>
</tr>
<tr>
<td>50% MVC*</td>
<td>94.36 ± 19.41</td>
<td>105.60 ± 31.01</td>
</tr>
<tr>
<td>RMSE force (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20% MVC</td>
<td>2.32 ± 1.48</td>
<td>2.61 ± 1.46</td>
</tr>
<tr>
<td>50% MVC</td>
<td>6.25 ± 2.61</td>
<td>7.76 ± 4.98</td>
</tr>
<tr>
<td>sEMG (mV)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20% MVC*</td>
<td>0.41 ± 0.10</td>
<td>0.46 ± 0.09</td>
</tr>
<tr>
<td>50% MVC</td>
<td>0.74 ± 0.36</td>
<td>0.84 ± 0.37</td>
</tr>
<tr>
<td>MUDR (Hz)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20% MVC*†</td>
<td>15.84 ± 3.20</td>
<td>13.62 ± 2.92</td>
</tr>
<tr>
<td>50% MVC*</td>
<td>18.46 ± 3.03</td>
<td>18.65 ± 5.21</td>
</tr>
</tbody>
</table>

*Main effect of time (p<0.01); #main effect of sex (p<0.01); †interaction (p<0.02). RMSE = root mean square error; sEMG = surface electromyography; MUDR = motor unit discharge rate.
to participating in this cross-sectional study (average values of all three groups in the chronic AKP patients with (n=14; ACL reconstruction=5, meniscectomy=4, and a history of knee surgery, to matched healthy controls.

It is unclear if a history of knee surgery additively affects quadriceps dysfunction in patients with chronic anterior knee pain (AKP). PURPOSE: To examine differences in muscle activation signal decay (MVC) between females and males.

Method: Eighty healthy females and 50 healthy males performed 5 trials of step-up before and after a sustained fatiguing isometric leg extension task of 20% maximal voluntary contraction (MVC). VMO and VL EMG signals were recorded and normalized to percent maximum. Results: Males took longer to perform the step-up than females (P<0.05), but the speeds did not change with fatigue. With sexes pooled, the activation levels of both VMO and VL during the step-up were lowered following fatigue (pre- vs. post-fatigue: VMO: 21.2% vs. 16.7% MVC, VL: 28.3% vs. 21.7% MVC, both P<0.05). Normalized pre-fatigue VL activation levels were lower in males than in females (11.6% vs. 45.0% respectively, P<0.05), whereas pre-fatigue VMO levels were similar between the sexes (males: 13.1% vs. females: 29.4% MVC). After fatigue, there was no difference in VMO and VL activation levels between the sexes, indicating greater fatiguing in the VL relative to the VMO in females (activation %males - %females/ female VL - VMO: -11% vs. -5%, P<0.05). In males, the VMO and VL fatigued to a similar degree (VL vs. VMO: -2.5% vs. -3.3%). During the sustained isometric fatiguing contraction, the female VL tended to be activated to a greater degree than the VMO, whereas males activated both muscles more equally (VL/VMO activation ratio, 1.55 vs. 0.86, females vs. males, P=0.084).

Conclusion: Our results show that males and females exhibit different relative VMO-VL neuromuscular fatigue patterns. Females tend to rely more on the VL than the VMO during fatigue while males tend to use both muscles equally.

It is unclear if a history of knee surgery additively affects quadriceps dysfunction in patients with chronic anterior knee pain (AKP). PURPOSE: To compare quadriceps function (strength, activation, and power) in chronic AKP patients with or without a history of knee surgery, to matched healthy controls.

Method: Twenty-eight chronic AKP patients with (n=14; ACL reconstruction=5, meniscectomy=4, and a history of knee surgery, to matched healthy controls.

Results: There was an average 6.7% increase in activation (P=0.02), of the four calf muscle groups being tracked, after 15 min of barefoot walking. Muscle activation signal slowly decreased for 10 mins before plateauing at around 5.7% activation above the pre-exercise levels (P=0.07). This post exercise activation level remained relatively constant for over 30 mins.

Conclusion: Muscle activation from walking can be accurately measured immediately after exercise but continued measurements taken after 10 mins of scanning, post-low intensity exercise, may be affected by factors related to the MRI scanning procedure and not changes in actual muscle activation. This post exercise activation level plateau may be due to tissue heating or other factors related to prolonged scanning.

The bilateral deficit (BLD) phenomenon is an inability to maximally contract bilaterally as compared to the sum of the corresponding unilateral contractions, and is expressed as an index (BI). The underlying mechanism is unknown, but altered transcallosal inhibition (TCI) and diminished voluntary activation (VA) during bilateral homologous (BH), as compared to bilateral non-homologous (BNH) and unilateral tasks, is considered the most likely mechanism. PURPOSE: To examine corticospinal activity during BH, BNH, and unilateral maximal contractions, and resultant changes from task practice. METHODS: Eleven healthy adults (6 women/5 men, 25.6±3.7years; 171.8±1.4cm; 74.4±2.1kg) participated in the counterbalanced repeated measures study. TCI and VA were assessed with transcranial magnetic stimulation for BH, BNH, and unilateral dominant flexion (DF) sessions 1 and 7. For sessions 2-6, five of each BH elbow flexion, BNH flexion/extension, and DF maximal voluntary isometric contraction (MVIC) tasks were practiced. Paired t-tests or Wilcoxon signed-rank tests, as appropriate, were used to test TCI and VA between sessions 1 and 7. Pearson or Spearman correlation coefficients, as appropriate, between VA and TCI measures and BLD and peak force measures were used to assess any association between neurophysiological and performance variables on test days 1 and 7. RESULTS: There were no differences in VA or TCI between BH, BNH, and DF. BH VA decreased from day 1 (95.1±4.3%) to day 7 (92.2±4.4%, P=0.014), but did not exceed the minimal detectable change (6.47). VA for BH (r = -0.655; p = 0.039) and DF (r = -0.636; p = 0.035) was associated with BH BI on day 1. When associated with peak force, day 7 BH (r = -0.627, p = 0.039) and BNH (r = -0.682, p = 0.021) TCI was corrected.

CONCLUSION: BI was similar to prior research, but neurophysiological measures did not explain these differences. This is similar to previous equivocal research between BH and unilateral maximal force and TCI and/or VA, suggesting differences in BH and BNH BI are not solely influenced by neural drive modifications.

Muscle activation can be measured through a technique called muscle functional magnetic resonance imaging (mMRI), which uses T2 signal decay in muscle tissue to measure activation. This method allows for activation of deep muscles to be measured in a noninvasive way. However, this method requires users to account for the intensity of subjects’ previous activity and allow for sufficient rest time to assure the accuracy of measurements. Purpose: To determine a method to assess calf muscle activation from a single bout of walking.

Methods: Four participants (female=2; 20-25 y) having had minimal activity prior in the day rested their legs for over an hour to assure the calf muscle activation had completely returned to baseline prior to scanning. A pre-exercise scan of the participants right calf muscle was performed to measure baseline activation. Participants then walked barefoot on a treadmill at a brisk pace (~3.5mph) for 15 mins. Immediately after, they were scanned in the same location of the calf every 2 mins for the next 7 mins. Results: There was an average 6.7% increase in activation (P=0.02), of the four calf muscle groups being tracked, after 15 min of barefoot walking. Muscle activation signal slowly decreased for 10 mins before plateauing at around 5.7% activation above the pre-exercise levels (P=0.07). This post exercise activation level remained relatively constant for over 30 mins.

Conclusion: Muscle activation from walking can be accurately measured immediately after exercise but continued measurements taken after 10 mins of scanning, post-low intensity exercise, may be affected by factors related to the MRI scanning procedure and not changes in actual muscle activation. This post exercise activation level plateau may be due to tissue heating or other factors related to prolonged scanning.
There is a discrepancy in relation to the pre-classification intensity of Pilates exercises (PE) and their real impact on muscular activation compromising training prescription. PURPOSE: To compare five muscles EMG activation during seven PE.

METHODS: Surface EMG were recorded for lower (LRA) and upper rectus abdominis (URA), internal (IO) and external obliques (EO) and multifidus (MS) muscles, while seventeen women performed the Rolling Like a Ball basic (RLBas), Rolling Like a Ball intermediate (RLInt), Rolling Like a Ball advanced (RLAdv), the Seal, Open Leg Rocker (OLR), The Hundred basic, and The Hundred advanced (HDadv) exercises. RESULTS: For the URA, LRA, IO and EO muscles, the exercises RLBas (21.94% ± 7.3; 26.31% ± 9.7; 51.59% ± 11.6; 55.90% ± 13.5, respectively), RLInt (20.72% ± 11.52; 29.27% ± 9.8; 36.76% ± 16.44; 44.91% ± 15.95, respectively), RLAdv (25.29% ± 7.53; 30.89% ± 9.66; 35.35% ± 8.87; 43.88% ± 13.09), SL (24.11% ± 13.53; 33.28% ± 13.87; 35.15% ± 16.37; 37.76% ± 17.24, respectively), OLR (21.91% ± 10.78; 30.94% ± 11.39; 33.65% ± 13.87; 34.26% ± 10.26, respectively) and HDbas (53.92% ± 16.6; 47.92% ± 20.59; 36.54% ± 16.83; 46.64% ± 26.05, respectively) exercises presented significant less EMG percentage when compared to HDadv (71.69% ± 18.03; 75.69% ± 17.44; 57.86% ± 16.49; 88.71% ± 30.40, respectively). Besides, for the URA muscle significant (p<0.001) more EMG percentage was found comparing the HDbas to the RLBas, RLInt, RLAdv, SL and OLR exercises. Furthermore, for the MS muscle, significant greater EMG was found when compared the RLBas (27.59% ± 10.95), RLInt (27.68% ± 12.9), RLAdv (32.26% ± 13.29) and SL (32.13% ± 13.81) exercises to the HDbas (7.99% ± 3.20; p<0.001) and HDadv (9.89 ± 3.08; p=0.001; p<0.001; p=0.002, respectively) exercises.

CONCLUSIONS: The HDadv was the most effective exercise in producing muscular activity of the spinal flexors, while the other exercises could be grouped at the same moderate level of intensity for the LRA, URA, IO and EO muscles. Contrary to the current PE prescription, the RLBas, RLInt, RLAdv and SL exercises, although indicated as spinal flexors exercises (less than 30% of maximum for spinal flexor muscles), seemed to play a more significant role in the activation of MS, resulting in a moderate EMG activation. Supported by Capes and CNPq.

Fascicle length and pennation angles during muscle contraction are often used in biomechanical models of the muscle-tendon complex to understand the functional roles of muscles and tendinous tissues. However, previous studies have focused on the lower limb muscles, information on fascicle behavior of the upper limb muscles is missing. PURPOSE: Ando et al. (2016) showed different between superficial and deeper limb muscles, information on fascicle behavior of the upper limbs is missing. METHODS: Thirteen healthy men and women performed isometric elbow extension tasks at 50% and 75%MVC (8.7 ± 15.95, respectively). Of interest, TCI was highly correlated with force, revealing neurophysiological equivalence of the muscular behavior. Correlation coefficients between force and TCI were 0.85 and 0.87, respectively.

CONCLUSION: There was no significant Pennation Angle change during 50% (8.7 ± 0.3 to 7.6 ± 0.3 cm, P < 0.05) and 75%MVC (8.7 ± 0.3 to 7.5 ± 0.3 cm, P < 0.05) vs. 60% (8.7 ± 2.0 ± 7.2 ± 0.2 cm, P < 0.05) at 90° of extension. There was no significant fascicle shortening in the TB-Med muscle under any conditions. There was no significant change from rest in either muscle. The pennation angle of the TB-Long (e.g. rest, 12.9 ± 0.8° at 90°) was significantly greater than that of the TB-Med (e.g. rest, 9.3 ± 0.5° at 90°) under all conditions. Conclusion: These results suggest that fascicle shortening in the TB-Med muscle occurs in flexion; however, no change was found in the TB-Lat. Different MTC features between superficial and deep muscles will be developed in the upper limbs, as shown in lower limb muscles. Supported by a Grant-in-Aid for Scientific Research (B) from the Ministry of Education, Culture, Sports, Science and Technology Grants (17H02142).
limb dangling straight. The subject lowered the contralateral limb without ground contact for 5 repetitions in a row. Peak pelvis drop and lower limb joint angles at the time of peak knee flexion were calculated using visual 3D™ biomechanics software. After a practice trial, 1 trial was performed on each limb with 3 of the 5 repetitions included in an ICC two-way mixed effects model to evaluate kinetic repeatability reliability. RESULTS: Kinematic results across the angle, knee, hip, trunk and pelvis demonstrated good to excellent repeatability reliability with consistent levels of within item variability (Table 1). Peak knee, hip and trunk flexion and the position of the non-weight bearing limb demonstrated good to excellent consistency. The frontal plane measures, such as pelvis and trunk lateral flexion and hip adduction demonstrated good consistency (Table 1). CONCLUSIONS: Results demonstrate good to excellent repeatable kinematics during the RUPS activity especially in the sagittal plane. Findings of this repeatability study suggest that the RUPS may be a possible neuromuscular control screening tool for similar healthy athletes.

Table 1: Joint angle calculations at time of peak (ups and down) across repetitions of the reported isolated posterior tasks

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean (variance)</th>
<th>Cronbach’s ICC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ankle dorsiflexion/plantar flexion (%)</td>
<td>12.78 ± 0.002</td>
<td>0.99</td>
</tr>
<tr>
<td>Ankle eversion/Varus (%)</td>
<td>3.02 ± 0.098</td>
<td>0.95</td>
</tr>
<tr>
<td>Ankle plantar flexion/Inversion (%)</td>
<td>2.07 ± 0.005</td>
<td>0.95</td>
</tr>
<tr>
<td>Knee flexion/extension (%)</td>
<td>51.87 ± 0.044</td>
<td>0.97</td>
</tr>
<tr>
<td>Knee varus/varus (%)</td>
<td>2.12 ± 0.003</td>
<td>0.95</td>
</tr>
<tr>
<td>Knee valgus/valgus (%)</td>
<td>2.73 ± 0.003</td>
<td>0.95</td>
</tr>
<tr>
<td>Hip flexion/extension (%)</td>
<td>24.10 ± 0.134</td>
<td>0.95</td>
</tr>
<tr>
<td>Hip abduction/adduction (%)</td>
<td>0.53 ± 0.030</td>
<td>0.95</td>
</tr>
<tr>
<td>Hip adduction/abduction (%)</td>
<td>0.47 ± 0.033</td>
<td>0.95</td>
</tr>
<tr>
<td>Trunk flexion/extension (%)</td>
<td>1.47 ± 0.032</td>
<td>0.95</td>
</tr>
<tr>
<td>Pelvis flexion/extension (%)</td>
<td>-7.08 ± 0.035</td>
<td>0.95</td>
</tr>
<tr>
<td>Pelvis lateral flexion (%)</td>
<td>6.42 ± 0.034</td>
<td>0.95</td>
</tr>
<tr>
<td>Pelvis lateral flexion (%)</td>
<td>6.42 ± 0.034</td>
<td>0.95</td>
</tr>
<tr>
<td>Correlated hip flexion/extension (%)</td>
<td>91.55 ± 0.112</td>
<td>0.95</td>
</tr>
<tr>
<td>Correlated hip abduction/abduction (%)</td>
<td>0.91 ± 0.047</td>
<td>0.95</td>
</tr>
</tbody>
</table>

PURPOSE: Visual feedback of one’s balance has potential to augment balance training. However, natural visual cues of the environment already provide robust stabilization, and therefore additional visual biofeedback may have little effect on body sway. We quantified the extent to which different types of visual feedback influence sway in a novel trunk balancing task. METHODS: Twelve healthy young adults sat on a motorized bench that tilted up and down in direct proportion to trunk sway. This paradigm greatly increases the difficulty of the balance task and requires subjects to rely on visual and vestibular systems. In each trial, participants were provided different types visual feedback through a rotating needle-gage display on a 15 by 20 cm computer monitor located 0.85 m in front of the participant. Trials lasted 100 s, were randomly ordered, and included direct feedback (needle rotated in proportion to body sway), inverted feedback (needle rotated in the opposite direction of sway), time delayed feedback (0.5 s), random feedback RF, eyes closed, and control (eyes open with screen off). Participants were informed “visual feedback might be helpful”. RESULTS: Direct feedback trials had a large and significant (p < 0.05) impact on sway resulting in lower positional variability (root-mean-square, RMS): 62% of control trials. Despite moving in the opposite direction, inverted feedback also reduced sway to appreciable amounts of 80% RMS compared to control, but was not statistically significant. Time delayed feedback only reduced sway to 90% of control RMS. In contrast, random feedback actually significantly (p < 0.05) increased participants' sway by 44%, similar to the anticipated significant (p < 0.05) increase in sway in the eyes closed trial (90% increase). RMS velocity was less impacted by visual feedback with only eyes closed trials associated with significant changes. CONCLUSION: Real-time position-based visual biofeedback had a powerful effect on balance, reducing body sway, while random feedback increased sway. Interestingly, even when participants were trying to ignore the random feedback, it still increased body sway. Results suggest that carefully selected real-time visual biofeedback could be useful in augmenting balance training during challenging balance tasks. Funding: NSF DARO 1803714

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Anterior pelvic tilt is associated with excessive foot pronation, excessive hip internal rotation (HIR), and knee valgus, which may lead to hip muscle strains, sciatic nerve compressions, and sacroiliac and lumbar joint instability. Posterior pelvic tilt is associated with feet supination and increased hip external rotation (HER), which may lead to tibial stress fractures, medial tibial stress syndrome, knee pain, anterior cruciate ligament injury, and low back pain. Hip adductors/abductors (add/abd TR) and torque ratio (TR) below 80%, was associated with adductor strains. The average hip flexors/extensors (flex/extend) TR in sport performance was found to be 70%. There is a lack of evidence that correlates pelvic tilt angle with limited HIR, HER, add/abd TR, and flex/extend TR. PURPOSE: to examine the correlation between natural pelvic tilt angle and HIR and HER in prone position, for the right and left limbs, were recorded. Hip torque were collected with an isokinetic dynamometer, five trials at 30 deg/s and 60 deg/s. RESULTS: The mean value for NPT was 5.7±5.4 deg. There were no significant correlations between NPT and the dependent variables for the right limb: HIR (r=-0.16, p=0.43), HER (r=0.11, p=0.58), add/abd TR at 30 deg/s (r=-0.19 p=0.34), add/abd TR at 60 deg/s (r=-0.13 p=0.51), flex/extend TR at 30 deg/s (r=0.32 p=0.10) and flex/extend TR at 60 deg/s (r=0.70 p=0.70). Similar results were observed for the left limb: HIR (r=-0.20, p=0.89), HER (r=-0.25, p=0.21), add/abd TR at 30 deg/s (r=-0.17 p=0.38), add/abd TR at 60 deg/s (r=-0.12 p=0.55), flex/extend TR at 30 deg/s (r=0.60 p=0.75) and flex/extend TR at 60 deg/s (r=-0.19 p=0.33). CONCLUSION: the measurement of NPT angle in standing natural position is not a good predictor of HIR, HER, add/abd TR, and flex/extend TR. Future research should look at these relations the measurement of NPT angle in standing natural position is not a good predictor of HIR, HER, add/abd TR, and flex/extend TR. PURPOSE: to examine the correlation between natural pelvic tilt angle and HIR and HER in prone position, for the right and left limbs, were recorded. Hip torque were collected with an isokinetic dynamometer, five trials at 30 deg/s and 60 deg/s. RESULTS: The mean value for NPT was 5.7±5.4 deg. There were no significant correlations between NPT and the dependent variables for the right limb: HIR (r=-0.16, p=0.43), HER (r=0.11, p=0.58), add/abd TR at 30 deg/s (r=-0.19 p=0.34), add/abd TR at 60 deg/s (r=-0.13 p=0.51), flex/extend TR at 30 deg/s (r=0.32 p=0.10) and flex/extend TR at 60 deg/s (r=0.70 p=0.70). Similar results were observed for the left limb: HIR (r=-0.20, p=0.89), HER (r=-0.25, p=0.21), add/abd TR at 30 deg/s (r=-0.17 p=0.38), add/abd TR at 60 deg/s (r=-0.12 p=0.55), flex/extend TR at 30 deg/s (r=0.60 p=0.75) and flex/extend TR at 60 deg/s (r=-0.19 p=0.33). CONCLUSION: the measurement of NPT angle in standing natural position is not a good predictor of HIR, HER, add/abd TR, and flex/extend TR. Future research should look at these relations during functional dynamic movements and during pelvic tilt end range of motion.

Baseline balance assessments are commonplace in the athletic training field. They are used in comparison with re-evaluations to determine if an injury has occurred. PURPOSE: The specific aim of this study was to evaluate in what manner a warm-up affected hip range of motion (ROM) and balance testing in a collegiate population. The significance of this study is to reduce the inconsistencies surrounding baseline balance assessments. Currently there is limited research looking into how hip ROM directly impacts balance. METHODS: Data was collected from a total of 16 participants. Participants completed two testing periods under the condition of a biking protocol or a waiting protocol. The biking protocol required participants to cycle on an ergometric bike for 20 minutes at 3-5 METs, while the waiting protocol required no movement for 20 minutes. Immediately following each protocol, a manual goniometer was used to collect ROM values for hip flexion, extension, abduction, and internal and external rotation. The two balance assessments were then completed. Test one consisted of the Balance Error Scoring System (BESS) with the second test utilizing a baseline balance test with the use of force plate technology. Hip ROM values and balance scores were compared between the two conditions. RESULTS: A Shapiro test was used to ensure the sample points were normally distributed. The results demonstrated a significant difference between the matched pairs. The flexions values for the left (p-value < .008) and right (p-value < .01) hip joints were found to be significant. All other hip ROM values demonstrated no significance. Significance was found for total errors of the BESS (p-value < .01). No significance was recorded for the force plate balance test. CONCLUSION: These results demonstrate the presence of a warm-up increased hip flexion range of motion in both hip joints and also impacted BESS balance scores. In conclusion, this suggests the addition of a warm-up to baseline balance assessment. A larger sample size is needed to further validate these findings.

Three main sensory systems (somatosensory, visual, and vestibular) contribute to human postural control. These three sensory systems can compensate for each other if one of them lose their orientation information. Adjusting sensory input is referred to as sensory re-weighting. However, due to experimental limits, little is known how disrupted vision affects sensory re-weighting during dynamic postural control. PURPOSE: Therefore, this study examined the effect of impaired visual sensory input on dynamic postural control through the use of stroboscopic glasses. METHODS: Subjects were 24 physically active adults (male: 12, female: 12; height: 172 ± 7.5 cm, weight: 67.5 ± 10.4 kg) recruited from a university population, aged 18-35 years. Each subject performed the star excursion balance test (SEBT), which includes 3 trials comprised of 3 directions (anterior, posteromedial: PM, and posterolateral: PL) on each vision condition (eyes open: EO, Low Strobe frequency Vision: LSV, High Strobe frequency Vision: HSV) Each trial and visual condition was run on both firm and foam surface. Reach distance was analyzed by 2 (surface conditions) × 3 (vision conditions) ANOVAs. RESULTS: In surface condition main effects, subjects performed significantly (p<.05) shorter reach distances (anterior, PM, and PL) in vision condition main effects, subjects with EO performed significantly lower reach distances in the PM direction than HSV and LSV (p<.05, both), and subjects demonstrated shorter reach distance with EO than with LSV in PL direction (p<.05). Only with HSV, subjects performed shorter reach distance on the foam surface than the firm surface (p<.05). CONCLUSIONS: People with impaired visual sensory (strobe vision) input and/or unstable surface tend to have decreased dynamic postural control when tasked to move in a medial and lateral direction. People also demonstrated higher reliance on visual information when the somatosensory function is disturbed. The stroboscopic glasses may be used to identify the reliance of visual information in people who have an altered or reduced somatosensory system.

Dynamic visual acuity (DVA) requires visuo-perceptual processing to resolve the critical details of a target in motion. Athletes demonstrate superior DVA performance compared to non-athletes in a seated position. PURPOSE: To investigate the effects of different postures and exertion levels on DVA in athletes. METHODS: Forty rugby players (40-42 yrs, ±14) without recent concussion (> 2 years) and/or vestibular-ocular abnormalities were included. DVA was assessed using a custom program (mov& V&MP, University of Waterloo, Ontario) displayed on a 55” LCD monitor at a viewing distance of 4m. The program presented a randomly (RW) or horizontally (H) moving letter ’E’ target facing left/right/up/down. Participants had to correctly identify the orientation of the target with a keypad as it progressively reduced in size. DVA was scored as the log of the minimum angle of resolution (LogMAR), of the smallest target correctly identified (i.e., low score = better DVA). Participants completed one RW and H trial at a speed of 2.31m/s (30°/s) during four conditions: seated; standing; and treadmill walking at low (0.5-1.0 km/h) and medium condition was calculated for each of the other conditions. There were no interaction effects of target motion and posture (F=1.02, p=3.82), and no main effect of target motion (F=0.30, p=598). However, there was a trending main effect of posture (Stand: 0.00 vs. Walk Low: -0.14 vs. Walk Mod: 0.04 vs. 56, p=0.25). These findings indicate that athletes’ DVA improved from seated to moderate treadmill walking more so than both standing and low-intensity treadmill walking. CONCLUSION: Athletes appear to have improved DVA in sport-specific conditions of greater postural and exertional demands. Therefore, sport training experience may enhance visuo-perceptual skills. These findings may inform clinicians to consider the assessment of DVA with progressive, dynamic contexts for rehabilitation, such as for return to sport from concussion.
Beginning at about middle-age (e.g., 40 to 50yrs), notable declines in strength, balance and functional performance begin to occur; however, participation in physical activity has been demonstrated to slow down the progression of these age-related declines. Middle-age runners (RUN) are demonstrated to exhibit superior balance compared to healthy age-matched counterparts. Whether similar balance benefits occur in middle-age Olympic weightlifters (OWL) has not been studied. PURPOSE: To compare balance performance between middle-age adults regularly participating in either OWL or RUN. METHODS: A total of 48 National Masters Olympic Weightlifting competitors (22 females, 47.3±8.5yrs) and 42 (17 females, 47.7±8.5yrs) distance RUN who were training at least 30km/week participated in two 30s balance testing trials on firm (FI) and foam (FO) surfaces with eyes open (EO) and eyes closed (EC). Medial-lateral center of pressure velocities (MLCPV) were averaged across trials for each condition and natural logarithm transformed to reduce positive skewness. Bivariate coefficients (separate by group) between age, height, mass, years of experience, and body mass index (BMI) with MLCPV were performed followed by a three factor (exercise group x gender x condition) repeated measures analysis of variance. RESULTS: No significant (P<0.08) relationships for the OWL between MLCPV and age, height, mass, BMI and experience (r = .230 to .211) were revealed. For the RUN, age was significantly related (P=0.043) to MLCPV across all four conditions (r=.313 to .360). While there were no significant differences between the groups for either EO-FI (P=0.143, d=±.34) or EO-FO (P=0.209, d=±.26), the OWL demonstrated significantly better balance (lower MLCPV) than the RUN for both EC-FI (P=0.009, d=.59) and EC-FO (P=0.001, d=±.70). There were no significant differences related to gender (P<0.05). CONCLUSIONS: The most salient result was the identification of better balance performance by the OWL, particularly when visual inputs were unavailable, compared to the RUN. As Olympic weightlifting involves high-velocity whole-body movements, the OWL may develop an enhanced ability to utilize vestibular and somatosensory inputs to compensate for the absence of visual information.

Mal de debarquement (MdD) is the subjective perception of self-motion experienced after prolonged episodes of passive motion (PM) such as a boat ride (e.g. sea legs). Transient MdD (< 48 hours) occurs frequently and is described as a rocking, bobbing, or swaying sensation accompanied by unsteadiness and disequilibrium after cessation of the PM stimulus, and is suggested to impact postural control. PURPOSE: To examine changes in postural control after prolonged exposure to boat movement at sea. METHODS: Postural control of 24 adults (13 M, 11 F; age = 35 ± 12 y; height = 170.3 ± 8.8 cm; mass = 84.2 ± 17.0 kg) was assessed in bilateral stance on a force platform with eyes open (EO), eyes closed (EC), foam surface eyes open (FOE), and foam surface eyes closed (FEC) before (PRE) and after (POST) a 7-hour deep sea fishing excursion. Postural control measurements including average sway (cm), sway range (cm), sway velocity (cm/s), and maximum sway velocity (cm/s) were analyzed in the medial/lateral (ML) and anterior/posterior (AP) directions. Time-to-boundary (TTB) measures of postural control (minimum, average, SD of minima) were computed. All variables were compared PRE/POST using a paired t-test and Cohen’s d effect sizes were calculated. RESULTS: Greater ML sway excursion was observed POST in EC (t = 2.37, p = .013, d = 0.66, PRE = 0.13 ± 0.04, POST = 0.18 ± 0.10), FEO (t = 2.95, p = .004, d = 0.46, PRE = 0.40 ± 0.14, POST = 0.47 ± 0.17), and FEC (t = 2.03, p = .027, d = 0.42, PRE = 0.50 ± 0.12, POST = 0.55 ± 0.15). Greater AP sway excursion was observed POST in FEO (t = 1.77, p = 0.045, d = 0.34, PRE = 0.63 ± 0.17, POST = 0.72 ± 0.30) and FEC (t = 2.18, p = 0.02, d = 0.48, PRE = 0.87 ± 0.21, POST = 0.98 ± 0.24). ML sway range (r = 3.34, p = .001, d = 0.54, PRE = 2.42 ± 0.66, POST = 2.87 ± 0.99) and AP sway range (r = 2.18, p = 0.020, d = 0.53, PRE = 4.01 ± 0.80, POST = 4.64 ± 1.56) increased POST in FEO. Maximum AP sway velocity increased POST in EO (r = 1.73, p = 0.049, d = 0.45, PRE = 4.20 ± 1.26 cm/s, POST = 5.14 ± 2.93 cm/s). Analysis of TTB measures did not reveal PRE/POST differences among any condition. CONCLUSION: Extended durations on a boat at sea increase postural sway upon returning to land. These findings suggest that ‘sea legs’ impairs the ability to re-weight appropriate sensory information in conditions dependent on somatosensory and vestibular feedback.

Static and dynamic postural stability have been characterized in athletes and shown to differ across sports. However, these tests of stability may not specifically capture the...
balance required for reactive athletic movements. The Push-and-Release (P&R) test is a standardized clinical tool used to assess reactive postural control in balance-impaired populations.

**PURPOSE:** To examine differences between sport team and task (single [ST] and dual task [DT]) in reactive postural response measures.

**METHODS:** 40 healthy, male athletes (age 18.50 ± 0.75; body mass index [BMI] 24.11 ± 2.38) were recruited from 3 collegiate teams: baseball (n=12), lacrosse (n=17), and swimming (n=11). Reactive postural responses were assessed using the P&R in backward and forward directions under ST and DT (concurent verbal cognitive task) conditions. All conditions were performed with eyes closed. Inertial sensors on the sternum, lumbar, feet, and right tibia were used to assess step latency (L), time of first heel contact (HC), and time to stabilization (TTS). A sensor on the tester’s hand was used to determine release time. To assess if postural response measures differ by sport and task, linear mixed effects models with random intercepts and stratified by direction (forward or backward), were used and adjusted for age and BMI.

**RESULTS:** Lacrosse players had faster L compared to baseball players in the forward direction (p=0.018). No other differences by sport were observed. In the forward direction, DT outcomes were slower than ST outcomes (L: p=0.0001; HC: p=0.0004; TTS: p=0.0064). In the backward direction, L was slower in the DT condition (p=0.0034), but no task differences were found for HC or TTS (p=0.0628 and p=0.8733, respectively).

**CONCLUSION:** In the forward direction only, DT slowed all postural responses. While L differed between lacrosse and baseball in the forward direction, no other differences were found across sports. As most outcomes were unaffected by sport, the P&R may be a clinically relevant assessment in athletes. However, due to the limited sample size, caution should be applied when interpreting these findings and future studies are needed.

**Supported by:** PAC 12 Student Athlete Health & Wellbeing (PI: Fino, Dibble); and University of Utah Study Design and Biostatistics Center through NCATS Grant 8UL1TR000105.

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**Table: Reactive Postural Responses In Collegiate Athletes**

<table>
<thead>
<tr>
<th>Direction</th>
<th>Latency (s)</th>
<th>Time to Stabilization (s)</th>
<th>Heel Contact (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backward</td>
<td>0.13 (0.12 - 0.14)</td>
<td>1.19 (1.14 - 1.24)</td>
<td>-</td>
</tr>
<tr>
<td>Left</td>
<td>0.18 (0.17 - 0.19)</td>
<td>1.02 (0.97 - 1.08)</td>
<td>-</td>
</tr>
<tr>
<td>Right</td>
<td>0.17 (0.17 - 0.18)</td>
<td>1.03 (0.98 - 1.09)</td>
<td>-</td>
</tr>
<tr>
<td>Forward</td>
<td>0.20 (0.19 - 0.21)</td>
<td>1.06 (1.01 - 1.11)</td>
<td>-</td>
</tr>
</tbody>
</table>

**Task**

<table>
<thead>
<tr>
<th>Task</th>
<th>Latency (s)</th>
<th>Time to Stabilization (s)</th>
<th>Heel Contact (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>0.15 (0.14 - 0.15)</td>
<td>1.00 (0.96 - 1.04)</td>
<td>-</td>
</tr>
</tbody>
</table>

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**CONCLUSION** Postural responses differ by direction during the P&R in college athletes. The largest differences were between the forward and backward directions. These directions may be most sensitive to detecting changes in reactive postural control; future work will examine the utility of the P&R for return-to-play decisions.

**Supported by:** PAC 12 (PI: Fino, Dibble); University of Utah Study Design and Biostatistics Center (UL1TR002538)

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**The Effects of Golf Specific Footwear on Muscle Activation During Standing Postural Control**

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(No relevant relationships reported)

Postural control in golf represents an unusual challenge as players are on their feet four hours or more. Several golf specific footwear are available, though, little is known about how these footwear affect human balance. **PURPOSE:** To examine the effects of durations of walking/standing while barefoot (BF) and wearing a dress shoe (DS), tennis shoe (TS), and minimalist (MIN) style golf shoe, on muscle activity of the lower extremity during balance. **METHODS:** Six male adults completed this study. Balance was recorded under six conditions: eyes open (EO), eyes closed (EC), eyes open sway referenced vision (EOSRV), eyes open sway referenced platform (EOPSR), eyes closed sway referenced platform (ECSRSP), and eyes open sway referenced vision and platform (EOSRVP). Surface electromyography (EMG) was recorded during balance testing from the left leg tibialis anterior (DF), and medial gastrocnemius (PF). Raw EMG data were collected at 1,500 Hz, Band-pass filtered (20-250Hz) and rectified. Variables of interest were the mean muscle activity (mV) of each muscle. Testing sessions consisted of a counterbalanced allocation of footwear over 4 separate days, separated by at least 48 hours. Each session included muscle activity measures during balance every 60 minutes, for 4 hours (pre, 60, 120, 180, 240 minutes). A 4x5 repeated measures ANOVA was used, with an alpha level of 0.05. **RESULTS:** A significant interaction was observed in the EO condition for PF muscle activity (F(12,60) = 1.94, p = 0.04). With the MIN muscle activity significantly lower than TS, and DS at 2 hours (4.16 < 6.86 & 6.58). An interaction was also observed in the EOSRVP condition for the PF (F(12,60) = 1.97, p = 0.048), suggesting that at 4 hours, the DS was significantly higher than the MIN (9.96 > 8.33). A footwear effect was observed for the EC condition.
Functional movement assessments are used to predict injury in multiple populations, but the components that most contribute to functional movement are unknown. Identifying the influence of static balance via the Balance Error Scoring System (BESS) and dynamic balance via the Y-Balance Test (YBT), can provide valuable information to clinicians. This knowledge can be used to help individuals improve functional movement screening (FMS) scores which, in turn, can reduce injury risk.

**PURPOSE:** To examine the contributions of static and dynamic balance on functional movement.

**METHODS:** Participants from the general population (N = 77; men = 31; women = 46; average age = 42 ± 16 years) completed the FMS, YBT, and BESS (RT 0.2+/-0.001, FT 0.2+/-0.1, CC 0.02+/- 0.005; P<0.001) of muscle activation. TA showed a faster Timed to peak [seconds] (RT 0.007+/-0.001, FT 0.001, CC 0.02+/- 0.005; P<0.001) and BESS (< .001, < .001) during one laboratory visit.

**RESULTS:** The three-weeks renewal massage seems to have differed only in the sacral inclination angle (F[2,17] = 3.590, p<.05). The post-hoc test showed that the renewal massage group (9.86 ± 3.18) has lower mean than control group(34.63 ± 4.07). No statistical significance difference was found on C-spine angle, T-spine angle, L-spine angle, sacral inclination angle, femoral-tibial angle of both right and left. Descriptive analyses including mean and standard deviation were computed for all variables using Šnˇedekor F distribution. The gender difference was analyzed as ANCOVA with the pre-test values as covariates. The post-hoc test was performed with the least significant difference (LSD). The significance level set at .05.

**RESULTS:** The ANCOVA result indicated that after controlling for differences in pre-test values, there was a significant difference in the sacral inclination angle (F(2,17) = 3.950, p<.05). The post-hoc test result showed that the renewal massage group (9.86 ± 3.18) has lower mean than control group(34.63 ± 4.07). No statistical significance difference was found on C-spine angle, T-spine angle, L-spine angle, femoral-tibial angle of both right and left.

**CONCLUSION:** The three-weeks renewal massage seems to have differed only in the sacral inclination angle. Further studies are warranted to examine the effect of dose-response relationship (i.e., changing the duration and frequency) for the renewal massage.

**Impairment in executive functioning has been reported as a result of sustaining repetitive, sports-related head impacts (RHI) after just one season of play. Brain networks associated with executive functioning may be damaged by RHI, which can be assessed through resting-state functional connectivity (rs-FC) with fMRI, which has previously shown connectivity to be affected by RHI. PURPOSE:** To examine rs-FC related to the frontal-parietal network (FPN) over the course of an ice hockey season. METHODS: Twenty-three collegiate club ice hockey players (19M/4F) were divided into two groups: Impact (men’s forwards/defensemen, n=17) and No Impact (goalkeepers and women, n=6). Players were scanned on a Siemens Prisma 3T scanner prior to the first game of their season (PRE) and within two weeks of their final game (POST). Six seed regions-of-interest (ROIs) within the FPN were selected for rs-FC analysis: R/L middle frontal gyrus, R/L posterior parietal cortex, and R/L lateral prefrontal cortex; all data analysis was completed using SPm12/Conn Toolbox. A 2x2 repeated measures ANOVA was performed to test for significant (p<0.01) group-by-time interactions. A secondary regression analysis was performed in a subset of Impact players (n=13) to identify if accelerometer (Triax, Norwalk, CT) and video confirmed total number of head impacts sustained over a season were predictive of PRE/POST changes in rs-FC. RESULTS: A significant group-by-time interaction was found in connectivity between the R middle frontal gyrus and R posterior parietal cortex T-3.49, p<.01; post-hoc analysis revealed significant POST hyperconnectivity in the Impact group only (T=2.96, p<.01) and no PRE/POST changes were noted in the No
Impact group. Total number of impacts (54.8±33.5) significantly predicted POST hyperconnectivity between the L. lateral prefrontal cortex and L. pallidum (r=0.79, p<0.001)

CONCLUSIONS: Post-season hyperconnectivity between ROIs involved in executive functioning was found in athletes who regularly sustain impacts compared to those who do not, which is consistent with previous rs-fc RHI findings in different networks. Hyperconnectivity has been suggested to represent brain injury and players who sustain more impacts may be more likely to have neurological damage that results in deficits in executive function.

3448 Board #269 May 29 1:30 PM - 3:00 PM Identifying The Educational Needs Of 9th And 10th Grade High School Students Regarding Concussion
Brent A. Harper. Chapman University, Irvine, CA. (Sponsor: A. Lynn Millar, FACSM)
Email: ptmi@aol.com
(No relevant relationships reported)

PURPOSE: To evaluation adolescent concussion knowledge and behaviors regarding concussion using a modified Rosenbaum Concussion Knowledge and Attitudes Survey (RoCKAS) questionnaire.

METHODS: RoCKAS questionnaire was taken by female and male 9th and 10th grade high school students (n=190) with a mean age of 15.1±0.8 years (64.7% female; 35.3% male). 59.4% reported belonging to a competitive sports team. A sampling of questions from the RoCKAS questionnaire was used to assess groups for (1) general concussion knowledge and (2) the demonstration of safe attitudes and behaviors in situational decision making (“safe” or “unsafe”).

RESULTS: Validity scale scores were appropriate, meaning participants were actually reading and answering the questions thoughtfully. General concussion knowledge was correctly answered by 74.1% of participants (p<0.001). Those not participating in athletics were less knowledgeable about concussion than those participating in sports (20.1%). Males not participating in sports answered incorrectly 23.4% of the time. There was no statistical significance comparing females in relation to sports participation. Responses to the four situational questions analyzed identified answers to be unsafe on the behavior questions 87.1 % of the time (p<0.001). In fact, the actual age of the participants negatively correlated with the behavior answers (r=−0.4, p=0.001).

CONCLUSIONS: High school 9th and 10th-graders are knowledgeable about concussion. Those participating in sports teams are more knowledgeable, especially males. There is no knowledge differences between females who participate or do not participate in sports. Situation based questions indicate an unacceptable level of safety, suggesting poor behaviors in return-to-play (RTP) and concussion reporting decisions, which was worse in older individuals. The RoCKAS information may be helpful to identify behavior deficits that can inform cohort-specific concussion educational programs designed to enhance the safety of youth athletes.

3449 Board #270 May 29 1:30 PM - 3:00 PM Fear Of Re-injury Correlates With Concussion Symptoms And Reaction Time Among Adolescents With Concussion
Sarah Elizabeth Reinking1, Julie C. Wilson2, Gregory C. Walker2, Corrine Schecken1, David R. Howell3,1 Children’s Hospital Colorado, Aurora, CO. 1University of Colorado School of Medicine, Aurora, CO.
Email: sarah.reinking@childrenscolorado.org
(No relevant relationships reported)

Background: Athletes appear to be at an increased risk of musculoskeletal injury following return to play after concussion. Underlying causes are likely multi-factorial but not well established. Fear of re-injury has been widely studied in musculoskeletal injuries, but its effect on concussion recovery is unknown.

Purpose: To examine the association of fear of re-injury with physical and self-reported measures after concussion. We hypothesized that greater fear of re-injury would be correlated with a higher symptom severity, worse sleep quality, and worse physical test performance.

Methods: Athletes (n=19; 15.0±1.8 years of age; 42% female; 7.4±3.3 days post-injury) were tested within 14 days of concussion, and underwent assessments of TSK scores were not significantly correlated with single-task tandem gait (r=0.23; p=0.23), Post-Concussion Symptom Inventory (PCSI), and Pittsburgh Sleep Quality Index (PSQI). Physical symptoms were significantly associated with slower clinical reaction time performance (β=−2.8; 95% CI=−9.4, 4.62; p=0.06), greater symptom severity (β=3.64; 95% CI=−2.07, 5.21; p<0.001), and worse sleep quality (β=0.37; 95% CI=−0.05, 0.68; p=0.03).

Conclusions: In accordance with our hypothesis, higher TSK scores were correlated with higher symptom severity and slower reaction times. This suggests that assessing an athlete’s fear of re-injury may be useful following concussion and throughout recovery.

3450 Board #271 May 29 1:30 PM - 3:00 PM Neurofilament Light Not Associated With Concussion History Or Recency In Special Operations Forces Combat Soldiers
Jacob R. Powell1, Adrian J. Boltz2, Jamie P. DeCicco1, Avinash Chandran1, Stephen M. DeLellis2, Marshall L. Healy1, Shawn F. Kane, FACSM1, James H. Lynch, FACSM1, Gary E. Means1, Jason P. Mihalik, FACSM1,2,3, The University of North Carolina at Chapel Hill, Chapel Hill, NC. 1Defense Medical Strategies LLC, Fayetteville, NC. 2United States Army Special Operations Command, Fort Bragg, NC. (Sponsor: Jason Mihalik, FACSM)
Email: jrpowell@unc.edu
(No relevant relationships reported)

PURPOSE: To determine the effects of concussion history, lifetime incidence, and recency on NFL concentrations in SOF combat soldiers. METHODS: 185 SOF combat soldiers (age=33.0±3.5 yrs) participated in our cross-sectional study and self-reported concussion history (90 no, 95 yes), lifetime incidence (0, 1, 2, 3+) and recency (<1 month, <1 year, >1 year). Fasted blood samples were obtained from an antecubital vein at a standardized time for all subjects. Serum was separated and stored until analysis. Serum NFL levels were quantified using sandwich enzyme immunoassay kits according to manufacturer instruction. Medians and interquartile ranges (IQRs) were reported because NFL concentrations were not normally distributed. A weighted p-value analysis comparison NFL concentrations between those with and without concussion history. Kruskal-Wallis tests compared NFL concentrations across lifetime incidence and recency. RESULTS: We did not observe differences in NFL concentrations (p=1.80, p=0.07) between those with (median=449.7 pg/mL, IQR=192.1) and without (median=449.7 pg/mL, IQR=192.1) concussion history. There was no effect of concussion lifetime incidence (X²(3)=3.87, p=0.28) or recency (X²(2)=0.86, p=0.63) on NFL concentrations. CONCLUSION: We did not observe differences in serum NFL concentration in SOF combat soldiers based on concussion history, lifetime incidence, and recency. Our SOF combat soldiers were otherwise healthy and asymptomatic. Despite this, our findings suggest SOF combat soldiers demonstrated higher NFL concentrations than those reported for civilian severe brain injury and neurodegenerative disease patients. Funded by USA SOC

3451 Board #272 May 29 1:30 PM - 3:00 PM Parent Beliefs Regarding Chronic Traumatic Encephalopathy Associated With Sport-related Concussion
Email: kfidd10@gmail.com
(No relevant relationships reported)

PURPOSE: To determine CTE beliefs of youth athletes’ parents, and examine the association of sex and prior concussion history with those views.

METHODS: This was a cross-sectional survey study of parents (n = 467; males = 185, females = 282, history of concuss reversion 52) of youth contact sport athletes (i.e., football, soccer, ice hockey, lacrosse). The survey included items on demographics, diagnosed concussion history, and a standardized concussion knowledge assessment with two exploratory items about CTE beliefs. Parents were asked if CTE was a complication of multiple concussions and premature return-to-play. The 15-minute
The effects of concussion history (CH) and years of playing football on cognitive function and mood-related symptoms in former football players is unclear. Most former player studies include mid-to-late life individuals, and little is known about the impact of concussion history (CH) and years of playing football on cognitive function and mood-related symptoms in former football players. In our relatively young sample, SS at the time of testing was associated with worse outcomes. Continued longitudinal analyses may explain age-related changes on these outcomes.

### Table 1: Backwards Elimination Diagnostic Coefficients

<table>
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<tr>
<th>Outcomes</th>
<th>Age β</th>
<th>Years of Football Played β</th>
<th>Body Mass Index β</th>
<th>Average Sleep Duration β</th>
<th>Total Symptom Severity β</th>
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Table 1 illustrates the diagnostic coefficients for the final model. The model included age, years of football played, body mass index, average sleep duration, and total symptom severity. The final model explained a significant proportion of variance in the outcomes, with beta values ranging from -0.47 to 0.06. The model was significant at p < 0.05, indicating a strong association between the factors and the outcomes.

### CONCLUSIONS

The study found that concussion history (CH) and years of playing football are associated with worse outcomes on most measures. Worse SDMT scores were partially explained by greater CH and years played. In addition to SS, greater CH related to worse outcomes on most measures. Worse SDMT scores were partially explained by greater CH and years played. In addition to SS, greater CH related to worse outcomes on most measures.
Concussive injury and depression affect millions of individuals each year and are connected through common overlapping symptoms. PURPOSE: Aim 1 was to establish an association between post-concussion depression-related symptoms and post-concussion symptoms, balance performance, vestibular function, and executive function. Aim 2 was to further establish the relationship between concussion history and post-concussion depression-related symptoms, concussion symptoms, and mood disturbance. METHODS: 164 concussed individuals (mean age=14.52±3.51 years, 50.61% male, mean time from injury=18.24±13.60) were included in this analysis. Depression-related symptoms were quantified using the Beck Depression Inventory (BDI-II) and post-concussion symptoms using the Rivermead Post-Concussion Symptoms Questionnaire (RPQ). Clinical post-concussion assessments utilized were the modified Balance Error Scoring System (mBESS), Vestibular/Ocular-Motor Screening (VOMS), and, for adolescent patients, the Behavior Rating Inventory of Executive Function (BRIEF). Mood disturbance was quantified using the Profile of Mood States (POMS). mBESS, VOMS, RPQ, and BRIEF were measured during BDI-II scores using Pearson Correlation and Linear Regression analyses. BDI-II, POMS, and RPQ scores were analyzed based on concussion history using Wilcoxon Rank-Sum Tests. RESULTS: As depression-related symptoms increased, post-concussion symptoms (p<0.001, r=0.68) and VOMS scores measuring changes in headache and dizziness (p<0.001, r=0.34; p<0.01, r=0.20 respectively) significantly increased. There was no significant correlation between depression-related symptoms and balance performance (p=0.093, r=0.13). In adolescents, as depression-related symptoms increased parent reported executive function decreased (p<0.001, r=0.46). Those who reported a concussion history reported significantly more depression-related symptoms (p<0.004), concussion symptoms (p<0.004), and mood disturbance (p=0.002). CONCLUSION: This study adds to the current literature surrounding the relationship between concussion and depression by identifying a relationship between depression-related symptoms, post-concussion symptoms, and post-concussion clinical assessments.

Athletes with previous diagnosis of a psychiatric condition, such as depression or anxiety, have been shown to experience a larger overall concussion symptom score compared to those without a previous psychiatric treatment. Anxiety rates in college students is high (42%) with student-athletes only slightly lower (37%) compared to the general the population (18%). PURPOSE: The purpose of this study was to compare concussion-related anxiety symptoms and validated anxiety disorder screeners to see if baseline concussion symptoms could be used as a screening tool for follow-up mental health assessments. METHODS: 254 club level collegiate student-athletes (18.2±1.4yrs, 150 female, 104 male) completed the Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) including the 22-item Post-Concussion Symptom Scale (PCSS), the Patient Reported Outcome Measurement Information System (PROMIS-29), and the Depression Anxiety Stress Scales (DASS-21). DSM-5 Anxiety symptoms were compared to the PCSS symptoms and an anxiety-related concussion symptom score was calculated. These along with the anxiety sub-scales for both the DASS-21 and PROMIS-29 were used for analysis. RESULTS: Participants were divided into 4 anxiety level groups based on norms from the DASS-21 (normal=36; mild=76; moderate=87; severe=28). There was a significant correlation (p<0.001) between Anxiety Cluster PCSS symptom score and DASS-21 anxiety subscale (r=0.41) and PROMIS-29 Anxiety Sub-score (r=0.44). The DASS-21 and PROMIS-29 scores were also significantly correlated (r=64, p<0.001). There were significant group differences across the 4 DASS-21 anxiety levels for Anxiety Symptom Cluster (F(4,226)=9.27, p<0.001) and the PROMIS-29 Anxiety subscale (F(4,223)=31.01, p<0.001). CONCLUSIONS: The significance from this data shows that the proposed symptom clusters that potentially pertain to anxiety symptoms are meaningfully related to higher scores on the DASS-21 and the PROMIS-29 anxiety related questions. Participants that demonstrated a higher overall concussion-related anxiety symptom score were more likely to exhibit more severe levels of anxiety suggesting that this cluster score could potentially screen individuals at risk for anxiety disorders thus providing a pathway to refer and provide resources and support.
Firefighters have substantial levels of fitness and a high prevalence of overweight and obesity. Understanding exercise status and barriers to exercise may be important factors regarding body composition. PURPOSE: The purpose of this study was to examine the influence of exercise status and barriers to exercise on percent body fat (%BF) in career firefighters. METHODS: Fifty-eight male career firefighters [age: 31.3 ± 7.0 years; stature: 186 ± 8 cm; body mass: 83 ± 11 kg; %BF: 23.5 ± 7.5%] volunteered for this investigation. Participants self-reported exercise status and completed a list of rated sixteen barriers to exercise (e.g., too busy) on a Likert-scale type (1-7). Dual-energy X-ray absorptiometry was used to assess %BF. Aerobic exercise time [AER = moderate intensity minutes + (vigorous intensity minutes × 2)] and resistance training workload [RT = days × minutes × intensity] were calculated. Pearson’s correlation coefficients were used to determine the relationships between %BF and potential predictor variables including AER, RT, and the sixteen barriers. The significant exercise barriers were averaged into one construct (BAR). The internal consistency of BAR was measured using Cronbach’s alpha. Multicollinearity was monitored using the variance inflation factor (VIF). Stepwise regression analysis was conducted. An alpha level was set at 0.05 for all analyses. RESULTS: %BF was related to AER ($r = -0.36, P = 0.005$) and RT ($r = -0.40, P = 0.002$). Seven of the sixteen barriers (i.e., too busy, not enough time, irregular work hours, family obligations, interferes with work, too tired, lack of support from officers) were significantly related with greater %BF ($r = 0.27, P = 0.006-0.042$) and were included in the final construct BAR. The Cronbach’s alpha for BAR was 0.80. The stepwise analysis suggests that AER and BAR were significant predictors of %BF ($R^2 = 0.36, P < 0.001$; maximum VIF = 1.98). CONCLUSIONS: These findings suggest that firefighters with poorer body composition likely partake in less aerobic exercise and experience greater perceived barriers to exercise. Interventions aiming to mitigate barriers to exercise, specifically aerobic exercise, may be helpful in improving body composition.

Lack of physical activity (PA) is a major public health concern, especially for older people. However, data on possible factors limiting older adults’ engagement in PA are still under-investigated. Purpose: The purpose of this study was to: 1) examine the association of perceived PA barriers with leisure-time PA (LTPA) in a sample of older adults; and 2) to explore the possible moderating effect of body mass index (BMI). METHODS: 296 older adults aged ≥76 years old took part in a cross-sectional survey. LTPA was measured by the International Physical Activity Questionnaire and participants were categorized into the three groups, no-LTPA group for individual who did not report LTPA; and below/upper 50th percentile of total LTPA MET values for low- and high-LTPA groups, respectively. Barriers to being active (AER) and barriers to being active and physical activity (BAR) were used to assess perceived PA barriers in a binary manner (i.e., no barrier/least 1 barrier) for each of the seven domains (i.e., time, social, energy, will, injury, skill, and resources). BMI (kg/m²) was calculated by self-reported height and weight and used to create the three BMI groups (BMI <25, 25-29.99, and ≥30). Using a no-LTPA group as a referent, a multinomial logistic regression was conducted for predicting low- and high-LTPA groups. Construction: In general, “lack of will” (49.66%) was the most frequently cited PA barrier followed by “social influence” (38.51%) and “fear of injury” (36.49%). In the fully adjusted multinomial logistic regression model, greater perceived barrier in “social influence” was associated with lower odds of reporting high-LTPA (AOR: Safe(OR) = 0.41). In the follow-up stratified analyses demonstrated that PA barriers differently affect LTPA levels by BMI groups. Among individuals with BMI between 25 and 29.99, “lack of time” (OR = 0.11) was the significant predictor of LTPA level. Whereas, “fear of injury” (OR = 0.11) and “lack of energy” (OR = 0.18) were the significant factors associated with LTPA among those with BMI≥30. CONCLUSIONS: The presented study provides relevant data on barriers to LTPA for older adults. Promotion and intervention strategies should consider the exposed barriers of older adults in order to reduce their obstacles to PA.
PA patterns and obesity. After controlling for all the covariates, MANCOVA indicated boys had higher levels of VPA than girls (F < 0.01), but no significant differences were found for overall motor competence and MPA. Girls had higher waist circumference and LPA than boys. CONCLUSION: The findings indicate that engaging in at least vigorous PA may lead to higher and more accurate ball skill competence among adolescents. The potential “physical activity divide” may occur especially among girls between low-skilled adolescents and their skilled counterparts, which suggests a potential trajectory of obesity in adolescent years.

Self-reported sedentary behaviors have been negatively related to executive functions (EFs) in older adults. However, the relationship of objectively measured sedentary time (ST) to EFs in adults with overweight and obesity is poorly understood. PURPOSE: To assess the relationship between accelerometer-measured ST and inhibitory control in middle-aged adults with overweight and obesity. METHODS: Pre-intervention data from 87 subjects (60 (67%) females, Mage = 35.0 ± 5.9 yrs, BMI= 32.2 ± 5.4 kg/m²) participating in the Perseus America for Total Health Randomized controlled trial were analyzed. ST and physical activity were measured over 7 days with a hip-worn wGT3X-BT accelerometer. Valid wear time was defined as ≥ 4 days, ≥ 10 hrs/d. Daily ST (min/d), frequency, and time spent in sedentary bouts lasting ≥ 5, 10, 20 and 30 consecutive min were estimated using a < 100 counts per minute (CPM) cut point. Moderate-to-vigorous physical activity (MVPA) was defined using an NHANES cut point. Inhibitory control was expressed as accuracy (AC), reaction time (RT), and inverse efficiency (IE = AC/RT) on incongruent trials of a modified Eriksen flanker task; performance on congruent trials indexed controlled processes. Multiple hierarchical regression models controlling for age, sex, intelligence, % fat mass, MVPA and ST (for sedentary bouts) were used to assess relationships between ST, sedentary bouts, inhibitory control, and controlled processes. RESULTS: Frequency (t(6) < -0.22, n ≤ 2.11, Ps ≤ 0.04, F(6,68) ≥ 3.25, Ps ≤ 0.007) and time (t(6) < 2.02, n ≤ 2.01, Ps ≤ 0.047, F(6,68) ≥ 3.17, Ps ≤ 0.008) spent in sedentary bouts lasting ≥ 20 and 30 min were associated with lower AC during incongruent trials. While ST and time spent in sedentary bouts ≥ 20 min were related to faster RTs during congruent trials (t(6) < -0.23, n ≤ 2.08, Ps ≤ 0.047, F(6,68) ≥ 3.04, Ps ≤ 0.013, greater ST was related to lower IE on congruent and incongruent trials (t(6) < 0.43, n ≤ 2.33, Ps ≤ 0.023, F(6,68) ≥ 2.76, Ps ≤ 0.01). CONCLUSION: In adults with overweight and obesity, more prolonged inhibitory control and less efficient controlled processes as indicated by more impulsive responding. Our results reveal a novel relationship between sedentary patterns and an aspect of EFs that has been implicated in the maintenance of obese behaviors.

The Diabetes Prevention Program (DPP) was created after a 27-center randomized clinical trial was conducted to determine if lifestyle intervention alone, or combined with pharmacological therapy could prevent or delay the onset of Type 2 Diabetes (T2DM). Lifestyle intervention decreased the incidence of T2DM by 58% compared with a 31% reduced incidence in the pharmacological group. A key component of the DPP are lifestyle coaches (LC). LC deliver curriculum intended to initiate and maintain effective lifestyle changes in adults at risk for T2DM. Little is known about the behaviors of the LC. PURPOSE: The purpose of this study was to investigate the habits and motivations of LC to elucidate their motivations for coaching. METHODS: A sixteen item electronic survey was emailed to LC. Data was analyzed using descriptive and qualitative analyses, as well as chi-square tests. RESULTS: Sixty-three participants (60 female, 3 male) (Age range = 18-75+) responded to the survey. Descriptive analyses indicated that the majority of responding coaches worked in healthcare fields (59.65%) and achieved ≥ 150 minutes of physical activity (PA) per week (68.42%). Qualitative analyses indicated two types of motivation for coaching: internal (N=19) and external motivation (N=36). External motivation further included reward (N=30). CONCLUSION: These results suggest that lifestyle coaches are employed mainly in healthcare fields and are motivated to coach by external factors. The findings indicate a source of reward is much more significant to athletes.

Physical activity (PA) and motor competence are closely related to each other since PA patterns and obesity. After controlling for all the covariates, MANCOVA indicated boys had higher levels of VPA than girls (F < 0.01), but no significant differences were found for overall motor competence and MPA. Girls had higher waist circumference and LPA than boys. CONCLUSION: The findings indicate that engaging in at least vigorous PA may lead to higher and more accurate ball skill competence among adolescents. The potential “physical activity divide” may occur especially among girls between low-skilled adolescents and their skilled counterparts, which suggests a potential trajectory of obesity in adolescent years.

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Physical activity (PA) and motor competence are closely related to each other since motor competence is mainly, although not entirely, determined by PA patterns (i.e., Light PA [LPA], Moderate PA [MPA], and Vigorous PA [VPA]) in adolescence (Stodden et al., 2009). How the development of the motor competence may be influenced by PA patterns and how the interaction of these two variables may be correlated with obesity in adolescent years are understudied. PURPOSE: The main purpose of this study was to test the gender differences among the study variables. METHODS: Participants were 307 students (M = 12.5 ± 9.3 years, boys = 125, girls = 182) who were 14 years of age or older. All students’ 14-year-old PA patterns were assessed using Actical monitors for 5 consecutive school days. Students’ ball skill competence including volleyball, soccer, and ultimate Frisbee (PE Metrics Inc., NASPE, 2010) were assessed in PE classes. Body mass index (BMI) and waist circumference were measured to detect obesity in this study. RESULTS: Both LPA and VPA were significantly correlated with BMI and waist circumference (r < 0.35). All three ball skills were significantly associated with both LPA and VPA (r ranges from .21 to .33). Regression analyses indicated that only VPA and soccer skill emerged as significant predictors of BMI (β = -.16; β = -.24, p < .05) and waist circumference (β = -.15; β = -.15, p < .05), respectively. Structural equation modeling suggested a mediating role of motor competence in the relationship between...
significant demographic factors in the first step, aerobic fitness in the second step when significant, and BMI in the final step. RESULTS: Analyses indicated that children exhibited improved task performance (p’s ≤ 0.001) following the walking intervention, as well as decreased interference (p = 0.04), indicating greater benefits following acute PA for the task condition requiring greater inhibitory control. Regression analyses were conducted to examine the influence of BMI on task performance following each intervention. Results revealed that increased BMI was related to decreased performance following acute PA (p = 0.001), an effect not seen following restful reading (p’s > 0.11). CONCLUSIONS: These findings indicate that the beneficial effects following an acute bout of PA on cognition are generalized across conditions of a flanker task, but are selectively greater for the task conditions requiring greater inhibitory control. However, the effects may be blunted in children with higher BMI. These results suggest that indices of inhibition are influenced by PA and adiposity in children.

An Investigation Of Exercise Motivation In Normal Weight And Obese Humans And Rodents

Julia C. Basso, Medha K. Satyal, Deborah J. Good, Daniel F. English, Warren K. Bickel, Virginia Tech, Blacksburg, VA.

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(Purpose) Purpose: The leading causes of morbidity and mortality stem not from predetermined factors, but from maladaptive health behaviors that people have the ability to change. One primary example is physical inactivity, which is the fourth leading risk factor for global mortality and is a direct contributor to the global epidemic of obesity. Both the behavioral and neural mechanisms underlying sedentary behavior in healthy and obese populations are unknown, and constitute a major gap in our understanding of health behaviors. Understanding the mechanisms that regulate the motivation for exercise would allow us to devise treatments to target sedentary behaviors in both healthy and obese populations. As a precursor for these studies, the purpose here was to delineate levels of exercise motivation in both humans and a preclinical mouse model of obesity.

(Methos) Methods: Self-report measurements of exercise motivation in humans (n=727) was collected via Amazon Mechanical Turk. Voluntary wheel running data was collected in both wild type mice and mice with a targeted deletion of the basic helix-loop-helix (bHLH) gene Nhlh2 (N2KO), which serve as a preclinical model of obesity. Wheel running data was collected continuously for a period of 21 days as well as after a 72-hour period of wheel deprivation (rebound running response, Basso & Morrell, 2015).

Results: Results: Here, we demonstrate that compared to normal weight controls, exercise motivation is significantly impaired in obese individuals, with normal weight controls reporting higher intrinsically regulated motivations to exercise, and obese individuals reporting higher extrinsically regulated motivations to exercise. Further, we demonstrate that wheel running in rodents is highly motivating and that running motivation is significantly impaired in the N2KO mice.

Conclusions: Impairments in exercise motivation may be a driver of obese outcomes, which are demonstrated here in both human and preclinical models of obesity. Previous work from our lab has demonstrated that regions of the motivational circuitry including the medial prefrontal cortex regulate the motivation for voluntary wheel running in rodents. We are currently investigating in both wild type and N2KO mice the hypothesis that neural activity in the PFC, modulated by dopamine, regulates the motivation for exercise.

Sleep Parameters During A 12-month Behavioral Weight Loss Intervention With Varying Doses Of Physical Activity: The Heart Health Study

Christopher E. Kline, Renee J. Rogers, FACSMM, Nalingna Yuan, John M. Jakicic, FACSM, University of Pittsburgh, Pittsburgh, PA.

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(Purpose) Purpose: To examine whether self-reported sleep parameters improve as a result of a behavioral weight loss intervention that included varying doses of moderate-vigorous PA compared to a diet-only condition. Methods: 383 adults with overweight or obesity (age=46.2±7.7 years; BMI=32.1±3.8 kg/m²) participated in a 12-month behavioral weight loss intervention and were randomized to one of three conditions: diet (DIET, n=127), diet plus a moderate dose of MVPa (DIET+MODPA; n=129), diet plus a high dose of PA (DIET+HIGHPA; n=127). All intervention conditions were prescribed a diet that reduced caloric intake to 1200-1800 kcal/day and received behavioral counseling targeting weight loss. DIET+MODPA and DIET+HIGHPA conditions were prescribed home-based MVPa that progressed to 150 and 250 min/wk, respectively. Weight and sleep measures were collected at 0, 6, and 12 months. Sleep measures included the Pittsburgh Sleep Quality Index (PSQI) and Epworth Sleepiness Scale (ESS). Results: Weight (LS mean [95% CI]) significantly decreased over time (0 months: 90.3 [89.0, 91.7] kg; 6 months: 81.7 [80.4, 83.0] kg; 12 months: 81.2 [79.8, 82.6] kg) (p<0.001), with no difference between groups (Group: p=0.29; Group X Time: p=0.50). PSQI scores (LS mean [95% CI]) were reduced (i.e., improved) (0 months: 3.0 [2.8, 3.2]; 6 months: 2.8 [2.5, 3.0]; 12 months: 2.8 [2.5, 3.0]) (p<0.05), with no difference in the pattern of change by group (Group X Time: p=0.59). ESS scores did not change over time (p=0.98) in any group. Weight change (adjusting for intervention group) was associated with PSQI change at 6 months (P<0.05) and 12 months (P<0.001), but not ESS change at either time point (P>0.41). Conclusion: Improvements in sleep quality were primarily associated with weight change in this behavioral weight loss intervention. Physical activity did not result in any additive improvements in sleep quality. In adults with overweight or obesity, enhancing long-term weight loss may be an important target for improving sleep quality. Support: National Institutes of Health (RO1HL103646)

Free Communication/Poster - Smartphone and Behavior

Kayla M. Gustek, Kimberly A. Reich, High Point University, High Point, NC.

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(Purpose) Purpose: To evaluate top-ranked free health and fitness apps for PA behavior change potential and to determine the relationship between this evaluation and consumer perceptions of quality, such as app store ranking and consumer ratings. Methods: The top 100 “free” health and fitness apps in the US iOS app store were screened for inclusion. Apps were excluded if the descriptions did not address any aspects of PA or fitness; required an external device, purchase/subscription after a trial period, or a health club membership or specific health insurance. Apps were also excluded if their descriptions was not written in English. Two investigators downloaded and evaluated the remaining apps that met the inclusion criteria using the App Behavior Change Scale (ABACUS). Apps were scored on 21 strategies within 4 categories (knowledge/information, goals/planning, feedback/monitoring, and actions), and prevalence in the sample was calculated. Pearson correlations were estimated for the relationship between ABACUS total scores and relative app ranking, as well as consumer rating. Significance was set at p < 0.05. Results: 23 apps met the inclusion criteria. 100% offered some form of personalization; 96% incorporated self-monitoring and/or feedback; and 70% included options for goal-setting. Only 13% recommended restructuring of the environment, and 4% provided advice on distraction or avoidance. There were no significant correlations between ABACUS score and store ranking (r²= -0.15, p = 0.49) or consumer rating (r²= -0.26, p = 0.91). Conclusion: Free apps may have the potential to support PA behavior change, especially in the areas of planning and self-monitoring. There is no correlation between the total number of evidence-based behavior change strategies and app popularity, however, so it may be beneficial for wellness professionals to counsel patients and clients on app choice.

Determining Participant Compliance In Completing Pre- And Post-exercise Surveys In Real Time Using Smartphones

Kelley Strohacker, FACSMM, Paula-Marie M. Ferrara, Cory T. Beaumont, University of Tennessee, Knoxville, TN.

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(Purpose) Purpose: Ecological momentary assessment of physical activity and its correlates is often implemented using mobile surveys distributed in a full coverage, semi-randomized
Multiple studies from our research group examining American adults have conclusively identified smartphone use as a sedentary behavior (SB). However, the same work has repeatedly found no relationship between smartphone use and physical activity (PA). Typically, SB is negatively related to PA. This may not be true of smartphones as the device can displace PA (e.g., watching videos, social media) and also promote PA (e.g., fitness apps, mHealth). Thus, different smartphone behavioral patterns should be considered in relationship to PA. Researchers have recently identified problematic smartphone use as a behavioral pattern motivated by the recurrent craving to use a smartphone. It is an addiction-like behavior leading individuals to use their smartphone compulsively in inappropriate situations such as during classroom lectures, while driving a car, or perhaps in environments intended for PA or planned exercise. Therefore, while total use is not associated with PA, problematic smartphone use may interfere with PA.

PURPOSE: To assess the relationship between total and problematic smartphone use to PA in a sample of American college students.

METHODS: A sample of American college students (N = 471, 21.1 ± 2.8 years old) completed validated surveys assessing total daily smartphone use, PA, SB (both assessed via the International Physical Activity Questionnaire) and problematic smartphone use (assessed via the Mobile Phone Problem Use 10-item scale). Pearson’s correlations were then performed.

RESULTS: As in previous studies, there was a significant, positive relationship between total daily smartphone use and SB (r = 0.31, p < 0.001) and no relationship with PA (r = 0.05, p = 0.32). However, while problematic smartphone use was similarly significantly and positively related to SB (r = 0.26, p < 0.001) it was also significantly and negatively related to PA (r = −0.18, p < 0.01).

CONCLUSION: While prior research and the current study has found no relationship between total smartphone use and PA, this is the first study to assess the relationship between problematic smartphone use and PA. Results suggest that, unlike total daily smartphone use, problematic smartphone use may occur at the expense of PA behavior.
Previous studies from our research group have examined the potential link between portable screen-based devices (i.e., smartphones and tablet computers) and sedentary behavior. Physical activity in a primarily suburban population of young children and their parents was determined. Child sedentary behavior was related to portable screen-based device use while physical activity was not. Such relationships were found in a suburban population, rural demographic groups have been shown to differ in both their screen-based device use and physical activity variables suggesting the corresponding associations may also differ.

PURPOSE: To examine screen-based media device (smartphone, tablet, television, video games, computer) use in children and parents from a rural population in relation to sedentary behavior and physical activity.

METHODS: Parents (N = 7, 33.57 ± 3.95 years old) completed a validated questionnaire assessing average daily total screen use (smartphone, tablet, television, video games, computer), portable screen-based device use (smartphone, tablet), sedentary behavior, and physical activity for both themselves and their children (N = 7, 7.00 ± 1.15 years old). Four standard regression models were used to assess the relationship between criterion variables and the following predictor variables: child age, child sex, child average daily sedentary time, and child physical activity. Criterion variables included (a) child portable screen-based device use (Model 1), (b) child total screen use (Model 2), (c) parent portable screen-based device use (Model 3), and (d) parent total screen use (Model 4).

RESULTS: Child sedentary time was significantly (β = 0.92, t = 4.65, p < 0.05) related to either parent or child portable or total device use.

CONCLUSION: Contrary to findings in young children from suburban populations, the current results from this limited sample suggest child sedentary behavior was not found to be related to portable screen-based device use in rural children. Furthermore, the data confirms previous findings that parental screen-based device use was predictive of sitting in their children.

Screen-time (e.g., television, phone, tablet use) has been linked to increased depression and sedentary behaviour. A better understanding of associations between screen-time and depression is critical due to increased levels of screen-time and sedentary behaviour. Purpose: As part of a large nationally-representative observational study, the cross-sectional study reported here examined associations between self-reported screen-time and depressive symptoms among 396 adolescents (13.43±0.87y; 157 females) in primary and secondary level schools in the Republic of Ireland. Methods: Participants completed the Quick Inventory of Depressive Symptomatology and reported the number of days during the prior seven days that spent watching television, on a computer, and on a tablet or smartphone, and, on average, the number of hours spent on these devices on each reported day. One-way ANOVA examined potential sex-related differences in screen-time and depressive symptoms. Linear regression quantified crude and adjusted associations between total weekly hours of screen-time and depressive symptoms. Age, sex, waist circumference, functional disabilities, MVPA, and school status (i.e., whether the school is in a government-identified economically disadvantaged location) were included covariates. Results: Mean±SD hours of screen-time per week and depressive symptoms for girls were 17.33±18.53 and 5.47±4.27, respectively. Males (18.10±19.75) reported more screen-time than females (15.19±17.77; p=0.084). Depressive symptoms did not differ by sex (p=0.99). Total weekly hours of screen-time was significantly, positively associated with depressive symptoms (β=0.10; p<0.05). After adjustment for age, sex, waist circumference, functional disabilities, MVPA, and school status, screen-time was significantly, positively associated with depressive symptoms (β=0.14; p=0.006). MVPA was the only statistically significant covariate in the model (β=0.11; p=0.04).

Conclusions: Screen-time was significantly associated with greater depressive symptoms in Irish adolescents. Lower levels of screen-time and sedentary behaviour should be encouraged to reduce depressive symptoms among adolescents.

F-68 Free Communication/Poster - Hydration/Fluid Balance
Friday, May 29, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

Hypohydration is common among athletes and can be the result of a failure to maintain hydration between exercise bouts. The negative impact of hypohydration on aerobic performance is well characterized. However, little is known about the effect of hypohydration on anaerobic power performance particularly when the hypohydration is the result of insufficient water intake prior to the onset of exercise, not water loss due to body temperature regulation. Purpose: The purpose of this study was to examine the effect of hypohydration on anaerobic performance following voluntary water intake reduction. Methods: Fifteen healthy adults (8 women, 7 men) completed two exercise sessions, euhydration (EUD) and hypohydration (HYP). Subjects were asked to voluntarily limit water intake during the 24-hours prior to the hypohydration trial. Sessions consisted of baseline anthropometric and blood lactate measurement followed by a 30-second Wingate test and 3 maximum vertical jump trials. The vertical jump trials were completed approximately 1 minute after finishing the 30-second Wingate test and used to measure anaerobic performance in an anachronically challenged state. Additional blood lactate measurements were taken immediately and at 5, 10, and 15-minute post-Wingate test. Results: The hypohydration protocol resulted in a significant 1.5% reduction in body mass (EUD 69.1 ± 17.2kg, HYP 68.1 ± 16.6kg, p = 0.039). The 30-second Wingate peak power (EUD 971 ± 302W, HYP 960 ± 316W, p = 0.578) was not different between conditions, nor was maximum vertical jump height (EUD 26.4 ± 4.5cm, HYP 26.6 ± 3.6cm, p = 0.778). Blood lactate (p = 0.001) was elevated immediately following the 30-second Wingate test and remained elevated throughout the remainder of the trial. There were no differences in blood lactate between conditions. Conclusions: Acute anaerobic power and exercise performance are not negatively affected by mild voluntary hypohydration during and following a single 30-second Wingate test.
PURPOSE: This study evaluated the effect of cold water intakes before and during exercise in the heat on the cognitive function in healthy young men. METHODS: Ten men (24 ± 3 yrs, 72 ± 5 kg, 172 ± 8 cm, 25 ± 4% body fat) who participated in vigorous exercise at least twice a week and performed maximal aerobic capacity tests (>85% VO2max) were recruited. They underwent three testing sessions with different conditions in separate days: cold water (CW, 4 °C), neutral temperature water (AW, 36 °C), and no water conditions (NW). Testing order was randomly assigned and balanced. In each session, they were asked to ingest a prescribed amount of tap water (10 ml/kg body weight) at rest (1/3 of the total amount) and during exercise (2/3 of the total amount). After resting, they ran on a treadmill for 20 min in a hot environment (39 ± 2 °C, 41 ± 7% relative humidity) at their predicted 75% of maximal heart rate. At 6, 12, and 18 min of exercise of CW and AW, they drank water. Cognitive test was performed 3 times at rest; immediately after exercise, and after 20 min of recovery, by using Stroop color-word test (SCWT). During resting and exercise, their temperature, heart rate (HR), ratings of perceived exertion (RPE), and body mass measures were measured. RESULTS: The average ear temperature during exercise was 37.2 ± 0.6 °C, and mean skin temperature was 34.8 ± 2.3 °C, 35.3 ± 1.6 °C, and 34.9 ± 1.2 °C at CW, AW, and NW, respectively (p < 0.05). Average HR and RPE were 148 ± 3 ± 14.1, 150 ± 8 ± 15.6, and 149.9 ± 12 ± 7.3 bpm and 13.3 ± 0.7, 13.0 ± 0.9, and 12.7 ± 1.4 at CW, AW, and NW, respectively (p < 0.05). They drank a total of 813 ± 133 ml at CW and 812 ± 134 ml at AW. They lost weight by sweating 493 ± 145, 507 ± 257, and 390 ± 139 ml at CW, AW, and NW, respectively. The reliability of cognitive test was 0.909. The cognition score was 23.5 ± 16.2, 24.3 ± 15.5, and 22.0 ± 11.8 in CW, 24.2 ± 13.5, 28.1 ± 10.4, and 25.1 ± 9.7 in AW, and 17.5 ± 8.3, 22.3 ± 10.6, and 21.1 ± 7.9 in NW at rest, immediately after exercise, and after recovery, respectively (p < 0.05). CONCLUSIONS: No advantage of cold water drinking before and during a short bout of exercise in the heat was evident for the cognitive function. The mode, intensity, and duration of exercise may be responsible for the outcomes.

PURPOSE: Inadequate sleep and underhydration have been independently associated with adverse health outcomes. However, the relation between hydration status and sleep has yet to be investigated over the course of several days in young adults. Thus, the purpose of this study was to assess the association between 24h urinary hydration markers and both perceived and objective sleep quality. METHODS: Eighteen participants (female, n=7; age, 23 ± 3; height, 174 ± 15.5cm; body mass, 73.5 ± 15.9 kg; body fat, 19.4 ± 9.4%) provided a 24h urine sample on seven consecutive days for measures of urinary volume (Uvol), urine osmolality (USOM), urine specific gravity (USG), and urine color (UCOL). Objective sleep metrics (wrist-worn actigraphy) and subjective sleep assessments (Karolinska Sleep Diary) were recorded each day. Actigraphy measures included periods of wakefulness after defined sleep onset (WASO), sleep time, wake time, and sleep efficiency. The Karolinska Sleep Diary included nine questions used to assess perceived sleep quality from the previous night. Mean values were calculated for each participant for all variables on weekdays (Monday-Friday) and weekend days (Saturday-Sunday). RESULTS: Higher weekday Uvol and darker UCOL were both associated with greater weekend time spent sleeping (r = -0.203; p = 0.04) and higher weekday Uvol was associated with greater weekend WASO actigraphy measures (adj R² = 0.205; p = 0.045). CONCLUSIONS: Mean 24-hr urinary hydration markers depicting a state of underhydration (elevated Uvol and reduced USOM) across weekdays were associated with an increased number of wake-awakens throughout the weekend nights, albeit, having a longer sleep time. Determining how day-to-day variations in hydration status and other general health behaviors influence sleep has yet to be explained.

PURPOSE: This study was to examine the effects of 3 different fluid conditions on hydration, physiological strain (PSI), and cognitive processing speed during and following a simulated wildland firefighter (WLFF) ingress hike. METHODS: 7 subjects (27 ± 4 yrs, 54 ± 20 kg) performed 3 visits of 2hrs of treadmill walking at 3mph/7% grade in an environmental chamber set to 33 ± 10°C relative humidity. In random order, subjects consumed either water (W), water/electrolyte (GZ), or water/electrolyte/sugar (GLU) at each visit. Throughout exercise (EX), subjects wore fire-retardant attire, carried a 50lb pack, and drank ad libitum to mimic WLFF conditions. Pre and post EX, body mass (BM), fluid consumption, and plasma osmolality (pOsm) were measured. PSI, an calculated index of cardiovascular (CV) and thermal strain, and core temperature (Tc) were recorded every 15 mins during EX. Plasma glucose (GLU) was measured every 30 mins. Cognitive processing speed, measured via the Stroop Color and Word Test (SCWT), was measured post EX and compared to baseline (BL) values. RESULTS: There were no significant differences between fluid conditions (W, GZ, and GLU) for BM (A. 06.0±2.0, 0.9±0.3, and 0.8±0.2 kg), fluid consumption (1.9±0.3, 2.2±0.2, and 1.9±0.3 l), pOsm (A.12.5±1.1, 9.5±5.4, and 8.1±2.1·mmol/L), peak PSI (7.6±0.6, 7.8±0.5, 8.6±0.7) and peak Tc (38.8±0.2, 38.9±0.2, and 39.1±0.2 °C). Compared to W and GZ, GLU significantly increased in the G condition (107±14, 113±11 mg/dL at 60, 90, and 120 mins, p<0.05). Compared to BL, SCWT performance significantly decreased in all conditions (204±2±21, 213±24, 222±21 ms, p<0.05). CONCLUSION: Fluid condition had no effect on hydration status or physiological strain. Following EX, there was a similar decrease in SCWT in all conditions, indicating a decreased ability to inhibit cognitive interference. Additionally, PSI was higher than previously reported, suggesting that the ingress hike may lead to dangerously high CV and thermal strain in WLFFs. PSI should be monitored (HR and Tc) during ingress hikes by military staff or supervisors, especially when conditions yield high ambient temperatures. This could aid in reducing the amount of WLFFs that succumb to heat related illness each year.

Grant Funding: The project was funded by the US Forest Service.


MAP001 Vol. 52 No. 5 Supplement
Reduced circulating concentrations of the endogenous peptide apelin is implicated in many negative health outcomes and apelin administration can reverse sarcopenia processes. While acute and chronic exercise elicits greater circulating apelin concentrations, little attention has been given to apelin’s water regulatory roles (i.e., AVP opposition) and manipulation by water intake to enhance human health. PURPOSE: We investigated the impact of hydration status and process on plasma apelin following prolonged endurance exercise and after a subsequent water challenge. METHODS: Twenty-two male cyclists (age median=54y and range=29-72y) completed a 161km event (mean=26°C, 76%RH; maximum=30°C, 93%RH; mean finish time = 372 ± 93min). Participants were interviewed for dietary intake in the morning and during the ride. Hydration biomarkers included body mass change (BMΔ), urine specific gravity (Usg) and color (Ucol), plasma osmolality (P(osm)), and copeptin (P(Cpe)) and apelin (P(Ap)), which were collected before (PRE), immediately after the ride (POST), and 1h following a 650mL water bolus (POST1h). RESULTS: P(Ap) paradoxically decreased after exercise (PRE = 1.19 ± 0.29, POST = 1.02 ± 0.27 ng/mL; p = 0.04). It is plausible that hypohydration at POST (according to -1.96% dehydration at POST and POST1h P(USG), osmolality (P(Uosm)), and volume (L). METHODS: Eleven participants (n=5 male: 21 ± 3y, 69.97 ± 8.4 kg, 172.4 ± 3.8 m; n=6 female: 20 ± 2y, 57.04 ± 3.62 kg, 163.4 ± 4.9 m) underwent passive dehydration via 24-h FR. RESULTS: Body mass was reduced 1.9 ± 1.3% with FR compared to EU (mean difference: 1.8 ± 1.5 kg, body mass loss assessed via nude body mass, plasma osmolality (P(osm)), and urine osmolality (P(Uosm)) were increased in the FR trial (1.28 ± 1.14, female: 68 ± 1.2, p=0.07); plasma osmolality post-FR (male: 291 ± 4 mOsmo·kg⁻¹, female: 296 ± 4 mOsmo·kg⁻¹; p=0.31); U(osm) (male: 5 ± 2, female: 6 ± 1, p=0.001) and volume (L): No differences were found in perceived exertion tended to be increased in the FR trial (16.1 ± 1.8) compared to the EU trial (15.1 ± 1.9, p=0.06, d=0.87). Perception of perceived exertion tended to be increased in the FR trial (16.1 ± 1.8) compared to the EU trial (15.1 ± 1.9, p=0.06, d=0.87). Isometric strength was also not different between conditions at 50°/sec (EU 198.4 ± 50.7, FR 184.8 ± 38.7 Nm, P = 0.26, η² = 0.24) and 150°/sec (EU 132.6 ± 35.8, FR 129.0 ± 41.9 Nm, P = 0.20, η² = 0.31). During the fatigue protocol, total work completed was not different between conditions (EU 2656 ± 794, FR 2689 ± 902 Nm, P = 0.63), but, average power demonstrated a moderate-large effect (d = 0.71) for reduction in the FR condition (182.6 ± 65.0 W) compared to EU (206.5 ± 58.8 W, P = 0.14). CONCLUSION: These preliminary results suggest FR does not alter muscular strength or fatigue. However, perceptual strain (thirst, exertion) may be increased, requiring a greater effort to produce similar performance.
Medicine & Science in Sports & Exercise®

FRIDAY, MAY 29, 2020

Rectal temperature (Trec) were monitored throughout trials. Serum \([Na+]\), hemoglobin, and hematocrit levels were measured at baseline, pre- and post-work, and 16-hr post-work. Urinary kidney injury molecule-1 (uKIM-1) and urinary neutrophil gelatinase-associated lipocalin (uNGAL) were measured pre- and post-work, 3-hr and 16-hr post-work. Urinary specific gravity (USG), heart rate (HR), and rectal temperature \((T_r)\) were monitored throughout trials. Serum \([Na^+]\), hemoglobin, and hematocrit levels were measured at baseline, pre- and post-work, and 16-hr post-work. Urinary kidney injury molecule-1 (uKIM-1) and urinary neutrophil gelatinase-associated lipocalin (uNGAL) were measured pre- and post-work, 3-hr and 16-hr post-work.

Purpose:

Method:

RESULTS:

CONCLUSION:

No Relation Between Short-term Sodium Intake And Whole Body Sweat Sodium Concentration During Exercise-heat Stress

Ryan P. Nuccio, Meagan O’Connor, Corey T. Ungaro, Kelly A. Barnes, Adam J. Reimel, Shreyatha D. Brown, Lindsay B. Baker, FACSM. Gatorade Sports Science Institute, Barrington, IL. Email: ryan.nuccio1@pepsico.com

CONCLUSION: These findings indicate that beverage type did not affect renal stress biomarkers following simulated industrial work in the heat when euhydration was maintained.

Research has been limited and mixed with regards to the effect of normal, short-term dietary sodium (Na) intake on sweat Na concentration \([Na]\) and total sweat Na losses during exercise.

Purpose:

Methods:

RESULTS:

CONCLUSION:

3485 Board #306 May 29 2:30 PM - 4:00 PM Renal Stress Responses To Work In The Heat Comparing Different Hydration Regimens

Rachel A. Backes, Whitley C. Atkins, Samantha L. Thomas, Colin E. Glenny, Abby L. Flynn, Rachel M. Held, Brendon P. McDermott, FACSM. University of Arkansas, Fayetteville, AR. Email: rbackes@uark.edu

(no relevant relationships reported)

Workplace safety organizations recommend that workers predisposed to incure heavy sweat loss should consume a ‘sport drink’ during work. These sweet-sugared beverages (SSB) often include fructose, which can lead to acute kidney injury (AKI), especially when combined with hypo-hydration. PURPOSE: Investigate the effect of SSB on renal stress in response to simulated industrial work in the heat, while maintaining euhydration.

METHODS: Twenty male participants (24±2 yr, 179±6 cm, 24.7±9.0% body fat) completed two randomized, matched trials of simulated industrial work (2-hr total; two 45-min work and two 15-min rest bouts) in the heat (30°C, 55% RH). Equal amounts of SSB or placebo were provided during each rest and within 2-hr of completing work. Urine specific gravity (USG), heart rate (HR), and rectal temperature \((T_r)\) were monitored throughout trials. Serum \([Na^+],\) hemoglobin, and hematocrit levels were measured at baseline, pre- and post-work, and 16-hr post-work. Urinary kidney injury molecule-1 (uKIM-1) and urinary neutrophil gelatinase-associated lipocalin (uNGAL) were measured pre- and post-work, 3-hr and 16-hr post-work. Urinary specific gravity (USG), heart rate (HR), and rectal temperature \((T_r)\) were monitored throughout trials. Serum \([Na^+],\) hemoglobin, and hematocrit levels were measured at baseline, pre- and post-work, and 16-hr post-work. Urinary kidney injury molecule-1 (uKIM-1) and urinary neutrophil gelatinase-associated lipocalin (uNGAL) were measured pre- and post-work, 3-hr and 16-hr post-work.

RESULTS:

CONCLUSION:

No Relation Between Short-term Sodium Intake And Whole Body Sweat Sodium Concentration During Exercise-heat Stress

Ryan P. Nuccio, Meagan O’Connor, Corey T. Ungaro, Kelly A. Barnes, Adam J. Reimel, Shreyatha D. Brown, Lindsay B. Baker, FACSM. Gatorade Sports Science Institute, Barrington, IL. Email: ryan.nuccio1@pepsico.com

Reported Relationships: R.P. Nuccio: Salary; Gatorade Sports Science Institute, PepsiCo Inc. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo Inc., Ownership/interest/stock; Gatorade Sports Science Institute, PepsiCo Inc. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo Inc.

Research has been limited and mixed with regards to the effect of normal, short-term dietary sodium (Na) intake on sweat Na concentration \([Na]\) and total sweat Na losses during exercise.

Purpose:

Methods:

RESULTS:

CONCLUSION:

F-69 Free Communication/Poster - Thermoregulation/Hyperthermia

Friday, May 29, 2020, 1:30 PM - 4:00 PM

Room: CC-Exhibit Hall

Heat Load, Cooling Methods And Hydration Of Sailors During Summer Training Camp In Japan

Dalya Navot Mintzer, Eyal Shargal, Rotem Kislev Cohen. Wingate, Netanya, Israel. (Sponsor: Naama Constantini, FACSM)

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(no relevant relationships reported)

Purpose: Weather forecasts for the upcoming Olympic Games in Tokyo predict hot and humid conditions, which have a negative effect on performance. Our aim was to...
estimate the heat load sensation and efficacy of cooling methods using self-reports, and by measuring parameters of hydration status of Olympic-level 470 sailors and windsurfers, during a training camp in the summer of 2019 in Japan.

Methods: Seven females (4 windsurfers, 3 sailors 470) and 4 males (470 sailors), age 21.17 ± 1.4, used cooling vests, plates, and collars before and in-between training races. Weather conditions were measured using Kastel 5500. Athletes scored their heat load sensation on a scale of 1 – “comfortable” to 5 – “unbearably hot” after each practice. Following the use of different cooling accessories, the athletes were asked to rate cooling method efficiency between 1 – “not efficient” to 5 – “very efficient”.

Hydration status, was assessed by urine specific gravity (USG) prior to each training, body weight change and fluid intake measure during training sessions.

Results: During the 8 training days the average weather conditions were: heat index 26.3°C ±3.7, humidity 84% ±5%, and temperature 27.7°C ± 1.5°C. Average sea training duration was 22 min/66 for sailing and 177 min ±34.6 for windsurfing. Although the heat index did not change, the heat load sensation rating was affected by wind speed – rated as 2.5 when the wind speed was above 8 knots and 4 with lower wind speed (P < 0.002). Using cooling vests before and between races was rated as efficient (4). Cooling plates (inserted under the life vests) and a cooling collar were somewhat less efficient (3.5 and 3.1 respectively). Athletes were well hydrated before training (average USG 1.099 ± 0.007), and maintained good hydration during training (average fluid consumption of 2.1L ± 0.9 and average weight loss of 0.05Kg ± 0.55).

Conclusions: High humidity with a moderate heat index was measured at the area of the Tokyo Olympic Sailing Arena during July 2019. The athletes reported high heat load sensation during training and found different methods efficient. Higher wind speed decreased the heat load sensation, probably due to the acceleration of sweat evaporation. High awareness and prior training in a hot environment like Israel may contribute to improved drinking behavior and hydration status.

Sweat testing is often conducted to assist with electrolyte replacement plans for athletes. However, the effect of patch application timing and on-skin duration on local sweating rate (LSR) and sweat electrolyte concentrations is unclear. Purpose: To determine the effect of patch application timing and on-skin duration on LSR and local sodium ([Na+]) and chloride ([Cl−]) concentrations. Methods: Nine recreationally trained individuals (VO2max: 47.1 ± 7.8 mL/kg/min) were randomly assigned to one of three treatments: PRE LONG > PRE SHORT > PRE LONG + PRE SHORT for [Na+] (56.8 ± 21.6, 58.5 ± 22.3 > 50.7 ± 21.0 > 46.8 ± 19.6 mmol/L, p < 0.001), [Cl−] (55.2 ± 23.5, 53.5 ± 25.1 > 49.4 ± 22.1 > 38.2 ± 21.7 mmol/L, p < 0.0001), and LSR (1.4 ± 0.3, 1.6 ± 0.6 > 1.1 ± 0.3 > 0.8 ± 0.4 mg/cm²/min, p < 0.0001). There were no significant differences for [K+] between EX LONG, EX SHORT, PRE LONG, and PRE SHORT (3.8 ± 0.6, 4.0 ± 0.9, 3.9 ± 0.6, 3.5 ± 0.6 mmol/L, p = 0.79). Conclusion: The on-skin duration did not affect sweat [Na+] and [Cl−] when patches were applied during exercise. However, applying patches prior to exercise resulted in lower sweat [Na+] and [Cl−], especially when removed after a short duration. This was likely due to lower LSR during the ramp up to steady state sweating. Therefore, practitioners should take patch application timing into account when interpreting sweat electrolyte results. Local sweat [Na+] and [Cl−] measured from patches applied prior to exercise may not be representative of concentrations during the full bout of exercise. However, more research is needed to determine the impact of patch timing in the context of whole body sweat [Na+] and [Cl−] estimations.

We have previously published regression equations to estimate whole body (WB) sweat sodium concentration ([Na+]WB) from regional (REG) measures; however, a cross-validation is needed to corroborate the applicability of these prediction equations.
between studies. PURPOSE: To determine the validity of published regression equations (Baker et al. 2018) in predicting WB sweat [Na] from REG measures when applied to a new data set. Physiological strain index (PSI) was calculated as previously described. Paired sample t-tests or repeated measures analyses of variance, with Bonferroni post-hoc testing were used to identify significant differences (p<0.05). RESULTS: There was no significant difference in Tc between trials (p=0.84). However, maximum Tc achieved was greater in EQ (39.3±0.7°C) compared to NEQ (39.0±0.7°C, p=0.016). Regardless of time point, HR (p=0.001) and PSI (p=0.004) were significantly greater in EQ compared to NEQ. Trec was significantly elevated in EQ compared to NEQ throughout trials (p<0.001). Perceptually, EQ increased RPE (p=0.003) and TS (p=0.012) compared to NEQ throughout trials. Urine specific gravity (USG) following trials was not significantly different between trials (p=0.151). CONCLUSION: Trial differences in Tc, HR and perceptual measures suggest a greater impairment in thermoregulation while wearing men’s lacrosse protective equipment in the heat. Supervising entities for men’s lacrosse should mandate heat acclimatization periods similar to those in place for American football to ensure athlete safety.

Climate change is increasing the number of hot days to which outdoor workers are exposed, thereby increasing their risk of heat illness. Currently, continuous monitoring of core temperature (Tc) is expensive, invasive, and impractical. The BioModule is a non-invasive physiological monitor that uses heart rate to provide an estimation of Tc, but its accuracy is unknown. PURPOSE: To test the association between measured gastrointestial temperature (TGI) and estimated core temperature (Tc-est) from the BioModule device during outdoor work in a hot environment. METHODS: Twenty groundskeepers (18 men; mean±SD age = 38.8±y, body mass index = 31.5±7.5 kg/m²) swallowed an ingestible temperature sensor and strapped on a BioModule before work. Tc-est was collected every 15 minutes during the workday. Tc-est was determined by a 1-min average from the same time of day. Data collection occurred in Alabama during July and August (31.4±4.1 °C WBGT). Relationship between Tc-est and Tc was quantified using the repeated measures correlation coefficient (r), Agreement (bias±1.96 SD) between Tc-est and Tc was evaluated using the Bland-Altman method for repeated observations. RESULTS: There was a moderate, positive relationship between Tc-est and Tc (r=0.56, p<0.001). Agreement analysis indicated that Tc-est overestimated Tc (0.28±0.58 °C). The error between Tc-est and Tc was larger at lower temperatures, as indicated by a strong negative trend (Pearson’s r = −0.73). CONCLUSION: The BioModule provides an estimation of Tc that may be helpful for a guide during outdoor work in hot environments but should not be used for safety considerations or measurement of Tc. Funded by the Deep South Center for Occupational Safety and Health, a National Institute for Occupational Safety and Health, and Research and Education Center.

Sweat electrolytes: Influence of environment, sex and exercise intensity. Mindy Millard-Stafford, FACSM, Michael L. Jones, Teresa Snow, Nicholas W. Shea, Georgia Institute of Technology, Atlanta, GA. Email: mindy.millardstafford@ap.gatech.edu

Reported Relationships: M. Millard-Stafford: Consulting Fee; The Coca-Cola Company.

Sweat electrolytes: Influence of environment, sex and exercise intensity. Mindy Millard-Stafford, FACSM, Michael L. Jones, Teresa K. Snow, and Nicholas W. Shea. School of Biological Sciences, Georgia Institute of Technology, Atlanta, GA. Sweat rate and electrolyte loss are highly variable among individuals; but sources of intra-individual variability due to test conditions remain to be quantified. PURPOSE: To determine the impact of exercise intensity and environment on sweat electrolyte losses in men and women. METHODS: Twenty adult male and female participants completed two sessions during summer months: 3 x 20 min intermittent cycling beginning at low intensity (50/75 Watts) with 25 W increases in work rate under hot-humid (35°C, 60%RH) or hot-dry (35°C, 20%RH) conditions. Whole body sweat rate, regional sweat [Na⁺] and [K⁺] were obtained at each work rate. Sweat was acquired via Omnicon centrifugation method and sweat volume and electrolyte losses were measured using Horiba LAQ/Autrin ion meters. RESULTS: Sweat rate and [Na⁺] was significantly higher (p<0.001) due to increased RH in the heat and incremental changes in exercise intensity. Compared to low exercise intensity, sweat [Na⁺] increased by 26 (72%) and 39 mmol (108%) with successive 25W increases, similar in relative magnitude to
sweat rate increases of 0.4 l/min (67%) and 0.6 l/min (100%) compared to low exercise intensity. However, [Na+] difference due to greater %RH of environment (60% vs. 20%RH) was only 7.7 mmol (14%) higher for all bouts combined. Sweat [K+] was not different (p=0.4) based on environment, but significantly higher (p<0.003) under low intensity exercise compared to higher work rates (6.9±1.9 vs. 6.0±1.4 mmol). When work rate was matched (75W) under humid conditions, no differences between men and women were observed in sweat rate (0.8 ± 0.3 mm) or sweat sodium (49.2 ± 17.2 vs. 47.6 ± 15.5 mmol). CONCLUSIONS: At matched low intensity exercise, sex differences in sweat sodium and rate were not observed. Intra-individual variability in sweat sodium is influenced more by modest incremental changes (25 W) in exercise intensity than the ambient humidity in hot conditions. Sweat test variability of athletes using field techniques should carefully consider the intensity of the training session to accurately translate results.

Supported by a grant from The Coca-Cola Company

3497 Board #318 May 29 2:30 PM - 4:00 PM
Abstract Withdrawn

3498 Board #319 May 29 2:30 PM - 4:00 PM
Core Temperature And Blood Lactate Kinetics After Graded Exercise Testing In The Heat
1University at Buffalo, Buffalo, NY. 2California State University, Fresno, Fresno, CA. 3Concordia University, Chicago, IL.
(No relevant relationships reported)

Utility of a verification to confirm maximal oxygen intake (VO2max) in the heat is unclear and initial studies are needed to explore recovery duration between the initial graded exercise test (GXT) and the verification test to ensure verification trial fidelity.

PURPOSE: To compare the recovery kinetics of gastrointestinal temperature (Tgi) and blood lactate (BLa) after a GXT in the heat between trained and untrained cyclists.

METHODS: Trained (n=10; age: 22.6±2.2 y; body fat: 15.4±5.8%) and untrained (n=11; age: 23.4±2.9 y; body fat: 21.5±5.8%) male cyclists volunteered. Tgi, BLa (finger prick), expired gases, and power output (watts; W) were continuously measured during the GXT in a heated chamber (39°C, 31%RH). After the GXT, subjects exited the chamber and rested in a temperate room (22°C, 40%RH) until Tgi returned to baseline levels. Concurrently, BLa at recovery (trained: 37.8±0.2; untrained: 37.7±0.2ºC; p=0.37). BLa at recovery (trained: 34.9±0.2 mmol/L; untrained: 34.7±0.2 mmol/L; p=0.99) in both groups (p<0.001) with no group main effects (p=0.14).

RESULTS: As expected, the trained cyclists GXT was longer (709.8±316.6 vs. 569.0±98.0 s; p=0.02) and achieved greater peak power output (278±32 vs. 238±32 W; p=0.009) than the untrained cyclists. Tcore fell 3.2±1.5 mmol/L in the trained cyclists and 3.1±1.7 mmol/L in the untrained cyclists (p=0.03). Post GXT, Tmuscle (0.96±0.15 deg C) was positively correlated with the increases in Tcore (R = 0.75, p=0.01). During recovery, Tmuscle rose ~1 deg C (i.e. similar to that seen during WBH), the exercise paradigm was repeated.

CONCLUSION: As expected, the trained cyclists GXT was longer (709.8±316.6 vs. 569.0±98.0 s; p=0.02) and achieved greater peak power output (278±32 vs. 238±32 W; p=0.009) than the untrained cyclists. Tcore fell 3.2±1.5 mmol/L in the trained cyclists and 3.1±1.7 mmol/L in the untrained cyclists (p=0.03). Post GXT, Tmuscle (0.96±0.15 deg C) was positively correlated with the increases in Tcore (R = 0.75, p=0.01). During recovery, Tmuscle rose ~1 deg C (i.e. similar to that seen during WBH), the exercise paradigm was repeated.

3499 Board #320 May 29 2:30 PM - 4:00 PM
New Zealand Blackcurrant Extract Modulates Peripheral Blood Mononuclear Cell Response To Exertional Heat Stress
1University of St. Thomas, Saint Paul, MN. 2University of Colorado, Denver, CO. 3University at Buffalo, Buffalo, NY. 4University of California, Berkeley, Berkeley, CA. 5University at Buffalo, Buffalo, NY.
(No relevant relationships reported)

Exertional Heat Stress
Peripheral Blood Mononuclear Cell Response To

METHODS. Trained (n=10; age: 22.6±2.2 y; body fat: 15.4±5.8%) and untrained (n=11; age: 23.4±2.9 y; body fat: 21.5±5.8%) male cyclists volunteered. Tgi, BLa (finger prick), expired gases, and power output (watts; W) were continuously measured during the GXT in a heated chamber (39°C, 31%RH). After the GXT, subjects exited the chamber and rested in a temperate room (22°C, 40%RH) until Tgi returned to baseline levels. Concurrently, BLa at recovery (trained: 37.8±0.2; untrained: 37.7±0.2ºC; p=0.37). BLa at recovery (trained: 34.9±0.2 mmol/L; untrained: 34.7±0.2 mmol/L; p=0.99) in both groups (p<0.001) with no group main effects (p=0.14).

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Prior studies suggest that moderate whole-body heating (WBH), which raises internal temperature (Tcore) –0.6–1.0 deg C, alters the exercise pressor reflex. It is speculated that elevated muscle temperature (Tmuscle) changes the sensitivity of muscle afferents. However, less is known about the effects of passive WBH on the limb Tmuscle during exercise.

PURPOSE: To determine limb Tmuscle during exercise under passive WBH and limb heating conditions.

METHODS: Forearm Tmuscle was measured with a needle probe (thermocouple) in 8 healthy subjects (57 ± 3 yrs). Mean skin temperature (Tsk), Tcore (telemetric pill), the arm skin temperature (Tarmskin, not covered by suits), blood pressure (BP) and heart rate (HR) were measured during WBH with water perfused suits. After Tcore rose –0.6 deg C, subjects performed a fatiguing handgrip exercise followed by post exercise circulatory occlusion (PECO). In a separate visit, the forearm was heated with a water perfused sleeve. After the Tcore rose –1 deg C (i.e. similar to that seen during WBH), the exercise paradigm was repeated. RESULTS: Passive WBH significantly raised Tsk (3.2 ± 0.3 deg C), Tarmskin (1.9 ± 1.0 deg C), Tmuscle (0.96 ± 0.15 deg C) and HR. The increases in Tmuscle were positively correlated with the increases in Tcore (R = 0.75, P < 0.05). Limb heating raised Tmuscle (0.98 ± 0.11 deg C), Tarmaskin (2.3 ± 0.6 deg C), and did not affect Tcore or HR. There was no significant difference in the grip force, grip time, or the change in HR with handgrip between the trials. The increases in Tmuscle during the last min of grip (0.37 ± 0.07 vs. 0.92 ± 0.17 deg C, P < 0.03) and PECO (P = 0.01) were significantly lower during WBH than during the limb heating trial. CONCLUSION: Although local limb heating and WBH induced similar elevations in Tmuscle, the responses in Tmuscle to exercise were different between these two heating conditions. Supported by NIH R01 LM141198 (Li and Cui) and UL1 TR002014 (Sinoway), and AHA Award #15GRNT24490051 (Cui).

The use of verification bouts (VRB) to confirm maximal oxygen consumption (VO2max) in thermoneutral conditions is well established. Less is known about the utility of VRF in the heat. The impact of a hot environment may affect trained and untrained subjects differently. Data demonstrating the impact of heat on repeat bouts of high-intensity exercise may be useful for individuals performing an uncustomized activity in the heat.

PURPOSE: To compare VO2heart rate (HR), and rating of perceived exertion (RPE) from a graded exercise test (GXT) vs. VRF in trained vs. untrained subjects.

METHODS: Aerobically trained (T) (n=10) and untrained (UT) (n=11) college-aged males volunteered. Baseline gastrointestinal temperature (Tgi)

Abstracts were prepared by the authors and printed as submitted.
and resting VO\textsubscript{2}, RPE, and HR values were collected then subjects rested in a heated chamber (39°C, 31% relative humidity) for 20 min before completing the GXT. Post-GXT, subjects exited the chamber and rested in a thermoneutral room (22°C, 40%RH) until Tgi returned to baseline. Subjects re-entered chamber and repeated pre-GXT procedures prior to VRF. For VRF, subjects warmed-up cyclic at 60% maximal wattage (Wmax) from GXT and then cycled at 110% Wmax until exhaustion. VO\textsubscript{2}, HR, and RPE values from the last complete min were used for comparison. A 2 × 2 [(T vs. UT)/GXT vs. VRF] mixed-factor ANOVA with Bonferroni post hoc tests and an alpha of 0.05 was used for analysis. RESULTS: VO\textsubscript{2} trained cyclists VO\textsubscript{max} was greater than untrained (56.4±8.6 vs. 40.1±5.9 mL·kg\textsuperscript{-1}·min\textsuperscript{-1}, p<0.001). VO\textsubscript{2} during GXT was greater than VO\textsubscript{2} for both groups (p=0.013, η\textsuperscript{p}=0.29). HR: subjects had significantly higher HR during GXT vs. VRF (T:178.8±178.0 bpm; UT:196.0±181.5 bpm; p=0.001, η\textsuperscript{p}=0.74) and HR was not significantly different between groups (p=0.77). RPE: There was a significant difference between VO\textsubscript{2} (p=0.004, η\textsuperscript{p}=0.21), and with a hot water immersion and sauna suits on VO\textsubscript{max}, running economy, and lactate threshold. METHODS: Participants (see table for physical characteristics) were randomized into three standardized 3wk exercise training groups: 1) exercise training alone - control (N=10), 2) exercise training with immediate post-exercise hot water immersion in the heat (N=10), and exercise training with immediate post-exercise sauna suit (N=10). At baseline and post-program participants completed a running economy protocol and maximal exercise testing protocol to measure VO\textsubscript{max} and lactate threshold. The running economy protocol consisted of three consecutive 5-minute stages: stage 1 = 4.6 mph, stage 2 = 5.0 mph, and stage 3 = 5.4 mph. RESULTS: After 3wk, mean VO\textsubscript{max} and lactate threshold changes in the sauna suit and hot water immersion groups were significantly greater (p < 0.05) when compared to the control group (see table). The hot water immersion group showed significant within-group improvements (p < 0.05) in economy baseline and 3wk for all three stages (see table), although there were no between group differences (p > 0.05). CONCLUSION: Both post-exercise passive heating strategies were equally effective at improving running economy relative to wearing a sauna suit after untrained subjects.

### Table

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Control group</th>
<th>Sauna suit group</th>
<th>Hot water immersion group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age [yr]</td>
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<td>24.8±17</td>
<td>23.9±15</td>
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<td>Height [cm]</td>
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<tr>
<td>Economy - stage 2 [W/kg\textsuperscript{-1}]</td>
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<tr>
<td>VO\textsubscript{2max} [ml/kg/min]</td>
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*Control group change is significantly different from baseline, p<0.05. Change from baseline is significantly different from control group, p<0.05.

### Conclusion

Post-exercise passive heating strategies may be tied to VO\textsubscript{2max} more than HR in the heat in trained subjects. VO\textsubscript{2} during VRF may not be necessary for the determination of VO\textsubscript{2max} in all subjects during GXT which may confirm VO\textsubscript{max} or indicate premature fatigue due to heat. Thus, a VRF may not be necessary for the determination of VO\textsubscript{max} in non-trained subjects.

### Methodology

**Vol. 52 No. 5 Supplement**

**Board #323** May 29 2:30 PM - 4:00 PM

**Post-exercise Passive Heating Strategies Improve VO\textsubscript{max}, Running Economy, And Lactate Threshold**

Bryant R. Byrd\textsuperscript{1}, Joyce S. Ramos\textsuperscript{2}, Claire Drummond\textsuperscript{2}, Jonathan W. Specht\textsuperscript{3}, Angelo K. Valenciana\textsuperscript{1}, Lance C. Dallice\textsuperscript{1}.\textsuperscript{1}Western Colorado University, Gunnison, CO. \textsuperscript{2}Flinders University, Adelaide, Australia. Email: bbyrd@western.edu

(No relevant relationships reported)

VO\textsubscript{max}, running economy, and lactate threshold have long been established as physiological determinants of endurance performance. Strategies to optimally improve these parameters have therefore been of much interest to endurance athletes.

**PURPOSE:** To determine the effects of post-exercise passive heating strategies relative to wearing a sauna suit after exercise.

**METHODS:** Participants (see table for physical characteristics) were randomized into three standardized 3wk exercise training groups: 1) exercise training alone - control (N=10), 2) exercise training with immediate post-exercise hot water immersion in the heat (N=10), and exercise training with immediate post-exercise sauna suit (N=10). At baseline and post-program participants completed a running economy protocol and maximal exercise testing protocol to measure VO\textsubscript{max} and lactate threshold. The running economy protocol consisted of three consecutive 5-minute stages: stage 1 = 4.6 mph, stage 2 = 5.0 mph, and stage 3 = 5.4 mph. RESULTS: After 3wk, mean VO\textsubscript{max} and lactate threshold changes in the sauna suit and hot water immersion groups were significantly greater (p < 0.05) when compared to the control group (see table). The hot water immersion group showed significant within-group improvements (p < 0.05) in economy baseline and 3wk for all three stages (see table), although there were no between group differences (p > 0.05). CONCLUSION: Both post-exercise passive heating strategies were equally effective at increasing VO\textsubscript{max} and lactate threshold values. Additionally, the absence of between-group statistical significance, preliminary evidence suggests post-exercise hot water immersion may be a more effective strategy at improving running economy relative to wearing a sauna suit after untrained subjects.

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*Control group change is significantly different from baseline, p<0.05. Change from baseline is significantly different from control group, p<0.05.*
PurPOSE: Determine the effect of hydration status and ice water dousing on heart rate variability (HRV) prior to and during intermittent exercise in the heat.

METHODS: Ten team sport athletes (mean [M]= standard deviation [SD]; age, 21±1; body mass, 68.8±1.7 kg; height, 175.0±7.3 cm; VO2max=54.5±6.8 ml·kg⁻¹·min⁻¹) performed a soccer simulated intermittent exercise treadmill protocol in the heat (ambient temperature, 33°C; relative humidity, 50%); with four conditions: Euthydrated without dousing (EuNd), Dehydrated without dousing (DeNd), Euthydrated with dousing (EuD), and Dehydrated with dousing (DeD). Resting HRV (LnRRMSD) was measured prior to (PRI) and between intermittent exercise (MID) for 5 min. Repeated measures ANOVA was used to examine the differences of HRV in each condition followed by post-hoc with LSD. 95% confidence intervals (95%CI) were calculated. Significance was set a-priori p<0.05.

RESULTS: Percent body mass loss for each condition at MID was Eu-ND=0.5±0.3%, Eu-DeND=0.6±1.5%, Eu-DeD=0.8±1.1%, and Eu-PreDeD=2.4±2.2%. There were no differences between PRE-EuNd (M±SD; 17.0±0.5 ln ms), PRE-DeNd (M±SD; 1.8±0.9 ln ms), PRE-EuD (M±SD; 2.0±0.6 ln ms), and PRE-DeD (M±SD; 19.7±0.2 ln ms) (p>0.05). However, MID-EuNd (M±SD; 1.9±0.8 ln ms) was significantly lower than MID-EuD (M±SD; 2.8±0.6 ln ms, 95%CI=−1.7−0.2, p=0.021) and MID-DeD (M±SD; 1.6±0.5 ln ms) was significantly lower than MID-EuD (M±SD; 2.8±0.7 ln ms, 95%CI=−1.8−0.6, p=0.002). Furthermore, MID-DeNd was significantly lower than MID-EuD (95%CI=−1.8−0.7, p=0.001) and MID-EnD was significantly lower than MID-DeD (95%CI=−1.9−0.1, p=0.037). CONCLUSIONS: There were no differences in HRV between euthydration and dehydration prior to exercise. However, ice water dousing increased HRV regardless of hydration status at the middle of intermittent exercise. Thus, ice water dousing is practical and time efficient, might lead to improved recovery at the middle of intermittent exercise in the heat.

PurPOSE: Define the effects of ischemia, hypothermia, and cerebral autoregulation on changes in blood pressure (BP), heart rate (HR), and cerebral blood flow (CBF) during recovery from a hyperthermic state.

METHODS: Seventeen healthy participants (age: 22±2 y, 6 females) completed two randomized trials which consisted of 30 min of HOT (39°C) or TN (35°C) HOWI. Beat-to-beat blood pressure (MAP), middle cerebral artery blood velocity (MCAv), and the partial pressure of end-tidal CO2 (PETCO2) were recorded continuously. After 5 min of seated baseline, participants breathed hypercapnic gas (3%, 7%, and 13% CO2, for 3 min each) in a stepwise fashion. CVR testing was completed pre, 30 min into HOWI, and immediately post-HOWI. CBF was measured as the volume of blood flow to the brain, as calculated by the product of PETCO2 and MCAv, and PETCO2 was measured as the partial pressure of CO2 in exhaled air.

RESULTS: PETCO2 increased significantly from pre (PRE-PETCO2) to mid (MID-PETCO2) to post (POST-PETCO2) in the HOT condition (p<0.05). However, in the TN condition, PETCO2 remained stable throughout the trial (p>0.05). MCAv showed a significant increase from pre to mid to post in the HOT condition (p<0.05) and remained stable in the TN condition (p>0.05). MAP increased significantly in the HOT condition from pre to mid (p<0.05) and remained stable in the TN condition (p>0.05). CVR testing showed significant reductions in CVR from pre to mid to post in both conditions (p<0.05).

CONCLUSIONS: Ischemia, hypothermia, and cerebral autoregulation are affected by the hyperthermic state. Further investigations are needed to determine the long-term effects of hyperthermia on cerebral autoregulation and CBF.
The human intestinal microbiota (IM) contains a diverse array of micro-organisms from more than 1,000 species that inhabit the surface and contents of the gastrointestinal tract. The number of bacterial cells (10^13 - 10^14) is approximately the number of cells in the human body. Most research ignores the contributions of this biomass to human metabolic and physiologic responses. PURPOSE: To examine influences of the IM on research measurements of metabolism and calculations of heat balance. METHODS: This prospective study combined data from 9 IM, 4 small animal, and 6 human peer-reviewed publications. Our analyses compared IM versus human metabolism and heat production. RESULTS: We calculated the rate of IM heat production in the human colon to be 32 kcal/h for fecal bacteria (based on 46 g dry weight of colonic fecal bacteria and a median Lactobacillus heat production of 800mW/g dry weight during anaerobic fermentation). This calculated rate of IM heat production is considerable, when compared to both the resting metabolic rate (RMR) of men (42% of 76.2 kcal/d) and women (34% of 94 kcal/h). The heat production of bacteria residing within the intestinal mucosa is unknown and adds to that of fecal bacteria. Diet contents (e.g., resistant starch) are primary determinants of IM heat production. Considering Acceptable Macronutrient Distribution Ranges published by the National Academy of Sciences, USA, the fermentation of plant material generates 69.3 - 264.6 Kcal/d during metabolism of a 2200 kcal/d intake. CONCLUSIONS: Because IM metabolic and thermal effects are sufficiently large to have a measurable impact on research, we conclude that the IM represents an uncontrolled, unmeasured factor in the experimental design of human studies. Resting experimental protocols will incur a larger percent error than protocols involving exercise and elevated IM metabolic rates. Researchers should acknowledge the IM as a study limitation and control these factors which strongly affect IM metabolism such as exercise, antibiotics, diet, and prebiotics.
Sports clothing potentially limits evaporation from the skin due to an inhibitory microclimate between the skin and the environment. New materials and aeration systems are being developed to negate this limitation from current clothing.

**METHODS:** Eight healthy male participants were recruited in the study (age: 25±3yr; height: 171.6±7.4cm; weight: 79.2±14.2kg). Participants performed 4 exercise trials in a cross-over randomized design: standard-F (S-F), novel-F (N-F), standard-V (S+V), and novel-V (N+V). Participants exerted for 60-min on a cycle ergometer in a heated, humidity-controlled chamber (24.9±0.4°C and 32.0±2.6%RH; temperature and RH p>0.05 for all trials). During the first 30min, participants exercised in the trial specific with no external wind. In the second 30min, the fan was used to simulate wind speed equivalent to 2m/s applied to the chest or the vest was worn to simulate wind to chest and back. Heart rate (HR), skin temperature (Tsk), and core temperature (Tcore) were recorded every 5min. Tsk was measured by ingestible sensor 4.5 hours before exercise and Tsk was assessed at 5 sites: upper chest, mid-chest, forearm, upper back, and mid-back. The vest had 10×15cm ventilation area that covered mid-chest and mid-back. Rating of perceived exertion (RPE) and feeling (‘5 good; ‘5 bad) were assessed every 5min.

**RESULTS:** Mean weighted Tsk was lowest in N+F (31.3±1.2°C) compared to other trials in final 30min. Tsk of averaged mid-chest and mid-back was lower in the final 30min (32.1±1.9°C) exercise compared to the first 30min in N+F (33.0±1.3°C; p<0.001). However, Tsk of averaged upper chest and back (outside of ventilation area) remained the same in final 30min as first 30min (~34°C). No significant differences were found in Tsk and HR across the trials. N+F had lowest RPE and best overall feeling compared to other trials in the final 30min.

**CONCLUSIONS:** N+F had greatest impact on upper body heat dissipation, mainly appearing in lower chest Tsk and RPE. In addition, novel ventilation vest successfully decreased the Tsk of mid-chest and back in final 30min exercise.

**abstract withdrawn**

**Board#337 May 29 2:30 PM - 4:00 PM Investigating The Effect Of Mouth Guard Use On Aerobic Performance In Amateur Boxers.**

Irfan Ahmed, Courtney Kips, Peter Fine. UCL, London, United Kingdom. (Sponsor: Dr James Hull, FACSM)

Purpose – To assess if wearing a mouth guard effects maximal aerobic capacity in amateur boxers.

Methods – 13 amateur boxers took part in a prospective crossover study to assess maximal aerobic capacity achieved during the 20m Multi Stage Fitness Test (MSFT). Each participant completed the MSFT 7 days apart, under control (no mouth guard – C) and intervention conditions (mouth guard – MG). The order of tests was determined via a coin toss on day 1, and two primary outcomes measures were recorded: (1) the estimated maximum oxygen uptake (VO2 max – kg·mL·min−1) and (2) distance run (meters – m). Data on height, weight, and type of mouth guard were recorded. Complete datasets on Rate of Perceived Exertion (RPE) were available for 10 boxers. Results – Mouth guard use was shown to reduce estimated VO2 max and distance run during the 20m MSFT from 56.31 kg·mL·min to 54.12 kg·mL·min and 2572 m to 2380 m respectively, (P=0.05). All 13 participants recorded lower VO2 max scores when wearing a mouth guard. (Mean=2.43±Lm·kg·min, Range=4.2±0.9 mL/kg/min). 10 participants submitted data on RPE and reported a 32.3% increase in mean RPE scores when compared to the MSFT in mouth guards compared to control conditions, (P<0.05).

Conclusions – Mouth guard use was shown to significantly reduce aerobic performance in amateur boxers and increase the perceived rate of exertion during the 20m MSFT.

**Board#338 May 29 2:30 PM - 4:00 PM The Relationship Between Flourishing, Pain, And Injury In Collegiate Athletes.**

Garrett Bullock1, Shefali Christopher2, Bryanna J. Veroneu2, Bailey A. Toddlock2, Amy Knab3, Chris Harriman2, Vallabhajosula4,5, Dr. Stephen Bailey, FACSM

1University of Oxford, Oxford, United Kingdom. 2Elon University, Elon, NC. 3Queens University of Charlotte, Charlotte, NC. 4Mary Baldwin College, Staunton, VA. (Sponsor: Dr. Stephen Bailey, FACSM)

Email: garrettbullock@gmail.com

**Purpose:** To evaluate the relationship of pain and injury with flourishing in NCAA athletes and to compare by division.

**Methods:** NCAA division 1 (D1), 2 (D2), and 3 (D3) athletes were given a questionnaire incorporating the flourishing scale and the Oslo Sports Trauma Research Center Overuse Injury Questionnaire (OSTRC). Athletes were further classified by OSTRC scores into overuse and substantial overuse injuries. Multivariable regressions with logarithmic transformations and ANCOVAs were performed to investigate the relationship between flourishing and OSTRC in pain and flourishing, overuse and substantial overuse injury. Confounders controlled for included age, gender, history of orthopaedic surgery and major injury, hours of sleep, and non-steroidal anti-inflammatory use. Unadjusted and adjusted effect size and 95% confidence intervals (95% CI) were reported.

**Results:** 253 athletes (Age: 19-43 (1.18) years; Male: 70; D1: 102; D2: 74; D3: 77; 7-8 hours of sleep: 157 participated. Mean flourishing scores were D1: 48.59 (10.43), D2: 50.08 (5.31), and D3: 48.58 (8.09). The median OSTRC score was 0 (0-22). 124 reported an overuse injury and 47 a substantial overuse injury. There was a unadjusted negative relationship between OSTRC total score and flourishing (r=0.22).
Exertional rhabdomyolysis is a serious clinical condition in which skeletal muscle is rapidly broken down, potentially leading to life-threatening systemic complications. Clinicians often diagnose rhabdomyolysis based on elevations in circulating creatine phosphokinase (CPK) and symptomology. Normal CPK and other biomarker concentrations following intense exercise are unknown. **Purpose:** This study aimed to determine reference concentrations for selected biomarkers that suggest muscle damage, or rhabdomyolysis. **Methods:** Twenty collegiate NCAA I football players were enrolled in the study. Serum and urine samples were collected immediately and responses after strenuous exertion. **Conclusion:** CPK levels were elevated at 0h (958.2 ± 544.1 IU/L), but trended down 24h post practice (751.0 ± 410.5IU/L, p=0.059). LDH was acutely elevated at 0h (217.9 ± 36.7 ng/mL), but decreased 24h post (0.66 ± 1.43 ng/mL, p=0.001).

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**MEDICINE & SCIENCE IN SPORTS & EXERCISE®**

**Friday, May 29, 2020**

**3519 Board #340**
May 29 2:30 PM - 4:00 PM
**Characterization Of Normal Biomarkers Of Muscle Damage In Collegiate Athletes**
Heather Quiari1, Nathan Lemoine1, Haoyan Wang2, Matthew Martone3, Rachel Matthews4, Derek Dalvert1, Jack Marucci5, Stephen Ethridge6, Guillaum Spielmann7, Brian Irving8, FACSM9, Neil Johannsen3, 1Louisiana State University, Baton Rouge, LA. 2Baton Rouge Orthopedic Clinic, Baton Rouge, LA. (Sponsor: Brian Irving, FACSM)
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(No relevant relationships reported)

Exertional rhabdomyolysis is a serious clinical condition in which skeletal muscle is rapidly broken down, potentially leading to life-threatening systemic complications. Clinicians often diagnose rhabdomyolysis based on elevations in circulating creatine phosphokinase (CPK) and symptomology. Normal CPK and other biomarker concentrations following intense exercise are unknown. **Purpose:** This study aimed to determine reference concentrations for selected biomarkers that suggest muscle damage, or rhabdomyolysis. **Methods:** Twenty collegiate NCAA I football players were enrolled in the study. Serum and urine samples were collected immediately and responses after strenuous exertion. **Conclusion:** CPK levels were elevated at 0h (958.2 ± 544.1 IU/L), but trended down 24h post practice (751.0 ± 410.5IU/L, p=0.059). LDH was acutely elevated at 0h (217.9 ± 36.7 ng/mL), but decreased 24h post (0.66 ± 1.43 ng/mL, p=0.001). Average serum myoglobin was higher post-practice (1.31 ± 1.57 ng/mL), but decreased 24 h post practice (751.0 ± 410.5IU/L, p=0.059). LDH was acutely elevated at 0h (217.9 ± 36.7 ng/mL), but decreased 24h post (0.66 ± 1.43 ng/mL, p=0.001).

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**MEDICINE & SCIENCE IN SPORTS & EXERCISE®**

**Friday, May 29, 2020**

**3520 Board #341**
May 29 2:30 PM - 4:00 PM
**Abstract Withdrawn**

**3521 Board #342**
May 29 2:30 PM - 4:00 PM
**The Effectiveness Of Warmup Programs For Lower Extremity Injury Prevention In Basketball: A Systematic Review**

**Reported Relationships:** A.C. Davis: Industry contracted research; National Basketball Association.

**Purpose:** Given the many benefits of sports participation, leading experts have called for attention to factors that might inhibit youth participation. Basketball is the most popular team sport among youth in the US; the popularity of basketball translates to a large absolute number of basketball related injuries. The objective of this review is to evaluate the evidence to support the effectiveness of neuromuscular warm-up-based strategies for preventing lower extremity injuries (LEIs) in basketball. **Methods:** We conducted a systematic review of the literature. We searched the PubMed and Cochrane Library databases, and focused on English-language randomized controlled trials, non-randomized controlled trials, and prospective cohort studies. We included studies that tested neuromuscular and/or balance-focused warmup interventions among basketball players, and that assessed at least one type of LEI as a primary outcome. We critically appraised the quality of the included studies and abstracted data on the interventions, populations, outcomes and exposures. We contacted the authors of five of the studies to obtain details about the interventions or outcome data specific to basketball athletes. **Results:** Thirteen studies testing neuromuscular interventions for LEI prevention in basketball athletes were included in this review. They reported significant protective effects for the following LEIs: ankle injuries (significant in 4/9 studies that assessed this outcome); ACL injuries (2/4 studies); a general knee injury outcome (1/5 studies); and overall LEIs (composite; 5/7 studies). Significant results were almost universally directionally favorable. **Conclusions:** Neuromuscular interventions that require minimal equipment are an appealing injury prevention strategy in youth sports. In soccer, the FIFA 11+ warmup program has been rigorously studied and proven effective when adoption and adherence are strong. Overall, the evidence is supportive of the warm-up for LEI prevention. However, most studies are underpowered, intervention components are varied, and adoption and adherence is often low. More work is needed to validate the necessary and sufficient warmup activities, and to maximize adoption and sustained adherence to these strategies over time.

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**MEDICINE & SCIENCE IN SPORTS & EXERCISE®**

**Friday, May 29, 2020**

**3523 Board #344**
May 29 2:30 PM - 4:00 PM
**The Effect Of Injuries And Pain On Athlete Identity Across NCAA Divisions**
Bryanna Veroneau1, Bailey Tadlock1, Shefali Christopher4, Srikant Vallabhajosula1, Amy Knab2, Chris Harnish3, Garrett Bullock4, 1Elon University, Elon, NC. 2Queens University of Charlotte, Charlotte, NC. 3Mary Baldwin College, Staunton, VA. 4University of Oxford, Oxford, United Kingdom. (Sponsor: Dr. Stephen Bailey, FACSM)
Email: bveroneau@elon.edu

(No relevant relationships reported)

There is a high prevalence of pain and injury in collegiate athletes, which can affect playing time and performance. Previous studies have observed that surgery and concussions can affect athletic identity. Currently, there is a paucity of research investigating how current pain and injury affect athletic identity.

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**MEDICINE & SCIENCE IN SPORTS & EXERCISE®**

**Friday, May 29, 2020**

**3524 Board #343**
May 29 2:30 PM - 4:00 PM
**Time Course Of The Acute Effects Of Static Stretching On Passive Stiffness In Elderly Men**
Ty B. Palmer, Alalee C. Farrow, Chinonly C. Agu-Udumba, Ethan A. Mitchell. Texas Tech University, Lubbock, TX. (Sponsor: C. Roger James, FACSM)

(No relevant relationships reported)

The time course of passive stiffness responses after an acute bout of static stretching has received little research attention, particularly in older adults. **Purpose:** To determine the time course of the acute effects of static stretching on hamstring passive stiffness in elderly men. **Methods:** Fifteen elderly men (70 ± 7 yrs.) underwent one passive straight-leg raise (SLR) assessment before (Pre) and at 0 (Post0), 5 (Post5), and 10 (Post10) min after two randomized conditions that included a control treatment (quiet resting for 2 min) and a stretching treatment. During the SLR, participants laid in a supine position with the knee braced in full extension. Each SLR was administered manually by the primary investigator who applied force against a load cell attached to the heel, while the leg was moved toward the head. All SLR assessments were performed on the right leg to the point of discomfort, but not pain as indicated by the participant, which was regarded as the max range of motion (ROM). An electromyogram was used to measure the hip joint angle. For the stretching treatment, four 15-s SLR static stretches were completed in the same manner as the SLR assessments; however, when max ROM was reached, the leg was held at this position for 15 s. Each 15-s stretch was separated by 15 s of rest. Passive stiffness was calculated during each SLR assessment as the slopes of the initial and final phases of the angle-torque curve. **Results:** Passive stiffness (collapsed across phase) was significantly reduced from immediate post-stretch (P = 0.029 and Post0 (0.95 ± 0.19 Nm/º; P = 0.042) but not Post10 (1.03 ± 0.26 Nm/º; P = 0.999) compared to Pre (1.07 ± 0.23 Nm/º) for the stretching treatment. There were no significant differences (P > 0.999) in passive stiffness between any of the time points (Pre = 1.07 ± 0.25 Nm/º; Post0 = 1.10 ± 0.36 Nm/º; Post5 = 1.09 ± 0.24 Nm/º; Post10 = 1.06 ± 0.24 Nm/º) for the control. **Conclusions:** These findings showed that hamstring passive stiffness in elderly men decreased after four 15-s SLR static stretches but returned to baseline values within 5-10 min. Given the transient nature of these changes in stiffness, we recommend that acute bouts of SLR static stretching be performed on older adults 5 to 10 min prior to physical activity or exercise, as this may ensure lower stiffness and perhaps, greater performance at the start of the event.
**Purpose:** To determine how current collegiate athlete pain and injury affect athletic identity and how these relationships differ across NCAA divisions. **Methods:** NCAA division 1 (D1), 2 (D2), and 3 (D3) athletes were administered a questionnaire through an encrypted database. The Athletic Identity Questionnaire (AIM) and Oslo Sports Trauma Research Center Overuse Injury Questionnaire (OSTRC) were used within the survey. AIM estimates self-perceived athletic identity while OSTRC measures level of participation, training volume, performance, and pain. Athletes were further classified by OSTRC scores into overuse and substantial overuse injury subgroups. Multivariable and logistic regressions assessed the relationship between AIM, OSTRC scores, and overuse injury. Models were adjusted for age, gender, NCAA division, history of orthopedic surgery, and history of major injury, with adjusted coefficients and Odds Ratios (OR) with 95% confidence intervals (95% CI). **Results:** 252 athletes (age of 19.4 years (IQR), female: 181, male: 70; D1: 101, D2: 74, D3: 77) participated. Mean AIM scores were D1: 37.98 (7.61), D2: 37.03 (7.03), and D3: 38.86 (6.98). The OSTRC median score was 0 (QR: 0.02). 127 (50%) athletes had an overuse injury while 47 (19%) had a substantial overuse injury. Adjusted total OSTRC score was -0.67 (95% CI: -2.4, 1.1; p=0.474). Adjusted OR for OSTRC overuse injury was 1.00 (95% CI: 0.97, 1.04; p=0.589) and substantial overuse injury was 0.95 (95% CI: 0.91, 0.99; p=0.036). Similar results were observed between gender and division subgroups. **Conclusion:** After adjusting for confounding variables, it was determined that substantial overuse injuries negatively affected athletic identity, regardless of gender or NCAA division. Sports medicine professionals need to consider the possibility of lost athletic identity when an athlete sustains an injury. Measures should be taken to ensure that athletes continue to have meaningful contribution to sport following pain or injury.

Subjective well-being is related to injury in soccer athletes, but little is known about how these variables change around a single athletic competition. Continued athletic participation combined with negative well-being may lead to tissue overload and subsequent injury. **Purpose:** The purpose of this study was to identify the differences in daily well-being measures before, during and after the day of each match. **Methods:** Thirty female soccer (age: 19.8 ± 1.1 years, height: 1.6 ± 0.05 m, mass: 64.9 ± 6.6 kg) players provided daily measures of readiness, physical fatigue, mental stress, and soreness intensity over the course of a competitive season. Subjective well-being was taken on standard practice days (P), game days (D0), and on days one (D1) two (D2) following games. One-way within subject analysis of variance was used to compare the subjective well-being variables between each time point. Post-hoc analysis was performed with a Bonferroni adjustments. **Results:** A significant main effect was present for readiness (F=52.96, P<0.01). Post-hoc testing revealed readiness on D1(68.5 ± 12.4) was significantly more negative than readiness on P (77.9 ± 8.0, p<0.01), D0 (73.0 ± 13.4, p<0.01), and D2 (77.1 ± 8.8, P<0.01). A significant main effect was present for fatigue (F=41.8, P<0.01). Post-hoc testing revealed fatigue on D1 (0.5 ± 1.6) was significantly more negative than fatigue on P (1.7 ± 1.4, P<0.01), D0 (2.3 ± 1.4, p<0.01), and D2 (1.7 ± 1.5, p<0.01). A significant main effect was present for stress (F=3.8, p=0.01) and soreness (F=15.1, p=0.01), but after accounting for multiple comparisons, there was no differences between times. **Conclusions:**: Self-reported readiness to train and physical fatigue are decreased for a full day following competitive soccer competition. Coaches, strength coaches, and athletic trainers may use this information to tailor training programs to promote recovery and limit injury risk, as previous literature indicates that negative outcomes on subjective scales may be indicative of injury. Future research should incorporate training load assessments into this analysis to understand if these changes are correlated to the frequency, intensity, or volume of soccer training and participation.
Balance and Functionality in Breast Cancer Survivors: Does Improvement in Balance After Exercise Intervention Improve Functional Test Outcomes? Dean Amatuli, Jordan T. Lee, Chad W. Wagoner, Kirsten A. Nyrop, Hyman B. Muss, Brian C. Jensen, Claudio L. Battaglini, FACSM. UNC-Chapel Hill, Chapel Hill, NC.

PURPOSE: Postural control is necessary for proper functionality, independence, and quality of life. Breast cancer survivors (BCS) is a population that has displayed challenges in postural control post-treatment (Wampler et al. 2007). This study evaluated changes in balance and functionality following an exercise intervention which included balance training. METHODS: BCS who completed major anti-cancer treatments within the past year participated in an intervention including aerobic, strength and balance exercises, 3 days/week for 16 weeks. Training progressed in intensity and volume and incorporated movements that challenged whole-body balance. Functionality was measured using the 6 Minute Walk Test (6MWT), dynamic balance using Timed Up and Go (TUG), and balance using the NeuroCom Sensory Organization Task (SOT). Dependent samples t-test using pre and post intervention scores were used to evaluate the impact of exercise on functionality and balance. Pearson correlations were used to assess the relationship between physical function and balance outcomes. RESULTS: Thirty-two BCS (54±12 years) participated. 6MWT distance significantly increased (34.7±48.9m, p<.001) & TUG times significantly improved (-55±10s, p<.005) from pre/post-intervention. SOT composite balance scores also improved (4.0±9.3, p<.025). There was a strong correlation between pre-testing scores of TUG & 6MWT (r=−.70, p<.001). CONCLUSION: A 16-week exercise intervention improves physical function evaluated using 6MWT and TUG and balance using SOT composite scores. However, no relationship was observed between improvements in physical function and balance; possibly due to the differences in the dynamic nature of the physical function and static assessment of balance. Future studies should consider the evaluation of balance using dynamic tasks in order to further examine the relationship between physical function and balance in BCS. Funded by Breast Cancer Research Foundation (New York, NY).

The adverse effects accompanying androgen deprivation therapy (ADT) compromise prostate cancer (PCa) patients’ ability to complete activities of daily living (ADL) requiring muscular strength and mobility. Although emerging evidence suggests lifestyle interventions combining modification of exercise and dietary intake (EX-D) result in improvements in mobility in PCa patients undergoing ADT, the effects of EX-D interventions upon simulated ADL performance has yet to be delineated.

PURPOSE: The purpose of the single-blind, randomized controlled Individualized Diet and Exercise Adherence-Pilot (IDEA-P) trial is to evaluate the preliminary efficacy of a lifestyle EX-D intervention, implementing a group-mediated cognitive behavioral (GMCB) approach, relative to standard of care (SC) among PCa patients undergoing ADT. In the current study, we evaluated the effects of the EX-D intervention on performance of a simulated ADL task at the end of the intensive phase of the intervention.

METHODS: A total of 32 PCa patients (M age = 65 years) on ADT were randomly assigned to the EX-D (n = 16) or SC (n = 16) interventions. Assessments of simulated ADL performance, measured using a lift and carry task, were obtained at baseline and 2 month follow-up assessments. RESULTS: A total of 32 PCa patients (M age = 65 years) on ADT were randomly assigned to the EX-D (n = 16) or SC (n = 16) interventions. Assessments of simulated ADL performance, measured using a lift and carry task, were obtained at baseline and 2 month follow-up assessments. RESULTS: Results of intention to treat ANCOVA analysis of residualized change scores yielded a significant Treatment main effect for (p<0.01) demonstrating that the EX-D intervention resulted in superior improvements in lift and carry performance (d = 1.02) relative to the SC intervention at 2 months. CONCLUSIONS: Findings from the IDEA-P trial suggest that the intensive phase of the EX-D intervention, implementing a GMCB approach designed to promote adoption and adherence to lifestyle behavior change, resulted in superior changes in a simulated ADL performance task relative to SC. These results underscore the utility of lifestyle interventions promoting change in both exercise and dietary behavior for preserving mobility and functional health among PCa patients undergoing ADT.
from December 2013–present. Data were extracted on BC outcomes from 8 published exercise intervention studies involving 307 PCA patients on ADT. The magnitude of pre- to post-intervention change was examined. To isolate the effects of exercise, studies combining other interventions were excluded. Weighted, bias-corrected Cohen’s d effect sizes were calculated for change in each outcome and averaged across included studies. RESULTS: Results revealed that exercise yielded small average improvements in lean body mass (d = 0.09), appendicular lean mass (d = 0.08), trunk fat mass (d = 0.04) and visceral fat mass (d = −0.11). All other measures of whole-body and regional BC showed negligible average effects of exercise.

CONCLUSIONS: The findings of this updated systematic review suggest that while exercise attenuates the established adverse effects of ADT on BC, the magnitude of exercise-induced improvements in BC outcomes is small and inconsistent across studies. These findings have important implications for delineating the effect of exercise on disablement post treatment outcomes and underscores the potential of complementing exercise with targeted nutritional approaches in the supportive care of PCA patients on ADT.

**3532 Board #353 May 29 2:30 PM - 4:00 PM**

**Dynapenic Obesity: Strength, Body Composition, and Physical Function In Women Diagnosed With Head and Neck Cancer**

Lindsey L. Hanson1, Diane K. Ehlers2, Gregory Russell3, Edward Levine4, Marissa M. Howard-McNatt1, Shannon L. Mihalko1. 1University of Nebraska Medical Center, Omaha, NE. 2Wake Forest School of Medicine, Winston-Salem, NC. 3Wake Forest University, Winston-Salem, NC.

(No relevant relationships reported)

**Background:** Breast cancer survivors (BCS) report more limitations performing activities requiring strength compared to women without a cancer history. Combined with obesity, BCS with dynapenia (poor muscle strength) may have greater risk of physical function (PF) difficulties; however, the prevalence and impact of dynapenic obesity (DO) in BCS remains unknown.

**Purpose:** This study aimed to: 1) prospectively determine the prevalence of DO; 2) evaluate associations among DO, clinical factors, and resistance training (RT) and; 3) determine if DO predicts PF in BCS from diagnosis to 2-year follow-up.

**Methods:** DO was operationalized as waist circumference (WC) ≥88 cm and categorized using ACSM normative values. RT participation was determined via interview and categorized as meeting/not meeting RT guidelines for cancer survivors. PF was self-reported as level of difficulty with tasks including standing in place, walking 2 blocks, and lifting objects. Assessments were conducted at diagnosis and repeated at 1- and 2-years post-surgery during scheduled oncology visits. Data were analyzed using descriptive statistics and linear regression.

**Results:** BCs (N=396, Mage=57.11±16.6 years, BMI=29.2±6.2 kg/m²) had a mean WC of 96.2±17.6 cm and combined grip strength of 50.01±13.13 kg. The prevalence of DO was 18.3% at diagnosis, 28.2% at 1-year, and 34.5% at 2-year follow-up. DO was not associated with clinical factors (e.g., diagnosis stage) at diagnosis. A weak, positive association between DO and age was observed at baseline (p=0.09). Meeting RT guidelines at diagnosis was inversely associated with DO at baseline (p=0.008) and 1-year (p=0.05). Controlling for age and RT participation, DO at diagnosis significantly predicted PF difficulty at 1-year (p=0.06) and significantly predicted PF difficulty at 2-year follow-up (p=0.09).

**Conclusions:** A significant proportion of BCS had high central adiposity and poor muscle strength from diagnosis to 1- and 2-year follow-up. DO significantly predicted PF difficulty after surgery, indicating the importance of strength and body composition prior to treatment. RT may be protective against DO; therefore, greater efforts to increase RT engagement in BCS are critically needed.

**3533 Board #354 May 29 2:30 PM - 4:00 PM**

**Manual Therapy And Dynamic Splint Use For Trismus In Head And Neck Cancer Survivors**

Joni Nedeljak1, Suresh Nayyar2, Susan ArmiJo Olivo2, Ivonne Hernandez1, Margaret McNeeley1. 1University of Alberta, Edmonton, AB, Canada. 2Institute for Reconstructive Sciences in Medicine, Edmonton, AB, Canada. 3University of Applied Science, Osnabrueck, Germany.

Email: jnodeljak@mail.ualberta.ca (No relevant relationships reported)

Head and neck cancer (HNC) accounts for 3–5% of cancer cases in the United States. A known complication of oncological treatments for HNC is trismus, defined as limited mouth opening of less than 35mm. Trismus occurs in 6–86% of survivors. There is no standardized treatment for trismus, however, commonly used conservative interventions include manual therapy (MT), active exercises and assistive stretching devices. These interventions have shown promise as means to improve jaw mobility and alleviate symptoms. Without early detection and intervention, trismus is often chronic and progressive in nature.

**Purpose:** To determine the feasibility of study protocols, including recruitment rate, completion rate, adherence to protocol, and to establish processes for the dynamic splint mouthpiece fitting and intervention protocol.

**METHODS:** A single subject design was used in this pilot feasibility study. Participants underwent a treatment protocol involving MT, exercises, and use of a dynamic splint at home for eight weeks. Multiple maximal interincisal opening (MIO) measures were performed at baseline testing, before and after each treatment session, and at the end of the intervention period. Researchers documented participant adherence to supervised sessions and dynamic splint use, and subjective responses to treatment after each session.

**RESULTS:** 70% of participants had an improvement in their MIO after eight weeks, with an average increase of 3.0mm (range: 2.0 to 7.5mm). 90% of participants had 100% adherence to supervised sessions and 70% adherence to home use of the dynamic splint. Two participants were unable to be fitted with a dynamic splint mouthpiece due to insufficient mouth opening and, therefore, used the flat plate of the device. Two participants required special adaptation of the mouthpiece, one due to dental pain and the other due to being edentulous. Treatment protocols required tailoring to facilitate comfort and adherence.

**Conclusion:** Home use of a dynamic splint with MT shows promise as an intervention to address trismus in HNC survivors. The need for adaptations to the mouthpiece and treatment protocol should be anticipated, and a longer intervention period is recommended to optimize outcomes. Supported by: Faculty of Rehabilitation Medicine.

**3534 Board #355 May 29 2:30 PM - 4:00 PM**

**BODY COMPOSITION, PHYSICAL FUNCTION AND QUALITY OF LIFE ACROSS DIFFERENT STAGES OF PROSTATE CANCER: A CROSS-SECTIONAL ANALYSIS**

Cameron K. Stopforth1, Mohamnod Alzer1, Jack Carver2, Alexander Lucas3, Young Whang4, Matthew Milowsky5, David B. Bartlett2, Michael Harrison1, Alan Hayes2, Rhonda L. Bitting3, Anthony C. Hackney2, Claudio L. Battaglini, FACS/M, Erik D. Hanson1. 1University of North Carolina, Chapel Hill, Chapel Hill, NC. 2Wake Forest University, Winston-Salem, NC. 3Duke University, Durham, NC. 4Victoria University, Melbourne, Australia. (Sponsor: Claudio Battaglini, FACS/M)

Email: cstopflor@live.unc.edu (No relevant relationships reported)

**Purpose:** Androgen deprivation therapy (ADT) has detrimental side effects, but changes between localized and advanced prostate cancer are unclear. The purpose is to determine body composition, physical function, and quality of life (QoL) differences across progressive stages of men with PCa on ADT.

**Methods:** Men with localized (PC, n=43, age 67±6.4y) or metastatic castration-resistant prostate cancer (mPC, n=21, age 72±8.3y) and non-cancer controls (CON, n=37, age 69±6.1y) completed total body DXA scans (% fat, lean and fat mass), physical function testing (6m walk, chair stands, timed up and go (TUG), stair climb), and QoL questionnaires (FACT-P).

**Results:** Percent fat differed between all groups, along with greater fat mass in mPC vs. CON. Both stair climb and TUG were slower in mPC compared to both CON and PC, whereas chair stands and 6m walk were only slower in mPC vs. CON. There were trends for lower QoL scores in mPC vs. CON across the FACT-P sub-scales. Percent fat differed between all groups, along with greater fat mass in mPC vs. CON. Both stair climb and TUG were slower in mPC compared to both CON and PC, whereas chair stands and 6m walk were only slower in mPC vs. CON. There were trends for lower QoL scores in mPC vs. CON across the FACT-P sub-scales.

**Conclusions:** Body composition and physical function appear to deteriorate in advanced prostate cancer. As the length of ADT is similar between groups, this suggests that the additional forms of ADT for mPC appear to be influencing these changes. However, increases in body fat and reduced functional capacity with ADT do not translate into lower QoL for mPC. Exercise interventions targeting these outcomes are warranted to minimize the side effects of anti-cancer therapy.

**Table 1. Between group differences in body composition, functional tasks, and quality of life questionnaires in men with various stages of prostate cancer**

<table>
<thead>
<tr>
<th>Body Composition</th>
<th>CON (n=37)</th>
<th>PCa (n=42)</th>
<th>mPC (n=21)</th>
<th>p Value</th>
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<tbody>
<tr>
<td>% Fat</td>
<td>28.1±6.5</td>
<td>29.9±8.9*</td>
<td>34.5±5.6*</td>
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<td>Total Fat Mass</td>
<td>22.7±8.9</td>
<td>27.9±12.1</td>
<td>32.2±17.0</td>
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<tr>
<td>Functional Tasks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stair Climb (sec)</td>
<td>4.7±1.0</td>
<td>4.8±1.0</td>
<td>6.1±2.4*</td>
<td>0.006</td>
</tr>
<tr>
<td>TUG (sec)</td>
<td>6.1±1.3</td>
<td>6.0±1.5</td>
<td>10.4±8.0*</td>
<td>0.011</td>
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<td>Chair Stands (sec)</td>
<td>9.3±2.2</td>
<td>10.6±3.1</td>
<td>12.8±6.9*</td>
<td>0.007</td>
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<td>6m Walk (sec)</td>
<td>3.9±0.7</td>
<td>3.9±0.4</td>
<td>4.7±1.5*</td>
<td>0.018</td>
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<td>Quality of Life</td>
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<tr>
<td>FACT-P</td>
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<td>121.8±20.7</td>
<td>120.0±18.5</td>
<td>0.050</td>
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<td>Social Well-Being</td>
<td>27.0±5.1</td>
<td>21.8±4.4*</td>
<td>22.9±3.4</td>
<td>0.006</td>
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<td>Trial Outcome Index</td>
<td>91.6±6.9</td>
<td>80.2±14.8</td>
<td>77.8±37.2*</td>
<td>0.044</td>
</tr>
</tbody>
</table>

Data reported are mean (standard deviation).

Indicate significant results (p<0.05).

*pPC vs. CON; *mPC vs. PCa; *PCa vs. CON

Abstracts were prepared by the authors and printed as submitted.
While individualized exercise training improves physical and psychosocial health, paired exercise training may result in similar improvements at a reduced patient-to-staff ratio. **Purpose**: To compare the effect of paired vs. individualized exercise training on physical and psychosocial health in cancer patients. **Methods**: Twenty-five female cancer patients (mean±SD: 62±8 years) were assigned to exercise in pairs (n=13) or individually (n=12). They completed 36, 90-min sessions consisting of cardiovascular, resistance, balance and flexibility training according to standardized guidelines. Cardiorespiratory fitness (VO_{2peak}), muscular strength (1-repetition max), endurance (chair squat test), balance (single leg stance), and flexibility (sit-and-reach) were measured pre-and post-exercise. Psychosocial health was assessed pre-, mid- and post-intervention (Functional Assessment of Cancer Therapy-General (FACT-G), Insomnia Index, Brief Fatigue Index, Patient Health Questionnaire-9). Two-way ANOVAs (Factors: Group, Time) were used to identify main effects or interactions; main effect (Time) was not significant for insomnia for either group (p=0.0778), but paired patients exhibited larger improvements in lower body endurance (S: 24.0% vs. P: 17.8%), flexibility (S: 5.3% vs. P: 11.0%), and balance (S: 17.8% vs. P: 36.8%). A significant main effect (Time) was detected in the functional dimension (FACT-G) but not in social (p=0.200), emotional (p=0.054), or physical well-being (p=0.076). Time (main effect) was not significant for insomnia for either group (p=0.0778), but paired patients had significant improvements in sleep from pre-to mid-intervention (9.8±6.9 vs. 7.2±6.3). **Conclusion**: The social aspect associated with paired exercise sessions may have increased motivation, resulting in enhanced improvements in fitness and mental well-being in the paired group. These data suggest that exercising in pairs is a promising approach to cancer rehabilitation.
In blood cancer, aerobic physical activity may improve fatigue and depression, though its effect on quality of life and physical function is less clear. Assessment of Fit to Thrive (FTT), a community-based individualised, supervised exercise program for people with blood cancer, may assist with future recommendations.

**Purpose:** To assess the effect of the FTT program on physical function and quality of life (QoL) in people with blood cancer.

**Methods:** The 12-week FTT program utilised progressive aerobic and resistance training, supervised by an Accredited Exercise Physiologist, in small groups (n=6), twice weekly, for 8 weeks, with associated psychosocial and peer support. Physical function was assessed via the six minute walk (6MW), functional forward reach (FFR) and 5 times-sit-to-stand (5TSTS) tests. QoL was measured using the 36-item Short Form Survey Instrument (SF-36) and the Functional Assessment of Cancer Therapy General (FACT-G). Minimally important differences (MID) involved a change of 2 points for the SF-36, 3 points for the FACT-G and +50m for 6MW.

**Results:** Participants (n=106) who attended the FTT program between 2014 and 2016 were recruited. Participants completed standard questionnaires pre- and post-intervention.

**Conclusion:** The FTT program was effective in improving physical function and QoL, with some evidence for long-term effects. An individually-prescribed exercise program supervised by an Accredited Exercise Physiologist should be considered as part of standard care in people with stable blood cancer.
about their usual physical activity, weight history, reproductive history, and past-year dietary intake. Body weight was abstracted from medical records. A sample of breast tissue was collected during surgery. An adipose tissue section was isolated under sterile conditions. Part of the sample was formalin fixed (sectioned at 7 μm thickness for measurement of mean adipocyte size with Image J) and part was flash frozen for RNA isolation. Associations between mean adipocyte size and lifestyle variables were examined by multivariate analysis to determine associations between genes and lifestyle variables. The results of 72 women recruited, RNA was isolated from 65 samples. Participants were a mean age of 43 years (range 19-70) and had a mean body mass index of 27.0 kg/m² (SD 5.0). BMI was positively associated with adipocyte size (β = 0.06, p<0.01) and transportation physical activity was negatively associated with adipocyte size (β = -0.25, p<0.02). Six genes, namely SLC27A2, TTC36, WHSC1L1, AASS, ARCO1, GLUT4, were found to be associated with adipocyte size.

**CONCLUSION:** Adipose tissue biology is associated with lifestyle exposures in normal breast tissue. Our findings provide directions for future research into the impact of lifestyle on the microenvironment of healthy breast tissue.

**3542 Board #363**

**May 29 2:30 PM - 4:00 PM**

**MICROVASCULAR OXYGENATION RESPONSE DURING PADDLING GRADED EXERCISE TEST IN BREAST CANCER SURVIVOR DRAGON BOAT RACERS**

Brooklyn E. Herbert, Trent E. Cayot, Riggs J. Klika, FACSM, University of Indianapolis, Indianapolis, IN. (Sponsor: Riggs J Klika, FACSM)

(Congress Abstract - No relevant relationships reported)

Cancer treatment is associated with numerous peripheral pathologies including altered blood flow and vascular dysfunction. A pilot study was conducted to measure the peripheral microvascular oxygenation response during maximal exercise in a group of cancer survivors. **PURPOSE:** To investigate the differences that paddling side (paddling side, PS; non-paddling side, NPS) and treatment side (treatment side, TREAT; healthy side, HEAL) has on the near-infrared spectroscopy (NIRS) responses during a unilateral paddling graded exercise test in breast cancer survivor dragon boat racers. **METHODS:** Thirteen breast cancer survivors/racers (56 ± 9 years, 1.65 ± 0.06 m, 76.5 ± 11.0 kg) performed a unilateral, discontinuous graded exercise test (2-minute exercise, 1-minute rest) on a stationary rowing ergometer to volitional fatigue. Tissue oxygenation saturation (StO2) and total hemoglobin concentration ([THC]) were measured via NIRS from the posterior deltoid muscles during the graded exercise test. StO2 and [THC] responses were averaged during the last 30 seconds of each exercise stage and normalized to baseline exercising data. Paired t-tests were used to examine if treatment side had an effect on StO2 or [THC] and if paddling side had an effect on [THC] responses at maximal intensity. Due to non-normally distributed data, a Wilcoxon Signed Rank Test was used to determine if paddling side had an effect on StO2 at maximal intensity. Significance was established a priori at p < 0.05. **RESULTS:** Paddling side did not significantly affect the StO2 (PS = 5.2 ± 15.7%, NPS = -13.5 ± 26.7%), [THC] (PS = 0.014 ± 0.19%, NPS = 0.15 ± 0.21, p = 0.425) responses. Treatment side had a significant, moderate (ES = 1.12) effect on the StO2 response (TREAT = -0.006 ± 16.1%, HEAL = -18.7 ± 17.3%, p = 0.008). Treatment side did not significantly affect the [THC] response (TREAT = 0.13 ± 0.20, HEAL = 0.16 ± 0.19, p = 0.313). **CONCLUSION:** Based upon the pilot results, it would suggest that the exercising muscles on the breast cancer treatment side may have a residual impaired ability to use oxygen for energy production during maximal intensity exercise.

**3543 Board #364**

**May 29 2:30 PM - 4:00 PM**

**The Role Of Aerobic Physical Training On Colon Tumor Metabolic Reprogramming**

Joao Lucas Penteado Gomes. University of Sao Paulo, Sao Paulo, Brazil.

Email: joao.gomes@usp.br

(Congress Abstract - No relevant relationships reported)

**PURPOSE:** Tumor cells are known for marked growth and proliferation, however adequate energy support is required to sustain the growth and proliferation of cancer cells. Therefore, tumors have a large change in energy metabolism, for example, the glycolysis pathway is overactivated. These phenomena are linked to changes in metabolic genes expression, such as microRNA-33a and its gene target SIRT6. On the other hand, aerobic physical training (APT) is known to increase cellular respiration in tissues such as cardiac and skeletal muscle, unlike cancer APT, also contributes to decreased tumor progression.

**METHODS:** We first evaluated if a longer training time prior colon cancer cell inoculation (CT26) contributes to lower tumor progression, we observed that the time APT is not a major factor since all cancer trained mice have lower tumor progression compared to the sedentary cancer group (SC). Thus, we proceeded to evaluate two groups: 1) group with cancer and 8-weeks training prior to inoculum (TR8), 2) and SC and 3) Wild type (WT). **RESULTS:** TR8 group presented longer survival (p=0.007), cancer promoted decrease of fat mass (WT: -7.3±3.07; SC: -1.4±0.8); TR8: -3.6±2.8; p=0.01) and increase of liver mass (WT:62±7.9; SC:91.7±11.9; TR8:81.5±11.1; p=0.01) in sedentary e trained group compared with WT. SIRT6 gene expression (100±14.2; TR8:88.7±27.9) and the microRNA-33a-2 (100±14.2; TR8:78.2±30.6) expression in tumor tissue was not different between the groups. However, we observed differences in HIF1α expression (100±21.4; TR8:74±13.4 p<0.01), which was decreased due to APT, as well as the GLUT1 (100±32.4; TR8:69.1±36.2; p=0.07), PDK (100±20.9; TR8:76.8±22.6; p<0.05), Ldhα (100±26.2; TR8:65.4±35.7; p=0.03) expression also increased due to APT. **CONCLUSIONS:** Our results show that APT decreases tumor progression and increases survival. Also, our results suggest that APT plays an important role in metabolic reprogramming. In conclusion, we showed that APT decreases the glycolytic pathway enzymes gene expression that is related to increased proliferation and malignancy of colon cancer.

**3544 Board #365**

**May 29 2:30 PM - 4:00 PM**

**Combined Aerobic And Strength Exercise Maintains Circulating FGF-21 In Asian Breast Cancer Patients**

Jorming Gohl1, Lima Lim1, Brian Kennedy1, Soo Chin Lee2, National University of Singapore, Singapore, Singapore. 1National University Cancer Institute, Singapore, Singapore. Email: jorming@nus.edu.sg

(Congress Abstract - No relevant relationships reported)

**PURPOSE:** Combined aerobic and resistance training improves systemic inflammation and muscle mass in breast cancer survivors, whether combined exercise modulates novel metabolic hormones and is unknown. FGF-21 was reported to modulate glucose metabolism in physically active adults, while IL-33, a recently discovered alarmin, is prognostic for breast cancer outcomes. This study aimed to determine the effects of 3 months of combined aerobic and strength exercise on systemic FGF-21, FGF-23, IL-33 and cytokines in Asian breast cancer patients.

**METHODS:** Patients with early stage (I-II) breast cancer underwent curative breast surgery and were randomized into a combined aerobic and strength exercise group (Age: 55.3 ± 9.2 years; BMI: 26.7 ± 3.8; N = 23) or observation group (Age: 49.3 ± 8.7 years; BMI: 24.7 ± 4.6; N = 20) that spanned 3 months. Antecubital blood was collected at baseline, 3 months and 6 months. Serum concentration of cytokines (IL-10, IL-12, IL-33, IFN-γ, TNF-n) and myokines (FGF-21, FGF-23) were quantified using a customized magnetic bead panel (Milliplex®) and read with a Luminex 200™ instrument. Biomarker data were assessed by a 2-way [group (exercise vs. observation) by time (baseline, 3 months, 6 months)] analysis of variance (ANOVA). Data are reported as means ± SD, with significance set at P < 0.05.

**RESULTS:** A significant main effect of intervention was observed for FGF-21 (P < 0.01), with patients in the exercise group presenting with higher FGF-21 at 3 months (73.16 ± 54.05 pg/mL vs. 46.47 ± 25.33 pg/mL) and 6 months (66.67 ± 50.03 pg/mL vs. 41.79 ± 33.81 pg/mL), compared with the observation group. A significant main effect of exercise on IFN-γ (P < 0.05) was observed, with lower serum IFN-γ in the exercise group at 3 months (3.85 ± 4.34 pg/mL vs. 5.43 ± 7.28 pg/mL and 6 months (3.89 ± 4.58 pg/mL vs. 5.32 ± 8.1 pg/mL) compared, with controls. No significant differences were observed between groups in other outcome measures.

**CONCLUSIONS:** A 3-month aerobic and strength exercise program preserves serum FGF-21, possibly associated with better glucose control in breast cancer patients. Lower serum IFN-γ after exercise training may suggest an attenuated pro-inflammatory response, which may be linked to better immune outcomes.

**3545 Board #366**

**May 29 2:30 PM - 4:00 PM**

**Acute Inflammatoru And Hormonal Response To Strength Training In Breast Cancer Survivors: A Preliminary Study**

Sandro N. Chaves1, Brenda L. Burtuli Perondi1, Filipe Dinato de Lima1, Martim Botta1, Filipe Rodrigues Beltrão2, Claudio L. Battaglini, FACSM3, Ricardo Jacó Oliveira1,1Unidade de Brasília-UnB, Brasília, Brazil. 2Integrated College IESGO, Formosa, Brazil. 3University of North Carolina, Chapel Hill, NC. (Sponsor: Claudio L. Battaglini, FACSM)

Email: sandronobrec@gmail.com

(Congress Abstract - No relevant relationships reported)

There is increasing interest in the use of strength training (ST) exercise in cancer survivors. Aside from the direct beneficial effects on muscle, ST has the potential to chronically attenuate some of the negative alterations commonly seen in the immunological and hormonal physiology of cancer survivors. However, the acute effects of a high intensity traditional ST session in breast cancer survivors have not been well documented. **PURPOSE:** To examine the acute hormonal and inflammatory responses of one high intensity traditional ST session in breast cancer survivors (BCS). **METHODS:** Eight BCS (47±6 years; 67.75±5.90 kg;169.51±28cm)
participated in this study. BCS completed one traditional session of ST consisting of 3 sets of 10-12 repetitions to maximal concentric failure with 120 seconds of rest between sets. The exercises included: 1) leg extension, 2) deadlift, 3) leg press, 4) machine bench press, 5) latpull down, and 6) sit ups. Venous blood samples were obtained to assess biomarkers of exercise-induced inflammation (C-reactive protein), and hormonal response (Cortisol, and IGFI). Measurements were assessed before and immediately after the ST session. Sample-dependent test samples were used to compare pre and post blood biomarkers.

RESULTS: No significant changes in C-reactive protein (pre 2.61±2.78, post 2.46±2.99mg/L, p = 0.056), cortisol (pre 9.5±3.12, post 7.61±1.90µg/dL, p = 0.062), and IGFI-1pgre (150.38±37.913, post 154.88±40.336mg/mL, p = 0.125) were observed after one session of traditional ST.

CONCLUSIONS: Although in healthy people one-timehigh intensity strength training has been associated with increases on different inflammatory and hormonal biomarkers, our results shows that in BCS one session of ST does not appear to significantly increase C-reactive protein, cortisol or IGFI-1 concentration levels. These results may be attributed to the lower absolute force production and physiological stress during the ST session in this population. Furthermore, selective estrogen receptor modulators (SERMs), a class of drugs often used to treat certain types of breast cancer can have a suppressive effect on adrenal corticosteroid release, suggesting disrupted HPA-axis feedback inhibition processes contributing to low cortisol release during exercise.

INTRODUCTION: Reductions in skeletal muscle mass contribute to reduced physical function and poorer prognosis among breast cancer survivors (BCS). Elevated pro-inflammatory markers stimulate catabolic pathways in skeletal muscle, and have been associated with muscle loss in overweight individuals and older adults. This evidence suggests that elevated pro-inflammatory markers such as IL-6, TNF-alfa, and C-reactive protein (CRP) may explain subsequent muscle loss in BCS. While we previously found exercise reduces inflammation and increases skeletal muscle mass in overweight or obese BCS, an associative investigation is warranted. PURPOSE: The purpose of this secondary analysis was to determine whether associations between post-exercise inflammatory markers and skeletal muscle mass exist among overweight/obese BCS. METHODS: Sedentary, overweight/obese BCS (BMI ≥ 25 kg/m²; Stages I-III) were randomized to exercise (EX, n=50) and control (CON, n=50) groups. EX participated in a supervised 16-week moderate-vigorous intensity aerobic and resistance exercise intervention. CON was asked to maintain current levels of activity. Appendicular Skeletal Muscle Index (ASM1), calculated as BMheight (m²), was obtained from a whole-body scan using Dual Energy X-Ray Absorptiometry. CRP, IL-6, and TNF-alpha were measured using enzyme-linked immunosorbent assays from fasting blood samples. Pearson’s correlations assessed associations between post-exercise ASMI and inflammatory biomarkers. RESULTS: On average, BCS were 53.5±10.4 years old, postmenopausal (60%), and Hispanic (55%) with a BMI of 33.5±5.5 kg/m². Post-intervention, EX experienced an increase in ASMI (8.3%; p = 0.001), and reductions in CRP (-47.8%; p = 0.001) and CRP (-73.6%; p = 0.001) and TNF-alpha (-25.1%; p = 0.001). No significant changes were seen in CON (p > 0.05). There were significant correlations between ASMI and IL-6 (r = -0.28, p = 0.02), CRP (r = -0.91, p = 0.001), and TNF-alpha (r = -0.82; p = 0.03). CONCLUSIONS: This secondary analysis provides preliminary evidence to support the relationship between changes in skeletal muscle mass and inflammation among BCS, and supports the implementation of exercise to maintain muscle mass during survivorship.
correlated with OSU-CLL tumor cell growth (e.g. miR-451a: r=0.606, p<0.001), and 6 miRNAs negatively correlated with OSU-CLL tumor cell growth (e.g. miR-24: r=-0.669, p<0.002).

CONCLUSIONS: Physical fitness in CLL patients appears to beneficially modify T-cells and NK-cells, plasma lipoproteins and exosomal miRNAs. Certain lipoproteins and miRNAs are associated with tumor cell growth and death. Further studies will hope to define the possible beneficial effects of exercise training for CLL patients.

Supported by Internal Duke Funds
Thematic Poster - Environmental Determinants of Physical Activity and Sedentary Behavior

Saturday, May 30, 2020, 9:00 AM - 11:00 AM
Room: CC-2007

3618 May 30 9:00 AM - 11:00 AM
Chair: Eric J. Shiroma, National Institutes of Health, Bethesda, MD.
(No relevant relationships reported)

3619 Board #1 May 30 9:00 AM - 11:00 AM
Do Environmental Factors Predict Changes To Physical Activity And Sedentary Behaviour Equally?
Tom Yates1, Karen Appiah1, Joe Henson1, Charlotte Edwardson1, Cameron Razieh1, Francesco Zaccardi1, David W. Dunstank1, Kamlesh Khunti1, Melanie Davies1.1University of Leicester, Leicester, United Kingdom, 2Baker IDI Heart and Diabetes Institute, Melbourne, Australia.
Email: ty20@le.ac.uk
(No relevant relationships reported)

Purpose
To investigate environmental determinants of change to sedentary behaviour (SB), light-intensity physical activity (LPA) and moderate-to-vigorous intensity physical activity (MVPA) in those at risk of diabetes.

Methods
Cohort of 808 adults recruited from family practice (age = 63 years, BMI = 32 kg/m2, women = 36%) followed up annually over 3 years. Participants were included based on being above the 90th percentile of the Leicester Diabetes Risk Score, indicating a risk of developing diabetes. At baseline, accelerometers were worn for an average of 649 (83) minutes/day, during which an average of 27 (25) minutes/day, 288 (77) minutes/day and 543 (100) minutes/day were spent in MVPA, LPA and SB respectively. Across the study period, wear time did not change, whilst SB increased by 9 (7, 10) minutes/day per year, matched by a decrease in LPA and MVPA of 7 (5, 8) and 2 (1, 2) minutes/day per year respectively. Less green space, higher road connectivity (busier traffic), greater air pollution and existing pollution were all determinants of increasing SB and decreasing LPA (See Table 1), but none were associated with change to MVPA.

Conclusion
In this high risk population, a less healthy environment predicted greater annual increases in SB and decreases in LPA, but not MVPA. Policies and interventions aimed at improving the liveable environment may therefore act to slow the trajectory of increasing SB and decreasing LPA in populations at risk of diabetes.

Table 1: Association between environmental factors and annual change to SB, LPA and MVPA

<table>
<thead>
<tr>
<th>Environmental determinant</th>
<th>Change in sedentary time (minutes/day per year) for a given unit difference in the corresponding environmental factor</th>
<th>Change in light-intensity physical activity (minutes/day per year) for a given unit difference in the corresponding environmental factor</th>
<th>Change in moderate-to-vigorous physical activity (minutes/day per year) for a given unit difference in the corresponding environmental factor</th>
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<tr>
<td>Greenspace (% within 800m radius)</td>
<td>-2.34 (-4.30 to -0.38)</td>
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<td>Road density (km of road within 800m radius)</td>
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<td>Footpath density (km of footpath within 800m radius)</td>
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<td>-0.06 (-1.68 to 1.56)</td>
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<td>Intersections that are connected (% within 800m radius)</td>
<td>6.41 (1.19 to 11.64)</td>
<td>-6.43 (-11.07 to -1.79)</td>
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<td>Air pollution (prevailing outdoor nitrogen dioxide and particulate matter concentrations with 800mx800m area: NO2, PM2.5 and PM10/µg m3)</td>
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<td>Fast Food (restaurants within 1km radius)</td>
<td>1.09 (0.38 to 1.80)</td>
<td>-1.00 (-1.63 to -0.47)</td>
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<td>0.04 (-0.09, 0.18)</td>
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Results
At baseline, accelerometers were worn for an average of 649 (83) minutes/day, during which an average of 27 (25) minutes/day, 288 (77) minutes/day and 543 (100) minutes/day were spent in MVPA, LPA and SB respectively. Across the study period, wear time did not change, whilst SB increased by 9 (7, 10) minutes/day per year, matched by a decrease in LPA and MVPA of 7 (5, 8) and 2 (1, 2) minutes/day per year respectively. Less green space, higher road connectivity (busier traffic), greater air pollution and existing pollution were all determinants of increasing SB and decreasing LPA (See Table 1), but none were associated with change to MVPA.

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Background: Physical activity (PA) levels are decreasing among college aged individuals in the US. To develop healthy behavior-change strategies for these individuals, a better understanding of their living environment is needed. PURPOSE: This study compared PA trends of college students relative to their living environment. METHODS: A volunteer sample of students (n = 338) from a large northeastern US university completed an online survey. Demographics, height/weight, frequency/mode of active travel to/from campus, and amount of self-reported weekly PA were obtained. Students were dichotomized into groups depending on their self-reported walking time to campus (≥15 or <15 minutes), never walk or walk ≥ once/week to campus, and if they have a bus pass or not. An equipment index was created using the participants self-reported responses to their access of multiple types of recreational facilities/equipment at their home (e.g. treadmill, pool, etc.). These groups were compared to moderate PA (MPA), strength training (ST), vigorous PA (VPA) minutes, and walking time to campus using t-tests. RESULTS: Participants were primarily white (n = 182, 54.3%) and majority were female (n=153, 50.5%). Students that live ≥ 15 minutes from campus had significantly lower levels of weekly MPA (p = .024), METS (p = .021), and ST (p = .002). Weekly MPA, METS, and ST (p < .05) were also significantly lower in students who did not walk to campus at least once a week. Students that had access to a bus pass showed lower amounts of MPA, METS, and ST per week (p < .05). Students who did not walk once a week to campus and those who lived ≥ 15 minutes away from campus had significantly higher accessibility to exercise equipment. CONCLUSIONS: There were significant differences in the amount of weekly PA for those living further from campus. Even though students showing higher
accessibility to exercise equipment live further away, they are more likely to use non-active travel methods. Active travel, especially in college students, is shown to be an important and significant variable to increase and meet weekly PA levels.

### PURPOSE

It remains unclear whether the relationship between built environment and walking behavior differ by age groups. Therefore, this study aimed to examine age-related differences in associations of built environmental attributes with walking in older Taiwanese adults.

### METHODS

This study was based on a cross-sectional telephone survey using a computer-assisted telephone interviewing, targeting 1,086 older Taiwanese adults (over 65 years) in 2017. Time spent in walking was measured by the short version of the International Physical Activity Questionnaire. Built environmental attributes were assessed by geographic information systems (GIS), including population density, street connectivity, sidewalk availability, leisure destinations, utilization destinations & access to public transportation. Adjusted binary logistic regression models adjusting for potential confounders were employed to examine the relationships between the seven built environment variables & walking time in total sample, and stratified for young (65-74 year) & old (75+ years) adults.

### RESULTS

A total of 1,040 respondents provided complete information for analysis. The mean age (SD) of the respondent was 73.04 (± 6.13) years. 68.8% achieved 150 min of walking in a week. In total sample, only one GIS-derived environmental attribute - leisure destinations was positive associated with the 150 min of walking in a week (odds ratio (OR)=1.34, 95% confidential interval (CI)=1.02-1.75). After stratifying by age groups, among 65 to 74 age group, population density was negative associated with the 150 min of walking in a week (OR=0.65, 95%CI=0.46-0.93) and number of leisure destination was positive associated with the 150 min of walking in a week (OR=1.55, 95%CI=1.10-2.19). However, no significant associations were observed between all environmental attributes and walking in old adults who aged over 75 year. CONCLUSIONS: These results showed that age could be a potential moderator between built environment and walking in older adult population. High-density neighborhoods with favorable leisure destinations can be supportive for walking among young older adults (65-74 year). However, for old older adults (over 75 years), it is critical to further explore other multi-level factors related to their walking behavior.

### Board #4

### Physical Fitness And Neighborhood Design - Walkability, Cardiorespiratory Fitness, Muscular Strength, And Flexibility In Adults


Email: gmmccormack@ucalgary.ca

(No relevant relationships reported)

Regular physical activity can improve physical fitness levels and promote health. Consistent evidence suggests an association between the neighborhood built environment and physical activity exists, yet few studies have investigated the contribution of the neighborhood built environment to fitness levels in adults.

**PURPOSE:** To investigate the associations between objectively-determined and self-reported neighborhood walkability and perceived cardiorespiratory fitness, muscular strength, and flexibility. **METHOD:** We recruited a random sample of 592 adults (≥18 years of age) from Calgary (Canada). Participants provided complete data to an online questionnaire capturing perceived cardiorespiratory fitness (CRF), muscular strength (MS), and flexibility, frequency of moderate-to-vigorous physical activity (MVPA), frequency of strength training, and sociodemographic characteristics. The questionnaire also captured participant's perceptions of their neighborhood's walkability (Physical Activity Neighborhood Environment Scale; PANES) and the physical activity supportiveness of neighborhood parks (Park Perceptions Index; PPI). Objectively-measured walkability was estimated using Walk Score® assigned to each participant's residential postal code. Covariate-adjusted linear regression estimated the associations between the built environment and perceived fitness variables.

**RESULTS:** The average age of participants was 46.6 (14.8) years and 67.2% were female. Participants, on average, participated in at least 30-minutes of MVPA on 3.4 (2.1) days/week and reported strength training 2.0 (1.8) days/week. Walk Score® was not associated with any fitness variables. The PANES index was positively associated (p<0.05) with CRF, MS, flexibility and overall fitness and the PPI was positively associated (p<0.05) with all fitness variables except MS. CONCLUSION: Our novel findings suggest the neighborhood built environment has the potential to support and promote higher fitness levels in adults.
Table 1. Characteristics of sample

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>314</td>
<td>178</td>
<td>136</td>
<td></td>
</tr>
<tr>
<td>Characteristics, mean (SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>15.70±0.62</td>
<td>16.08±0.47</td>
<td>15.38±0.54</td>
<td>14-19</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>165.87±6.03</td>
<td>175.95±8.22</td>
<td>152.18±6.13</td>
<td>155-183</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>62.83±12.72</td>
<td>70.16±13.28</td>
<td>59.79±12.41</td>
<td>43-140.41</td>
</tr>
<tr>
<td>PA, mean (SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SB (min/week)</td>
<td>7177.5±1872.00</td>
<td>7906.1±1122.00</td>
<td>6673.3±2513.30</td>
<td>2200.8±1049.23</td>
</tr>
<tr>
<td>LDA (min/week)</td>
<td>338.03±211.60</td>
<td>446.71±71.62</td>
<td>195.76±131.60</td>
<td>199.16±432.72</td>
</tr>
<tr>
<td>MVPA (min/week)</td>
<td>1851.5±806.22</td>
<td>2071.6±890.90</td>
<td>948.6±418.84</td>
<td>643.13±1302.83</td>
</tr>
</tbody>
</table>

Table 2. The relationship between home environment and different physical activity of sample

<table>
<thead>
<tr>
<th>Variable</th>
<th>Male only</th>
<th>Female only</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>95% CI</td>
<td>Coefficient</td>
</tr>
<tr>
<td>PA availability</td>
<td>-6.64***</td>
<td>(-7.57, -6.48)</td>
<td>-6.79***</td>
</tr>
<tr>
<td>Parental role</td>
<td>-4.04</td>
<td>(-6.30, -1.77)</td>
<td>-3.66</td>
</tr>
<tr>
<td>modelling of PA (father)</td>
<td>-2.35</td>
<td>(-5.03, 0.33)</td>
<td>-2.03</td>
</tr>
<tr>
<td>Parental role</td>
<td>-0.60</td>
<td>(-2.88, 1.67)</td>
<td>-0.76</td>
</tr>
<tr>
<td>support PA (father)</td>
<td>-0.61</td>
<td>(-3.17, 2.65)</td>
<td>-0.56</td>
</tr>
<tr>
<td>modelling of PA (mother)</td>
<td>7.60</td>
<td>(-0.39, 15.67)</td>
<td>7.46</td>
</tr>
<tr>
<td>LDA availability</td>
<td>10.41***</td>
<td>(8.12, 12.70)</td>
<td>10.36***</td>
</tr>
<tr>
<td>PA accessibility</td>
<td>-1.28</td>
<td>(-2.10, -0.46)</td>
<td>-1.35</td>
</tr>
<tr>
<td>Parental role</td>
<td>-2.79</td>
<td>(-3.18, -2.40)</td>
<td>-2.53</td>
</tr>
<tr>
<td>modelling of PA (father)</td>
<td>-2.03</td>
<td>(-2.71, -1.35)</td>
<td>-2.03</td>
</tr>
<tr>
<td>Parental role</td>
<td>3.55</td>
<td>(-5.34, -1.14)</td>
<td>3.35</td>
</tr>
<tr>
<td>support PA (mother)</td>
<td>2.40</td>
<td>(-4.41, 9.20)</td>
<td>2.44</td>
</tr>
<tr>
<td>MVPA availability</td>
<td>-1.80</td>
<td>(-4.94, 1.34)</td>
<td>-1.87</td>
</tr>
<tr>
<td>PA accessibility</td>
<td>-1.27</td>
<td>(-3.21, 0.67)</td>
<td>-1.31</td>
</tr>
<tr>
<td>Parental role</td>
<td>-3.71</td>
<td>(-6.71, -0.71)</td>
<td>-3.82</td>
</tr>
<tr>
<td>modelling of PA (father)</td>
<td>-1.94</td>
<td>(-3.94, 0.06)</td>
<td>-1.90</td>
</tr>
<tr>
<td>Parental role</td>
<td>4.45</td>
<td>(-3.53, 12.43)</td>
<td>4.45</td>
</tr>
<tr>
<td>support PA (mother)</td>
<td>49.89**</td>
<td>(20.69, 89.09)</td>
<td>49.86**</td>
</tr>
<tr>
<td>Parental role</td>
<td>10.93</td>
<td>(-4.19, 27.22)</td>
<td>10.97</td>
</tr>
<tr>
<td>support PA (mother)</td>
<td>65.93</td>
<td>(42.20, 99.67)</td>
<td>65.93</td>
</tr>
<tr>
<td>Notes: * p &lt; 0.05; ** p &lt; 0.01</td>
<td></td>
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</tr>
</tbody>
</table>

The physical and built environments are related to physical activity (PA) in adults and the relationship seems apparent in children. Child PA behavior often depends on parents in a variety of ways including involvement, facilitation, or role modeling. The home environment is one setting in which these relationships may be further examined.

PURPOSE: To examine facets of the home environment and parent perceptions of neighborhood safety may be associated with child total PA and moderate-to-vigorous (MVPA) levels in a rural sample.

METHODS: Baseline data were analyzed from NU-HOME, a childhood obesity prevention, randomized controlled trial in rural communities. 105 children (age=9.6±1.06 yrs) and their parents (age=37.91±5.42 yrs) reported on sociodemographics and home/neighborhood environments. Child daily PA (total and MVPA) was measured using accelerometers and, using SAS 9.4, associations were examined with home/neighborhood environment variables through multivariate regression models, both unadjusted and adjusted for economic assistance. Normality was not met for child daily MVPA therefore analyses used the log-transformed variable.

RESULTS: Mean child total PA was 259.08±58.22 min/day and MVPA was 44.95±18.58 min/day. In unadjusted analyses, access to PA equipment in the home (P=0.037) and neighborhood safety (p=0.049) were associated with total PA; however, no factors were statistically significantly associated with MVPA, although access to PA equipment (p=0.008) and family support for PA (p=0.062) were trending towards significance. For both total PA and MVPA outcomes, the regression models including all variables and accounting for economic assistance were statistically significant (P=0.026 and p=0.034, respectively). For each model, the individual effects of parent PA and PA equipment were statistically significant (r ranges from 0.088 to 0.037).

CONCLUSIONS: This study highlights the potential of the home/neighborhood environment as a space for interventions to increase PA in rural children. Only 14% of children in this rural sample met PA recommendations, so interventions to increase PA, particularly MVPA, are needed. Future studies should include multiple levels of a rural child’s environment (i.e., school, town) to examine which may play the largest role in PA.

Abstracts were prepared by the authors and printed as submitted.
the most active and least sedentary when at school, yet children only accumulated 17.5 minutes of MVPA in this environment. Thus, in-school and out-of-school interventions are needed to help children meet the daily recommended minutes of PA.

G-20  Thematic Poster - Physical Activity and Health Equity
Saturday, May 30, 2020, 9:00 AM - 11:00 AM
Room: CC-2009

3627  May 30 9:00 AM - 11:00 AM
Chair: Michelle Martin, FACSM, University of Tennessee, Memphis, TN.

Influence Of Social Networks On Nutrition And Physical Function Of Ethnic Older Minorities Over Time
Evans A. Asamane, Carolyn A. Greig, Janice L. Thompson, FACSM. University of Birmingham, Birmingham, United Kingdom. (Sponsor: Janice L. Thompson, FACSM)
Email: asamaneevans@yahoo.com

BACKGROUND: Social networks (SN) are consistently shown to influence health outcomes in later life. However, relatively little is known about SN of ethnic older minorities, and how they impact on health outcomes over time. PURPOSE: To explore SN and their impact on nutritional intake and status, and physical function in ethnic older minorities (≥60 years) living in Birmingham, United Kingdom. METHODS: SN were assessed using the Wenger Practitioner Assessment of Network Types (PANT). Multiple-pass 24-hour dietary recalls and the Mini Nutritional Assessment-Short Form assessed nutritional intake and status, respectively. Short Physical Performance Battery (SPPB) and handgrip strength measured physical function. Correlation and regression analyses examined relationships between SN, physical function, nutritional intake and status. The influences of SN were captured through semi-structured interviews at baseline (N=92) and follow-up (N=81). Interviews were transcribed verbatim and analysed using directed content analysis. RESULTS: Of the 100 participants measured at baseline, 81 were followed up 8-months later. Mean age –70.9±8.1 years (62% male) comprising African/Caribbean (65%), South Asian (28%), and other ethnicities (7%). Five SN were identified and grouped into two broad categories: integrated SN (locally integrated (44%) and wider community (8%)); and non-integrated SN (family dependent (25%), locally self-contained (17%), and private restricted (6%)). At follow-up, SN declined in 19% and improved in 11%. There was an overall decrease in physical function (F1)=9.73, P=0.03) and nutritional status (F1)=6.04, P=0.016) over time. Participants in integrated SN compared with non-integrated SN at baseline were less likely to experience a decline in physical status (F(1)=6.04, P=0.016) over time. Participants in integrated SN compared with non-integrated SN (family dependent (25%), locally self-contained (17%), and private restricted (6%)).

3628  Board #1  May 30 9:00 AM - 11:00 AM
Influence Of Social Networks On Nutrition And Physical Function Of Ethnic Older Minorities Over Time
Evans A. Asamane, Carolyn A. Greig, Janice L. Thompson, FACSM. University of Birmingham, Birmingham, United Kingdom. (Sponsor: Janice L. Thompson, FACSM)
Email: asamaneevans@yahoo.com

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3629  Board #2  May 30 9:00 AM - 11:00 AM
Acculturation And Leisure-time Physical Activity Among Asian American In The United States, 2011-2016
Xuanxuan Zhu, Jhong Liu, Maria Sevoyan, Russ R. Pate, FACSM. FACS. University Of South Carolina, Columbia, SC. (Sponsor: Russell R. Pate, FACSM)
Email: xzhu@email.sc.edu

BACKGROUND: Acculturation is the process by which individuals or groups adjust to a new cultural environment. It is a multidimensional construct that includes language shift, social integration, and cultural integration. PURPOSE: To examine the relationship between acculturation and leisure-time PA among Asian American adults.

METHODS: Data concerning 1,989 Asian Americans aged 20 years and older, came from the 2011-2016 National Health and Nutrition Examination Survey (NHANES). Acculturation was assessed in three dimensions: the language preference at home (only Non-English language, both English and Non-English language, and only English), length of residency in the US (<10 years, 10-29 years, ≥30 years, US born), and birth locations (US-born, foreign-born). Using self-reported minutes/day and days/week moderate and vigorous leisure-time PA, we calculated moderate-to-vigorous PA (MVPA) MET minutes/week. MVPA was analyzed as a continuous variable and a categorical variable (i.e., meeting WHO PA guidelines, ≥600 MET minutes/week) in multiple linear and logistic regression models after controlling for covariates, respectively.

RESULTS: Among participants, 24.5% of Asian Americans spoke only English at home, while 47.8% spoke only non-English at home. 13.0% of participants were born in the US. The odds of meeting PA guidelines were higher among Asians speaking only English (adjusted OR [AOR]=1.8, 95% confidence interval [CI]: 1.4, 2.4) and those speaking both non-English and English at home (AOR=1.6, 95% CI: 1.3, 2.0), compared to those who spoke only non-English at home. US-born Asians were more likely to meet PA guidelines than foreign-born Asians (AOR=1.8, 95% CI: 1.3, 2.6) and on average they performed 137 more minutes of leisure-time MVPA each week than foreign-born Asians. Asians in the US since birth had higher odds to meet PA guidelines than Asians stayed in US for less than 10 years (AOR=2.2, 95% CI: 1.5, 3.3).

CONCLUSIONS: More acculturated Asian Americans such as those who spoke more English at home and US-born Asians, perform more leisure-time MVPA than less acculturated Asian Americans. Interventions are needed to promote PA among non-English speaking Asian immigrants and those who stayed in the US for less than 10 years.

3630  Board #3  May 30 9:00 AM - 11:00 AM
Developing Smart Goals With Latinos To Address Their Life Concerns Surrounding Physical Activity And Recreation
Sharon E. Taverno Ross, Maria del Rosario Christophersen, Patricia I. Doonet, University of Pittsburgh, Pittsburgh, PA. (Sponsor: Andrea Kriska, FACSM)

BACKGROUND: Latinos are the fastest growing ethnic group in the United States. However, less than a quarter of Asian Americans meet WHO Physical Activity (PA) Guideline. Few studies have examined the association between acculturation and leisure-time PA among Asian Americans. PURPOSE: To examine the association between acculturation and leisure-time PA among Asian American adults.

METHODS: Data concerning 1,989 Asian Americans aged 20 years and older, came from the 2011-2016 National Health and Nutrition Examination Survey (NHANES). Acculturation was assessed in three dimensions: the language preference at home (only Non-English language, both English and Non-English language, and only English), length of residency in the US (<10 years, 10-29 years, ≥30 years, US born), and birth locations (US-born, foreign-born). Using self-reported minutes/day and days/week moderate and vigorous leisure-time PA, we calculated moderate-to-vigorous PA (MVPA) MET minutes/week. MVPA was analyzed as a continuous variable and a categorical variable (i.e., meeting WHO PA guidelines, ≥600 MET minutes/week) in multiple linear and logistic regression models after controlling for covariates, respectively.

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3631  Board #4  May 30 9:00 AM - 11:00 AM
Aging Effects Of A 12-month Period On Cardiometabolic Risks In Older Adults
Kivana Keane1, Alexis Sides1, Austin Anderson1, Malli Fowler1, Sarah Ging1, Adam Donohon Hinson1, L. Jerome Brandon1, Benjamin Patterson1, Colleen Pecoraro1, Tommy Scott1, L. Jerome Brandon, FACSM1, Trudy Moore-Harrison1, UNC-Charlotte, Charlotte, NC. 2Georgia State University, Atlanta, GA. (Sponsor: L. Jerome Brandon, FACSM)
Email: kkeane5@unc.edu

BACKGROUND: Aging is characterized by decreased functional ability and increased cardiometabolic (CMO) risks. Being physically active is believed to slow these diminishing characteristics in older adults. Therefore, the purpose of this study was to determine if CMO values would decline following a 12-month period in active older adults.

METHODS: The participants were 148 active older adults from the metropolitan area of a southern city. Activity ranged from participating in structured fitness classes...
RESULTS: Among recipients of concussion care, there were 2,226 (68%) non-concussion or PCS between 9/2015 and 6/2019 within a large academic health system. Utilizing an Integrated Data Repository, i2b2, a query was performed to identify individuals with history of concussion or post-concussion symptoms within a large academic medical center to determine if there were differences in race, ethnicity, and sex among youth and young adults who sought care for concussion based on their health system setting. The purpose of this study was to explore differences in race, ethnicity, and sex among youth and young adults who sought care for concussion based on their health system setting.

METHODS: The purpose of the study was to explore differences in race, ethnicity, and sex among youth and young adults who sought care for concussion based on their health system setting. The purpose of the study was to explore differences in race, ethnicity, and sex among youth and young adults who sought care for concussion based on their health system setting.

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CONCLUSIONS: Comparison of these results with community demographic data reveals AA/B and Hispanic YAYA seeking concussion care may be underserved within the trauma system. Additionally, higher incidence of female PCS deserves further exploration to ascertain whether individual, initial management, or delays in connecting with the healthcare system may be factors in persistent symptomatology post-TBI. Additional research is needed to ascertain health system factors that may address and reduce future disparities in TBI care delivery and patient outcomes, including geocoding to ascertain the impact of YAYA residence and proximity to the trauma center.
Thematic Poster - Physical Activity Children and Youth

Saturday, May 30, 2020 - 9:00 AM - 11:00 AM
Room: CC-2010

G-21

Chair: Tao Zhang, University of North Texas, Denton, TX.
(No relevant relationships reported)

3636

Board #1

May 30 9:00 AM - 11:00 AM

Evaluating Extension-supported Implementation Of A Classroom-based Physical Activity Program In Under-resourced Schools

Thomas Packebush, Katherine B. Gunter, FACSM, Tammy Winfield, Oregon State University; Corvallis, OR.
(No relevant relationships reported)

PURPOSE: Regular exposure to physical education (PE) increases children’s physical activity, but access is not equitable, particularly in under-resourced schools. Oregon recently passed legislation requiring public elementary schools to provide PE for ≥150 minutes per week. BEPE 2.0 (BEPE 2.0) is a K-5 classroom-based physical activity program aligned to PE standards, developed to help under-resourced schools reach the mandated PE minutes. We evaluated BEPA 2.0 implementation among teachers in schools receiving BEPA 2.0 trainings. METHODS: County-based Cooperative Extension faculty were trained to deliver BEPA 2.0 teacher trainings. Trainings were conducted in 33 schools in Fall 2018 and Winter 2019 and 433 teachers attended trainings. Three to six months post-training, a brief survey assessing implementation factors was distributed to all teachers at trained schools. Descriptive and chi-square analyses were conducted to evaluate BEPA 2.0 use, and the relationship of training to use. RESULTS: A total of 212 teachers from 11 Oregon counties provided survey responses (49% response rate). Overall, 92.4% of teachers reported using BEPA 2.0, most commonly to provide classroom activity breaks (88.8%) and meet PE minute requirements (44.4%). Forty-four percent of teachers chose BEPA 2.0 for its alignment to state PE standards. Most teachers (74.2%) implement 1-2 times per week, with extra support from trainers (e.g., email prompts, booster trainings) reported among 66.9% of users. More trained (82.8%) versus untrained teachers (53.3%) reported using BEPA 2.0 (p=0.006). CONCLUSIONS: Results indicate a high rate of BEPA 2.0 use, particularly among trained teachers. This suggests training is an important component of the implementation process. Increasing trainings and support for teachers may increase frequency of use.

3637

Board #2

May 30 9:00 AM - 11:00 AM

Aggregated Impact Of Locally Implemented SNAP-Ed Programming On Physical Activity In Michigan Youth

Kerri L. Vasold, Lila Guttuskey, Marcia K. Scott. Michigan Fitness Foundation, Lansing, MI.
Email: kvasold@michiganfitness.org
(No relevant relationships reported)

Equity in physical activity engagement is a critical issue. Supplemental Nutrition Assistance Program Education (SNAP-Ed) reaches low-income youth, with physical activity as one of the key foci. In Michigan, SNAP-Ed includes locally relevant programs selected and implemented by community organizations. Consistent evaluation is conducted across programs. PURPOSE: To evaluate state-level change in physical activity and sedentary behaviors of Michigan youth who receive locally relevant SNAP-Ed programming selected and implemented by community-based organizations. METHODS: Participants were youth (grades 4-8) receiving SNAP-Ed programming that included evidence-based interventions with a physical activity component. Youth received a physical activity questionnaire pre- and post-intervention. Participant data were matched based on demographic indicators, and data were aggregated at the state-level. Descriptive statistics were calculated for all variables of interest, and Wilcoxon Signed Rank tests were used to compare differences pre- and post-intervention for physical activity and sedentary behaviors (i.e. weekday hours spent watching TV). RESULTS: Participants included 1,899 youth (grades 4-8) from SNAP-Ed programming delivered through 15 different community organizations across Michigan. The majority of participants were Caucasian (65.0%) and non-Hispanic (86.5%), and approximately one-half were male (49.9%). A statistically significant increase was found for the number of days that youth self-reported being physically active for at least 60 minutes pre- and post-intervention (pre: 4.18±2.13; post: 4.43±2.05; p<0.001), and a statistically significant decrease was found for the number of hours youth reported watching TV on a weekday pre- and post-intervention (pre: 1.76±1.55; post: 1.66±1.49; p=0.012). CONCLUSIONS: Implementation of locally relevant SNAP-Ed programming selected by community organizations can positively impact physical activity and sedentary behaviors. Future research should explore commonalities amongst locally relevant programs to identify key implementation characteristics for greatest impact and progress toward equity.

3638

Board #3

May 30 9:00 AM - 11:00 AM

Investigation On The Prevalence of Scoliosis In Primary And Secondary School Students In Changzhou

Yunqing Liu1, Baohu Li1, Haiyan Zhu1, Ruijiang Gao1, Bowen Li2,1, Changzhou Research Institute of Medical Treatment, Changzhou, China. Nanning Sport Institute, Nanning, China. (Sponsor: Zhengzhen Wang, FACSM)
Email: liuyunqing0529@sina.com
(No relevant relationships reported)

Purpose: With the increase of academic pressure, students spend more time in sedentary behaviour. Long-term wrong sitting posture will bring many health problems. To investigate the prevalence of scoliosis among primary and secondary school students in Changzhou city.

Methods: From May to July 2019, we measured the spine index of 10292 students (age: 10-13 years) from 7 primary and 3 middle schools in Changzhou City, including 5437 boys and 4708 girls, 84 of whom did not participate in the screening, and 10145 of whom were effectively screened. We screen scoliosis in three steps: 1: with examine back exposed and standing naturally, the examiner check if the shoulders are equal in height; whether lower scapular horn, bilateral lumbar fovea is symmetrical; whether bilateral lumbal ridge is equal; the above has an anomaly positive, can be defined as posture abnormality. 2: positive result of first test, carry out Adam test, if Adam bending test has the above signs, measure the back with the spine, the maximum oblique part and angle of spine, if the deviation is more than 5 degrees, it is suspected scoliosis, if it is greater than 10 degrees, it can be defined as scoliosis. If the Adam bending test has the above signs, the spine is measured by the ruler: 3: the patients with suspected scoliosis were diagnosed as scoliosis by radiologist to take the full-length orthopedic radiography of the upright spine and measure the Cobb angle≥10°.

Results: In first step, 4585 cases of abnormal posture, the incidence of bad posture was about 45.2%; the detection rate of high and low shoulder among the students was 35.2%; the detection rate of boys was 28.5%. The detection rate of female students was 38.8%. The incidence of pelvic rotation was 15.1% in boys and 17.9% in girls, and the incidence of lateral flexion in neck was 4% in boys and 9% in girls. The detection rate of scoliosis was 24.3%. Finally, some students carried out the third inspection, and the consistency between the third inspection and the second inspection reached 98%.

Conclusion: Through screening, it was found that the detection rate of abnormal posture was high. Therefore, the establishment of spine health records will help them pay attention to spine health. Supported by Social Science Foundation of Jiangsu Province(BE2018752),Science and Technology Support Planof Changzhou(CE201905046).

3639

Board #4

May 30 9:00 AM - 11:00 AM

Physical Activity Contributions From An Outdoor Education Pre-kindergarten Program

Nathan R. Tokarek, Chi C. Cho, Ann M. Swartz, FACSM. University of Wisconsin - Milwaukee, Milwaukee, WI.
Email: ntokarek@uwm.edu
(No relevant relationships reported)

Traditional educational practices may contribute to the overall decline in physical activity (PA) and increases in sedentary behaviors (SB) that have been documented as children age. Beginning early in children’s elementary education, unstructured physical activity program aligned to PE standards, developed to help under-resourced schools. Consistent evaluation is conducted across programs. PURPOSE: To evaluate state-level change in physical activity and sedentary behaviors of Michigan youth who receive locally relevant SNAP-Ed programming selected and implemented by community-based organizations. METHODS: Participants were youth (grades 4-8) receiving SNAP-Ed programming that included evidence-based interventions with a physical activity component. Youth received a physical activity questionnaire pre- and post-intervention. Participant data were matched based on demographic indicators, and data were aggregated at the state-level. Descriptive statistics were calculated for all variables of interest, and Wilcoxon Signed Rank tests were used to compare differences pre- and post-intervention for physical activity and sedentary behaviors (i.e. weekday hours spent watching TV). RESULTS: Participants included 1,899 youth (grades 4-8) from SNAP-Ed programming delivered through 15 different community organizations across Michigan. The majority of participants were Caucasian (65.0%) and non-Hispanic (86.5%), and approximately one-half were male (49.9%). A statistically significant increase was found for the number of days that youth self-reported being physically active for at least 60 minutes pre- and post-intervention (pre: 4.18±2.13; post: 4.43±2.05; p<0.001), and a statistically significant decrease was found for the number of hours youth reported watching TV on a weekday pre- and post-intervention (pre: 1.76±1.55; post: 1.66±1.49; p=0.012). CONCLUSIONS: Implementation of locally relevant SNAP-Ed programming selected by community organizations can positively impact physical activity and sedentary behaviors. Future research should explore commonalities amongst locally relevant programs to identify key implementation characteristics for greatest impact and progress toward equity.

3640

Board #4

May 30 9:00 AM - 11:00 AM

Physical Activity Contributions From An Outdoor Education Pre-kindergarten Program

Nathan R. Tokarek, Chi C. Cho, Ann M. Swartz, FACSM. University of Wisconsin - Milwaukee, Milwaukee, WI.
Email: ntokarek@uwm.edu
(No relevant relationships reported)
CONCLUSIONS: Children engaged in significantly more PA and less SB while learning outdoors compared with indoor learning, despite less time being allocated to free play. Modifying educational practices to include outdoor education has the potential to increase the quantity of in-school PA children accumulate while simultaneously reducing SB.

PURPOSE: The lack of physical activity among children is a global issue that requires attention. It has been suggested that a relationship exists between the lifestyles of children at an early age and that of parents. We quantified physical activity differences among preschool children and their fathers and mothers.

METHODS: Forty-seven children (kindergarten level: aged 6.11 ± 0.267 years) and their parents (fathers: aged 43.1 ± 4.83 years, mothers: aged 41.1 ± 4.29 years) participated in this study. Each participant wore an activity tracker on the waist during waking hours to measure step counts and time of moderate-to-vigorous physical activity (MVPA). The data were divided into work/school day and day off and evaluated accordingly. Partial correlation coefficient was used to evaluate the physical activity relationships between children and fathers or mothers.

RESULTS: For the work/school days, there was a significant positive correlation of step count between children and mothers (children: 15,800 ± 2,560 steps; mothers: 9,450 ± 2,590 steps, r = 0.322, p < 0.05) and between children and fathers (children: 8,280 ± 2,990 steps, r = 0.249). For the days off, there was a significant positive correlation of step counts between children and fathers (children: 11,700 ± 3,520 steps, fathers: 8,190 ± 2,790 steps, r = 0.473, p < 0.01) but no significant correlation between children and mothers (10,000 ± 2,530 steps, r = 0.096).

There was a significant positive correlation in MVPA time for days off between children and fathers (children: 74.5 ± 25.9 min, fathers: 51.0 ± 22.5 min, r = 0.487, p < 0.01) but no significant correlation between children and mothers (74.5 ± 25.9 min, r = 0.075). There were no significant correlations in MVPA time for work/school days between children and fathers (children: 97.5 ± 23.8 min, fathers: 59.8 ± 18.3 min, r = 0.503) and between children and mothers (56.9 ± 13.7 min, r = 0.131).

CONCLUSIONS: These findings suggest that the children may have spent time with their mothers on work/school days, and with their fathers on days off. Thus, an increase in fathers’ physical activities may lead to a corresponding increase in the physical activities of some children with modern Japanese lifestyles.
A change in running speed influences gait mechanics of running. PURPOSE: The purpose of this study was to investigate the influence of a change in running speed on muscle activity during forward and backward running at different body weight support (BWS) conditions. METHODS: Eleven participants (29.7 ± 12.3 years) ran forward and backward on a lower body positive pressure treadmill at 0% BWS, 20% BWS, and 50% BWS conditions. The running speed conditions consisted of forward and backward running at preferred speed (PS), PS+10%, and PS-10%. Muscle activity from the rectus femoris, biceps femoris, tibialis anterior, and gastrocnemius and stride frequency were measured. Muscle activity and stride frequency were analyzed using a 2 (running direction) x 3 (BWS) x 3 (running speed) repeated measures analysis of variance (α = 0.05). RESULTS: Muscle activity from the rectus femoris (P<0.01) and gastrocnemius (P<0.01) were significantly different between running speeds. For example, muscle activity from the rectus femoris and gastrocnemius (P<0.05) during running at PS were significantly greater than when running at PS-10%, regardless of running direction and BWS. Furthermore, muscle activity from the rectus femoris (P<0.01) and gastrocnemius (P<0.05) during running at PS-10% were significantly greater than when running at PS, regardless of running direction and BWS. Stride frequency was influenced by the interaction of running direction and running speed (P<0.05). Using the pairwise comparisons, stride frequency during running at PS was significantly higher than that of running at PS-10% only when running forward and backward at 0% BWS (e.g., 84.5 strides/min and 82.0 strides/min for forward running at PS and PS-10% conditions, respectively; P<0.05). Furthermore, stride frequency during running at PS-10% was significantly higher than that of running at PS during forward and backward running at 0% BWS (P<0.05). CONCLUSIONS: Muscle activity from the rectus femoris and gastrocnemius during running may increase with increasing running speed, regardless of BWS and running direction. However, unique biomechanical strategies for the increased muscle activity from the lower extremity may exist for running with BWS.
Resistance training is important to maintain an athlete’s health and regain strength after injury. Light-weight wearable resistances allows loading in the context of sport specific movements and can lead to specific strength adaptations benefiting the athlete. However, limited knowledge of the associated biomechanical changes with such a training modality exists.

**Purpose:** To determine biomechanical changes during running with lower limb light-weight wearable resistance.

**Methods:** Fourteen healthy participants volunteered for the study (age: 28±4 years; height: 180±8 cm; body mass (BM): 77±6 kg). Participants wore shorts and calf sleeves allowing capture of light loads and performed 4 x 2 mins 20-m over-ground shuttle running bouts at 3.3 m/s±1, alternating by 3 mins rest. The first running bout was unloaded and the other three bouts under randomised loaded conditions. The loaded conditions consisted of 1 %, 3 % and 5 % additional loading of the BM. Loads were distribution on the legs with 2:3 on the thigh and 1:3 on the shank. Two force plates embedded in the floor at the 10-m mark of the runway recorded peak vertical ground reaction forces (vGRF) and ground contact time (GCT). Recorded kinetic data was filtered using a low-pass Butterworth filter at frequency 120 Hz and normalised to body weight. A repeated measures ANOVA (α ≤ 0.05) was used to determine differences between conditions and Cohens d was calculated with effect sizes defined as small (d = 0.2), medium (d = 0.5) and strong (d = 0.8).

**Results:** Peak vGRF decreased (-0.5 %) with additional loading of 1% BM (p = 0.19, d = 0.5) and significant increased (+1.1 %) with additional loading of 3% BM loading (p = 0.13, p = 0.91) compared to unloaded condition. Higher peak vGRF (+1.4 %) was also found during 5% BM loading (d = 0.19, p = 1) Ground contact time showed no significant differences (+0.13 ± 0.20, 0.4 ± p ≤ 1) between all conditions and only a slightly increased with 5% BM loading (+1 %).

**Conclusion:** Small changes in peak vGRF and GCT during loaded running occurred. Maintaining targeted speed and running economically might result from kinematic adaptations, needing further evaluation. Additionally, examination of acute neuromuscular alterations, hypothesised by increased muscular output before gait occurred. Maintaining targeted speed and running economically might result from 5 % BM loading (+1 %).

### 3650 Board #5

**An Investigation Into The Feasibility Of A Split-belt Instrumented Treadmill Running Protocol With Perturbations.**

Andrew Quaromy, Mina Khajoei, Tilman Engel, Hannes Kaplick, Frank Mayer.

**University of Potsdam, Potsdam, Germany.**

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Unanticipated disturbances to human gait can occur during daily life or sports performance. Compensating successfully for such disturbances or perturbations is crucial in maintaining effective postural control and avoiding potentially injurious events. Studies of perturbed walking protocols using instrumented treadmills have previously been validated, however the validation of and responses to perturbed running protocols remain less investigated. **PURPOSE:** To investigate the feasibility of a new instrumented treadmill-perturbed running protocol. **METHODS:** Fifteen participants (28±3years;172±9cm;69±10kg; 60% female) completed an 8-minute running protocol at a baseline velocity of 2.5ms (9 km/h), whilst 15 one-sided belt perturbations were implemented (pre-set perturbation characteristics: 150ms delay (post-heel contact): 2.0m/s amplitude; 100ms duration). Perturbation characteristics and sEMG responses (right leg: gastrocnemius medialis (GM), tibialis anterior (TA), peroneus longus (PL), biceps femoris (BF), vastus medialis (VM); trunk bilateral: rectus abdominus (RA), erector spinae L3 (ES); Root Mean Square (RMS) normalized to unperturbed walking) were recorded. Bland-Altman analysis (BLA) was employed (bias=limits of agreement (LOA), bias=1.96SD) and intra-individual variability of repeated perturbations was assessed via Coefficients of Variation (CV) (mean±SD). **RESULTS:** On average, 9.4±2.2 of 15 intended perturbations were identifiable. Perturbation delay was 143±10ms, amplitude was 17±10.2ms and duration was 69±10ms. BLA showed -7.13ms delay, -0.30±1ms amplitude and -30±10ms duration. CV showed variability of 19±4.5% for delay, 58±12% for amplitude and 30±7% for duration. RMS AMPLs were 113±25% (GM), 225±73% (TA), 139±68% (PL), 134±34% (BF), 200±168% (VM), 332±305% (RAonit), 324±162% (RAleft), 220±130% (ESright), 183 ± 122% (ESleft). **CONCLUSION:** This study showed that the application of sudden perturbations during running can be achieved, though with increased variability across individual perturbations. The perturbations with the above characteristics elicited a detectable neuromuscular response during running, especially in the muscles of the trunk and anterior leg. Responses in the calf muscles were minimal.

### 3651 Board #6

**The Effect Of Verbal Cues On Lower Extremity Kinematics During Running.**

Allison Lieb,1 Quinn Garner,2 Nicholas Reynolds,1 Jennifer Bagwell2, Terry Grindstaff1.

1 Creighton University, Omaha, NE. 2 California State University, Long Beach, Long Beach, CA.

(Sponsor: Joan Eckerson, FACSMD)

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Previous research indicates that verbal cues such as “push with your feet” can alter ankle and hip kinetics during walking. Clinicians often use cues such as “push with your hips” when working with runners, but the effect of such verbal cues on lower extremity kinetics during running remains poorly understood. **PURPOSE:** The purpose of this study was to determine the effect of verbal cues emphasizing use of hips and glutes or use of toes and ankles on lower extremity running kinetics.

**METHODS:** Ten healthy subjects (age 23±3 years, mass 67±16 kg, height 168±11 cm) participated. Subjects performed 3 running trials, at a self-selected pace, on an instrumented treadmill while collecting kinematics and kinetics. First, a baseline running gait was established, then each subject was given the instruction to “push yourself forward with your hips and glutes” or “push yourself forward with your toes and ankles” in a randomized order. After 1 minute to adapt to each condition, 30 seconds of data were recorded. Variables of interest included peak sagittal hip, knee, and ankle moments and positive, negative, and total sagittal work at the hip, knee, and ankle. One-way repeated measures ANOVAs were used to assess kinetic changes across conditions.

**RESULTS:** There was a significant main effect of running cue with respect to negative and total work at the ankle (p=0.031 and p=0.002). Post-hoc analyses indicated that ankle negative work was greater when running with the ankle cue compared to baseline running (-0.44±0.17 J/kg vs -0.38±0.14 J/kg; p=0.031) and ankle total work was greater when running with the ankle cue compared with baseline and hip cue running (p=0.019 - 0.008). There were no significant differences in any of the other lower extremity sagittal moments or work across tasks (p>0.05).

**CONCLUSIONS:** Subjects demonstrated increased negative and total work at the ankle in response to the ankle running cue. There was no change in positive work, which was anticipated with a cue emphasizing forward propulsion. Running kinetics remained largely unchanged in response to either running cue, possibly due to the quality of the cue (i.e. internal rather than external focus). These data suggest telling clients to “use your hip more to run” may not be an effective method to change running mechanics.

### 3652 Board #7

**Influence Of A Novel Music App On Spatiotemporal Mechanics During Running.**

Danielle Mannino, Matthew F. Moran.

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An increased running step rate (i.e., cadence) can decrease lower extremity joint loads and potentially reduce running-related injury (RRI) risk. Many gait interventions have significantly increased a runner’s cadence through a variety of external stimuli (e.g., metronome). Runners have been shown to spontaneously manipulate their cadence when listening to music with a tempo that differed ±3% from their baseline cadence. However, no study has determined whether a runner will subconsciously increase cadence > 3% when listening to up-tempo music. **PURPOSE:** To determine if music tempo (beats per minute, bpm) set 10% higher than baseline cadence affects spatiotemporal running mechanics. **METHODS:** Utilizing a blinded experimental design, twenty-two runners (15F, 7M, 18-46 yrs) were recruited, granted informed consent, were randomly assigned to a control (C) or experimental (E) group, and picked four motivational songs. The Brunel Music Rating Inventory was used to rate song motivational level. Subjects ran three 5-min trials (5/10 effort) on a pressure-sensitive treadmill (Noraxon U.S.A., 100 Hz) with vertical ground reaction force and pressure recorded during the last 45 sec and lowpass filtered (40 Hz). Five-minute of rest was given between trials. During the second trial, subjects listened to music via headphones with the bpm set to baseline cadence (C) or 10% higher (E). Music was administered via a novel smartphone application that permitted song tempo to be adjusted and maintained in one bpm increments. The last trial was completed without music with velocity held constant across all trials. A mixed design analysis of variance was run in JASP with a significance set a priori at 0.05. **RESULTS:** Baseline cadence was not significantly different between groups (C: 165±4; 95% steps per minute, E 167±2; 6, p=0.61). There was not a significant main effect (p=0.54, p=0.32, p=0.152, p=0.70) of music tempo between groups for cadence (F(1,20)=0.39, step width (F(1,20)=1.02), stance phase (F(1,20)=2.23), or foot rotation (F(1,20)=0.16).
CONCLUSION: Spatiotemporal running mechanics do not spontaneously adjust when runners listen to motivational music set at a tempo 10% greater than baseline cadence. Listening to up-tempo music should not be considered an effective external stimulus to promote increased running cadence.

**Figure 1:** Mean and standard deviations for positive knee (A) and hip (B) joint work and negative knee (C) and hip (D) joint work prior to and following the LHR for the MAX and CON groups. * denotes statistically significant difference. # denotes data trending towards a statistical difference.

**METHODS:** Twelve trail runners (sex: 10 M, 2 F; weekly mileage: 30.3 ± 14.9 miles) were randomly assigned to either a CON or MAX shoe and ran a 10-mile LHR which matched the elevation profile of a popular local trail run. 3D kinematics and ground reaction forces were collected during five-minute level ground running sections prior to and following the LHR. Sagittal plane positive (POS) and negative (NEG) joint work for the hip, knee, and ankle were calculated by integrating the POS and NEG portions of the joint power curves. Two-way mixed ANOVAs (shoe condition, time) were used to evaluate differences in joint work. **RESULTS:** There were no differences between groups in any joint work parameter before the LHR (Figure 1). Following the LHR, POS (p = 0.014) and NEG knee (p = 0.041) and NEG hip (p=0.014) work increased in the MAX group. Compare to the CON group, the MAX group also had higher NEG knee work (p = 0.009) and was trending towards higher POS knee (p = 0.072). No differences were observed in ankle work or positive hip work.

**CONCLUSION:** Proximal redistribution of joint work following a LHR was observed, but not to the extent reported in previous studies using level runs. However, the increased knee work in MAX footwear suggests the knee is being loaded more during a LHR compared to CON footwear. This may have implications for injury risk as higher knee loads are related to common running injuries.

Footwear provided by New Balance, Inc.
Suspected diagnosis of right ovarian torsion

TVUS revealed a 7 cm edematous right ovary with 2 small follicles and no large cyst.

Ovarian abscess

PHYSICAL EXAMINATION: Examination on the sideline revealed a click upon palpation of the anterior neck near the thyroid cartilage. He had full ROM of his cervical spine with a normal neurological exam. He had no respiratory distress, subcutaneous crepitations, or voice changes. He did have some pain with swallowing. Hyoid bone and cricoid cartilage is non-tender. Cardiac and pulmonary exams were also unremarkable. Exam was stable when repeated in emergency department.

DIFFERENTIAL DIAGNOSIS: Fracture of Thyroid Cartilage Fracture of Hyoid Bone Contusion of Neck Carotid Artery Dissection

TEST AND RESULTS: CT Neck with Contrast

Minimally displaced fracture

Bone Contusion of Neck Carotid Artery Dissection

PHYSICAL EXAMINATION: The patient exhibited joint pain and extreme hypermobility on examination. Genetic tests were performed on the patient, his mother, and his sister.

DIFFERENTIAL DIAGNOSIS: While there exists a family history of hypermobility, along with orthostatic hypotension in this patient (consistent with Ehlers-Danlos Syndrome, or EDS) the patient also exhibits CD5 immune deficiency, psychogenic seizures, a likely pathogenic variant in the AK2 gene (c.656delT), associated with reticular dysgenesis. His sister also carries this variant. He also carries the variant associated with cystic fibrosis, the congenital bilateral absence of the vas deferens, and chronic pancreatitis.

TEST AND RESULTS: We are presently working with this patient to determine if a moderate-intensity exercise program yields a decrease in joint pain, hypermobility, and downregulation of gene expression.

FINAL WORKING DIAGNOSIS: This is a work-in-progress of a patient with two rare diseases and a variety of genetic issues, which to our knowledge have never been exhibited in a single patient.

TREATMENT AND OUTCOMES: We will present working data and determine if an exercise intervention has a positive impact in this patient.

Ovarian Torsion Presenting As Referred Cyclical Hip Pain In A Division I Athlete

Emily D. Geyer1, Christina L. Charles2, Rachel Deniseon, Bridget M. Geyer3, James A. Onate1. 1Ohio State University, Columbus, OH. 2Columbus Obstetricians-Gynecologists, Inc., Columbus, OH. 3University of Notre Dame, Notre Dame, IN. 4Duke University School of Medicine, Durham, NC.

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HISTORY: A 22-year-old female Division I rower presented to the emergency department (ED) due to severe right lower quadrant pain with nausea and vomiting. She had a three-year history of right hip pain diagnosed as femoroacetabular impingement (FAI) and infrequent flares of worsened hip pain treated with rest and intra-articular cortisone injections or oral steroid dose-pack. During ED visit, abdominal computerized tomography (CT) and transvaginal ultrasound (TVUS) revealed significantly enlarged right ovary diagnosed as ovarian cyst. She was discharged and was seen by OB/GYN that afternoon for follow up.

PHYSICAL EXAMINATION: Patient presented to the office in moderate distress due to unrelieved right lower quadrant (RLQ) pain. Abdomen was soft and tender throughout. Physical exam was otherwise unremarkable.

DIFFERENTIAL DIAGNOSIS: Prior to imaging:

1. Musculoskeletal: fracture, FAI, osteoarthritis, nerve compression, bursitis
2. Genitourinary: urinary tract infection, pyelonephritis, nephrolithiasis
3. Gastrointestinal: Irritable Bowel Syndrome, constipation, appendicitis
4. Gynecologic: ovarian cyst, ovarian torsion, pelvic inflammatory disease, tubo-ovarian abscess

TESTS AND RESULTS

TVUS revealed a 7 cm edematous right ovary with 2 small follicles and no large cyst. There was very minimal to no Doppler flow. Blood work revealed elevated white blood cell (WBC) count.

FINAL WORKING DIAGNOSIS: Suspected diagnosis of right ovarian torsion

TREATMENT AND OUTCOMES

1. Patient was admitted to the hospital for mini-laparotomy and right oophorectomy.
2. Right ovary torsed 5 times and appeared normal other than being significantly enlarged to 7-8 cm.
3. Given that there was no cyst to be drained, the right ovary was removed.
4. The right fallopian tube, left ovary and fallopian tube, and uterus were all normal.
5. The patient tolerated the procedure well and has since experienced only mild hip pain consistent with FAI.

It is likely the patient’s flares of pain over the previous 3 years were ovarian etiology but disguised due to her irregular menstrual cycle and coincident chronic FAI. Ovarian etiology should be included in the differential for female athletes experiencing surges of lower quarter abdominal pain in a setting of hip pain.

Ehlers-Danlos Syndrome And CD5 Deficiency In A 22 Year-old Male

Thomas Lowder, Courtney Holloway. UNIVERSITY OF Central Arkansas, Conway, AR.

Email: tlowder@uca.edu

HISTORY: A previously-active male presented with joint pain at age 15. He is positive for joint hypermobility and dislocation/subluxation, joint pain, food allergies, gastritis, gastroesophageal reflux, and CD5 immune deficiency (diagnosed at age 5, one of eight in the world at the time). He has a family history of aortic aneurysm.

PHYSICAL EXAMINATION: The patient exhibited joint pain and extreme hypermobility on examination. Genetic tests were performed on the patient, his mother, and his sister.

DIFFERENTIAL DIAGNOSIS: While there exists a family history of hypermobility, along with orthostatic hypotension in this patient (consistent with Ehlers-Danlos Syndrome, or EDS) the patient also exhibits CD5 immune deficiency, psychogenic seizures, a likely pathogenic variant in the AK2 gene (c.656delT), associated with reticular dysgenesis. His sister also carries this variant. He also carries the variant associated with cystic fibrosis, the congenital bilateral absence of the vas deferens, and chronic pancreatitis.

TEST AND RESULTS: We are presently working with this patient to determine if a moderate-intensity exercise program yields a decrease in joint pain, hypermobility, and downregulation of gene expression.

FINAL WORKING DIAGNOSIS: This is a work-in-progress of a patient with two rare diseases and a variety of genetic issues, which to our knowledge have never been exhibited in a single patient.

TREATMENT AND OUTCOMES: We will present working data and determine if an exercise intervention has a positive impact in this patient.

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without medications. After discharge, patient was followed by a Pediatric Urologist with monthly imaging. 10 months later, he still had a small 0.5cm hematoma. Patient continues to have mildly elevated BP of unclear etiology. He was evaluated by a Pediatric Cardiologist, and echo did not show evidence of heart disease (LVH). He has not played soccer since the injury.

PHYSICAL EXAMINATION: Examination revealed skin color changes with blue therapy. anti-inflammatory gel, heat/ice, deep tissue massage, and dry-needling with physical therapy.

The proximal fibula. The pain was worse with movement and relieved with rest, ice and elevation.
The patient had swelling near the proximal fibula. He also had swelling and fullness in calf on lateral view. MRI right tibia and fibula with acute tear of the anterior gastrocnemius aponeurosis with a longitudinal component as well as a retracted transverse component.


TEST AND RESULTS: MRI without IV contrast of left tibia/fibula, foot, ankle:
- Mild intramuscular edema within gastrocnemius and soleus, focal fatty atrophy adjacent to medial soleus muscle. Generalized subcutaneous edema throughout ankle. EMG:
- No evidence of left lumbosacral radiculopathy, left lower limb mononeuropathy, or large fiber peripheral neuropathy

US lower extremity Veins:
- No DVT in left lower extremity

Ankle brachial index:
- Normal arterial Doppler study on the left leg during rest with normal PVR

TREATMENT/OUTCOMES:
1. Physical Therapy focused on strengthening exercises and desensitization techniques
2. Diclofenac topical gel applied up to four times daily
Left ankle with moderate amount of joint effusion and mild-moderate amount of swelling over proximal peroneal muscle.

AROM and PROM: limited to pain, especially in inversion and plantarflexion. Tenderness to palpation in proximal peroneal tendon/fibula and distal peroneal muscle. Strength: Ankle Dorsiflexion 5/5, Long peroneal, Plantarflexion, Inversion, Eversion all 4/5. Left Anterior Drawer Test ankle has increased laxity. Unable to perform single foot toe raise on left. Neurovascularly intact.

DIFFERENTIAL DIAGNOSIS:

Peroneal Muscle Strain
Peroneal Tendon Rupture
Compartment Syndrome
Fibular fracture
Lateral Ankle Sprain
Tests and RESULTS:

3x Xray Left ankle and 6v Xray Left tib-fib: no acute bony abnormalities.

MRI Left tibi-fib: high-grade partial to full-thickness tear of the peroneal longus tendon at the level of proximal fibula with adjacent torn tendon fibers to the level of proximal Meta-diaphysis. Low-grade partial tear of the proximal peroneal brevis tendon with intramuscular edema. Tendinosis and tenosynovitis of distal peroneal brevis and longus without high-grade partial tearing.

Final/Working Diagnosis:

Tear of Left Proximal Peroneal Tendon.

Treatment and outcomes:

The patient was shut down from sports and placed in a Cam walker boot. Treatment with rest, ice and PT. Pain control with acupuncture, muscle relaxant, and Tylenol or ibuprofen as needed.

2 days prior to the 2-week follow-up, the patient received 1 PRP injection at the site of pain. At 2 week follow-up, the patient’s pain improved. He was able to ambulate without limping but still had tenderness in the proximal peroneal muscle. He was able to have pain free AROM and PROM and regained 5/5 strength in left ankle motions, except 5/5 in Long Peroneal.

At 4 weeks follow-up, all symptoms resolved and he was cleared to return to 15 minutes of contact practice.

**3669 May 30 10:00 AM - 10:20 AM**

**Hi-yá!: A Rare Quadriceps Lesion In A Rising Champion**

Jose F. Velasquez, James Pearson, Alex Casey, Hamed Shalikar.

Emanate Health, West Covina, CA.

Email: jfvelasquez92@gmail.com

(No relevant relationships reported)

**History:** A 10-year-old Female w/o past medical history was brought to the ED by her mother due to left leg pain and swelling. The mother states that the patient practices tae kwon do. 3 days before during training, she sustained a direct kick over the proximal right lower leg, painful/antalgic gait, swelling over proximal peroneal muscle.

At 2 week follow-up, the patient’s pain improved. He was able to ambulate without limping but still had tenderness in the proximal peroneal muscle. The patient was taken to urgent care where X Rays ruled out a fracture. The patient was later taken to ED where he landed on his right lateral leg with immediate pain to the fibular head. There was no numbness, tingling, weakness or radiation of pain however he had a noticeable limp. He presented to clinic 2 days later and denied any prior injuries or trauma to the area.

**Physical Examination:** 2 days post injury (PCP office) — No deformity, 2 days post injury (PCP office) — No deformity, 2 days post injury (PCP office) — No deformity.

**Treatments and Outcomes:**

- Relative rest.
- Ice.
- Non-steroidal anti-inflammatory drugs (NSAIDs).
- Physical therapy.
- Rehabilitation.

**Discussion:**

In isolation this is a very rare injury. There was one reported case of a SH-3 fracture that presented with initial knee injury and ROM deficits that was treated non-operatively. Most injuries to the proximal fibula occur in combination with an interosseous membrane syndesmotic and distal tibiofibular injury - must rule out a Maisonneuve injury. The presenting complaint was pain and edema in the region of the soleus this may have been a soleus traction injury to the apophysis vs direct trauma from the fall.

**3670 May 30 10:20 AM - 10:40 AM**

**Leg Injury - Football**

Austin A. Brown, Joseph E. Escobar, James P. Toldi.

University of South Alabama, Mobile, AL.

(No relevant relationships reported)

**History:** A 12-year old male quarterback sustained a right leg injury while cutting back across the field. He was running across the field and made a lateral cut to change directions, as this happened he tripped over himself and fell without a twisting motion.

Cardiovascular disease is the leading cause of death worldwide. Aerobic exercise is recommended to reduce the risk of cardiovascular disease, however it may not be feasible for all individuals. Heat therapy via sauna exposure may be an alternative modality to aerobic exercise to improve cardiovascular health and lower risk of all-cause mortality. PURPOSE: To compare the influence of a single bout of sauna exposure (HEAT; ~56°C), cycling exercise (EXER; 40-50% control study. Trials consisted of a 20-minute supine baseline followed by 30 minutes of either infrared sauna exposure (HEAT; ~56°C), cycling exercise (EXER; 40-50%
3686  Board #3
Fli-1 And Endothelial Function Soon After Delivery: Effect Of Physical Activity
Chloe W. Caudell, Samantha Bouknight, Katherine Kramps, Erin O’Connor, Paige Wilbanks, Abbi Lane-Cordova. University of South Carolina: Arnold School of Public Health, Columbia, SC. Email: caudelc@email.sc.edu

Vascular adverse pregnancy outcomes (APOs) are characterized by elevated levels of antiangiogenic Fms-like tyrosine kinase (Flt-1), attributable to placental ischemia. Flt-1 directly impairs endothelial function during pregnancy and contributes to maternal features of APOs, but infusion of Flt-1 into non-pregnant animals did not cause endothelial dysfunction. PURPOSE: The purpose was to evaluate the relation of Flt-1 and endothelial function in women 6 months – 3 years after delivery. Given the angiogenic effects of exercise, we tested the hypothesis that Flt-1 would be lower in women who achieved adequate prepartum and current physical activity (PA). METHODS: 40 nonsmoking women free from diabetes and use of progesta inhibitors (mean age: 33.1 ± 1 yrs, mean BMI: 26.3 ± 1.0 kg/m², 58% with adequate pregnancy PA) completed a blood draw and vascular testing after an overnight fast. We used an ELISA assay to determine levels of circulating Fli-1. Reactive hyperemia (RH) was measured with venous occlusion plethysmography to quantify resistance vessel endothelial function. A validated physical activity questionnaire (Godin Leisure Time Exercise Questionnaire) was used to determine current and second trimester PA; APO history was determined using self-report. We tested for associations of RH with continuous levels Flt-1 using a multiple linear regression analysis. RESULTS: Fli-1 levels in postpartum women were lower compared to prepartum levels (p < 0.05). Flt-1 levels were not associated with RH (p > 0.05). CONCLUSIONS: Flt-1 levels in the postpartum period are lower compared to prepartum levels. Flt-1 might not be useful for identifying women at risk of vascular dysfunction after pregnancy ends.

3687  Board #4
Blood Pressure, Fitness, And Fatness In Children The Arkansas Active Kids Study
Eva C. Diaz, Judith L. Weber, Sean Adams, Young G. Catarina, Bai Shasha, Elisabet Barshim. University of Arkansas for Medical Sciences, Little Rock, AR. Email: ECDiazfuentes@uams.edu

Purpose The role of cardiorespiratory fitness (CRF) in pediatric health is gaining recognition. However, the quality and quantity of the current evidence are insufficient to inform clinical pediatric guidelines. Objective: to evaluate the association between direct measures of CRF and blood pressure status as determined by the 2017 screening guidelines from the American Academy of Pediatrics in school-age children. Methods Children (n=218) 7 to 10 years old participated in a single-study visit. Children were deemed to have high blood pressure (HBP) if blood pressure status was: elevated, stage-1 or stage-2 hypertension. CRF (VO2peak) was measured using an incremental cycle ergometer test. Body composition was measured with DXA, and physical activity with accelerometers (7/1 days). Blood was sampled in the fasting state and estimated glomerular filtration rate (eGFR) calculated using the updated Schwartz equation. Children were categorized as having excess weight (EW) or normal weight (NW) if their fat mass index was above or below 1 z-score, respectively. Children were further classified into EW/NW more-fit or EW/NW less-fit using the groups’ median VO2peak. Multivariate logistic regression analyses were used to model the probability of high blood pressure against VO2peak. Results Participants’ average age was 9 years, with 70% of EW children having HBP vs. 24% in the NW group (p<0.001). The probability of HBP decreased with increasing VO2peak in the EW group only (β=0.09, p=0.0095). There was no association between CRF and probability of HBP in NW children. eGFR was lower in the less-fit groups than in more-fit groups regardless of adiposity status, even after adjusting for age and blood pressure status (adjusted mean difference between more-fit and less-fit groups: EW=−7.1 ml·min−1·1.73 m²; p=0.0046 and NW=2.9 ml·min−1·1.73 m²; p=0.0144). Conclusion The probability of HBP dramatically decreases with increasing CRF in children with EW but not in children with NW. eGFR is lower in children with lower CRF, regardless of obesity status, but the effect of CRF on kidney function is greater in EW than in NW kids. Funding: USDA-ARS Projects 59-6250-4-001 and 6026-51000-126-005. ECD partially supported by ArCAPT-8UG1OD024945.
The chemotherapeutic drug doxorubicin (DOX) is commonly prescribed to treat patients diagnosed with cancer. However, patients on DOX cannot take it long term due to its cardio-toxic effects, as well as skeletal muscle wasting and dysfunction. The mechanism behind why skeletal muscle dysfunction occurs is not well known, so the effects of DOX on skeletal muscle mitochondria are currently being investigated.

**PURPOSE:** To determine the maximal respiration levels in DOX treated C2C12 myotubes. METHODS: Immortalized C2C12 myotubes were cultured in vitro and allowed full differentiation. Fully differentiated cells were then treated with 0.5mM DOX for 16 hours. Maximal mitochondrial respiration was analyzed with high resolution respirometry. The following substrates were used: diglucuron (permeabilize cells), glutamate (G), malate (M) (leak respiration), then ADP (complex I); cytochrome C (mitochondrial membrane integrity); succinate (S) (complex I & II); FCCP (uncoupled respiration); rotenone (Rot) (complex I inhibitor); antimycin A (complex III inhibitor). Results were analyzed using multiple t-tests. RESULTS: DOX caused an 18% reduction in complex I & II supported respiration compared to control (54.6 vs 66.2±0.2 J; P<0.005; n=4), a 32% decline in complex I supported respiration (37.2 vs 55.2±0.2 J; P<0.05), and a 26.6% decline in leak respiration (28.6 vs 38.99±0.2 J; P<0.05). Uncoupled respiration was not significantly different but continued in trend (P<0.08), indicating an overall decrease in mitochondrial respiration. CONCLUSION: Treating C2C12 differentiated myotubes with DOX for 16 hours inhibits complex I & II supported maximal respiration. These findings enable future research to be conducted in order to better understand why these cells are decreasing in maximal respiration. We are currently investigating whether co-treatments can reduce or rescue reduction in respiration caused by DOX.

**Max Respiration**

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**3691 Board #8**

**Undernutrition Promotes Oxidative Stress & Capillary Regression In Skeletal Muscle**

Takumi Hirabayashi1, Badur un Nisa1, Hiroyo Kondo2, Hidemi Fujito1, 1Kobe University, Kobe, Japan. 2Nagoya Women’s University, Nagoya, Japan.

(No relevant relations reported)

**PURPOSE:** An undernutrition condition results in muscle atrophy and mitochondrial dysfunction. However, it is still not well-known that the characteristics of the skeletal muscle capillary network during undernutrition. The purpose of the present study was to verify the effects of undernutrition on the capillary network in skeletal muscle. **METHODS:** Male Wistar rats were assigned randomly to control and undernutrition groups. The rats in the undernutrition group fed low protein and limited 50% diets daily for 12 weeks. Plantaris and soleus muscle were analyzed. The three-dimensional capillary network of skeletal muscle was visualized using a confocal laser scanning technique. The capillary volume, mean luminal diameter and capillary-to-fiber ratio were measured in both skeletal muscles. In addition, the levels of VEGF and thomobspordin-1 proteins, lipid peroxidation and SOD-2 proteins were determined. **RESULTS:** The muscle mass decreased only plantaris muscle in the undernutrition group. The level of lipid peroxidation was increased, and the expression levels of SOD-2 in plantaris and soleus muscles were decreased. In addition, the capillary volume, mean luminal diameter and capillary-to-fiber ratio were decreased in both muscles of the undernutrition group. Furthermore, the level of VEGF protein was decreased, and thomobspordin-1 was increased in both muscles of undernutrition group. **CONCLUSIONS:** These results suggest that undernourished skeletal muscle induces capillary regression with increased oxidative stress, which also occurs in slow muscle without atrophy.

**3692 Board #9**

**Long-chain Acyl-CoA Synthetases Relate To Fat Oxidation And Storage In Skeletal Muscle Of Lean Humans**

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(No relevant relations reported)

Recent evidence from genetically altered cell and mouse models indicate long-chain acyl-CoA synthetases (ACSLs), namely ACSL1 and ACSL6, may be critical determinants of partitioning of fatty acids toward oxidation or storage, respectively, within skeletal muscle. However, the role ACSLs serve in skeletal muscle fat oxidation and storage remains to be determined in humans, and it is unknown if ACSLs are altered by acute exercise. **PURPOSE:** To identify 1) relationships between skeletal muscle ACSL1 and ACSL6 protein content and measures of fat oxidation at rest and during exercise, and fat storage, and 2) whether acute exercise induces changes in ACSL protein content in humans. **METHODS:** Sedentary lean adults (n=14 [4M/10F]), BMI 22.2±2.1 kg/m², VO₂max 32.7±4.5 ml/kg/min) completed two metabolic visits in a randomized crossover design. Trials were identical other than completing 1 h of moderate intensity cycling exercise (65% VO₂max) or remaining sedentary. Vastus lateralis muscle biopsies were obtained 15 min post-exercise or rest and 2 h post-exercise to determine ACSL protein and triacylglycerol (TAG) content. **RESULTS:** TAG content was determined by lipidomic analysis. Substrate oxidation was assessed at rest and during exercise using indirect calorimetry. **RESULTS:** Skeletal muscle ACSL1 protein content was not related to whole-body fat oxidation at rest (P=0.64, r=0.14); however, ACSL1 tended to be positively related with whole-body fat oxidation during exercise (P=0.07, r=0.53); when skeletal muscle accounts for the vast majority of energy expenditure. Skeletal muscle ACSL1 was not altered 15 min or 2 h post-exercise (both P>0.05 vs. Rest). Skeletal muscle ACSL6 protein content was positively associated with resting muscle TAG content (P=0.05, r=0.57). ACSL6 protein content was not

Abstracts were prepared by the authors and printed as submitted.
altered 15 min or 2 h post-exercise (both P > 0.05 vs. Rest). CONCLUSIONS: Skeletal muscle ACSL1 and ACSL6 protein content were positively associated with measures of whole-body fat oxidation during exercise and skeletal muscle TAG content, respectively. We interpret our results to indicate ACSLs may be critical regulators of partitioning of fatty acids within skeletal muscle, but protein content was not altered in the hours after acute exercise in sedentary lean adults.

Supported by ACSM Foundation Doctoral Student Research Grant

3693 Board #10
Adiposity And Cardiovascular Health And The Reallocation Of Waking Activities In Preschool Children With Overweight
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(No relevant relations reported)

Physical activity and sedentary behaviors differentially relate to health outcomes in children. Isotemporal substitution provides opportunities to evaluate the relation of hypothetical time replacement scenarios across intensity categories with health. Few isotemporal studies have been conducted among preschool-aged youth and ethnically diverse populations.

PURPOSE: To examine the relation of reallocation of waking activity behaviors on 1) adiposity and 2) cardiovascular health indicators among preschool-aged children (ages 2-5 years) with overweight participating in Texas Childhood Obesity Research Demonstration (TX CORD), a low-income, majority Hispanic cohort.

METHODS: Participants wore an ActiGraph wGT3X-BT monitor (waist) and Demonstration (TX CORD), a low-income, majority Hispanic cohort. (ages 2-5 years) with overweight participating in Texas Childhood Obesity Research Demonstration (TX CORD), a low-income, majority Hispanic cohort.

RESULTS: Complete data were available for 131 children (Mean age = 4.3±1.1, 53% female, 87% Hispanic, 31%≤49% income to poverty ratio). For boys, reallocating 15 minutes of sedentary, light, or moderate intensity activity to vigorous intensity activity was significantly associated with beneficial reductions in all adiposity indicators; for girls, these relations were statistically null. For boys and girls, reallocating 15 minutes of sedentary (-5.0 SBP, -3.7 DBP), light (-4.3 SBP, -3.2 DBP), or moderate intensity activity (-7.3 SBP, -5.5 DBP) to vigorous intensity activity was significantly associated with favorable cardiovascular indicators.

CONCLUSIONS: Substituting vigorous for lower intensity physical activity is associated with several favorable adiposity and cardiovascular health outcomes among preschool children with overweight and obesity. Teaching caregivers how to engage young children in vigorous intensity is needed, especially as overweight children spend more time sedentary and less time in higher intensity activities.

3694 Board #11
Operationalization Of The Youth Physical Activity Guidelines Using The International Children’s Accelerometry Database (ICAD)

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(No relevant relations reported)

PURPOSE: Use data from the International Children’s Accelerometry Database to explore how different methods of operationalizing the youth physical activity (PA) guidelines influence: (i) the proportion of youth deemed compliant with the guidelines, and (ii) associations between guideline compliance and health indicators.

METHODS: Accelerometer data for 21,612 youth (5-18y, 62.4% female) was used to explore PA guideline compliance defined by four operationalization methods: daily method (DM; ≥60 minutes moderate-vigorous PA [MVPA] on every day of the measurement period), average method (AM; average of ≥60 minutes MVPA per day over the measurement period), AM5 (compliance with AM and ≥5 minutes of vigorous PA [VPA] on ≥3 days), AM15 (compliance with AM and ≥15 minutes VPA on ≥3 days). Relationships between guideline compliance and health indicators (e.g., BMI z-score, cholesterol levels, blood pressure) were examined for all operationalization methods. Descriptive statistics and McNemar’s tests were used to compare compliance estimates for the four methods. Multivariate regression models were used to test associations between compliance and health indicators.

RESULTS: Operationalization method influenced estimates of compliance with the youth PA guidelines: 5.3% using DM, 29.9% using AM, 29.4% using AM5, 23.7% using AM15. Associations between guideline compliance and health indicators were similar for the AM, AM5 and AM15 methods, for example, BMI z-score: AM compliance (coefficient -0.28, 95% CI: -0.33,-0.23), AM5 compliance (coefficient -0.28, 95% CI: -0.33,-0.23), AM15 compliance (coefficient -0.30, 95% CI: -0.35,-0.25). Compliance with the DM method demonstrated similar or weaker associations with health indicators, potentially due to a small number of participants that complied with DM and also had health indicator data (n=250-1,127). CONCLUSION: Operationalization method influences estimates of the proportion of youth meeting the PA guidelines. This finding adds to the PA data processing decisions that researchers need to consider. While operationalization method appears to have a minor influence on associations between guideline compliance and health indicators, further research with a larger sample of DM-compliant participants with health data is needed to confirm this finding.

3695 Board #12
Addressing Motivational Barriers For Early Morning Outdoor Physical Activity Using Smartphones
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(No relevant relations reported)

Lack of physical activity is a global health concern. Determining an appropriate time to motivate individuals for consistent outdoor exercise is challenging. Early morning outdoor physical activity (PA) has proven health benefits. However, in spite of known wellness benefits, people report motivational barriers such as lack of time, lack of enjoyment to experience morning outdoor PA. Smartphones are increasingly used as a tool to assist in outdoor PA. We have leveraged the smartphone technology capabilities to address the motivational barriers in early morning outdoor physical activity.

PURPOSE: The main purpose of our work is to share findings of an exploratory study for improving motivation of outdoor physical activity. METHODS: We developed an intervention called “Rise and Smile” led by one healthy participant and followed by 280 online followers for 365 consecutive days. The participant performed daily...
15 minutes of early morning PA of walking or running to reach an outdoor Sunrise viewing location. The participant then captured a photo of the beautiful view of nature during sunrise on their smartphone camera upon completion of their PA. The participant then instantly published the photo on a social media page. RESULTS: The individual participant self-reported increased energy, better sleep and increased productivity. The virtual participants (n=281) showed positive acceptance via social media with regular sunrise photo likes. The positive reaction to the Sunrise photo also motivated the individual to establish the daily wellness habit. The positive experience of watching sunrise and the picturesque photos of nature during sunrise were used as motivational tools. The participant’s motivation was used as a primary outcome measure and was reportedly improved upon successful completion of this study. The study also showed the influence of unique sunrise photos for emotional benefits and positive behaviour change. CONCLUSION: Our smartphone-enabled study suggested that use of technology to record unique picturesque outdoors during the sunrise can provide meaningful motivation for outdoor physical activity.

3696 Board #13
Physical Activity Prescription For Patients With Chronic Diseases: A Questionnaire Survey In Shenzhen, China
RUI HU, Stanley Sai-Chuen HUI, FACSM. The Chinese University of Hong Kong, Hong Kong, China. Email: hurui@link.cuhk.edu.hk (No relevant relations reported)

PURPOSE: To investigate the prevalence of prescribing PA in clinical setting for patients with chronic diseases in Shenzhen, China.METHODS: A total of 104 patients recruited from three general hospitals in Shenzhen of China completed a face-to-face questionnaire. Patients were asked “have you ever been provided with PA prescription by physicians/healthcare providers?”. Those who answered yes were then further prompted about the PA frequency (number of times per week), intensity (low, moderate or high intensity), duration (number of minutes per session) and type of PA provided by physicians/healthcare providers.

RESULTS: Overall, 53.4% patients reported receiving PA prescription from physicians/healthcare providers. Of those PA being prescribed, 61.8% of patients reported the frequency were introduced, whereas 65.5% included intensity and 67.3% included duration, respectively. Fewer participants (43.6%) reported being provided the type of PA, and the most common type of PA being prescribed was walking (75%). Moreover, less than a third of patients (31%) received a complete prescription (including PA frequency, intensity, duration & type) from their physicians/healthcare providers.

CONCLUSIONS: This study revealed that about half of physicians/healthcare providers are incorporating PA promotion into clinical setting in Shenzhen. However, only a small percentage of physicians/healthcare providers could provide completed PA prescription for chronic disease patients. Furthermore, the type of exercise that prescribed by physicians/healthcare providers seems to be limited. The results may support that further education/training to physicians/healthcare providers in China are needed in order to foster PA prescription in clinical setting.

3697 Board #14
Hydrotherapy With Hydrogen-rich Water Versus R.I.C.E. Protocol For Acute Ankle Sprain In Professional Athletes
Sergej M. Ostojic, Dejan Javorac, Valdemar Stajer. University of Novi Sad, Novi Sad, Serbia. Email: sergej.ostojic@chess.edu.rs (No relevant relations reported)

Different therapeutic approaches with hydrogen (H₂) have been recently put forward in sports medicine, yet the effectiveness of specific experimental treatments with H₂ was rarely compared with standard clinical procedures. PURPOSE: To analyze the effects of intensive hydrotherapy with hydrogen-rich water (HRW) on injury recovery in athletic men who suffered an acute ankle sprain and compare it with RICE protocol (rest, ice, compression, elevation), a universally accepted as best practice immediately after acute ankle sprains.

METHODS: Eighteen healthy male professional athletes who incurred an acute ankle sprain during a sport-related activity were randomly assigned immediately after the injury to either hydrogen group (n = 9) or the conventional RICE treatment group (n = 9). Hydrogen group received six 30-min ankle baths with HRW throughout the first 24 h post-injury, with hydrotherapy administered every 4 hours during the intervention period. RICE group stood off the injured leg, with ice packs administered for 20 min every 3 hours (total of 8 sessions), with the injured ankle compressed with an elastic bandage for 24 hours and elevated at all possible times above the level of the heart.

RESULTS: Hydrotherapy with hydrogen-rich water was equivalent to RICE protocol to reduce ankle swelling (2.1 ± 0.9 cm vs. 1.6 ± 0.8 cm; P = 0.26), range of motion (2.4 ± 1.3 cm vs. 2.7 ± 0.8 cm; P = 0.60), and single-leg balance with eyes opened (18.4 ± 8.2 sec vs. 10.7 ± 8.0 sec; P = 0.06) and closed (5.6 ± 8.4 sec vs. 3.9 ± 4.2 sec; P = 0.59). Neither intervention affected serum CRP, TNF-α and IL-1β (P > 0.05), although hydrogen group tended to reduce circulating IL-1β levels at 24-h follow up (10.8% on average; 95% confidence interval from 6.0 to 27.6; P = 0.07).

CONCLUSIONS: HRW appeared to be equally effective to RICE for improving recovery after an acute ankle sprain in professional athletes, therefore advancing this innovative approach as an effective alternative in the field of sports medicine. However, more studies are needed to corroborate these findings in other soft tissue injuries.

3698 Board #15
Clinical Benefit Of Cntx-4975 Intra-articular Injection For Moderate To Severe Osteoarthritis Knee Pain
Randall M. Stevens1, Peter D. Hanson1, Paul Tisco1, Kimberly Guedes1, James N. Campbell1, James Connolly1, Stephanie Ruggiero1, Meg Corfi1, Valerie H. Smith1, Andrew I. Spitzer2. Centrexion Therapeutics Corp, Boston, MA. 1Cedars Sinai Orthopedic Center, Los Angeles, CA. R.E. HU, Stanley Sai-Chuen HUI, FACSM. The Chinese University of Hong Kong, Hong Kong, China. Email: hurui@link.cuhk.edu.hk (No relevant relations reported)

Purpose: To evaluate the effect of CNTX-4975 intra-articular (IA) injection on pain, function, and quality of life (QoL) in subjects with knee osteoarthritis (OA). METHODS: A phase 3, open-label, 8-week study (NCT03661996) enrolled subjects aged 40–95 y with stable, moderate to severe OA knee pain in the index knee (average pain ≥2) after ≥2 failed therapies. Subjects were assigned to unilateral/bilateral CNTX-4975 1 mg IA injections as determined by OA pain/joint replacement status (Table) and randomized by site to 1 of 5 joint cooling/injection regimens to evaluate procedure experience. The circumferential joint cooling wrap used in the phase 2 pivotal trial was compared with 4 circumferential gel-pack wrap cooling groups with varying cooling schedules/injection techniques. Outcomes assessed through wk 8 included average daily index knee pain with walking (numeric pain rating scale [NPRS], 0 [no pain] to 10 [worst pain]) and Knee Injury OA Outcomes Score (KOOS) subscales (range, 0–100; higher is improvement; Table). Least squares (LS) mean, 95% CI, and P value were calculated for change from baseline in NPRS and KOOS scores using a mixed model for repeated measures. RESULTS: The intent-to-treat population included 848 subjects; baseline NPRS index knee pain with walking scores (mean [SD]) by subject type: A, 6.5 (1.50); B, 7.4 (1.35); C, 6.2 (1.21). By day 3, NPRS scores were significantly (P<0.0001) improved; LS mean (SE [95% CI]): A, −3.98 (0.170 [−4.32, −3.64]); B, −4.21 (0.103 [−4.41, −4.01]); C, −3.71 (0.375 [−4.48, −2.94]). Improvement was maintained at wk 8: A, −3.48 (0.191 [−3.86, −3.10]); B, −4.02 (0.118 [−4.25, −3.79]); C, −3.52 (0.416 [−4.38, −2.67]); all P<0.0001. All KOOS subscale scores were significantly improved at wk 8 (Table). Conclusions: Subjects with moderate to severe knee OA pain showed significant clinical improvements as early as 3 days and through 8 wks post injection in knee pain, function, and QoL after a single CNTX-4975 1 mg IA injection.
Purpose: Synovitis is common in osteoarthritis of the knee (OAK) and is associated with pain and disease severity. This open-label phase 3 study is evaluating the effect of an intra-articular (IA) injection of triamcinolone acetonide extended release (TA-ER) on synovial tissue volume (STV), pain, and function (NCT03529942). The primary endpoint was met: standardized least squares mean change in STV was −1.13 (95% CI, −1.35 to −0.91; p < 0.001). Western Ontario and McMaster Universities Osteoarthritis Index (pain) was significantly reduced at 6 weeks (<0.001). The mean change in STV was −1.13 (95% CI, −1.35 to −0.91; p < 0.001).

Results: We enrolled 116 OAK pts with typical OA characteristics (77%) demonstrated synovitis at BL. STV was significantly reduced from BL at 6 weeks (<0.001).

Conclusions: TA-ER significantly reduced STV, pain, and function in patients with OAK. Clinical significance and further investigation are needed to establish the role of IA injections in patients with OAK.
traditional exercise. This study was conducted to answer the important question, “Can high-intensity interval training (HIIT) improve CRF for prior non-responders?”

METHODS: Participants were 8 (5 women, mean age 54) prior non-responders from the CardioRACE study who were at high-risk of cardiovascular disease including 35-70 years old with overweight/obesity and elevated/stage 1 hypertension. They participated in CardioRACE traditional continuous aerobic exercise for 3 times/week, 60 min/session, at 50-80% heart rate reserve [HRR]. They were identified as non-responders due to no or minimal increase in CRF (similar to 5% CRF increase) after 6 months of exercise, following the non-respondent definition that considers technical errors in CRF assessment and day-to-day variability. In this study, participants performed HIIT exercise 3 times/week, 30 min/session for 1 month, containing four 4-min high-intensity intervals at 85-95% HR separated by three 3-min active recovery at 40-60% HRR with 5-min warm-up and cool-down. CRF was measured by maximal treadmill test using a Balke protocol. RESULTS: This short HIIT exercise significantly improved CRF with a mean increase of 8% from 26.7 to 28.8 ml/kg/min (p<0.01 from paired t-test) in prior non-responders to traditional exercise (Figure 1). All participants improved CRF and became responders. All high-risk participants safely completed HIIT with 100% attendance rate without adverse events. CONCLUSION: Even half the HIIT exercise time (30 min/session) over 1 month significantly improved CRF in prior non-responders. A long-term HIIT trial with a control group is necessary to confirm the findings. CardioRACE was supported by NIH Grant R01HL133069.

Figure 1: CRF changes from HIIT exercises (who were prior CardioRACE non-responders) as well as from 8-month prior CardioRACE traditional aerobic exercise responders and non-responders.
Sex Differences In Quadriceps Angiogenic Signaling And Muscle Capillary Supply After ACL Injury

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Following an Anterior Cruciate Ligament (ACL) reconstruction, females have worse functional outcomes; however, skeletal muscle biology has preferentially been studied in males. Muscle adaptation and recovery from injury are intimately tied to the muscle capillary network, which delivers oxygen, nutrients, and hormones to muscle fibers. PURPOSE: To examine differences in skeletal muscle angiogenic signaling and capillary supply in males and females after ACL injury. METHODS: Vastus lateralis (VL) biopsies were collected (24.6 ± 5.5 yr; 8M, 5F) from the ACL injured (INJ) and non-injured (NI) leg before reconstruction. Samples were assessed for vascular endothelial growth factor receptor 1 and 2 (VEGFR1 and VEGFR2) by western blot. CAPillary to fiber ratio (CFPR), capillary to perimeter exchange index (CFPE), and capillary tortuosity (% fiber border directly contacting capillary wall) were assessed by immunohistochemy. RESULTS: The percentage of phosphorylated relative to total VEGFR2 was not different between INJ and NI, but was lower in females (76.9 ± 4.1%) compared to males (89.2 ± 3.2%; P = 0.043). VEGFR2 abundance tended to be higher (P = 0.098) and CF was lower (INJ: 2.3 ± 0.2 capillary/1000µm; NI: 2.6 ± 0.2 capillary/1000µm; P = 0.018) in INJ compared to NI, but neither parameter was different between sexes. VEGFR1 abundance displayed a sex by injury interaction (P = 0.004), with females having greater abundance of VEGFR1 in INJ (548 ± 54 A.U.) compared to NI (478 ± 53 A.U.; P = 0.004), with another parameter that was different in males. Capillary tortuosity was lower in INJ compared to NI (INJ: 5.1 ± 0.3 capillary•1000µm; NI: 5.8 ± 0.3 capillary•1000µm; P = 0.002), and post-hoc analysis revealed that the difference was driven by females. Capillary tortuosity was lower in INJ (13 ± 2%) compared to NI (17 ± 2%) for females only (P = 0.006). CONCLUSION: Differences in angiogenic signaling between males and females in both INJ and NI limbs were evident, and ACL injury resulted in an exacerbated deficit in muscle capillary supply for females. These results support the idea that sex-specific differences in VL capillary network remodeling following ACL injury contribute to different functional outcomes following reconstruction and rehabilitation. Supported by NIH grants: K01 AR072061 and K23 AR062069.

Mechanistic Insights Into Using Aerobic Exercise To Remodel Tumor Vasculature And Increase Chemotherapy Efficacy

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(No relevant relations reported)

Tumor blood vessels pose obstacles for drug delivery because they are hyper-permeable and non-functional. There is a critical need to identify safe methods to increase chemotherapy delivery to the tumor. PURPOSE: We demonstrated that aerobic exercise improves tumor vasculature function, in multiple disparate tumor models, causing increased chemotherapy delivery and efficacy in mice. Across models, exercise reduced tumor vessel permeability. Because aerobic exercise increases blood flow both in healthy and tumor vessels, we aimed to investigate shear stress responsive mechanisms by which exercise may reduce tumor vessel permeability. METHODS: In vivo approaches including pharmacologic agents, a forced treadmill model of moderate aerobic exercise, and transgenic mouse models were utilized in combination with in vitro modeling of exercise induced shear stress, using a cone and plate viscometer. RESULTS: In tumor endothelium, we found the flow responsive kinase and co- transcriptional activator extracellular signal-regulated kinase 5 (ERK5) regulates tumor vessel permeability, similar to exercise. ERK5 activation in response to exercise was investigated in vivo, using a Krippel like factor 2 (KLF2) reporter mouse. KLF2 is a well-defined downstream target of ERK5. KLF2 was upregulated by exercise in the lung and aorta endothelium providing the first evidence for the involvement of ERK5 activation in response to aerobic exercise. Based on this and our previous data demonstrating that exercise induced shear stress upregulates spingosine-1 phosphate receptor 1 (S1PR1) on tumor vessels, we hypothesized that exercise activates ERK5, causing S1PR1 upregulation and decreasing permeability in tumor endothelium. To investigate this, we modeled basal tumor vasculature (low shear stress, 3 dyne/cm²) and exercise-induced flow (high shear stress, 15 dyne/cm²) with a cone and plate viscometer in vitro. We found the ERK5 axis has a similar flow responsive pattern as S1PR1. Further, ERK5 directly regulates S1PR1 in cultured endothelial cells revealing a novel EC pathway, the ERK5-S1PR1 axis. CONCLUSION: In summary, our data identifies the ERK5-S1PR1 axis as a potential exercise responsive pathway in tumor and healthy vasculature. We are currently investigating activation of the ERK5 axis in tumor vasculature.

The Impact Of High Intensity Interval Training On Fitness, Stress And Immunity In Breast Cancer Survivors

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PURPOSE: The aim of this study was to explore the impact of exercise intensity on aerobic fitness and autonomic cardiac regulation (heart rate variability (HRV)) and salivary biomarkers of the stress systems (HPA-axis, cortisol, sympathetic nervous system, α-amylase) and mucosal immunity (secretory IgA, sIgA), in breast cancer survivors. METHODS: Seventeen participants (62 ± 8 years) were randomly assigned to; 1) high intensity interval training (HIIT; n = 6); 2) moderate-intensity, continuous aerobic training (CMT; n = 5); or 3) a wait-list control (CON; n = 6) for a 12-week (36 session) stationary cycling intervention. Cardiorespiratory fitness (VO2peak) resting HRV and salivary biomarkers were measured at baseline 2-4 d pre-intervention and 2-4 d post the last exercise session. RESULTS: A significant improvement (p ≤ 0.05) was observed for VO2peak in the HIIT group; 19.3% (B = 3.98, 95%CI = [1.89; 46.62]) and a non-significant increase in the CMT group; 5.6% (B = 1.96, 95%CI = [0.11; 4.03]), compared with a 2.6% (B = 0.64, 95%CI = [-2.10; 0.82]) decrease in the CON group. Post intervention improvements in HRV markers of vagal activity (log[In]LF/HF, LnRMSSD) and sympathetic nervous system (α-amylase waking response) occurred for individuals exceeding gaiting (> 93% CI) levels at baseline compared to general population. CONCLUSIONS: HIIT (compared to CMT and CON) improved cardiorespiratory fitness in breast cancer survivors. Non-invasive measures of the autonomic nervous system, stress systems and mucosal immunity was explored further to understand the individualised responses to training adaptations within the breast cancer population.

A Longitudinal Study Of Combined Exercise Intervention With Internet And Social Media For Breast Cancer Patient

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(No relevant relations reported)
3708 Board #25

**Associations Between Physical Activity, Quality Of Life And Emotional Well-being During Active Surveillance For Prostate Cancer**

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(No relevant reports conducted)

**PURPOSE:** The purpose of this retrospective longitudinal study was to examine the association between post-diagnosis physical activity (PA), and the change in quality of life (QoL) and emotional well-being over time in men on active surveillance (AS) for low-risk prostate cancer. METHODS: Our analysis included 630 participants from AS initiation until AS discontinuation or loss to follow up. A modified Godin Leisure-Time Exercise Questionnaire was used to measure post-diagnosis PA in metabolic equivalent-minutes per week (MET-min/wk). Participants were categorized based on their PA levels: inactive (<210 MET-min/wk), insufficiently active (210-499 MET-min/wk), active (500-1000 MET-min/wk), and highly active (>1000 MET-min/wk). QoL and emotional well-being were assessed by the Patient-Oriented Prostate Utility Scale. The association between post-diagnosis PA (independent variable) and QoL (dependent variable) was assessed using generalized estimated equations (GEE). GEEs were also used to determine the relationship between PA (independent variable) and emotional well-being (dependent variable). All models adjusted for participant’s age. RESULTS: Compared to inactive participants, active (β=0.61; 95%CI = 0.11, 2.16, p=0.029) and highly active (β=0.58; 95%CI = 0.28, p=0.002) participants had higher QoL during AS. Highly active participants were more likely to experience higher emotional well-being (β=0.11; 95%CI = 0.01, 0.21, p=0.02) and a lower risk of emotional well-being over time (OR = 2.17; 95%CI = 1.06, 4.46, p=0.034) relative to lowest PA (<210 MET-min/wk). CONCLUSIONS: Our findings emphasize the importance of PA as a supportive care strategy during AS for low-risk prostate cancer.

3709 Board #26

**Reliability Of The Athlete Diet Index: A Rapid Dietary Assessment Tool For Athletes**


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(No relevant reports conducted)

Diet quality indices are a practical and inexpensive way to evaluate dietary patterns and adherence to nutrition guidelines. While the diet quality of athletes has been reported using population indices, there is currently no reliable athlete-specific diet index. **PURPOSE:** To assess the reliability of the recently developed Athlete Diet Index (ADI) in athletes. METHODS: Eighty-three athletes (55 female; 181.9±4.2 years) from a state-based Australian sports institute consented to complete the ADI deployed using FileMaker® Pro 16 (FileMaker Inc., 2017, Santa Clara, USA) on a portable device (iPad mini®) on two occasions two weeks apart between June and December, 2019. Sixty-eight athletes completed the ADI on two occasions. Scoring (maximum=125) was based on population guidelines and international sports nutrition recommendations. Scared ADI items measured intake of core and discretionary foods, and markers of dietary habits relevant to athletes. Reliability was evaluated by comparing ADI scores of the first and second administrations using paired t-tests, intra-class correlation coefficients (ICC) and Bland-Altman plots (limits of agreement (LOA) set at mean±1.96SD, and bias determined via regression analysis) all conducted using SPSS Statistics version 26 (IBM Corp, Armonk, NY, USA). RESULTS: In preliminary analyses, the mean ADI score was 84.1±15.2 (range 42.5-114.0, median 85.0). There was no difference between ADI scores on the two occasions of administration, mean difference 1.94 (95% CI: -0.49, 4.38, P=0.117) (paired t-test). The ICC was very good (ICC=0.80, 95% CI: 0.69, 0.87, P<0.0001). Bland-Altman analysis showed a mean difference of 1.94 (LOA: -17.79, 21.60) and the regression line demonstrated no indication of systematic bias (r=4.57.03x) (95% CI: -0.19, 0.13, P=0.701). There were no differences in serves of fruit, vegetables and grains between assessments; while differences were reported in serves of meat (1.69 vs 1.55, P=0.01) and discretionary foods (1.83 vs 1.86, P<0.0001). CONCLUSIONS: The ADI is a valid athlete-specific diet index which has demonstrated very good reliability in athletes, providing practitioners with a promising measure of usual dietary intake. Further evaluation of the ADI, including validation compared to established dietary methodology, is warranted.

3710 Board #27

**Abstract Withdrawn**

3711 Board #28

**Effects Of Mitochondria-targeted Antioxidant Supplementation On The Transcriptional Response To Exercise And Cycling Performance**

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(No relevant reports conducted)

Oral supplementation with general antioxidants has little impact on performance and, in some cases, interferes with training-induced adaptations that improve performance. This may be attributed to the non-specific nature of most antioxidant supplements. Mitochondria-targeted antioxidants are becoming popular amongst active individuals as they are specifically designed to accumulate within the mitochondria to provide more targeted protection against oxidative damage. The aim of this research was to investigate the effect of MitoQ on 1) the transcriptional response to high intensity interval exercise (HIIE) and HIIT training (HIIT)-induced changes in performance and 2) cycling performance in trained cyclists.

To understand how MitoQ supplementation during training affects the transcriptional response to HIIE and HIIT-induced changes in performance, twenty-three untrained middle-aged (age 44.6± 8 years) men were randomised to receive MitoQ (20 mg/d) or a placebo before completing HIIE (cycle ergometer, 10 x 60s at VO2 peak workload with 75% rest) and HIIT (3 x 3 wk for 3 wk). Mitochondrial and antioxidant gene expression were measured in muscle biopsies collected before, immediately and 3 hr after HIIE and VO2 peak, 20 and 20 km time trial performance were measured before and after HIIT. To further elucidate where MitoQ could be an ergogenic aid, twenty trained (VO2 peak 55.1± 13.2 ml.kg.min-'), middle-aged (age 44 ± 3 years) male cyclists were randomly assigned to the order in which they received MitoQ (20 mg/d) and the placebo for 6 weeks before completing a performance test (cycling at 70% VO2 peak for 45 min followed by an 8 km time trial). In untrained men, expression of peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC1-a) was increased 3 hr after HIIE and this effect was increased by MitoQ (Cohen’s d = 0.89). While VO2 peak and 20 km time trial performance improved similarly in the MitoQ and placebo group after HIIT, the improvement in peak power output (PPO) achieved during the VO2 peak test was greater in the MitoQ group (by 5.8%, p<0.03). MitoQ also significantly improved 8 km time trial performance in trained cyclists. These results suggest that MitoQ may augment exercise-induced increases in PGC1α expression and improve cycling performance when taken during exercise training.

3712 Board #29

**Fit And Fast Versus Slow And Steady: The Relationship Between Fitness And Cognitive Performance In Males And Females**

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(No relevant reports conducted)

**PURPOSE:** Previous research shows aerobic fitness influences attentional inhibition. However, few studies have reported a differential relationship between aerobic fitness and inhibition between males and females. This study investigated the relationship between fitness and inhibitory performance in college-aged males and females. METHODS: Seventy-nine young adults (M: 19.90 ± 1.1 yrs; 48 females) completed measurements of physical fitness (VO2max test) and inhibitory control (modified flanker task). Moderation analyses were conducted to determine the influence of sex on the relationship between aerobic fitness and inhibitory control. RESULTS: RT, response accuracy, and percentage of commission errors were regressed onto mean-centered fitness (VO2max percentiles), sex, and the interaction between fitness and sex. Fitness was significantly correlated with congruent accuracy (p<0.05), but not correlated with incongruent accuracy (p>NS) OR RT (p>NS). Fitness was negatively correlated with total commission errors (p<NS). The interaction between fitness and sex revealed males who are more fit are faster in both congruent (p<0.05) and incongruent responses (p<0.05), whereas fitter females are slower in both congruent (p<0.05) and incongruent responses (p<0.05).
Interestingly, fitter males are significantly less accurate during incongruent trials (p < 0.005), whereas females did not differ in accuracy based on fitness (p = NS). Neither males nor females showed a fit effect for congruent trials. Similarly, fitter males have a greater percentage of incongruent commission errors (p < 0.005) but no differences in congruent commission errors (p = NS), whereas in females, fitness did not influence percentage of congruent (p = NS) or incongruent commission errors (p = NS). CONCLUSIONS: These results suggest that aerobic fitness may differentially influence flanker performance, particularly in the more challenging condition, in males and females. Furthermore, males and females may adopt different strategies in the difficult condition to maintain performance. These results suggest that while higher fit males may slow down in order to maintain accuracy, higher fit males may have faster responses at the expense of errors.

3713 Board #30
Alzheimer’s Disease-related Gene Expression Is Reduced Following Six Months Of High-intensity Exercise
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Extensive research supports the use of exercise to protect against Alzheimer’s disease (AD). Nevertheless, there is limited evidence from human studies regarding the mechanisms underlying the positive effects of exercise on the brain. Gene expression determines the extent to which a gene is ‘turned on or off’ and can be used to understand mechanistic pathways. Animal research has demonstrated that exercise influences the expression of genes related to various AD biological pathways; however, the impact of exercise on AD-related gene expression has not yet been studied in humans. PURPOSE: To examine changes in AD-related gene expression following a six-month high-intensity exercise intervention.

METHODS: Cognitively normal men and women (60-80y) were randomised to either six-months of work-matched high-intensity exercise (n=33), moderate-intensity exercise (n=34) or an inactive control group (n=32). Blood samples were collected pre- and post-intervention and expression levels from a panel of genes implicated in AD were measured. Analysis of covariance (covaried for age and gender), with adjustment for multiple comparisons, was conducted to determine group differences. RESULTS: Decreases in AD-related gene expression following six months of exercise, compared with the control group. More specifically, gene expression associated with cholesterol homeostasis was more likely to be elevated immediately following an EHS episode.

METHODS: We performed a retrospective analysis of EHS patient records in all US military personnel (41% between 20-24 years old) from 2008-2014 using the Military Health Systems Data Repository. We compared diagnoses of organ failure during the course of treatment and clinical laboratory markers of end organ damage. Sex differences in clinical outcomes were presented with odds ratios, and biomarker differences are presented as the median difference with 95% confidence intervals in brackets. RESULTS: A total of 2,529 EHS cases were recorded with 9.8% [8.7, 11.2] occurring in women. Patient treatment cost was lower in women by $110 [620, 1647]. Men were 2.35 [1.6, 3.38] times more likely to experience renal failure (p < .001). Blood urea nitrogen, (difference = 121.05 mg/dL [41.9, 182.28]), myoglobin (difference = 3 ng/mL [2, 4]), aspartate transaminase (difference = 7 units/L [1, 14]), and alanine transaminase (difference = 13 units/L [8.5, 15.92]) were elevated in men (all p < .01). Platelet count was also lower in men compared to women (difference = -22.14*10^10 per ul [-39.25, -2.99], p < 0.03). CONCLUSION: Female servicemembers appear to have a slightly less severe response to EHS compared to their male counterparts. In particular, renal failure was more common, and numerous markers of end-organ damage (hepatic, renal, and cardiovascular) were more likely to be elevated immediately following EHS in men.

Supported by USAMRDC; author views not official US Army or DoD policy.

3717 Board #33
Relationship Between Body Composition And Sport-specific Performance Metrics In Ncaa D1 Female Volleyball Players
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Emerging evidence indicates that there may be substantial individual variability in exercise-induced cognitive enhancement, which likely contributes to the inconsistent findings regarding exercise and cognition across the literature. Previous research is inconclusive with respect to how genetic risk for Alzheimer’s disease (defined by apolipoprotein E (APOE) ε allele carriage) modulates the relationship between exercise and cognitive health. PURPOSE: To examine the moderating effect of apolipoprotein E (APOE) ε allele carriage on cognition following a six-month exercise intervention.

METHODS: Ninety-nine cognitively normal men and women (aged 60-80 years) were randomised to either six-months of high-intensity exercise (n=33), moderate-intensity exercise (n=34) or an inactive control group (n=32). All participants underwent verbal learning and memory assessment using the California Verbal Learning Test (CVLT) at pre- and post-intervention. A series of linear mixed-models were undertaken to examine the effect of group*time, and group*time*APOE ε interaction term on repeated CVLT assessments. RESULTS: No effect of group*time was observed on any of the CVLT sub-scores. However, an effect of group*time*APOE ε was observed for CVLT learning (d=0.87, p < 0.01) and CVLT short delay recall (d=0.67, p < 0.05). Post-hoc analyses revealed only carriers of the APOE ε allele received benefit from the high-intensity intervention, compared with the moderate-intensity and control groups. CONCLUSIONS: No changes in verbal learning and memory were observed from pre- to post-exercise intervention in the whole cohort. However, we observed that APOE ε carriers received benefit from the high-intensity exercise intervention in terms of improvement on tasks assessing memory and thinking. Our results indicate that individuals at greater risk of AD, and thus more likely to be experiencing a degree of cognitive decline, may benefit most from exercise.

3716 Board #32
Sex Differences In The Clinical Sequelae Of Exertional Heat Stroke In Military Servicemembers
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Exertional heat stroke (EHS) represents a significant source of morbidity and mortality for the military and other occupational and athletic populations. EHS patients tend to present with elevated biomarkers of acute liver and kidney injury, rhabdomyolysis, and altered hematologic parameters. However, little is known about how men and women may respond differently to EHS, in terms of clinical severity and/or biochemical responses. PURPOSE: The aim of this study was to characterize clinical and biochemical differences between male and female servicemembers immediately following an EHS episode.

METHODS: Sex differences in clinical outcomes are presented with odds ratios, and biomarker differences are presented as the median difference with 95% confidence intervals in brackets. RESULTS: A total of 2,529 EHS cases were recorded with 9.8% [8.7, 11.2] occurring in women. Patient treatment cost was lower in women by $110 [620, 1647]. Men were 2.35 [1.6, 3.38] times more likely to experience renal failure (p < .001). Blood urea nitrogen, (difference = 121.05 mg/dL [41.9, 182.28]), myoglobin (difference = 3 ng/mL [2, 4]), aspartate transaminase (difference = 7 units/L [1, 14]), and alanine transaminase (difference = 13 units/L [8.5, 15.92]) were elevated in men (all p < .01). Platelet count was also lower in men compared to women (difference = -22.14*10^10 per ul [-39.25, -2.99], p < 0.03). CONCLUSION: Female servicemembers appear to have a slightly less severe response to EHS compared to their male counterparts. In particular, renal failure was more common, and numerous markers of end-organ damage (hepatic, renal, and cardiovascular) were more likely to be elevated immediately following EHS in men.

Supported by USAMRDC; author views not official US Army or DoD policy.

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with FM when controlling for FFM. FFM was positively correlated with PC and SVJ, and negatively with PA when controlling for FM. This suggests greater amounts of FFM are more advantageous for performance in the PC (lift greater amounts of weight and PA (perform in less time) than having low FM, while having low FM or greater FFM are both advantageous for SVJ (greater jump height).

3717 Board #34

Validity And Reliability Of A Portable Metabolic Analyzer For Assessing Oxygen Consumption And Ventilation
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(NO relevant relations reported)

Metabolic analyzers are standard tools in research-based, exercise physiology laboratories in university settings. Portable, low-cost metabolic analyzers have the capacity to extend the value of metabolic gas analysis beyond the traditional laboratory setting. PURPOSE: This study’s purpose was to assess validity and reliability of a portable, low-cost metabolic analyzer (VPRO) for assessment of oxygen consumption (VO2) and minute ventilation (VE) during progressive cycling testing. METHODS: In Protocol 1, eight male participants (height: 171.9 ± 5.8 cm, weight: 79.6 ± 9.3 kg, age: 41.0 ± 12.3 years) with previous competitive cycling experience ranging from 2-40 years completed an hour-long stationary cycling protocol twice, progressing from 100-300 Watts every 10-12 minutes while wearing the VPRO and a criterion measure (PMED) for five minutes each, at each stage. In Protocol 2, 16 recreationally active male participants (height: 168.2 ± 8.4 cm, weight: 76.5 ± 13.3 kg, age: 23.0 ± 9.4 years) completed three incremental, maximal stationary cycling tests wearing one of three analyzers for each test (VPRO version 1.11, VPRO version 1.2.1, PMED). Mean absolute percent differences (MAPD) ≤10% were deemed acceptable validity/reliability. RESULTS: For Protocol 1 and convergent validity, the VPRO had mean absolute differences from the PMED of <0.3 L/min for absolute VO2 and <5 L/min for VE overall and at each exercise stage. MAPD for VO2 and VE were <9% overall and <12% at each exercise stage. Test-retest reliability of VO2 and VE of the VPRO (MAPD: 8.9-11.0%) was lower than the PMED (MAPD: 4.7-7.6%). For Protocol 2, validity was similar for both VPRO versions (MAPD ≤12% overall) compared to the PMED for VO2 and VE. CONCLUSIONS: The VPRO had an acceptable validity and test-retest reliability for most variables and intensities tested and may be an appealing option for VO2 and VE analysis.

3718 Board #35

The Effects Of Acute Resistance Exercise On Bioelectrical Impedance Analysis Measures Of Body Composition
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PURPOSE: The purpose of this study was to determine if acute, localized resistance exercise disrupts the validity of DXA total body composition estimates. METHODS: In a crossover design, 18 healthy, resistance-trained, college-aged adults, including 7 females (age: 22.7 ± 1.9 y; height: 165.4 ± 8.4 cm; body mass: 62.1 ± 10.9 kg; body fat: 25.9 ± 7.3%; men: age: 23.6 ± 3.6 y; height: 179.1 ± 5.1 cm; body mass: 88.0 ± 7.6 kg; body fat: 18.4 ± 6.6%) completed three conditions in a randomized order: lower-body resistance exercise (RELOWER), upper-body resistance exercise (REUPPER), and no exercise (REST). A warm-up consisting of 2 sets of 12-15 repetitions of 3 upper-body exercises (upper), 3 lower-body exercises (lower) or nothing (rest). The RE circuit consisted of a RE warm-up consisting of 2 sets of 12-15 repetitions of 3 upper-body exercises, 5 sets of 10 repetitions per exercise, with 1-minute rest intervals between circuits. A DXA scan was performed immediately before exercise and at 60 minutes post exercise. DXA estimates of fat mass (FM) and fat-free mass (FFM) (calculated as lean soft tissue plus bone mineral content) were analyzed using 3 x 2 (condition x time) analysis of variance with repeated measures, follow-up pairwise comparisons, and evaluation of the partial eta-squared (η2) effect sizes.

RESULTS: Pre-exercise FM and FFM did not differ between conditions (0.2 to 0.4 kg; p > 0.14 for all). For FM, no statistically significant interaction or main effects were present (interaction: p=0.08, η2=0.01; time main effect: p=0.14, η2=0.12; condition main effect: p=0.92, η2=0.01). For FFM, no statistically significant interaction (p=0.13, η2=0.012) or condition main effect (p=0.856, η2=0.03) was present. However, a statistically significant time main effect was present (p=0.009, η2=0.34). Pairwise comparisons indicated that post-condition FM DXA estimates were 0.2 to 0.07 kg lower than pre-condition values in all conditions combined.

CONCLUSIONS: No differences were seen among conditions, indicating that DXA total body composition estimates may be relatively robust to the effects of acute, localized RE. However, investigation of segmental estimates is warranted due to RE-induced blood flow redistribution.

3719 Board #36

The Effects Of Acute Resistance Exercise On Dual-Energy X-Ray Absorptiometry Measures Of Body Composition
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PURPOSE: The purpose of this study was to determine if acute, localized resistance exercise disrupted the validity of BIA total body composition estimates compared to REST and lower-body RE and reinforces exercise abstinence as a pre-test consideration.

CONCLUSION: These data indicate that acute upper-body RE compromises the validity of BIA total body composition estimates compared to REST and lower-body RE and reinforces exercise abstinence as a pre-test consideration.

3720 Board #37

High School Basketball Coach And Player Perspectives About Warm Up Routines And Lower Extremity Injuries
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PURPOSE: To understand high school basketball coach and player routines, knowledge and attitudes relating to warm-ups and lower-extremity injuries (LEIs).

METHODS: A prospective qualitative study using data from semi-structured interviews with high school basketball coaches and players conducted from May-October 2019, then thematically analyzed by multiple coders employing team coding. RESULTS: We interviewed n=12 coaches (9 male; 3 female) and n=30 players (11 male; 19 female). Current warm-up. Coaches and players reported regular engagement in warm-up routines, but the types of exercises, time dedicated (range: 5-45 minutes) and exercise order varied. Coaches often rely on players to co-lead warm-up exercises.

Knowledge and beliefs re: LEI prevention research. Most coaches and players believe that regularly engaging in a warm-up routine is effective at preventing injury (“warming up is absolutely important. There’s no disputing...”). Lack thorough knowledge of the current evidence (“I have a general interest in sports and fitness...but I can’t give you any specific sources...”). Barriers. Warm-up routines suffer at game/practice time, with coaches employing team warming-up. Some coaches and players perceive youth as impervious to injury and minimize warm-up (“I remember being 16 and 17...you get out of bed and you just run two miles and you’re fine”). Coaches face multiple demands during practice, which can impede their focus on a warm-up routine (“I have to make sure I don’t have a lot of time...You can’t just go out there and get to the point of practice”). Coaches also expressed concern that they lack adequate knowledge to select the best exercises and skills to teach their players how to perform them correctly (“I don’t stretch...”).
are out there. I don’t think I know all of them.”). **Enablers:** Players’ past injury experience was a key motivator for warming-up (“I’d just put on my shoes and I’d start playing—‘just for fun’!”). My coach was also a motivator for players. **CONCLUSION:** Regular involvement in basketball warm-up routines was common among high school teams, but the methods and time dedicated to these practices varied. Players and coaches are eager for more information on warm-ups shown to reduce LEIs, as well as targeted strategies to effectively implement these routines.

3721 Board #38

**Validity And Reliability Of A Lower Body Power Test In Older Adults**

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Lower body power declines with age and is associated with decreased physical function in older adults. However, current tools to assess muscle power are expensive and non-portable which limits their widespread use. **PURPOSE:** The purpose of the study was to assess the validity and reliability of a functional sit-to-stand power test (STS) in older adults by comparing it with pneumatic leg press, which is widely used in clinical trials to measure lower body power. **METHODS:** A total of 51 community-dwelling adults, 65 years or older, were recruited. Lower body peak power was assessed using a portable linear transducer and pneumatic leg press. The highest peak power across three attempts with 1 min of rest in between was used for the analysis. To assess construct validity of the STS test, the participants completed the 8-Foot Up and Go (8’ UG) test, at both usual and fast pace, and the Short Physical Performance Battery (SPPB) that rates participants from 0 (worst performance) to 12 (best performance) based on balance, usual walk speed, and chair stand tests. A two-week test-retest was conducted to assess reliability in 36 participants. Pearson’s correlation coefficient was used to assess construct validity while intra-class correlation (ICC) was used to assess reliability. **RESULTS:** The mean age of the sample was 71.3 yrs, with 62% females, and an average SPPB score of 10.6. Peak power assessed using STS showed a high correlation (r = 0.98, P < 0.01) compared to the pneumatic leg press. As hypothesized in our pre-registered protocol, the STS test showed similar or greater correlation compared to pneumatic leg press for SPPB (0.30 vs. 0.40), chair stand test (-0.37 vs. -0.46), 8’ UG test at usual pace (-0.28 vs. -0.37) and fast pace (-0.35 vs. -0.41) and balance (0.23 vs. 0.33). The test-retest assessment yielded an ICC of 0.99 and 0.95 for leg press and STS, respectively. All variables were statistically significant (P < 0.05). **CONCLUSION:** The novel functional STS test is comparable to the pneumatic leg press in measuring lower body power. The STS test is relatively inexpensive, portable, takes less space, and should be considered for further validation and future implementation.

3722 Board #39

**INFLUENCE OF GENETIC BACKGROUND ON HEART MITOCHONDRIAL DNA LESIONS AND COPY NUMBER IN INBRED MICE**

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**PURPOSE:** The heart is a critical tissue responsible for facilitating a multitude of endurance training adaptations in aerobic capacity. Mechanisms of heart mitochondrial DNA (mtDNA) repair remain incompletely understood, and genetic susceptibility to exercise-induced mitochondrial-derived oxidative damage may be present. mtDNA damage presents as an indirect measure of mitochondrial-derived oxidative stress, while mtDNA copy number is a correlate of mitochondrial biogenesis. As two critical aspects for enhancing trainability in aerobic capacity, the purpose of this study was to characterize heart mtDNA lesions and copy number in a genetically diverse panel of male inbred mouse strains. **METHODS:** A genetically diverse panel of 34 inbred mouse strains were selected, and hearts of male mice (n = 184; 2 - 6 mice per strain) were removed and weighed. DNA was and a gene-specific quantitative PCR-based assay was used to measure mtDNA lesions and copy number.

**RESULTS:** Among the strains, we found significant interstrain variation in mtDNA lesions (range = -0.15 - 4.0 mtDNA lesions/10Kb) and copy number (range = 3682 - 111895 mtDNA copies). We did not find an association between mtDNA lesions or copy number with exercise capacity or heart weight. **CONCLUSIONS:** Our results demonstrate that there are inherent differences in heart mtDNA damage and copy number. Interestingly, the wild-derived PWD/PhJ strain had higher overall mtDNA lesions and lower mtDNA copies, possibly suggesting the hearts of this strain undergo significant mitochondrial-derived oxidative stress (e.g. higher fission vs fusion; mitophagy) compared to others. Thus, ongoing work aims to 1) characterize markers of mitochondrial-derived oxidative stress (i.e., fission/fusion; mitophagy), 2) sequence the complete mitochondrial genome and determine levels of heteroplasmy and indels that may associate with mtDNA damage and copy number.

3723 Board #40

**Acculturation And 24-hour Behaviors In Asian American Women**

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**PURPOSE:** Asian American (AA) women have elevated cardiovascular disease (CVD) risk but are an understudied minority group. Physical activity (PA), sedentary behavior (SB) and sleep duration are recognized as independent CVD risk factors, yet these behaviors have not been well described in this population. The study’s purpose was to describe AA women’s 24-hour behaviors and explore how these relate to acculturation. **METHODS:** Participants were middle-aged normotensive AA immigrant women living in New York City. They completed measures of acculturation along with 7 days of wrist and hip actigraphy to measure sleep duration, moderate-vigorous PA (MVPA), light intensity PA (LIPA) and SB, MVPA, LIPA, and SB were classified by Freedson (1998)’s cut-points and sleep duration was identified by using the Cole-Kripke algorithm and sleep diaries. Linear regression analysis was conducted to test the associations of ethnicity (East Asian vs. South Asian) and acculturation variables (age immigrated to the U.S., years of U.S. residency, English proficiency) on 24-hour behaviors, controlling for age, BMI, education, and employment. **RESULTS:** Of the 94 AA women enrolled, 89% (n=84) completed hip and wrist actigraphy monitoring (age=61.3±7.9, BMI=25.4±3.6, 58.9% college or higher, 54.4% employed). Their average hours spent on 24-hour behaviors were: MVPA=0.5±0.4, LIPA=6.2±1.6, SB=9.8±1.7, sleep =5.3±0.9. More daily MVPA was related to East Asian ethnicity (b=0.42, P<0.01), immigrating to the U.S. at an older age (b=0.43, P<0.01), and greater English proficiency (b=0.32, P<0.03). More SB was related to South Asian ethnicity (b=0.36, P<0.03) and longer U.S. residency (b=0.35, P=0.02). Average sleep duration was below recommendations in both East and South Asian women (5.4±0.8 vs. 5.1±0.9), but sleep duration and LIPA were not related to any of the acculturation variables. **CONCLUSIONS:** AA women’s 24-hour behaviors differed by ethnicity, and associations with some acculturation variables were observed in this study. Larger, prospective studies are needed to explore the heterogeneity in 24-hour behaviors within this growing minority group and explore both positive and negative effects of acculturation. Culturally tailored strategies may be needed to improve 24-hour behaviors and reduce CVD risk in AA women.

3724 Board #41

**The Effect Of Using Electromyostimulation To Taekwondo Athletes’ Brain Waves During PVF Stretching Methods**

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**PURPOSE:** The purpose of this study was to analyze the activity of brain waves depending on the different type of stretching exercise as a warm-up for Taekwondo competitions in order to find out the feasibility of using EMS during PVF-stretching method. We would like to see the difference between the stretching techniques used by Taekwondo athletes and the stretching methods using EMS. **METHODS:** A total of three methods of treatments were conducted to 8 elite Taekwondo athletes (Age: 25.87±0.99, Height: 185.75±11.01, Weight: 80.87±21.56) repeatedly in random order: PVF Stretching with electric stimulation(EMS+PNF), warm-up exercise with electric stimulation, and PNF stretching without electric stimulation. The EMS+PNF group’s electrical treatment was 60 Hz, with five seconds of stimulation and five
seconds of rest alternately. Exercise intensity is RPE 15-16 levels. The brain wave condition of all subjects were presented in comparison before and after (post-hoc) treatment procedures. We performed Two-way Repeated Anova test at the difference of the data between the before and after program. RESULTS: First, EMS part (M = 66.73, SD = 7.23), PFN part (M = 38.02, SD = 7.23), EMS during PFN stretching part (M = 59.33, SD = 7.23) were confirmed in Alpha value. So significant differences were found between warm-up exercise with EMS during PFN-stretching (p<.01); EMS during PFN-stretching and PFN-stretching (p<.05) in Alpha value. In addition, it showed significant increases in alpha value corresponding to duration of treatments (F=4.851, p<.009). Second, significant differences between before and after were found in beta values (F=5.024, p<.026). Third, significant differences were found between EMS (M=151.99, SD=14.93) and PFN-stretching (M=84.67, SD=14.93) in theta value (p<.01). EMS showed higher value than PFN-stretching in theta wave. CONCLUSIONS: This study was showed changes of an alpha wave, which reflects positive emotions, depending on presence of EMS. Thus, it can be considered as more effective method when applying EMS to conventional stretching which leads athletes to feel more effectively treated. The result of the increase in the beta wave was predicted about the difference between EMS stimulation and general stretching by reflecting the characteristics of the beta wave that is activated as cognitive processing occurs. Theta wave is activated when the influence and anxiety of a quiet environment are felt. We are guessed Player thinks that the effect of stretching is low and that the result is reflected when the traditional stretching is performed. Throughout this study, athletes can be expected to show better performance by using EMS during stretching exercise.

**RESULTS**

**CONCLUSION**

**L-citrulline (CIT) is a non-essential amino acid, found abundantly in watermelon, which has the ability to indirectly increase nitric oxide production by increasing arginine levels. A combination and the acute use of CIT with malate (intermediate of the Krebs cycle) has shown interesting results in the sports science literature, but the chronic effect of citrulline malate (CM) in the scientific literature is still unclear. PURPOSE: Investigate the chronic effects of citrulline malate supplementation in increasing strength and muscle mass in trained healthy adults. METHODS: A randomized, double-blind, crossover, placebo clinical study. Twenty four (25.96 ± 4.7 years) healthy adult men were randomly divided into 2 groups; citrulline malate group (CM= 12; 82.41±10.7kgs) or placebo group (PL = 12; 82.11±10.9kgs). The CM group received a sachet containing 6g of citrulline malate + 15g of maltodextrin and the PL group 6g of non-essential amino acids (NAAE) + 15g of maltodextrin. Supplementation was performed for 28 days (4 weeks) and included a wash-out week. After this week, there was an exchange of supplements in both groups. Before and after each supplementation, body composition (body weight, fat mass and muscle mass) by plethysmography (BodPod), and repetition maximum test (1RM) in the bench press were performed. Statistical analysis was performed using the covariance analysis model for crossover experiments, considering a significance level p<.05. RESULTS: CM supplementation promoted an increase in total lean mass (67.28 ± 8.11kgs vs 67.77 ± 7.97kgs, p<.005) in relation to placebo (67.83 ± 7.84kgs vs 67.43 ± 8.57kgs) (CM vs PL = p<.001), a decrease in total weight (CM 82.39 ± 10.72kgs vs 81.63 ± 9.98kgs and PL 82.11 ± 10.9kgs vs 82.08 ± 9.78kgs, CM vs PL = p<.05) and an increase in the final bench press (CM 37.95 ± 7.6kgs vs 41.55 ± 8.31kgs, p<.05) in relation to placebo supplementation (38.26 ± 8.69kgs vs 40.08 ± 8.19kgs, p<.05) (CM vs PL = p<.01), regardless of the sequence in which the supplement was ingested. CONCLUSION: Supplementation of CM for 4 weeks proved to be effective in improve body composition (decrease in total weight and increase lean mass) and increased strength, without showing adverse effects, indicating a viable strategy for practitioners of resistance exercise.

**RESULTS**

**CONCLUSION**

Blood flow restriction (BFR) is a low load exercise modality advocated to improve body composition. PURPOSE: To compare BFR against high intensity interval training (HIIT) body-weight squats (BWS), and 80% 1RM squats (CON) in body composition and quadriceps tendon cross section area (QXS). METHODS: Thirteen subjects participated in the study (27±5.8 years, BMI: 23.3±3.2, F:8). Subjects were randomly assigned to a BFR (n=5), HIIT (n=5), or CON (n=3). Body composition was measured via air plethysmography while QXS was measured via musculoskeletal ultrasound. Subjects were tested at baseline and 6-weeks after training. BFR bands were placed at the proximal thigh and inflated to 250mmHg while performing a 30/15/15/15 repetition (rep) protocol using a metronome (1 rep/2 secs). The HIIT group completed BWS during a 20 sec on and 10 sec off protocol for 8 sets. The control (CON) group completed 3 sets of 5 reps squats of their 80% 1RM. All three groups completed their workouts 3 times a week. Due to the small sample size, Kruskal-Wallis (KW) was performed for the variables of fat mass (fm,kg), lean mass (lm,kg), and QXS (cm) during baseline. If no differences at baseline were found, the same analysis was performed for the 6-week follow-up. In addition, a KW analysis between groups was performed for the difference between baseline and follow-up values between variables. RESULTS: Although BFR showed improvements (fm: -1.1 kg; lm: +0.3kg; QXS: + .01cm) for all variables over the other groups (HIIT: fm: +1.5kg, lm: -1.2kg, QXS: -0.02cm; CON: fm: -0.05kg, lm: +0.4, QXS: -0.01cm) none of the two KW analytical showed a statistically significant difference for any of the variables of interest. CONCLUSION: Although BFR showed improvements in all variables, the magnitude of these changes was not significant enough to demonstrate it is a superior modality than HIIT or 80% 1 RM or 6-weeks of training is not sufficient time to elicit changes in these outcomes.

**RESULTS**

**CONCLUSION**

Many exercise modalities are used to increase muscle strength and power output with differing load capacities. Purpose: To compare the effects of 80% 1RM (CON) squats, High Intensity Interval Training On Power Output And Muscle Strength

**RESULTS**

**CONCLUSION**

Blood flow restriction compared to high intensity interval training on body composition and tendon width

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Blood flow restriction compared to high intensity interval training on body composition and tendon width
training modalities are viable for improvements in power and strength. Nevertheless, the small sample size of the study might be hiding if one modality is superior over the others.

Traditional moderate intensity continuous training increases maximal oxygen uptake (VO\textsubscript{2max}). This effect is primarily attributed to an increased maximal cardiac output (Q\textsubscript{max}), as predicted by the Fick principle. Sprint interval training (SIT) increases VO\textsubscript{2max} similar to MICT, often despite a lower training volume, but the effect on Q\textsubscript{max} is unclear. PURPOSE: To determine the effect of 6 sessions of SIT over 2 wk on VO\textsubscript{2max}, Q\textsubscript{max} and exercise performance in healthy, untrained adults [n=12 (9 females); 21±2 y; mean±SD]. METHODS: Training was performed on a cycle ergometer and involved a 2-min warm-up (50 W), 3 x 20-s ‘all-out’ bouts interspersed with 2-min of recovery (50 W), and a 3-min cool-down (50 W). VO\textsubscript{2max} was determined using a ramp test to exhaustion. Q\textsubscript{max} was subsequently determined using inert gas rebreathing (Innocor) over a 2-min period of exercise performed at 90% of the peak work rate attained during the VO\textsubscript{2max} test. Pilot testing confirmed this protocol elicited VO\textsubscript{2max} over the 2-min period of Q\textsubscript{max} measurement. The performance test was a 2.1 kg body weight cycling time trial. All measurements were performed twice at baseline, and reproducibility determined as a coefficient of variation (CV). The CV for VO\textsubscript{2max}, Q\textsubscript{max} and time trial performance was 5.8, 4.7 and 4.2%, respectively. Pre- and post-training reproducibility was compared using a paired t-test. RESULTS: VO\textsubscript{2max} increased after SIT from 37.0±7.3 to 40.7±8.3 L/min (p=0.001), but Q\textsubscript{max} was unchanged (17.2±3.8 vs 17.7±4.6 L/min; p>0.05). Exercise performance improved after SIT from 1040±247 to 938±238 s (p=0.001). Absolute VO\textsubscript{2max} was positively correlated with Q\textsubscript{max} (r\textsuperscript{2}=0.86, p<0.001). CONCLUSION: Six sessions of SIT increased VO\textsubscript{2max} without changing Q\textsubscript{max} in previously untrained individuals. These data support previous suggestions that the early increase in VO\textsubscript{2max} after SIT may be due mainly to peripheral responses (i.e., enhanced oxygen extraction by skeletal muscle), rather than a central change in blood oxygen delivery. Supported by NSERC.

In the last decade, high intensity interval training (HIIT) has been shown to be an appropriate alternative to moderate-intensity, continuous exercise for improving cardiorespiratory fitness. HIIT protocols typically result in high blood lactate (La) levels. However, accumulated lactate acid is a potent metabolic stimulus, which plays a major role in the control of physiological adaptations. Therefore, it may be essential for improvements in endurance performance. The literature indicates that there is a strong positive relationship between maximum oxygen consumption (VO\textsubscript{2max}) and La production. Purpose: To investigate changes in La levels after 4 weeks of HIIT program. Methods: Blood samples were collected from five female and five male student-athletes (n=10) (M=21, SD=0.95). A short-term (4 weeks) HIIT protocol used and VO\textsubscript{2max} calculated through Course-Navette Test. The instruments used for this research was an Accutrend Plus-Roche meter and BM-Lactate test strips (Risch-Rotkreuz, Switzerland). The analysis consisted of t student tests for paired samples in IBM SPSS v.25 (p<0.001). Results: VO\textsubscript{2max} and blood La changed significantly in six participants (Pre-La M=11.65mmol/L; Post-La M=9.41mmol/L). The participants that achieved to increase their VO\textsubscript{2max}, produced lower amounts of capillary blood La. Conclusion: Using HIIT, our study results confirm the positive relationship of VO\textsubscript{2max} and La. The inferences of these preliminary results could be used in future, larger-scale interventions concerning ways to affect La production through the increase of VO\textsubscript{2max} using a HIIT program. Future studies should further investigate anaerobic threshold modification processes through different training programs, such as Repeated Sprint Training (RST), Sprint Interval Training (SIT) and Moderate Intensity Continuous Training (MICT). Limitations of this study include small sample size and indirect VO\textsubscript{2max} estimation.

Keywords: High-Intensity Interval Training, maximal oxygen consumption, lactate.

Studies have determined that physical training provides benefits in people’s physical health. Physical exercise is one of the most powerful lifestyle to positively affect the adult brain and emerging evidence points to high intensity interval training (HIIT) as an effective way to improve various aspects of brain function among them the improvement of cognition and short-term memory. Purpose: To analyze the effects of HIIT in university students. METHODS: 22 university athletes (Mage=21.6, SD=1.5, n=11 experimental group), (n=11 control group). A HIIT program of 12 sessions of short-term (3 weeks) and 6 sessions of short-term memory was applied. Maximum oxygen consumption (VO\textsubscript{2max}) was estimated through the Course Navette Test and memory evaluation through a Rey Auditory Verbal Learning Test (RAVLT). The instruments used for the investigation was a Polar H10® device. A student test for paired samples was applied by IBM SPSS v.22 (p.<0.001). The results: The maximum heart rate (HR\textsubscript{max}) of the control group obtained a value of M=199.9, SD=15pm and the experimental group M=195, SD=6.7pm. In the third week of intervention results were found statistically significant. Conclusion: After twelve training sessions of high intensity physical exercise (HIIT), statistically significant results were obtained, in relation to high intensity physical effort with short-term memory. For future research it is recommended to implement a greater number of training and memory sessions. Limitations of this study include indirect VO\textsubscript{2max} estimation and a small sample size.

Keywords: short-term memory, university students, high intensity interval training.
Although high-intensity functional training (HIFT) is an increasingly popular exercise strategy, research describing the acute physiological responses are few and predominantly limited to novice or untrained. PURPOSE: To compare the cardiorespiratory responses of a bout of HIFT among individuals with varying degrees of skill. METHODS: Twenty-four participants (31.0 ± 7.4 years; 172.6 ± 9.6 cm; 77.9 ± 13.8 kg) with at least six-months of HIFT experience and varying skill levels were tested. Skill level was categorized by self-reported times of the benchmark workout (“FrAn” [Novice (NOV), n = 32; Intermediate (INT), n = 24; Advance (ADV), n = 26; (times reported = 5.3 ± 2.7 mins)). All participants performed aerobic capacity testing to examine peak levels of oxygen consumption (VO₂max), heart rate (HR), respiratory exchange ratio (RER), and lactate (LT). A week later, similar variables were measured with averages obtained for VO₂, HR, RER, and LT during a 15-minute HIFT based workout. Univariate analysis of variance (ANOVA) with Bonferroni adjustments were used to examine differences between skill category and outcome variables. RESULTS: During the Treadmill test, significant differences were only observed for VO₂ (ADV = 49.53 ± 5.12 ml/kg/min; NOV = 43.83 ± 6.90 ml/kg/min, p = 0.001; ω² = 0.924) and LT (ADV = 12.13 ± 2.48 mmol/dL; NOV = 9.93 ± 3.33 mmol/dL, p = 0.004; ω² = 0.874), with ADV athletes having greater values than NOV (p = 0.05). No significant differences were observed between ADV & INT (p > 0.05). Similarly, during the HIFT workout, differences were also observed between ADV and NOV categories, but only for VO₂ (ADV = 38.71 ± 3.47 ml/kg/min; NOV = 34.42 ± 5.20 ml/kg/min, p = 0.002; ω² = 0.897) and LT (ADV = 9.04 ± 1.68 mmol/dL; NOV = 9.61 ± 2.40 mmol/dL; p < 0.001; ω² = 0.946). CONCLUSION: These findings provide evidence regarding the impact skill level has on physiological outcomes. During a maximal effort bout of HIFT, the more advanced athletes tend to exhibit more efficient cardiorespiratory markers. Further research is necessary to elucidate how these differences impact overall performance of HIFT exercise.

CONCLUSIONS

Effect Of High Intensity Interval Training On Body Composition In Overweight And Obese Sedentary Adults

Only ~20% of adults adhere to physical activity guidelines. Thus, exercise programs that require less time, such as high intensity interval training (HIIT), need to be investigated. Recent studies suggest HIIT incorporating body weight exercises result in increased exercise capacity (VO₂peak) and leg muscle endurance in healthy adults. PURPOSE: It is unclear if HIIT incorporating body weight exercises influences body composition and exercise capacity in overweight/obese, sedentary adults. We hypothesized that HIIT will 1) increase lean mass and decrease body fat and 2) increase VO₂peak to a greater extent than moderate intensity continuous training (MICT) in sedentary, overweight/obese adults.

METHODS: Eleven participants (10 women) were randomized and have completed all study components (6 HIIT vs. 5 MICT; Age: HIIT 39.7 ± 12 yrs vs. MICT 42.3 ± 12 yrs). Exercise capacity (VO₂peak -cardiopulmonary exercise testing) and body composition (via dual energy X-ray absorptiometry) were measured at baseline and after 12 weeks of training. The HIIT group performed 5 body weight exercises (squats, pushups, lunges, mose, skullcrackers, and plank) 3 days/week for 12 weeks at an intensity equal to a rating of perceived exertion (RPE) > 17. The MICT group performed 150 min of MICT/week for 12 weeks at a RPE between 12-14.

RESULTS: Percent (%) lean mass increased from baseline following HIIT (p<0.05), but not MICT (HIIT: 54.4±3.1 vs. 55.4±3.0 %; MICT: 53.5±3.1 vs. 53.7±3.0 %). Body fat % significantly decreased from baseline following HIIT (p<0.05), but not MICT (HIIT: 43.9±3.5 vs. 42.7±4.1 %; MICT: 45.9±4.1 vs. 46.7±4.7 %). VO₂peak significantly increased from baseline following HIIT (p<0.05), but not MICT (HIIT: 23.7±0.9 vs. 25.0±0.9 ml/kg/min; MICT: 22.2±1.6 vs. 23.1±1.6 ml/kg/min).CONCLUSIONS: These preliminary data support the hypotheses that non-traditional aerobic HIIT (e.g., HIIT incorporating body weight exercises) leads to more advantageous changes in body composition and exercise capacity compared to MICT alone.

A comparison of aerobic performance between stationary air bikes and other types of exercise equipment is often based on performance and physiological responses to HIIT. PURPOSE: The primary study was to compare the effects of stationary air biking, utilizing MICT, ultra short-HIIT (UH), and short-HIIT (SH) protocols on aerobic performance. METHODS: Thirty-two recreationally active participants were randomly assigned to MICT (n = 11), UH (n = 11), and SH (n = 10) groups. The intervention consisted of 3 sets of 8 intervals at an intensity equal to a rating of perceived exertion of 12-14 with intervals lasting 20s at 100% of VO₂max. All participants performed aerobic capacity testing and body composition (dual energy X-ray absorptiometry) were measured at baseline and after 12 weeks of training. The MICT group performed 150 min of MICT/week for 12 weeks at a RPE > 17. The MICT group performed 150 min of MICT/week for 12 weeks at a RPE between 12-14.

RESULTS: VO₂max improved following HIIT (HIIT: 43.9±3.5 vs. 42.7±4.1 %; MICT: 45.9±4.1 vs. 46.7±4.7 %). Body fat % significantly decreased from baseline following HIIT (p<0.05), but not MICT (HIIT: 43.9±3.5 vs. 42.7±4.1 %; MICT: 45.9±4.1 vs. 46.7±4.7 %). VO₂peak significantly increased from baseline following HIIT (p<0.05), but not MICT (HIIT: 23.7±0.9 vs. 25.0±0.9 ml/kg/min; MICT: 22.2±1.6 vs. 23.1±1.6 ml/kg/min).CONCLUSIONS: These preliminary data support the hypotheses that non-traditional aerobic HIIT (e.g., HIIT incorporating body weight exercises) leads to more advantageous changes in body composition and exercise capacity compared to MICT alone.

CONCLUSION: The significant group differences in TW, all groups similarly improved aerobic performance.
For more than twenty years, the Tabata protocol has provided the basis for high intensity interval training (HIIT). Although the improvements associated with the protocol are laudable, an intensity of 170% of max VO₂ is difficult for even highly motivated athletes to achieve. A repeated bout HIIT protocol at 100% of Max VO₂ may be a more tolerable option, if it achieves a similar metabolic stress. **Purpose:** The purpose was to determine the metabolic cost of 8 repetitions of HIIT at a workload equivalent to 100% Max VO₂ (HIIT) for 20 sec with recovery intervals of 10, 20, 30 and 40 sec at 20% of Max VO₂. **Methods:** 14 recreationally active college-age students (age: 21.6 ± 1.1 yrs., height: 171.4 ± 10.5 cm, body mass: 75.0 ± 10.6 kg, max VO₂: 2.89 ± 0.67 L/min) volunteered to participate in a randomized, single-blind crossover design study with a minimum of 4 days between trials. A max VO₂ ramp protocol on a Lode Cycle ergometer preceded the HIIT trials and established the max workload. VO₂ was obtained by continuous open circuit spirometry and blood lactate by finger puncture. Excess Post Exercise O₂ Consumption (EPOC) was obtained for 20 min after each trial. **Results:** Statistical analysis by ANOVA with repeated measures (**P** < 0.05) was applied to the following data:

<table>
<thead>
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<th>VO₂ % max</th>
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<th>20</th>
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<th>40</th>
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<td>86.9 ± 6.8</td>
<td>81.6 ± 7.2</td>
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<tr>
<td>VO₂ max L/min</td>
<td>2.59 ± 0.6</td>
<td>2.52 ± 0.5</td>
<td>2.49 ± 0.6</td>
<td>2.33 ± 0.5</td>
</tr>
<tr>
<td>HR b/min</td>
<td>181 ± 17.0</td>
<td>179 ± 8.2</td>
<td>176 ± 7.8</td>
<td>173 ± 6.5</td>
</tr>
<tr>
<td>LA mmol</td>
<td>15.0 ± 2.9</td>
<td>14.7 ± 3.3</td>
<td>15.2 ± 3.6</td>
<td>14.2 ± 2.6</td>
</tr>
<tr>
<td>20 min EPOC (L)</td>
<td>2.66 ± 1.0</td>
<td>2.52 ± 0.7</td>
<td>2.82 ± 0.7</td>
<td>2.47 ± 0.9</td>
</tr>
</tbody>
</table>

(**P** < 0.05: 10, 20, 30 vs 40)

**Conclusion:** The prescribed HIIT workload parameters provide ample metabolic stimulus, however recovery intervals in excess of 30 seconds substantially attenuate the anabolic and metabolic contributions. The use of eight repeat bouts of HIIT at a workload equivalent to 100% of max VO₂ may be a viable alternative to the traditional Tabata protocol.

3747

**Board #64**

**May 30 8:00 AM - 9:30 AM**

**A COMPARISON OF INTERNAL TRAINING LOADS BETWEEN OBJECTIVELY-VERSUS SUBJECTIVELY-DETERMINED HIGH-INTENSITY INTERVAL TRAINING**

David Elmer, Emma Chambers, Anna Tucker, Madelyn Smith, Elizabeth Hubbard. Berry College, Mount Berry, GA. **(No relevant relationships reported)**

High-intensity interval training (HIIT) is an effective and time-efficient method of aerobic training. Most HIIT programming relies on objectively determined work rate, velocity, or heart rate targets. There is very little evidence comparing HIIT that is programmed using objective measures and HIIT that is programmed using subjective ratings to determine the work and recovery intensities, even though subjectively-determined HIIT may have more real-world applicability. **Purpose:** To evaluate the internal training load generated by single treadmill sessions of objectively-determined HIIT (HIIT-Obj) and subjectively-determined HIIT (HIIT-Sub). **Methods:** Thirteen female (n=7), male (n=6) young (age 19.8 ± 2.0 years), healthy participants completed a baseline testing session to determine peak VO₂ and HR, followed by two HIIT sessions on a treadmill in a randomized order. Both HIIT sessions consisted of 10x1-min work intervals, interspersed with 1-min recovery intervals, with the work rate obscured from participants’ view. HIIT-Obj session work intervals used the work rate associated with 90% of VO₂max, with recovery intervals completed at 4 km/h. For HIIT-Sub sessions, participants were instructed to achieve an RPE of 8-9 on the Borg CR-10 scale during work intervals and drop to an RPE of 3-4 during the recovery intervals. Internal training load calculations included Training Impulse (TRIMP) and HR zone methods. **Results:** There were no significant differences in internal training load between HIIT-Obj and HIIT-Sub as determined via TRIMP (45.8 ± 12.3 vs. 47.8 ± 15.9 a.u., ES = 0.03, p = 0.59) and HR zones (57.9 ± 14.7 vs. 66.8 ± 22.6 a.u., ES = 0.28, p = 0.06) methods, though participants spent significantly less time in the lowest intensity HR zone (zone 1) while completing HIIT-Sub (HIIT-Obj = 3.57 ± 0.93 min; HIIT-Sub = 2.43 ± 1.13 min, ES = 0.48, p = 0.01). Peak HR reached during the sessions was also not statistically different (186 ± 12 vs. 188 ± 16 bpm, ES = 0.07, p = 0.38). **Conclusion:** Participants are able to generate similar internal training loads using real-time subjective measures of intensity during HIIT compared to objectively-regulated HIIT. This indicates that this simpler, more applicable method of HIIT programming may generate the desired training stress for a client or athlete without rigid work rate or HR targets.

3748

**Board #65**

**May 30 8:00 AM - 9:30 AM**

**The Oxidative Contribution Of Eight Repeat Bouts Of High Intensity Interval Training**

John Petrizzo, Michele Aquino, Colin Shaw, Justin St Peter, Erica Koutch, Rebecca Flax, Kerianne Nordland, John Wygand, FACSM, Robert M. Otto, FACSM. Adelphi University, Garden City, NY. **(No relevant relationships reported)**

Interval training requires bouts of work followed by recovery intervals. The intensity of the work interval impacts the metabolic response of the recovery interval. **Purpose:** The purpose was to determine the oxidative cost of both the work (W) interval and the recovery (R) interval during 8 continuous repetitions of high intensity interval training (HIIT) at a workload equivalent to 100% Max VO₂. **Methods:** All 20 work second work intervals were followed by recovery intervals of 10, 20, 30 and 40 sec at 20% of Max VO₂, 14 recreationally active college-age students (age: 21.6 ± 1.1 yrs., height: 171.4 ± 10.5 cm, body mass: 75.0 ± 10.6 kg, max VO₂: 2.89 ± 0.67 L/min) volunteered to participate in a randomized, single-blind crossover design study with a minimum of 4 days between trials. A max VO₂ ramp protocol on a Lode Cycle ergometer preceded the HIIT trials and established the max workload. VO₂ was obtained by continuous open circuit spirometry. **Results:** Statistical analysis by ANOVA with repeated measures (**P** < 0.05) was applied to the following data:

<table>
<thead>
<tr>
<th>% max VO₂</th>
<th>W 10 R</th>
<th>W 20 R</th>
<th>W 30 R</th>
<th>W 40 R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interval 1</td>
<td>78.3</td>
<td>74.0</td>
<td>73.3</td>
<td>72.6</td>
</tr>
<tr>
<td>Interval 2</td>
<td>96.6</td>
<td>87.2</td>
<td>96.8</td>
<td>85.1</td>
</tr>
<tr>
<td>Interval 3</td>
<td>98.5</td>
<td>88.7</td>
<td>95.9</td>
<td>84.1</td>
</tr>
<tr>
<td>Interval 4</td>
<td>96.0</td>
<td>88.0</td>
<td>94.7</td>
<td>82.5</td>
</tr>
<tr>
<td>Interval 5</td>
<td>95.1</td>
<td>88.8</td>
<td>92.3</td>
<td>85.6</td>
</tr>
<tr>
<td>Interval 6</td>
<td>96.7</td>
<td>89.4</td>
<td>93.2</td>
<td>87.0</td>
</tr>
<tr>
<td>Interval 7</td>
<td>98.5</td>
<td>89.1</td>
<td>95.9</td>
<td>86.2</td>
</tr>
<tr>
<td>Interval 8</td>
<td>99.1</td>
<td>84.7</td>
<td>97.0</td>
<td>83.4</td>
</tr>
</tbody>
</table>

With the exception of interval one, recovery protocols of 10, 20 and 30 sec sustained significantly greater oxygen requirements during W & R vs the 40 sec trial. W was in excess of 90% of max VO₂ for 10, 20 & 30 trials, while the 40 sec recovery bout HIIT protocol provided significantly less oxidative requirements and never achieved 90%. **Conclusion:** Short recovery intervals of 30 seconds or less provide the greatest oxidative stress during interval training, which may be attributed to insufficient phosphagen resynthesis during recovery.

**Board #66**

**May 30 8:00 AM - 9:30 AM**

**Effects Of Elevation Training Mask In Conjunction With High Intensity Interval Training On Lung Function**

Brandie C. Cheshier,1 Carlos A. Estrada,2 Masoud Moghaddam,2 Carter J. Stewart,1 Bert H. Jacobson1. 1Oklahoma State University, Stillwater, OK; 2Academy of Nutrition and Exercise, Tulare, CA. **Email: brandie.cheshier@okstate.edu** **(No relevant relationships reported)**

A recent training tool, the elevation training mask (ETM) is a commercially available simulated altitude training device with claims to increase lung function and aerobic capacity by incorporating valves to create respiration resistance. Previous studies have resulted in conflicting conclusion regarding the effectiveness of the ETM with respect to lung function. **Purpose:** To compare the effects of the ETM in conjunction with high intensity interval training (HIIT) and ETM alone (i.e., using mask with no resistance) on lung function. **Methods:** Sixteen healthy adults (control group, n=8 & experimental group, n=8) participated in this study. Pre- and post-test consisted of lung function (FEV1 & FVC) using spirometer, time to exhaustion (TTE) using the...
Bruce protocol on treadmill, and body mass index (BMI). Training was completed on a cycle ergometer on 3 consecutive days per week (MWF), for 4 wks. Participants exercised at 85% of HR_{max} using heart rate monitor, with a pedal rate of 100-120 rpm at individually set resistance levels. Each training session consisted of 10 bouts of 30s exercise followed by 30s of active recovery for a total time of 10 min. The respiratory resistance on the ETM for the experimental group was progressively increased from 915.4 m -2.743.2 cm (3,000.9+9,091.8) cm²/during wks of training, while the control group used an ETM with no resistance. RESULTS: Following training, a significant difference in FVC between the groups was found (F (1, 4) = 7.486, p = 0.016). In addition, no significant (p > 0.05) differences between the groups in FEV1, (experimental: 3.78 ± 0.94L; control: 3.83 ± 0.59L), TTE (experimental: 11:30 ± 1.92min; control: 12:23 ± 1.60min) and BMI (experimental: 23.01 ± 3.24kg/m²; control: 24.25 ± 2.97kg/m²) was noted. However, the experimental group yielded a greater increase in FVC, compared to the control group (experimental: 3.40%; control: 2.42%). CONCLUSION: In the present study, the ETM resulted in a small increase in FEV1 and, significantly improved FVC more than HIIT alone. Using the ETM in conjunction with HIIT may significantly improve lung function compared to HIIT only. When used in conjunction with HIIT, the ETM appears to create sufficient resistance to strengthen the muscles in respiratory ventilation and improve respiratory efficiency. 

**3750 Board #67**
May 30 8:00 AM - 9:30 AM
**Effects Of Deep Slow Breath Training On Performance And Recovery During High Intensity Interval Cycling**
Andrew Brown. Western Washington University, Bellingham, WA. (Sponsor: Dr. Lorrie Brilla, FACSM)

(Voluntary alternations in components of the respiratory cycle have been utilized for demonstratively and chronically. The efficacy of breath training in improving repeated glycolytic sprints has yet to be fully elucidated. PURPOSE: To delineate the effects of a six-week deep slow breathing (DSB) program on measures of cycling performance (mean power), recovery (heart rate recovery: HRR), and expired carbon dioxide: VCO2), and pulmonary capacities (maximum voluntary ventilation and forced expiratory volume). METHODS: Twenty male cyclists were divided into training (n=10) and control (n=10) groups, where the training group completed a six-week DSB program. Inclusion criteria included a minimum of 180-minutes of cycling volume per week for the previous 6 months. DSB was an app-driven program to extend expirations following each WAnT. Significant differences between the groups in VO2max and 90-sec active recovery periods. CONCLUSION: DSB significantly improved VO2max and 90-sec active recovery periods. MCT was continuous bout at 65% VO2max. Each trial lasted 53 min, matched for duration. Of note, despite identical duration, the MCT protocol involved more total work when compared to both HIIT and SIT. The efficacy of breath training in improving vagal tone, and subsequent exercise performance following breath training have been demonstrated acutely and chronically. The efficacy of breath training in improving repeated glycolytic sprints has yet to be fully elucidated. PURPOSE: To delineate the effects of a six-week deep slow breathing (DSB) program on measures of cycling performance (mean power), recovery (heart rate recovery: HRR), and expired carbon dioxide: VCO2), and pulmonary capacities (maximum voluntary ventilation and forced expiratory volume). METHODS: Twenty male cyclists were divided into training (n=10) and control (n=10) groups, where the training group completed a six-week DSB program. Inclusion criteria included a minimum of 180-minutes of cycling volume per week for the previous 6 months. DSB was an app-driven program to extend expirations following each WAnT. Significant differences between the groups in VO2max and 90-sec active recovery periods. CONCLUSION: DSB significantly improved VO2max and 90-sec active recovery periods. MCT was continuous bout at 65% VO2max. Each trial lasted 53 min, matched for duration. Of note, despite identical duration, the MCT protocol involved more total work when compared to both HIIT and SIT. 

**3751 Board #68**
May 30 8:00 AM - 9:30 AM
**The Effects Of Rich Hydrogen And Oxygen Mixed Gas Inhalation After High Intensity Exercise Influence On Exercise Performance**
Yudai Shibayama1, Shohei Dobashi1, Tamotsu Fukuo1, Takaaki Arisawa2, Katsuhiko Koyama1. 1University of Yamanashi, Kofu, Japan. 2Helm Japan Co. Ltd., Tokyo, Japan.

(Purpose: Both hydrogen-rich and normobaric hyperoxic gas exposure during exercise recovery is known to promote ergogenic and therapeutic effects on the whole body physiological function and exercise performances. However, the synergistic intervention of high concentrations of hydrogen and oxygen mixture gas (HO gas) inhalation on these indexes has been poorly investigated. Therefore, we examined acute HO gas inhalation during exercise recovery on subsequent oxidative stress, inflammation, and exercise performance. METHODS: According to a two-trial, double-blind, crossover, repeated measures design, eight physically males inhaled HO gas (67 % of hydrogen and 32 % of oxygen) or Placebo gas (ambient air) during 60-min recovery after completion of oxidative stress-induced exercise protocol consisting of 30 min treadmill running at 75 % of participant’s maximal oxygen uptake (VO2 max) and 5 × 10 repetitions of squat jump exercise. Before oxidative stress-inducing exercise and 10-min after post exercise gas inhalation, blood and urine samples were obtained and exercise performance (jumping ability, pedaling power output, muscle strength) were evaluated. RESULTS: A post-exercise HO gas inhalation attenuated the increase 8-OHdG excretion rate (p < 0.05), known as one of DNA oxidation markers, and the reduction in the jumping ability evaluated by the height of countermovement jump (p < 0.05) compared to Placebo gas inhalation. Moreover, the increase in urinary 8-OHdG excretion rate was significantly associated with the reduction in countermovement jump performance (r = -0.48, p < 0.01). Discussion: These suggested that HO gas inhalation during post exercise recovery might, at least in part, improve exercise performance via reducing systemic oxidative damage.)
training sessions, each ~2 hr in length. Sessions were categorized as endurance training (ET), skill training (ST) or game-based training (GBT). Movements were catalogued into 5 speed zones. Player positions were classified as forward (n=14) or back (n=15). RESULTS: Backs traveled greater total distances on all practice days than forwards, and in ET backs traveled greater distances per minute than forwards (50.07 ± 6.67 m; 47.95 ± 16.64 m, p < 0.01). Positional work-to-rest ratio was higher in forwards vs. backs in ET only (0.244 ± 0.158; 0.230 ± 0.051, p < 0.05). Backs traveled greater total distances in higher-intensity zones than forwards (7.23 ± 4.34 %; 4.32 ± 5.0 %, p < 0.05) during GBT. In all practice sessions, significant differences between positions were observed in time spent and distance traveled within the 5 speed zones. CONCLUSION: Locomotive training demands for back positions are of higher intensity in GBT, and greater volume on all practice days, compared to forward positions. ET was the only session that exhibited a significantly higher work-to-rest ratio for forwards. Though GPS technology is effective for quantifying linear movements, it is not capable of quantifying athlete exertion in low-speed, high-power movements, performed by forwards in rugby union. Research funded by a grant from NSERC, Canada.

Quantifying external training load (eTL), referred to as the biomechanical load during training, is becoming increasingly popular for team sport in an effort to manage fatigue, optimize performance, and guide return-to-play protocols following injury. During indoor team sport play, eTL can be measured via Inertial Measurement Units (IMUs) which incorporate accelerometers, gyroscopes, and a magnetometer to characterize an athlete’s movement signature, while Indoor Positioning Systems (IPS) are also common, which use Ultra-wideband (UWB) to detect player positioning and their subsequent movements. PURPOSE: The purpose of this study was to assess the association between a commercially available IMU and IPS used to monitor eTL in team sport. METHODS: A retrospective analysis was performed on 13 elite male NCAA Division 1 basketball players from three practices during the off-season training phase. A Pearson’s correlation was used to examine the association between the Distance traveled during practice captured by IPS system compared to PlayerLoad (PL), PlayerLoad per Minute (PL/Min), 2-Dimensional PlayerLoad (PL2D), 1-Dimensional PlayerLoad Forward (PL1D-FWD), Side (PL1D-SIDE), and Up (PL1D-Up) distance traveled during practice captured by the two systems used to monitor eTL in team sport. RESULTS: There were significant (p ≤ 0.001) positive correlations between Distance and PL (r=0.947), PL/Min (r=0.947), PL2D (r=0.901), PL1D-FWD (r=0.819), PL1D-SIDE (r=0.847) and PL1D-Up (r=0.891) captured from the Catapult Sport IMU. There were no significant (p > 0.05) differences between home and away games. However, some athletes showed varying changes in training load over the following weeks. CONCLUSION: Individually, athletes should be aware that each system may potentially provide unique outcomes that quantify movement capacity in terms of a generalized rating. Assessments relying on both measurement types may provide more robust performance information.

Urinary specific gravity (USG) has historically been utilized to classify an individual’s hydration status. Road trips, with decreased willingness to drink and increased “road food” selection, may affect athletes’ hydration status. Athletic performance has been shown to be affected by hydration status.

RESULTS: To compare urine specific gravity of home versus away weekends for DI volleyball athletes. METHODS: Fourteen NCAA Division II female collegiate volleyball athletes (Redshirt = 2, Freshmen = 1, Sophomore = 7, Junior = 1, Senior = 1) participated in this study. Urine was collected in sterile cups in the hours preceding games. Collections were conducted over two weekends of play with a total of five samples being collected. All samples were collected prior to the competitions. Home competitions (HM) were Friday and Saturday. Collections for away competitions (AW) were pre-trip Friday, post-trip/pre-game Friday, and post-trip/pre-game Saturday. Participants competed against the same two teams for home and away weekends. Urinalysis was conducted via reagent strips, according to manufacturer’s instructions. Data were analyzed via repeated measures ANOVA with an a priori level of 0.05.

GPs sports watches are a convenient tool used to monitor improvement and predict race performance. Ensuring these watches are accurate allows runners to specifically plan out training to reach a desired race time. However, if predicted race time is inaccurate, an athlete may become frustrated during training or not reach their goals.

### METHODS:

Nineteen participants (26.8 ± 7.9 years) were recruited for this study. Eligibility included participating runners at least 30 minutes a day, three times a week. Participants were required to visit the EMU Running Science Laboratory on two separate occasions. During the initial visit, participants completed a VO2max test on a treadmill. Participants ran at a self-selected speed while grade increased 2% every two minutes until volitional exhaustion. Following the VO2max test, participants were shown how to use a GPs sports watch and instructed to run three days a week for at least 30 minutes for two weeks. After two weeks, participants returned for their second visit and predicted 5k time was recorded from the GPs sports watch. Participants then completed a 5k race time trial on a 1.2km indoor track (measured 5k). A paired samples t-tests was used to compare predicted 5k to measured 5k (p < 0.05).

### RESULTS:

Three participants were excluded due to failure to return for the second visit. The remaining 16 participants (5 female, 11 male) had an average VO2max of 54.0 ± 9.1 ml/kg/min, height of 172.9 ± 7.0 cm, and weight of 69.5 ± 9.0 kg. There was a significant difference between measured 5k race time (25.3 ± 7.4 min) and predicted 5k race time (21.1 ± 2.5 min) indicating that the GPs watch underestimated 5k time.

### CONCLUSION:

The GPs sports watch underestimated 5k time by approximately four minutes. The prediction from the GPs sports watch was based on factors such as speed, heart rate, and distance measured while participants wore the watch for two weeks. Failure to accurately measure heart rate at the radial pulse, inaccuracy associated with GPS, and varied training intensity while wearing the watch could explain some of the error.
3761 Board #78 May 30 8:00 AM - 9:30 AM ECG-derived Aerobic And Anaerobic Indices For Training Efficiency Tracking Pavel Bulai, Tatiana Kulabava, Tarsa Ptitik, Timofei Lipski. RocketBody Inc., Minsk, Belarus. Email: pavel.bulai@gmail.com (No relevant relationships reported)

There is a continuous search for indirect methods and simple criteria to evaluate physiological effects of training. ECG analysis provides a relevant option for routine monitoring, as it can be supported in real-time mobile or wearable device applications. Determination of the optimal ECG features is essential for monitoring and assessing systems. PURPOSE: To introduce ECG-derived aerobic index (AI) and anaerobic index (ANI) which could determine training effects and indicate subject’s metabolic state. METHODS: A healthy, physically active subject performed endurance and strength trainings 3 times a week. He fulfilled 55 ECG measurements using single-lead wrist-wearable device before and after 28 trainings. ECG signals were processed with detection of QRS-complex. AI and ANI were calculated as R-peak normalized to S-R complex slope and as S-T complex slope normalized to R-S slope. Correlations of AI and ANI with training load were calculated using Pearson correlation coefficient (r) with p value. RESULTS: Correlations between AI and aerobic load as well as ANI and anaerobic load were identified. The more energy was burned during training, the lower correlation curves with confidence bounds (95 %).

3762 Board #79 May 30 8:00 AM - 9:30 AM VALIDATION OF HEART RATE MONITORING OF FENIX 5 DURING MOUNTAIN BIKING Brenna Barrios. UNLV, Las Vegas, NV. (Sponsor: James Navalta, FACSM) (No relevant relationships reported)

The availability of fitness trackers has increased in recent years. These trackers claim to accurately depict Heart Rate - among other factors. Little if any studies have looked into the accuracy of the HR sensor within these systems. Purpose: The GarminFenix 5watch boasts about its performance tracking capabilities, claiming that it will accurately track heart rate, this study aims to assess its accuracy using the Polar H7. METHODS: Sixteen participants (males = 8, females = 8, 24.69 ± 4.44yrs, 171.45 ± 8.9cm, 74.23 ± 21.07kg) rode a mountainbike a total of 3.22km along the McCullough hills trail (Henderson, NV) while simultaneously wearing both the GarminFenix 5and the Polar H7. Participants rode the same trail twice, each ride was 1.61km (round trip), with 10 minutes break in between rides. Validity was determined using the Mean Absolute Percent Error (MAPE), Bland-Altman analysis with accompanying bias and Limits of Agreement (LoA), and single measures Intraclass Correlations (ICCs). Prior to testing, the benchmark for validity was established as MAPE <10% and an ICC >0.75 (p<0.05), with the lower limit of the ICC95% confidence interval (CI) set at >0.7. RESULTS: During mountain biking the MAPE was 13.30%. The single measures ICCwas 0.16 with 95% confidence interval of 0.068.43, F(17142, 17142) = 1.40, p < 0.000. CONCLUSION: This datashows that the Fenix 5does not produce a valid measure of heart rate while mountainbiking due to the MAPE being above 10% and the ICCbeing well below 0.7.

3763 Board #80 May 30 8:00 AM - 9:30 AM Confounding Variables Influence Utility Of Heart Rate Measures In Collegiate Athletes. Nguyen D. Nguyen, Ashley Arnett, Ethan S. Gross, Haylee A. Bettencourt, J. Mark VanNess, Courtney D. Jensen. University of the Pacific, Stockton, CA. Email: n.nguyen55@u.pacific.edu (No relevant relationships reported)

Heart rate is easy to measure and a useful variable for determining training intensity, training status and fitness levels. The downward rate of the heart following a standardized stressor (heart rate recovery; HRR) and resting heart rate (RHR) are automonically-mediated and can be used to detect training distress. However, confounding variables can limit the usefulness of heart rate when criteria for rate changes are not individualized, especially when applied to entire sporting teams. PURPOSE: To determine influences of sex, training status, player position and season duration have on the RHR and the HRR response following a standardized physical stressor. METHODS: Subjects were male (n=17) and female (n=26) collegiate soccer players aged 17 to 22 years. RHR (taken in the morning just after awaking) and the HRR following a 300-yard shuttle run and maximal treadmill test were collected four times during one entire season. RESULTS: Pearson correlations showed men had faster times (p<0.001) and higher VO2 max (p<0.05) than women. Shuttle run performance and athlete’s class standing were not found to be significantly different but trended towards significance (p=0.052). HRR examined by sex found that men had a faster HRR time than women (p<0.010). A multivariate analysis examining RHR and player position found that there was a statistically significant difference (p<0.015): The forward players had higher HRR compared to defenders (p=0.051) and midfielders (p=0.049). CONCLUSION: Player fitness, sex, position and year in school should be considered when establishing guidelines for using heart rate information.

3764 Board #81 May 30 8:00 AM - 9:30 AM The Accuracy Of Heart Rate Monitors And Determination Of Heart Rate Percentages At Anaerobic Threshold Muhammet Enes Erol1, Michael A. Figueroa2.1William Paterson University, clifton, NJ. 2William Paterson University, Wayne, NJ. Email: meneserol11@gmail.com (No relevant relationships reported)

PURPOSE: To examine the heart rate percentage (HR%) at the Anaerobic Threshold (AT) in order to determine the appropriate exercise intensity below or above the AT. A second goal was to assess the accuracy of different types of wearable heart rate monitors (HRMs) during a graded exercise test. METHODS: Thirty healthy individuals (n=21 males & n=9 females; aged 24.5 ± 3.5 years) participated in a single incremental exercise protocol on a cycle ergometer (CE). AT was detected through a metabolic cart by using V-slope method, which determined the point of a nonlinear increase in carbon dioxide output (VCO2) against oxygen uptake (VO2). HR was measured each minute of exercise test via two optical-based monitors (Cellular Watch [IW] & Fitness tracker [FB]) and two electrical-based monitors (traditional monitor [ECG] & heart rate monitor [PL]). Electrocardiography (ECG) was used as “Gold Standard” for comparison in this study. RESULTS: AT was reached at the mean and standard deviation (SD) of 130 ± 16 bpm. HRs at AT was observed 67 ± 8 % of HRpeak. Heart Rate Reserve Percentages (HR%) at AT were observed at 42 ± 15 % of HRpeak. Across all exercise testing stages (Stage 1 [S1], Stage 2 [S2], Stage 3 [S3], etc.), no significant differences were found in HR values between ECG and PL. The most statistical differences were found in HR between ECG and IW, (S5=p<0.018), S6=p<0.041) and S7=p<0.005). As intensity increased, FB and IW underestimated the HR values throughout all stages when compared with the ECG. CONCLUSIONS: Analysis of HRs at AT was estimated at approximately 67% of participant maximum effort as well as HRs at AT was estimated at 42%. At the light-intensity, accurate outcomes of HR values were observed from all wearable HRMs. However, with increased intensity, the accuracy of wearable devices was varied at moderate and high-intensity exercise testing. The PL had the greatest agreement with...
ECG when compared to other devices. This might be due to the fact that both HRMs utilize a similar mechanism of measurement. The electrical-based HRM was found to be more accurate in comparison to the optical-based HRMs.

Previous studies have suggested that football players do not clinically diagnosed with concussion may still demonstrate differences in balance and neurocognitive performance by end of season. Clinically this is important as it indicates the athlete with sub-clinical injuries that may contribute to long-term deficits.

**Purpose:** To determine if non-concussive impacts sustained during normal play at NCAA Division I football practices and spring season scrimmage are sufficient to elicit detectable changes in ocuomotor (OM) and balance performance.

**Methods:** NCAA Division I football players were recruited to this pilot study during the 2019 spring football season. Questionnaires were used to collect demographic information. Portable virtual reality equipment was utilized to measure OM performance of smooth pursuit, saccade, and vestibular ocular reflex (VOR). BESS was utilized to measure balance performance. Assessments were administered at baseline, 24-48 hours after 3 practices, and the spring season scrimmage. Shapiro-Wilk analysis was used to assess changes in balance and OM skills in subjects across the pilot project.

**Results:** Of the 23 recruited subjects, 7 (30%) completed all assessments; however, there were missing data observations for the 7 subjects who completed all 5 assessment points. There was no significant change in balance performance (p = 0.375); one variable of horizontal or vertical VOR, while one variable of horizontal and vertical saccade testing (accuracy of left eye) demonstrated near significant changes (p = 0.0625).

**Conclusion:** We found no significant detectable changes in balance and OM performance in this pilot study.

**G-34 Free Communication/Poster - Performance**

**Saturday, May 30, 2020, 8:00 AM - 10:30 AM**
**Room:** CC-Exhibit Hall

**3766 Board #83**
**May 30 8:00 AM - 9:30 AM**
**Internal Load In Football Players: Can The Mind See What The Heart Says?**
Valerie Smith-Hale, Joshua Sabou, Ruben Mendoza, Alyssa Pollard-Grandy, Matt VanSumeren, Linda Jimenez, Tamara Hew-Butler, FACSM. Wayne State University, Detroit, MI. (Sponsor: Tamara Hew-Butler, FACSM)
Email: fg8819@wayne.edu

**Ratings of perceived exertion (RPE) is a simple, validated, measure of physical effort, largely reflecting heart rate (HR). However, RPE is being replaced by continuous HR monitoring to quantify internal loads which maximize performance and enhance trend accuracy. PURPOSE: Primary aim: assess relationships between RPE (athlete and coach) versus HR during football practice. Secondary aims: quantify internal load by end of season. Clinically this is important as it indicates the athlete with sub-clinical injuries that may contribute to long-term deficits.**

**Methods:** A pilot study to determine if non-concussive impacts sustained during normal play at NCAA Division I football practices and spring season scrimmage are sufficient to elicit detectable changes in ocuomotor (OM) and balance performance.

**Results:** Of the 23 recruited subjects, 7 (30%) completed all assessments; however, there were missing data observations for the 7 subjects who completed all 5 assessment points. There was no significant change in balance performance (p = 0.375); one variable of horizontal or vertical VOR, while one variable of horizontal and vertical saccade testing (accuracy of left eye) demonstrated near significant changes (p = 0.0625).

**Conclusion:** We found no significant detectable changes in balance and OM performance in this pilot study.
Curve (AUC) was calculated for ankle proprioceptive discrimination sensitivity score. 2-way repeated measures ANOVA was performed to determine the differences among the 3 AMEDA tests for players between 2 levels, and Pearson’s correlation evaluated among the measures. Results: Repeated measures ANOVA showed significant main effects for task load AMEDA tests (F=46.30, p<0.01) and competition levels (F=19.95, p<0.01), with no significant interaction (p=0.05). A significant linear effect was found across the 3 task load conditions (F=64.97, p<0.01). Pearson’s correlation showed that the Dual-FA and Dual-FL were significantly correlated with all 3 AMEDA scores (r ranged from 0.38 to 0.66, all p<0.05). In addition, years of training was significantly correlated with both HR for Dual-FA (r=0.46, p=0.02) and Dual-FL (r=0.61, p<0.01), as well as the proprioceptive AUC scores of both Single-A (r=0.45, p=0.02) and Dual-FA (r=0.64, p<0.01), but was not significantly correlated with the AUC scores of Dual-FL (p=0.05). Conclusion: Ankle proprioceptive function may be an essential ability underlying sport-specific performance and was significantly impaired under the dual tasks in youth table tennis players. Testing ankle proprioceptive ability during Dual-FL may place demand on central resources not developed by training. These findings have implications for ankle injury prevention, table tennis training and talent identification.

3770 Board #87 May 30 8:00 AM - 9:30 AM Predictors Of Obstacle Course Racing (OCR) Performance Weston Titus1, Richard F. Armenta1, Matthew M. Schubert1, 1Palomar College, San Marcos, CA. 2California State University, San Marcos, San Marcos, CA. Reported Relationships: W. Titus: Other (please describe): I was an employee of the gym where participants were recruited from and where data were collected at the time of this study (Fall 2018). I am no longer an employee at this facility.

Purpose: Obstacle course racing (OCR) has become a popular recreational activity in the last ~10 years, with more than 8.5 million participants. Despite the popularity, little is known about predictors of performance in OCR; research to date has focused on injury prevalence. The purpose of this study was to conduct laboratory and field tests of athletic performance in OCR athletes and examine their relationships to performance in a simulated OCR. Methods: Thirty-two men and women (mean ± standard deviation (SD) age: 42 ± 10 years; OCR experience: 2.8 ± 2.3 years) completed laboratory testing for VO2max, anaerobic power (Wingate), vertical jump, flexibility, and body composition. Additional field tests were completed for 400 meter and 1 mile running time, muscle strength (back squats and deadlifts) and endurance (bucket carry for distance), grip strength, and burpees. Participants also completed a 3-mile simulated OCR. Independent t-tests examined differences between sex and bivariate regressions were conducted between testing variables and OCR performance. Results: For the combined sample, the best individual predictors were mean relative power from the Wingate test (β=0.71 ± 0.12 minutes), mean multivariable analysis controlling for age, sex, and mile run time found an independent association between bucket carry for distance and race time (β= -0.04 ± 0.01 minutes), but mile run time was still the best predictor (β= 0.71 ± 0.07 minutes). Conclusions: Data from the present study suggest that aerobic and anaerobic fitness have important contributions to OCR success.

3771 Board #88 May 30 8:00 AM - 9:30 AM Relationship Between Seated Single Arm Shot Put And Isokinetic Shoulder Flexion And Elbow Extension Strength Matthew D. Watson, George J. Davies, Bryan L. Riemann. Georgia Southern University - Armstrong Campus, Savannah, GA. Email: watsonm32@gmail.com (No relevant relationships reported)

PURPOSE: Previous studies have demonstrated a strong correlation between isokinetic pushing force and seated single-arm shot-put (SSASP) test performance. However, there is limited research on the contribution of shoulder flexion and elbow extension strength on SSASP test outcomes. Therefore, the purpose of this study was to examine the relationship between isokinetic shoulder flexion and elbow extension strength and SSASP test performance and compare limb symmetry indexes (LSI) between the two tests.

METHODS: Healthy, physically active men (n=16, age=21-34 yrs) and women (n=15, age=18-29 yrs) performed dominant (DOM) and non-dominant (NDOM) shoulder flexion and elbow extension isokinetic tests (System 4, Biodex, Shirley, NY) at 60°/s (10 repetitions) and 180°/s (10 repetitions) to determine peak torque production. The average horizontal range from three SSASP (2.0kg ball) trials were computed separately for each limb. In addition to conducting correlational analyses between the peak torques and SSASP distances, the differences in LSI computed between each of the peak torques and SSASP distances were statistically compared at each velocity by joint analysis of variance.

RESULTS: Significant (p<0.001) relationships were revealed between DOM and NDOM SSASP performance and shoulder (r=0.819 to .853), elbow (0.78±0.129%, r=0.819 to .853), with no statistically significant differences (P=.64 to 844, r=.819 to .853).

CONCLUSIONS: Results demonstrate shoulder and elbow isokinetic torques are strongly associated with SSASP distances. Moreover, LSI for both tests were not significantly different from each other, thereby supporting the utilization of the SSASP for making bilateral comparisons in healthy individuals.

3772 Board #89 May 30 8:00 AM - 9:30 AM Evaluating The Impact Of Competition On Vertical Jump Performance Moroni de Moors1, Anna Blackley1, Andy Bosak1, Austin Deshner1, Abraham Frech1, Russell Lowell1, Maggie McDermott1, Grant Merry1, Hannah Nelson1, Madeline Shanahan1, Branden Ziebell1. 1Liberty University, Lynchburg, VA. 2University of Mississippi, Oxford, MS. (Sponsor: Jim Schoffstall, FACS)

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(No relevant relationships reported)

PURPOSE: The vertical jump (VJ) test is used in athletic populations to assess lower body power and this value can be utilized as a predictor for sports performance. Incidentally, athletes have often elevated their level of performance in competitive environments. However, competition during assessment tests has not been widely examined. It is logical to assume that conducting the VJ test where subjects compete against each other may contribute to higher jumps. The purpose of this study was to determine if a competitive environment would have an impact on VJ performance in females.

METHODS: Twenty-six no less than averagely fit college females (age = 21 ± 1.86 years, Ht. = 166.53 ± 7.30 cm, Wt. = 64.47 ± 11.84 kg, BF% = 23.55 ± 6.22%) completed a dynamic warm up followed by four minutes of passive recovery (PR). After the completion of familiarization jumps and a four-minute PR period, subjects completed two jump series (in a counterbalanced order, solo and competitive) consisting of six jumps per series. The competitive series consisted of two subjects jumping side by side against one another simultaneously. The highest jump from the second highest jump, and average jump heights of the solo (SFHJ, SSHJ, SAJ) and competitive (CFHJ, CSHJ, CAJ) jumps were compared and analyzed using a paired-samples T-test (p < 0.05).

RESULTS: Significant differences occurred between: CFHJ (54.61 ± 1.31 cm) and SFHJ (53.34 ± 1.27 cm) (p=0.001); CSHJ (53.68 ± 1.32 cm) and SSHJ (52.27 ± 1.34 cm) (p<0.001); and CAJ (52.97 ± 1.31 cm) and SAJ (51.45 ± 1.33 cm) (p<0.001).

CONCLUSIONS: The results of this study suggest that a competitive environment for the VJ test does have an impact on VJ performance. Future research may need to assess the impact of a competitive environment on the VJ test utilizing athletes from sports where jumping actions are of extreme importance. Furthermore, an evaluation of the competitive environment on other power tests, such as the broad jump, should occur.


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(No relevant relationships reported)

PURPOSE: To examine the influence of spectator presence on power output in a short-duration, high-intensity activity. METHODS: We tested 15 men and 28 women, ages 18-25, on a 30-second Wingate cycle ergometer test. All subjects were tested twice, separated by 72 hours. During one trial, performance took place in front of the test administrator; during the other trial, the administrator was accompanied by an audience. Spectators observed but did not interact with the subjects. Testing conditions (e.g., time of day, instructions provided, and verbal encouragement) were identical in the two trials. The order of tests was assigned in a counter-balanced design. Mixed ANOVA with repeated measures was used to compare peak power (PP), duration of peak power (DPP), and mean power (MP) between the two trials overall and by sex. RESULTS: Subjects were 20.4 ± 1.4 years of age; across all testing, PP 1.7 ± 1.3 w/kg, DPP was 2.6 ± 3.5 seconds, and mean power was 1.2 ± 0.3 w/kg. There was no effect of test order on performance (p=0.199). Similarly, there was no effect of audience presence on PP (p=0.348) or an interaction effect with sex (p=0.406). There was an increase
in MP in the audience trial; subjects were 0.1 w/kg higher, corresponding to a 6.5% increase (p<0.005; 95% CI: 0.03 to 0.13 w/kg). There was no interaction effect with sex (p=0.416). The increase in MP was the result of an increase in DPP, which was 1.6 seconds longer in the audience trial, corresponding to a 91.6% increase (p=0.002; 95% CI: 0.61 to 2.49 seconds). There was no interaction effect with sex (p=0.418).

CONCLUSIONS: The presence of an audience influenced power output on the Wingate test. Although peak power was unaffected, the duration peak power was maintained nearly doubled, indicating endurance at peak performance may be sensitive to arousal.

3774 Board #91 May 30 8:00 AM - 9:30 AM Combined Driving: Task-Specific Position Impacts Grip Strength Of Equestrian Athletes
Michaela Keener, Kimberly I. Tumlin, Nicholas R. Heebner.
University of Kentucky, LEXINGTON, KY. (Sponsor: John Keener, FACSM)
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(No relevant relationships reported)

Equivalent to a human triathlon, combined driving is an equestrian sport designed to test ability to navigate horses and carriage during three phases. Drivers control up to four horses at a time relying heavily on hand strength. PURPOSE: TO 1) establish baseline data on grip strength and endurance of combined drivers in standing and task-specific positions; and 2) compare grip values to normative data by driver age. METHODS: Drivers were evaluated if they were able to compete and free from current injury. Fifty-one combined drivers (9 males, 42 females) aged 21-78 participated during two nationally recognized events. All drivers were right hand dominant. 63% of drivers were over 50 y/o; 22% of drivers reported having arthritis in their hands/wrists. Drivers completed a demographics and sport-specific survey, and three grip tests in two positions: standing and task-specific (sitting). Measures included peak values and endurance. Peak grip was recorded into four categories based on normative values.

RESULTS: Females with more than 30 yrs of driving experience had higher strength in the non-dominant hand (p=0.0345). There was a significant difference between strength based on position for both sexes (Table 1). Over 45% of females were stronger than normative data for both dominant and non-dominant hand, while only 22% of males fell in the stronger category. Female drivers average hand grip strength was 1.25 times greater than the normative population. The endurance for all subjects was significantly higher for the right hand (p=0.002).

CONCLUSIONS: This study is the first to establish standing and task-specific grip strength in combined drivers. Female drivers over 50 y/o demonstrated greater strength in their non-dominant hand, suggesting continuous use of hands for driving promotes strengthening muscle and maintaining hand function regardless of reported arthritis. Results demonstrated equestrian driving is beneficial to hand grip strength.

3775 Board #92 May 30 8:00 AM - 9:30 AM Differences In Player Metrics Between Lacrosse Games And Practices
Kinta Dillon Schott, Ryan T. Conners, Paul N. Whitehead.
University of Alabama Huntsville, Huntsville, AL. (Sponsor: Don Morgan, FACSM)
(No relevant relationships reported)

Lacrosse participation in the United States has rapidly increased in recent years, however there is minimal research related to the sport. Existing research has mainly utilized laboratory-based testing procedures. There is a need to understand the physiological demands of players during live play to assist coaches with the training and conditioning necessary for improved player performance. PURPOSE: To compare player metrics of high school male lacrosse players during games and practices. METHODS: A team heart rate monitoring system with an internal global positioning system and gyroscope was used to record internal player metrics (heart rate [HR], calories) and external player metrics (duration, distance, speed, sprints). Participants in the study consisted of 13 male high school club lacrosse players (16.2 ± 1.5 yr; 175.3 ± 7.7 cm; 69.9 ± 13.6 kg). Subjects were monitored during two practices (130.9 ± 5.2 minutes) and one game (39.58 min). Differences in player metrics were compared by session, as well as by position: attack, midfield, defense, and face-off-get-off (FOGO). Game and practice data were compared utilizing paired samples t-tests, while individual position metrics were analyzed by independent sample t-tests. A standard p ≤ 0.05 was used to determine significance for the analyses. Effect sizes (r) were also calculated for each comparison. RESULTS: Significant differences and large effect sizes were found for both session and calendar expenditure (r ≥ 4.2, p ≤ 0.03, r ≥ 0.59). Significant differences and large effect sizes were also found for duration, total distance covered, and number of sprints between game and practice sessions (r ≥ 2.32, p ≤ 0.049, r ≥ 0.253). Positional comparisons identified significant differences and large effect sizes between midfield and FOGO positions for maximum HR (r = 2.41, p = 0.028, r = 0.52) and number of sprints (r = 3.242, p = 0.005, r = 0.745).

CONCLUSION: The results of the study suggest that both internal and external metric requirements differ between high school lacrosse practice and game sessions, as well as across varying positions. This data could be used to alter practice sessions to better mimic the higher intensities of games and provide coaches the ability to train athletes at game-like and position-specific intensities.
explained 58% of the variance (p < .001). The same metrics explained 55% of the variance for the first half (p < .001). For the second half, the same metrics with the addition of distance rate explained 57% of the variance (p < .001). Interestingly, the distance rate measure was only significant in the second half, although total distance contributed the most to the component, as it did in the first half and whole game data. The paired samples t-test showed differences between first and second halves for HHD (p < .001), accelerations (p < .001), decelerations (p < .001). In all cases, there was greater distance and more intense efforts in the first half than the second.

CONCLUSIONS: These results show that a combination of internal and external load measures should be used to determine load during games. The loaded metrics should be compared to a complimentary analysis for drills to ensure that training load metrics are similar. These data also support the concept of reduced high-intensity performance in the second half. This information should be used to bolster appropriate training methods to improve second half fitness.

3778 Board #95 May 30 8:00 AM - 9:30 AM
Cut-Off Values In The Prediction Of Success In Olympic Distance Triathlon
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Email: andrebonadias@gmail.com
(No relevant relationships reported)

PURPOSE: To determine cut-off values to reach a Top-3 position in an Olympic distance triathlon by investigating which discipline has the most influence in overall race performance, and whether or not this has changed over the decades.

METHODS: Data from 1989 to 2018 of 33,099 men and 18,928 women (n=52,027) who competed in the Triathlon World Cup, World Triathlon Series, and Olympics race events were included. In addition to exploratory data analyses, linear regressions were applied for performance trends in overall and top-3 of each race. A-t-test for independent samples was applied for sex comparison. Multivariate analysis was performed to assess which discipline may have the greater influence. The cut-off value to achieve a top-3 position was calculated.

RESULTS: The cut-off values for Men were: swimming=19.5min; cycling=60.7min; running=38.1min. Based on this analysis, it was shown that running is the discipline with the most influence for women. Cycling is the discipline with least influence on overall race time for men, while swimming is the discipline with most influence for women. Cycling is the discipline with least influence on overall race performance for both men and women.

CONCLUSIONS: In conclusion, the established cut-off values were set in order to increase the chances of achieving a successful rank in an Olympic distance triathlon. In summary, swimming split seems to be the better predictor of overall race performance in women, while running time is a better predictor for men. Our analyses showed that this influence pattern has not changed in the last three decades.

Figure 1. Performance trend of overall race time in Olympic distance triathlon from 1989 to 2018 in men and women.

3779 Board #96 May 30 8:00 AM - 9:30 AM
Abstract Withdrawn

3780 Board #97 May 30 8:00 AM - 9:30 AM
Differences In Mechanics Between First And Second Drop Vertical Jump Landings
Kirsten R. Buchanan1, Devin Finnegan1, Brooke Flaherty1, Jordan Lamb1, Elisabeth Michael2, Bryan Raksnis3, Irene Davis, FACSM1.
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(No relevant relationships reported)

PURPOSE: A drop jump and landing, followed by another maximal jump and landing, has been used when assessing injury risk using the Landing Error Scoring System (LESS). The LESS provides a way to measure frontal and sagittal plane alignment during landing and has traditionally used the first, but not the second, landing for assessment. Additionally, vertical ground reaction force (vGRF) and knee excursion are commonly analyzed during a drop vertical jump. The purpose of this study was to investigate whether there was a difference in LESS scores, vGRF, and knee excursion between the first and second landings of the drop vertical jump.

METHODS: Forty healthy subjects performed a drop vertical jump from a 30 cm box with an initial landing (L1) immediately followed by a second maximal jump and landing (L2). Three trials were scored using the LESS. Subjects were dichotomized as “high risk” on the LESS if they had a score greater than 5 (including moderate and poor scores) and “low risk” (including good and excellent scores) if they scored 5 or under. Jump height, peak vGRF, and knee excursion were recorded using an in-ground force plate and a 3-D motion analysis system. To further analyze the data, subjects were separated into “high” and “low” jumpers by dichotomizing the average jump height. Statistical analysis was performed with SPSS (version 25.0) to identify whether there were significant differences in LESS scores, peak vGRF, and knee excursion between landings for all subjects and “high” and “low” jumpers.
RESULTS:

<table>
<thead>
<tr>
<th>All Subjects</th>
<th>Low Jumpers</th>
<th>High Jumpers</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>L2</td>
<td>p-value</td>
</tr>
<tr>
<td>4.46</td>
<td>6.25</td>
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</tr>
<tr>
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<td>3.94</td>
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<tr>
<td>5.03</td>
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<td>0.001</td>
</tr>
<tr>
<td>4.88</td>
<td>0.071</td>
<td>19</td>
</tr>
</tbody>
</table>

CONCLUSIONS: The significant increase in LESS scores and peak vGRF between trials suggests that the second landing may be more indicative of injury risk when using the LESS. Low height jumpers had greater injury risk due to significantly higher LESS scores and minimal changes in knee excursion from landing one to landing two.

3781 Board #98 May 30 8:00 AM - 9:30 AM "Critical Oxygenation Model": A Novel Approach To A Classical Fatigue Threshold

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PURPOSE: The critical power (CP) model identifies a performance-based fatigue threshold which can be effectively used to predict time to task failure (TTF). The model’s hyperbolic form identifies a clear asymptote (CP) which determines an unsustainable metabolic process. The CP model’s hyperbolic form identifies a clear asymptote (CP) which determines an unsustainable metabolic process.

METHODS: Eighteen participants (age: 21 ± 1 years; height: 1.78 ± 0.08 m; weight: 68 ± 10 kg) performed three trials of single-leg knee extensions, at 5%, 10%, and 20% 1-RM, to exhaustion in order to evaluate individual power-duration curves. In order to eliminate systematic errors, all knee extensions were performed in occluded conditions (pressure suit).

RESULTS: The CP model predicted that W’ is constant across tasks to failure. The same physiological surrogate for CP and W’, through a time-SmO2 integral (O’), can be identified and used as a potential physiological measure.

CONCLUSIONS: The CP model predicts that W’ is constant across tasks to failure. The same physiological surrogate for CP and W’, through a time-SmO2 integral (O’), can be identified and used as a potential physiological measure.

3782 Board #99 May 30 8:00 AM - 9:30 AM Effects Of Different Intensity And Duration Of Warm-up On Hemodynamics, Jump Power, And Flexibility.

Imtiaz Masfique Dowllah, Ezra Meza, Amanda Hankins, Orlando Cepeda, Klarissa Ybarra, Brenda Palma, Brianna Lopez, Manuel Nunez, Alexandra Hinojosa, Uliku Karabulut, Murat Karabulut, FACSM. University of Texas Rio Grande Valley, Brownsville, TX.
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PURPOSE: Tabata protocol (TP), usually consisting of eight to nine bouts of 20-sec of maximal exercise with 10-sec rest, is time-efficient intervention with both aerobic and anaerobic benefits. This study investigated the effectiveness of different variations of TP as a warm-up procedure.

METHODS: Twenty-five healthy subjects (13 females and 12 males) participated in this study. Participants performed 6 randomized exercise sessions separated by at least 48 hours. The exercise sessions involved 3-min (TP3-20:10), 5-min (TP5-20:10), 8-min (TP8-20:10), and 10-min (TP10-20:10) consecutive bodyweight squats of either 20-sec workout with 10-sec rest (20:10) or 30-sec workout with 10-sec rest (30:10). Heart rate (HR), blood pressure (BP), thigh skin surface temperature (TT), vertical jump performance (VJ), and flexibility (F) were measured before and after execution of the protocols. Countermovement jump was used to measure VJ and stand-and-reach test was used for measuring F.

RESULTS: Two-way ANOVA demonstrated significant condition*time interaction (p<0.01) and time main effect (p<0.01) for F. Significant condition*time interaction (p<0.01) and condition (p<0.01) and time main effects (p<0.01) were observed for HR.

CONCLUSIONS: There were significant main effects for time with the post-test demonstrating higher values than the pre-test for both SBP and DBP (p<0.01). Significant time main effect (p<0.01) was also noted for TT indicating reduction in TT following exercise bouts.

3783 Board #100 May 30 8:00 AM - 9:30 AM Is Better Freestyle Swimming Technique Associated With Better Performance?

Travis R. Pollen1, David Ebaugh2, Jason H. Mohring1, Sheri P. Sillies1. Drexel University, Philadelphia, PA. 1University of Delaware, Newark, DE. 1University of South Carolina, Columbia, SC. (Sponsor: Clare Milner, FACSM)
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Swimming technique is widely believed to influence performance, but few studies have quantified this relationship using an objective, pool-side technique assessment. Methods: Freestyle swimming was assessed for technique errors during normal practice near the beginning of the season in 27 Division III college swimmers (16 females, 19.1 ± 1 years, 1.75 ± 0.11 m, 71.0 ± 10.4 kg). Seven freestyle swimming techniques were considered errors: (1) hand crossing the midline of the body at entry, (2) straight-arm recovery, (3) hand entering with the thumb first, (4) inadequate or excessive shoulder roll, (5) hand crossing the midline of the body during the underwater pull-through, (6) elbow dropping during the pull-through, and (7) excessive neck flexion/extension. Six of the errors were assessed bilaterally, resulting in a maximum possible score of 13 errors. Swimming performance was determined by each participant’s best freestyle event from the end-of-season meet as a percentage of the conference record. The correlation between errors and performance was assessed with Pearson’s r. One participant was removed due to a late-season injury that affected their ability to train and compete.

RESULTS: Participants averaged 2.7±1.7 errors (range: 0-5). Their performance averaged 2.7±1.7 errors (range: 0-5). Their performance averaged 91.5±5.4% (range: 85-95%). There was a significant negative correlation of moderate strength between number of errors and performance: r = -0.59, p = 0.01, R2 = 0.35 (Figuere). Fewer errors corresponded with better performance.

CONCLUSION: The fewer freestyle technique errors a swimmer made, the faster their best freestyle race time was as a percentage of the conference record. Technique explained 35% of the variance in performance. This study is one of the first to demonstrate this relationship using objective, pool-side assessment criteria.
Purposes: To determine the acute effects of different whole-body vibration (WBV) frequencies and squat depths on lower extremity isometric and isokinetic muscle function and vertical jump performance.

Methods: Thirteen healthy male (age = 23.8 ± 5.3 years) and fifteen healthy female subjects (age = 22.45 ± 3.04 years) performed six randomized sessions of vibration protocols (VPs) in different squat positions with 90° (low-squat) and 140° (high-squat) knee flexion angle at 30 Hz (30Hz90°; 30Hz140°), 40 Hz (40Hz90°; 40Hz140°) & 50 Hz (50Hz90°; 50Hz140°). Each subject performed 5 sets x 1 min of static squats with 30-sec rest between each set. Then they rested for 5 min and repeated 5 more sets. Once completed, vertical jump performance was measured. Furthermore, subjects were tested for maximum 5-sек right knee extensor isometric contractions at 60° of knee flexion, and isokinetic concentric knee extension and flexion at 180°/sec utilizing standard Biodex protocol. All VPs were performed on the same commercial side to side alternating vibration platform and foot placement for all squats was recorded to ensure consistency.

Results: Two-way repeated measures ANOVA indicated a significant condition main effect in average jump height (p<.01) and average jump time (p<.001), denoting enhanced jump performance following 40Hz140° (p<.05) and 50Hz140° (p<.01) compared to 30Hz90°. A significant condition main effect was found in peak-torque during the isokinetic test, where observed changes were greater for both 30Hz140° and 40Hz140° compared to 30Hz90° (p<.05) and 50Hz90° (p<.01). Lastly, the best performance on peak-torque during the isometric test was significantly higher after 30Hz140° (p<.05) and 40Hz140° (p<.05) compared to 30Hz90°. The findings are suggestive of greater muscular strength and explosive power production following a high-squat WBV warm-up compared to low-squat WBV warm-up, resulting in improved ability to produce muscular force.

Conclusions: The findings suggest that greater muscular strength and explosive power production following high-squat WBV warm-up compared to low-squat WBV warm-up can be attributed to augmented muscle fatigue and/or increased muscle length due to the plasticity of skeletal muscle while performing low-squat WBV warm-up, resulting in impaired ability to produce muscular force.

Cardiovascular exercise is known to exert a variety of positive physiological and psychological benefits on neurocognitive function, glucose and fatty acid metabolism, and muscle recovery. Many of these effects are thought to be mediated by brain derived neurotrophic factor (BDNF), a neurotropin produced both centrally and peripherally. The fate of BDNF during prolonged endurance exercise is unknown and may be implicated to mitigate potential negative consequences to ultra-endurance racing.

Purpose: To investigate the effects of a three-day ultra-endurance triathlon on serum BDNF concentrations pre- and post-race. Methods: Twenty triathletes (age: 40 ± 8.8 yrs) who competed in the 2015 (N=13 men, 3 women) and 2017 (N=3 men, 1 woman) Ultraman Florida triathlon participated in the present study. Blood samples were collected 24-36 hrs pre-race and within 12 hrs post-race. Serum BDNF levels were measured via ELISA. A paired sample t-test was used to evaluate differences between pre- and post-race BDNF concentrations. Values are reported as mean ± SD with significance accepted as p<0.05. Results: BDNF significantly increased from pre to post-race (0.17 ± 0.9 pg/mL vs. 0.23 ± 0.14 pg/mL; +9.6%; p<0.05). Conclusions: For the first time, BDNF is shown to significantly increase after a three-day ultra-endurance race. These findings may indicate that BDNF concentrations are elevated to potentially counteract any negative consequences derived from ultra-endurance exercise. The influence of both duration and intensity of exercise on BDNF concentrations need to be further elucidated due to its array of positive implications on cognitive and physical function and recovery from prolonged endurance exercise. Supported by the International Society of Sports Nutrition and Florida State University.
PURPOSE: Triathlon combines three sports (swimming, cycling, and running) into a single race and, because triathletes must cycle after the swimming, it is important to understand how cycling power may be affected by prior swimming. Therefore, the purpose of this study was to determine the effects of a 2-km swim at a self-selected race pace intensity on the cycling power-duration relationship measured during a 3-min all-out cycling test (3MT). METHODS: Eighteen trained triathletes (12 M, 6 F; 37.1 ± 10.6 years, VO2peak: 54.8 ± 10.1 ml·kg−1·min−1) performed two 3MTIs on separate days with one 3MT immediately following a 2-km swim (swim-bike; SB) and one without prior swimming (bike only; BO). The power-duration relationship was expressed as the total work done and subdivided into the end-test power (EP) and work done above EP. To assess swimming intensity, heart rate (HR) was continuously monitored during the swim and blood lactate was assessed immediately following the 2-km swim.

RESULTS: End-swatch lactate was 4.2 ± 1.8 mM and mean swimming heart rate was 147 ± 18 bpm. The 2-km swim decreased total work done during the 3MT by 6% (BO: 62.8 ± 12.7 kJ; SB: 58.8 ± 13.4 kJ; P < 0.001), though neither EP nor work above EP changed significantly. Triathletes may want to determine race cycling power following swimming because prior swimming affects performance during the 3MT. Future studies should look at how different swim pacing strategies affect the cycling power-duration relationship.

CONCLUSIONS: A cohort of 1094 NCAA Division I BCS college football Linemen. Success was determined by three criteria: level 1 included players who never made the starting line-up in their college careers, level 2 were players that made the starting line-up but never made it to the NFL, and level 3 were player that played at least one full year in the NFL. Data were analyzed using ordinal regression analysis. Results: The statistically significant predictors by position were as follows: for OL, BM (P < 0.01), BP (P < 0.01), PC (P < 0.05) and 40YD (P < 0.01); for DL, BM (P < 0.05), 40YD (P < 0.05) and VJ (P < 0.05).

Conclusions: These results suggest that it may be possible to predict the success of NCAA Division I football linemen in the positions tested, by looking at selected performance parameters. Our data suggests that for OL a large body mass combined with speed, upper body strength and explosive hip extension is important. For DL, a large body mass combined with speed and lower body power are good predictors of success.
PURPOSE: To evaluate the parameters of the power-duration relationship (i.e., critical power; CP; curvature constant, Wʹ) derived from the performance of two 3-min all-out tests (3MT) separated by 60 s passive recovery. We aimed to: 1) to establish the effect of a prior 3MT on CP and Wʹ; 2) to examine whether current models accurately predict inter-bout Wʹ reconstitution; and 3) determine the physiological factors that are related to Wʹ reconstitution.

METHODS: We analysed 19 datasets from 17 participants (age, 22 ± 3 years; body mass 64.6 ± 13.6 kg) who took part in two separate studies, and 10 datasets have previously been published (Black et al. 2018 *Front Physiol*. 9:11).

RESULTS: Including a ramp incremental test and the performance of two 3MT separated by 60 s passive recovery. Paired samples t-tests were used to assess differences in: peak power; end test power (EP, indicative of CP); work performed above bout 1 end test power (W’-EP1); and total work done (W), and total work done (W’), between bouts 1 and 2.

CONCLUSIONS: This study provides evidence that peak power and CP are not significantly correlated with peak power and CP, and between-bout W’ reconstitution was correlated with relative VO2max (r=-0.66, P=0.002) and power output at the gas exchange threshold (r=0.57, P=0.012). CONCLUSIONS: The power-duration relationship (i.e., CP and W’) is adversely impacted by prior all-out exercise, and current models do not adequately describe the subsequent rate of W’ recovery. These results have important implications for the design and use of mathematical models describing the energetics of exercise performance.

CONCLUSION: Twelve weeks of Aikido or yoga exercises improved functional movement. Brazilian Jiu Jitsu did not have a significant impact on functional movement.

PURPOSE: To determine the impact of the body mass and functional movement status on exercise test results (3MT) separated by 60 s passive recovery. We aimed to: 1) to establish the effect of a prior 3MT on CP and W’; 2) to examine whether current models accurately predict inter-bout W’ reconstitution; and 3) determine the physiological factors that are related to W’ reconstitution.

METHODS: We analysed 19 datasets from 17 participants (age, 22 ± 3 years; body mass 64.6 ± 13.6 kg) who took part in two separate studies, and 10 datasets have previously been published (Black et al. 2018 *Front Physiol*. 9:11).

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The standing long jump (SLJ) is intensively used in fitness preparation as a measure of lower limb power. The SLJ has also been shown to be related to maximal sprint speed. The power deployed during a SLJ can be calculated, but it is unknown what the effect of body weight has on the relationship between sprint speed and power. PURPOSE: Explore the relationship between a 20m sprint and the SLJ under 5 loading conditions (0%, 1%, 3%, 10% and 15% of bodyweight). METHODS: Anthropometric measures were gathered for each subject. Subjects (n=13) were taken prior to testing sessions (Age 16.0±0.7 years; Height 1.80±0.10 m; weight, 90.4±20.0 kg). The loads used during different loading conditions were confirmed using a body weight scale (Omnor, Canada). SLJ distances were measured from toes (starting line) to the closest heel using a jump mat (Javy Sports, Singapore). Peak velocity (PV), peak power (PP) and relative power (RP) to body weight were measured using a linear transducer (TENDO SPORTS MACHINES, London, UK) for each loading condition. The protocol consisted of 2 sprints of 20m with 3 minutes of recovery between sprints. The best of 2 completed attempts per loading condition was retained same for the best sprint time. The time at 10m and 20m were measured with photocell timing gates (Brower Timing System, Utah, USA). Linear regressions and 2-tailed Pearson correlations were calculated (SPSS Ver 26). RESULTS: Multiple significant (p<0.05) correlations were observed (r=0.573 to 0.892). Findings show that PV (r=0.640, r=0.619, r=0.646) with a load of 3, 10 and 15% respectively, RP (r=0.635) with a load of 3%, and SLJ distance (r=0.573, r=0.736) with a load of 10 and 15% respectively were significantly correlated with the 10m during sprint time. Also, PV (r=0.577, r=0.892) with a load of 1 and 15% respectively, PP (r=0.656) with a load of 15%, RP (r=0.859) with a load of 15% were significantly correlated with the 20m sprint time. CONCLUSION: Weighed SLJ using 15% of bodyweight is better correlated to 10m or 20m sprint times than a standard SLJ. We propose different formulas to predict peak velocity, 10m and 20m sprint time all based on SLJ distance. Peak velocity(m/s) = (Distance(m) x 2.50) – 0.58 R² = 0.601, p ≤ 0.01, SEE=0.38 10m time(s) = 2.98 – (SLJ15% distance(m) x 0.55) R² = 0.541, p ≤ 0.01, SEE=0.08 20m time(s) = 4.89 – (SLJ15% peak velocity(m/s) x 0.54) R² = 0.796, p ≤ 0.01, SEE=0.10

Body tempering is a form of passive myofascial release used amongst athletes, physical therapists and trainers, and is a hands-on application of pressure to the muscles using a heavy steel roller. There is little to no evidence in the literature showing its effectiveness for performance or injury rehabilitation. PURPOSE: To determine any acute differences between passive myofascial release with a steel roller (PMRS) and a dynamic warm up (DWU) on lower body anaerobic muscular endurance. METHODS: Ten participants, 5 females (23.0 ±1.3 years; 75.5±1.2 kg; 159.8±1.2 cm) and 5 males (24.6 ±2.1 years; 82.5±3.8 kg; 168.0±2.8 cm), were asked to participate in this study. The first session was a familiarization session to test leg press one repetition maximum (214.3±32.7 kg). The following two randomized sessions, separated by at least 72 hours, began with a five-minute cycle ergometer warm-up at 1.0kP for females and 1.5kP for males at 50RPM. Subjects performed a PMR protocol or a lower body DWU prior to beginning a leg press specific warm-up. The PMR protocol involved rolling the quadriceps and hamstrings for approximately two minutes each. The DWU protocol involved ten repetitions of six exercises (inchworms, hop-bridges, side-lying hip abduction, mountain climbers, lateral lunges, and squat jumps). Subjects then performed a set of ten repetitions at 25% and 50% and six repetitions at 75%. After a three-minute rest period, subjects performed repetitions to failure at 85%. One-way Analysis of Variance (ANOVA) was used to determine significant differences in repetitions. RESULTS: Repetitions were significantly different (p<0.002) different between protocols. Subjects performed more repetitions following the PMR (25.4 ±7.0 repetitions) condition than the DWU condition (16.8 ±4.5 repetitions). CONCLUSIONS: The current pilot data demonstrates that PMR may be an effective warm up modality in combination with a specific warm up to assist in lower body anaerobic endurance. Precaution must be taken with the current data, as some subjects had as many 40 repetitions at 85%, which is not congruent with that percent 1RM. The current DWU protocol seems to have possibly decreased performance due to fatigue. Further studies should use a multi-set approach with a resistance trained population approach to better determine its efficacy.

Passive myofascial release using a steel roller (PMRS), popularized as body tempering, is an emerging modality for performance enhancement and injury rehabilitation. Currently no evidence exists showing its effectiveness for performance or injury rehabilitation. PURPOSE: To determine the acute differences between a dynamic stretching protocol (DS), PMRS, and a combination of PMRS and DS on lower body explosive power. METHODS: Fourteen recreationally active subjects (height = 163.5±2.5 cm, weight = 68.3±3.9 kg) were recruited from the University of Texas Rio Grande Valley. Once informed consent was obtained, subjects were familiarized with the testing protocol. Subjects were asked to refrain from participating in exercise for 48 hours before each testing session. Three randomized sessions consisted of a five-minute light treadmill warm up, followed by one of three different modalities; DS only, PMRS only, or a combination of PMRS and DS (COMB). DS protocol consisted of five exercises (forward leg swings, twisting reverse lunges, lateral lunges, bent knee leg swings, and plantar flexion/extension). PMRS protocol consisted of rolling the hamstrings and quadriceps for 2.5 minutes each. Following the protocol, lower body explosive power was tested using a countermovement vertical jump and standing long jump. The best of three trials was recorded.

RESULTS: Repeated measures ANOVA found significant condition main effects for the (p=0.01) countermovement jump and (p=0.001) standing jump. Post-hoc pairwise comparisons, using Bonferroni adjustment for multiple comparisons, found COMB (45.9±3.2 cm) to have a significantly (p<0.05) greater vertical jump height than DS (42.1±3.0 cm) alone. PMRS (179.9±11.1 cm) and COMB (177.9±9.9 cm) had significantly (p<0.005) longer standing long jumps than DS (166.1±10.3 cm) alone.

CONCLUSIONS: The current data demonstrated that passive myofascial release with a steel roller or in combination with a dynamic stretching routine may increase lower body explosive power when compared to a dynamic stretching routine alone. Further research should use an athletic population to determine its efficacy in highly trained individuals.
treadmill speed (perceived effort of 12-13 on the Borg 6-20 RPE) for each condition was determined during a familiarization trial. Pre-run nutrition was standardized with use of a yogurt-based drink prepared based on each individual’s body mass and activity level (approximately one-quarter of their total daily calories as 80% carbohydrate, 3% fat, and 17% protein). Drinks were ingested 2 hours prior to the testing. During the maximal runs, speed was maintained at the previously described intensity, and grade was increased twice every 2 minutes until volitional fatigue. Metabolic data were gathered via a metabolic cart using a 15-lead moving average. Paired sample t-tests were used to compare appropriate data with significance accepted at p<0.05. Total fat oxidation during the tests was derived from VO2 and RER. RESULTS: The morning and night runs lasted 10.2±2.3 and 9.9±2.6 minutes, respectively. No statistical difference was found between morning and night runs for relative VO2max (47.9 ± 7.0 vs 47.3 ± 8.0 ml/kg/min, p = .721), total fat oxidation (248.8 ± 17 vs 27.7 ±23.3 kcal, p = .597), or maximal RPE (18.9 ± 1.5 vs 18.8 ± 1.5, p = .794). CONCLUSIONS: Relative VO2max, total fat oxidation, and RPE did not differ between maximal runs performed early morning and late-night. Running maximally at ends of the day may not elicit any differences in these variables among a group of younger, recreationally active adults provided a standard, pre-run meal.

Although Pilates improves flexibility, balance, and posture of symptomatic elderly or sedentary middle-aged adults, there has been little focus on studying the effect of Pilates in young athletes. PURPOSE: This study aimed to examine whether Pilates exercise improve core stability and joint flexibility in college athletes. METHODS: Fifteen healthy college students (control group) and 15 female college athletes (athlete group) participated in this study. Each student engaged in a 30-min Pilates session with a licensed instructor once a week over 12 weeks. The Functional Movement Screen (FMS) was used to evaluate core stability and joint flexibility before and after this intervention. The FMS focuses on seven fundamental movements: shoulder mobility (SM), hurdle step (HS), in-line lunge (ILL), active straight leg raise, trunk end range, and deep squat. A repeated-measures ANOVA was performed to compare the groups (control group vs. athlete group). RESULTS: Although there were no significant between-group differences, the results indicated significant main effect for the Pilates intervention (F=62.5, p < 0.001, ηp=0.82), Pilates intervention × FMS interaction (F=35.6, p < 0.001, ηp=0.72), and FMS (F=2519.6, p < 0.001, ηp=0.99). After 12-week intervention, SM (before: 2.37 ± 0.2 vs. after: 2.73 ± 0.1, p < 0.05), HS (before: 2.30 ± 0.1 vs. after: 2.70 ± 0.1, p < 0.01), ILL (before: 2.10 ± 0.1 vs. after: 2.40 ± 0.1, p < 0.01), RS (before: 2.13 ± 0.1 vs. after: 2.63 ± 0.1, p < 0.001), and total score (before: 16.17 ± 0.4 vs. after: 18.13 ± 0.3, p < 0.001) had significantly improved. CONCLUSION: Pilates exercise is effective for improving FMS scores, strengthening core stability, and flexibility for healthy controls and college athletes. Supported by JSPS KAKENHI Grant Number JP18K10973.

Research has demonstrated the effects of music on exercise performance such as heart rate, cadence, and rate of perceived exertion. Specifically, music tempo is considered a significant factor influencing physiologic changes and is measured in beats per minute (bpm). The preference for music with fast tempos may be due to a stimulus that increases physiological arousal. However, results have differed depending on population, exercise modality, and experimental protocol. PURPOSE: The purpose of this study was to determine the differences in heart rate and pedal frequency on a cycle ergometer with and without music. METHODS: Participants (N=20) were collegiate level students who were recreationally active and met physical activity standards. Each participant completed two 20 minute cycle sessions, one while listening to a predetermined music playlist and the second without any music. The predetermined music playlist included 4 songs at tempos of 77 bpm, 132 bpm, 82 bpm, and 126 bpm. Participants pedaled at a self-selected frequency. Heart rate and pedal frequency were recorded for each minute of exercise. A paired T-Test was used to determine statistical significance between variables (p<0.05). Analysis of Variance was also used to determine statistical significance between heart rate and music tempo (p<0.05) RESULTS: Results from this study show average heart rate with music at 140 ± 15.7 bpm and without music 130 ± 15.7 bpm. Pedal frequency averaged 62.7 ± 10.7 and 57.8 ± 7.5 revolutions with music and without respectively. There was a statistically significant difference between heart rate (p<0.01) and pedal frequency (p<0.01) from music to no music. A statistically significant difference in heart rate was observed between the music tempo groups, F = 24.51, p = 0.001, with a large effect size, η2 = 0.55. Bonferroni post-hoc tests indicated the heart rates for 77 bpm (126 ± 19), 132 bpm (140 ± 16), and 82 bpm (145 ± 7) was significantly higher than each other (p<0.01). CONCLUSION: The results indicate that music increased heart rate and pedal frequency significantly compared to no music. Additionally, there was a significant difference in music tempo on heart rate. The results from this study support the notion that music does increase physiologic changes during exercise.
Purpose: The purpose of the present study was to determine the relative contributions of handgrip and individual finger strength, body size, climbing experience, and training habits for the prediction of climbing performance in a bouldering competition.

Methods: Sixty-seven climbers (males: n = 46; females: n = 21; mean age ± SD = 21.1 ± 4.0 yrs; body mass = 69.5 ± 9.8 kg; height = 173.5 ± 8.3 cm; climbing experience = 2.7 ± 2.6 yrs; climbing frequency = 3.0 ± 1.2 sessions wk⁻¹) volunteered for this study. Data collection occurred immediately before an indoor bouldering competition and involved the assessment of handgrip and individual finger maximal force production using an electronic handheld dynamometer. Individual finger strength was defined as the maximal force generated using a tip-to-tip pinch between each finger and the thumb. All measures of strength were normalized to body mass (kg). Subjects also completed a questionnaire to determine climbing experience and training habits (i.e., climbing frequency). The bouldering competition consisted of 70 routes graded V0 (easiest) - V8 (most difficult) with higher point values awarded for completing more difficult routes. Stepwise multiple regression analyses were used to examine the relative contributions of handgrip and individual finger strengths, body mass, height, climbing experience, and climbing frequency to the prediction of performance scores in the competition.

Results: The results indicated there were significant [F(3, 63)=12.499, p < 0.001] predictors of climbing performance in our model. Specifically, ring finger pinch strength, climbing experience, and climbing frequency significantly (p < 0.05) contributed to the model (R² = 0.373), whereas body mass, height, full handgrip strength as well as index, middle, and little finger pinch strengths did not. The β-weights showed that ring finger pinch strength (β = 0.430) was the most significant contributor followed by climbing experience (β = 0.331) and climbing frequency (β = 0.244).

Conclusions: These findings illustrated the importance of ring finger pinch strength on climbing performance in a bouldering competition. Our results also suggested that increasing climbing experience and frequency of training may contribute to greater ring finger pinch strength and overall climbing performance.

Purpose: To compare the rates of success in coach-versus self-supervised performance at the USA Powerlifting Collegiate National Championships from 2016-2019. Methods: Using a repeated measures ANOVA design with specific post-hoc analysis, 88 members of the powerlifting team at a United States Service Academy had individual performances tracked during the annual USA Powerlifting Collegiate National Championships from 2016-2019. Performance metrics included: number of successful and non-successful attempts, total weight lifted, and Wilks total (a relative strength metric used in powerlifting). Results: A total of 88 competitions were tracked over the duration of this investigation. Successful attempts (79.9±1.2 vs. 54.1±1.2), total weight lifted (530.2±146.9 kg vs. 416.8±235.0 kg), and Wilks total (408.9±86.0 vs. 352.3±186.7) were significantly greater in the coach-supervised versus self-supervised population. Lifters following a coach-supervised versus self-supervised competition plan performed significantly better across all performance metrics (p < 0.001). Conclusion: The coach plays a significant role in determining performance outcomes during powerlifting competition. An abundance of research exists on the importance of a coach in developing long-term, periodized strength training for improving strength outcomes, but minimal research exists on the role of the coach in predicting success in individual competitions. These findings support the notion that supervisory mentorship is integral to the success of athletes during both training and competition.
**3806** Board #123  May 30 8:00 AM - 9:30 AM  
*The Impact Of Sleep Deprivation On Agility Performance And Pattern Recall*  
Carolyn Albright, Laura Lupin. Chestnut Hill College, Philadelphia, PA.  
Email: albrightc@chc.edu  
(No relevant relationships reported)  

**PURPOSE:** With sleep having the potential to affect both memory and physical performance associated with learning and performing sport related tasks, this study sought to determine the effects of sleep deprivation and college athletes on their ability to remember and perform agility drills similar to that which would be performed in practice or game. **METHODS:** Ten physically active college athletes (21-26 years) participated in the study (5 males and 5 females). Participants were tested under two conditions, 2-4 hours and 7-9 hours of overnight sleep. The night before each test day, participants were instructed in detail about a four-part agility pattern they had to recall and perform the following morning. The agility drill included: forward sprinting, back pedaling, in and out box stepping drills, Icky Shuffle, and a vertical jump. For each test day participants performed a warm-up and then the agility drill three times. They rated their perceived exertion (RPE) for each trial, and the best time for each drill was used for results. **RESULTS:** Completion speed was not significantly different after 2-4 hours sleep (26.9 ± 2.9 sec) compared to 7-9 hours sleep (26.1 ± 2.6 sec). RPE was also not significantly different for 2-4 hours sleep (8.4 ± 2.2) compared to 7-9 hours sleep (7.9 ± 1.3). There was also no gender difference for speed or RPE. However, participants who were instructed to undergo 2-4 hours of sleep for their first test took significantly longer to perform the drill for the first test day compared to those who received 7-9 hours of sleep for their first test day, taking on average 2.2 ± 1.7 sec longer. **CONCLUSION:** Although no difference was seen overall in agility performance times when comparing prior sleep, there was a difference in performance times when comparing the ordering of learning a new task. Learning a new agility pattern when sleep deprived first resulted in slower agility times than when seeing the new pattern for the first time with a full night sleep. Physically active college students are at risk of decreased performance times for drills as they are seeing for the first time on minimum sleep. Coaches often stress getting good sleep prior to competition but may be important for adequate sleep prior to practice sessions where new play routes are being taught.

**3807** Board #124  May 30 8:00 AM - 9:30 AM  
*The Acute Effects Of External Pneumatic Compression On Anaerobic Performance And Blood Lactate Concentration*  
Email: dbdat55@hotmail.com  
(No relevant relationships reported)  
The use of External Pneumatic Compression (EPC) among athletes as a recovery modality is rising. However the evidence supporting efficacy of EPC on recovery and performance is limited and thus warrants for further investigation. **PURPOSE:** To determine the acute effects of EPC on anaerobic performance and blood lactate (BLa) concentration following a fatigue protocol. **METHODS:** In a randomized, counterbalanced cross-over study design, 10 healthy university male athletes, aged (25.2 ± 1.1 yrs), were recruited to complete 3 experimental sessions with two 30-seconds trials of maximum effort Wingate Anaerobic Test (WAnT)(T1 & T2) on a cycle ergometer with a constant load of .075 kg per kilogram of body mass, separated by a 20-min recovery period where either passive recovery (PR), active recovery (AR) or EPC treatment were administered. BLa levels, heart rate and ratings of perceived exertion were recorded. Power output in Watts (PO), fatigue index (Fi) and total work in Joules(W) were examined. **RESULTS:** Mean power output (MP) in Watts following AR (T1: 634.90 ± 81.18, T2: 638.06 ± 99.98) was .022 and EPC (T1: 642.55 ± 78.38, T2: 637.85 ± 95.62) was .020 significantly higher than PR (T1: 623.21 ± 91.08, T2: 620.38 ± 103.03). However, MP between AR and EPC treatment were not significant. PO (PR T1: 954.90 ± 206.78, T2: 890 ± 2.83) was .567. Similarly, TW were significantly higher following AR (T1: 19.09 ± 2.54, T2: 19.02 ± 2.97) (p=.028) and EPC treatment (T1: 19.4 ± 2.33, T2: 19.04 ± 2.83) (p=.013) than PR (T1: 18.58 ± 2.73, T2: 18.47 ± 3.03) but mean differences were minimal between AR and EPC treatment. PO (PR T1: 954.90 ± 206.78, T2: 890 ± 2.83), TW, AR (T1: 100.01 ± 187.16, T2: 928.50 ± 172.46, EPC: T1: 970 ± 135.71, EPC: T1: 943.00 ± 152.58) (p=.481) and Fi (PR T1: 62.23 ± 17.05, T2: 57.40 ± 15.98, EPC: T1: 64.80 ± 17.41, T2: 59.42 ± 17.78, EPC: T1: 63.40 ± 18.03, EPC: T2: 56.86 ± 15.15 (p=.780) were not significant. BLa concentration decreased significantly from peak BLa at 5 minutes post-WAnT to 20 minutes post-WAnT in all trials (PR: p=.000, AR: p=.000, EPC: p=.000). However the mean difference in BLa (mmol/l) levels at 20 minutes post-WAnT and 5 minutes post-WAnT were 2.6 in PR, 4.0 in AR and 2.7 in ECP. **CONCLUSIONS:** Results indicated performance was better maintained with the use of EPC and AR. Therefore, the use of EPC may be a feasible alternative method when static recovery is desired.

**3808** Board #125  May 30 8:00 AM - 9:30 AM  
*Analysis Of The Water Polo Shots In Positions 1 And 2 In The Simple Temporal Numeric Inequality With Possession During The 15th Fina World Championship In Barcelona 2013*  
Yurema Sabio Lago, Myriam Guerra-Balic, Josep Solà, Josep Cabedo-Santomà. *Tecnocampus, University Pompeu Fabra, Barcelona, Spain.  
(No relevant relationships reported)  

The Fina World Championship is a major aquatic sport event that gathered teams from all over the world. Professional athletes from different nationalities, levels of technical expertise, and playing styles are represented in this championship. Firstly, we sought to determine the effects of sleep deprivation and college athletes on their ability to remember and perform agility drills similar to that which would be performed in practice or game. METHODS: Ten physically active college athletes (21-26 years) participated in the study (5 males and 5 females). Participants were tested under two conditions, 2-4 hours and 7-9 hours of overnight sleep. The night before each test day, participants were instructed in detail about a four-part agility pattern they had to recall and perform the following morning. The agility drill included: forward sprinting, back pedaling, in and out box stepping drills, Icky Shuffle, and a vertical jump. For each test day participants performed a warm-up and then the agility drill three times. They rated their perceived exertion (RPE) for each trial, and the best time for each drill was used for results. RESULTS: Completion speed was not significantly different after 2-4 hours sleep (26.9 ± 2.9 sec) compared to 7-9 hours sleep (26.1 ± 2.6 sec). RPE was also not significantly different for 2-4 hours sleep (8.4 ± 2.2) compared to 7-9 hours sleep (7.9 ± 1.3). There was also no gender difference for speed or RPE. However, participants who were instructed to undergo 2-4 hours of sleep for their first test took significantly longer to perform the drill for the first test day compared to those who received 7-9 hours of sleep for their first test day, taking on average 2.2 ± 1.7 sec longer. CONCLUSION: Although no difference was seen overall in agility performance times when comparing prior sleep, there was a difference in performance times when comparing the ordering of learning a new task. Learning a new agility pattern when sleep deprived first resulted in slower agility times than when seeing the new pattern for the first time with a full night sleep. Physically active college students are at risk of decreased performance times for drills as they are seeing for the first time on minimum sleep. Coaches often stress getting good sleep prior to competition but may be important for adequate sleep prior to practice sessions where new play routes are being taught.

**3809** Board #126  May 30 8:00 AM - 9:30 AM  
*Physiologic Evaluation Of A Collegiate Mascot During Football Games And Related Activities*  
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(No relevant relationships reported)  

**PURPOSE:** Our purpose was to collect collegiate mascot pilot data to determine physiologic HR responses during two football games and pregame-related activities. **METHODS:** A physiological tracking system was used to evaluate HR and movement from individuals (N=7 [1 female]; avg ht=1.82m, wt=75.6kg) who performed mascot activities “in suit” (weighing ~14kg) before and during two NCAA Division 1 University football games. Both games were played at night under moderate ambient conditions (temp=22-14 °C, rh=64%, wind speed=4 mph). Prior to the study, individuals’ HRmax values were determined during graded treadmill tests performed to volitional exhaustion. Variables analyzed during the games were time in suit, time in pre-established HR zones [including HRzone1 (50-59%HRmax), HRzone2 (60-69%HRmax), HRzone3 (70-79%HRmax), HRzone4 (80-90%HRmax), and HRzone5 (>90%HRmax)], and distance covered per minute. Differences in time per HRzone were evaluated using 95% confidence intervals. Differences in average HR between pre-game and game conditions were evaluated via a t-test. **RESULTS:** Sessions in suit lasted 43.5±10.5 min, and distance traveled was 47±22 m/min. HR averaged 82±8% of HRmax, with over half the time spent in HRzone4 (34±20%; p<0.05) and HRzone5 (23±27%), with only 2±2% spent in HRzone1. HR values were significantly lower during pregame (74±6%HRmax) compared to game (85±6%HRmax) activities (p<0.001). **CONCLUSIONS:** The mascot suit environment posed significant physiologic strain on the wearer, despite relatively little activity or movement performed per session.
Physical performance in field hockey (here on referred to as hockey) is determined by many different factors. Recently, the development of small wearable inertial measurement units (IMUs) has provided new possibilities to profile the physical demands in different team sports, especially in the high intensity events (HIEs) aspect of competition and training.

PURPOSE: The aim of this study was to profile the position-specific HIEs in elite female hockey matches with the use of IMUs.

METHODS: Sixteen matches analyzing 22 elite Chinese female hockey players (height: 168±5.4 cm, body mass: 62.4±5.3 kg) were recorded by using IMUs (OptimEye S5, Catapult Sports, Australia) during the 2016-2017 Chinese national competition season. Players were categorized in three different playing positions: strikers, midfielders and defenders. Mean speed (MS), PlayerLoad™ (PL), accelerations (Acc), decelerations (Dec), changes of direction (CoD) and the sum of events.

RESULTS: The mean on-field time for individual players was 48.8±15.8 min and the mean PL and MS when combining all playing positions were 9.4±1.3 PL/min and 108.6±12.3 m/min respectively. The mean HIEs, Acc, Dec and CoD combined for all players were 1.1±0.3 HIEs/min, 0.2±0.1 Acc/min, 0.2±0.1 Dec/min and 0.7±0.2 CoD/min respectively. Defenders showed significantly lower PL and MS (8.7±1.2 PL/min, 100.7±11.9 m/min) than strikers (9.7±1.4 PL/min, 111.9±9.2 m/min) and midfielders (9.8±1.0 PL/min, 119.9±9.2 m/min) (P<0.05).

CONCLUSIONS: The mean PL and MS when combining all playing positions were 9.4±1.3 PL/min and 108.6±12.3 m/min respectively. The mean HIEs, Acc, Dec and CoD combined for all players were 1.1±0.3 HIEs/min, 0.2±0.1 Acc/min, 0.2±0.1 Dec/min and 0.7±0.2 CoD/min respectively. Defenders showed significantly lower PL and MS (8.7±1.2 PL/min, 100.7±11.9 m/min) than strikers (9.7±1.4 PL/min, 111.9±9.2 m/min) and midfielders (9.8±1.0 PL/min, 119.9±9.2 m/min) (P<0.05).
The act of overhead throwing is a series of complex tasks that require synergy between multiple joints and muscle groups, lack of this synergy may lead to a decrease in performance and injury over time. In recent years, Kinesio tape has gained popularity as a means to enhance athletic performance and reduce the risk of injury. The purpose of this study was to investigate the effects of Kinesio tape on throwing velocity, accuracy, and range of motion, and angle of ball release after the application of Kinesio Tape. METHODS: NCAA Division II softball players (n=9) participated in this study. The act of overhead throwing is a series of complex tasks that require synergy between multiple joints and muscle groups. The randomized crossover design, subjects were either allocated to the control group (no Kinesio Tape) or the experimental group (Kinesio Tape), with each subject performing 15 overhead throws at their first testing session and then switched for the second testing session. RESULTS: The analyzed team won 60.6% of games. When performance was performed within 24hr of a game, winning percentage was 33.3% compared to 70.8% in games without prior practice (p=0.001). Holding constant the opponent’s rank (p=0.001) and whether it was a home game (p=0.001), practicing within 24hr of competition reduced the odds of winning by 98.2% (p=0.001; 95% CI of OR: 0.007 to 0.049) and reduced the win-loss margin by 4.7 points (p=0.001; 95% CI: -7.398 to -1.962). During games, players ran 6,735.1 ± 2,268.4 meters and had a HRmax of 98.6 ± 9.3. There was no difference in HRmax during practices that did and did not occur within 24hr of a game (p=0.598). During games, HRmax was elevated 2.4 bpm if practice occurred in the previous 24hr (p=0.001). The averaged confounding variables constant, practicing within 24hr prior predicted trends for each player to score 1.8 fewer points (p=0.067; 95% CI: -3.7 to 0.1) and accomplish 0.9 fewer rebounds (p=0.079; 95% CI: -1.8 to 0.1). CONCLUSION: These data do not support a “more is better” approach to college softball practice schedules. When practice occurs within 24hr of a game, despite increased in-game cardiovascular effort of the athletes, individual and team performances are compromised.

Previous research has reached conflicting conclusions regarding the effects of regulated (R) and self-controlled (SC) feedback during the practice of motor skill acquisition and retention. PURPOSE: Use the aggregate data meta-analytic approach to examine the effects of R and SC feedback on motor skill acquisition and retention in healthy participants of any age. METHODS: Randomized trials of SC and R feedback in motor learning published up to 2019 were included by searching eleven databases, cross-referencing and expert review. Studies were selected and extracted by two authors. Risk of bias was assessed using an adaptation of the TESTEX Scale (maximum points = 10). Random-effects models using the standardized mean difference effect size (ES) were used to pool results. Heterogeneity was examined using the Q statistic and inconsistency using the I² statistic. RESULTS: Twenty-two male collegiate baseball pitchers participated in this study (age: 19.9 years old ± 1.4 years, body mass: 87.1 Kg ± 11.6 Kg, body height: 182.5 cm ± 6.1 cm). All study participants were competitive athletes at the NCAA Division 1, Division 3, or University Varsity Club level. Results: Pitching velocity changes resulted in a mean increase of 0.732 km/h for all groups. Velocity change for each level tested resulted in mean increases of 1.652, 0.402, and 0.370 km/h for the university club, Division 3 and Division 1 levels, respectively. The results of a paired samples t-test analysis showed that there was a statistically significant improvement when using a mouthguard in pitching velocity across all groups combined; t(109) = 2.958, p < 0.004. Further, university club level pitchers experienced a statistically significant improvement; t(29) = 5.972, p = 0.000; while Division 3; t(39) = 0.772, p = 0.445; and Division 1; t(39) = 1.014, p = 0.317; players did not show a statistically significant improvement with the mouthguard. CONCLUSION: The authors found that a mouthguard may improve throwing velocity in male collegiate baseball athletes. These findings could be useful to both coaches and sport performance specialists that are working with pitchers to bring about increases in power output and subsequent increases in pitching velocity, simply by implementing the use of a mouthguard.

Successful pitching in baseball may be due to a number of factors including the mechanics of the motion, the strength, power, flexibility of the athlete, as well as their intent and fatigue levels. The pitching motion is a very powerful, violent, complex and abnormal range of motion of the body. In recent studies, it has been widely evidenced that the ability to produce instantaneous high peak force outputs is related to success in sport. Therefore, the ability to produce higher peak force may be related to the ability to pitching in baseball. Mouthguards have been shown to significantly increase power production in a number of dynamic exercise movements. PURPOSE: The purpose of this study was to determine if maximal and average pitching velocity could be increased when wearing a mouthguard. METHODS: Twenty-two male collegiate baseball pitchers participated in this study (age: 19.9 years old ± 1.4 years, body mass: 87.1 Kg ± 11.6 Kg, body height: 182.5 cm ± 6.1 cm). All study participants were competitive athletes at the NCAA Division 1, Division 3, or University Varsity Club level.

The Effects Of Kinesio Tape On Throwing Velocity And Accuracy In Collegiate Softball Players

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Effect Of Self-controlled And Regulated Feedback On Motor Skill Performance And Learning: A Meta-analytic Study

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Mouthguard Efficacy In Baseball Pitching Velocity

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(No relevant relationships reported)
Vertical displacement is a vital component of success in many power sport activities including volleyball and basketball. The Vertical Jump test (VJ) is a common, easy to use measure of power production applicable to many athletic populations. Treatments or preparations, such as Percussive Massage (PM), and Foam Rolling (FR) have been introduced to warm up routines on the premise that they will enhance power output and performance. **Purpose:** The purpose of this study was to assess vertical jump performance following a warm up of one of three treatments, including no massage (N), FR (FR) and PM. **Methods:** 11 male and 7 female recreationally active college-age students (age: 23.4 ± 3.7 yr., height: 171.6 ± 11.4 cm, body mass: 68.2 ± 15.8 kg.) volunteered to participate in a randomized single-blind crossover design study. Three trials of 3 VJ separated by 2 minutes between jumps were conducted. During the 2 minutes of rest, an intervention (N, FR, or PM) was administered. For both FR and PM, treatment was administered bilaterally for 30 seconds per muscle group (Gluteus Maximus, Hamstrings, Quadriceps, and Gastrocnemius) for a total of 2 minutes. Vertical jump height was recorded after each jump using a standard vertical jump test.

**Results:** Statistical analysis by ANOVA (P<0.05) revealed no significant difference (NSD) between best jumps. The best jumps for N, FR, and PM were 54.11 ± 2.5 cm, 54.96 ± 2.3 cm, and 54.05 ± 2.7 cm, respectively. In addition, subjects were very consistent among the first, second, on third trials across all conditions (NSD). **Conclusion:** The results of this study suggest that neither percussive nor non-percussive massage improve or detract from vertical jump performance and the use of either as a pre vertical jump warm-up may be an individual choice.

Supported, in part by a grant from Theragun®.

**Methods:** Twenty four women with chronic pain at least last 3 month prior to study participated (27.5±5.8 yrs, 230.0±3.8 kg/m²) and were divided into two groups; SNPE group (EG; n=12) and non-exercise group (NG; n=12). Subjects in EG participated in 12 weeks of exercise program consisted of 60 min per session, twice a week, while those in NG did not. Those in EG were tested before and after the program, and those in NG were tested twice in the same time interval. The pain perception was evaluated by Short-Form McGill Pain Questionnaire (MPQ). Movement tests were performed using Functional Movement Screen (FMS). Physical fitness was evaluated by grip and lower back strength, sit-and-reach, and back extension.

**RESULTS:** Pain perception in EG was decreased (pre; 9.5±7.2 vs. post; 3.5±2.8), and group difference was noticed (p<0.05). Hurdle step in EG increased (1.0±0.0 vs. 1.6±0.4, p<0.005). 360° side step in EG (2.7±0.4 vs. 3.0±0.2, p<0.005) was increased. Push up in EG increased (1.0±0.2 vs. 1.6±0.4, p<0.005). Rotation stability both in EG and NG did not show pre and post trial differences, but group differences were noticed (p<0.05). FMS total score both in EG (11.4±1.5 vs. 15.4±1.7, p<0.001) and in NG (12.1±1.7 vs. 13.2±2.0, p<0.05) increased, and group differences were noticed (p<0.05). Strength parameters were not changed. Rotational endurance in EG (19.7±6.4 vs. 22.7±6.0, p<0.01) and back extension in EG (53.4±8.8 vs. 58.5±7.8, p<0.05) increased, and group differences in both were noticed (p<0.05).
CONCLUSIONS: It is demonstrated that SNPE is valuable exercise modality to release pain perception, to improve functional movement, and to enhance flexibility in women experiencing chronic pain.

**RESULTS**

A pre-exercise treatment (RT) counter-movement jump (CMJ) has been proposed as a convenient neuromuscular readiness test to predict specific RT performance and thus guide acute program modification. The present study assessed whether fatigue-related decrements in CMJ were associated with concomitant reductions in barbell squat performance.

**METHODS:** Adult males (n = 12, 25 ± 5 years; 178 ± 5 cm; 89 ± 12 kg) with >1 year RT experience performed 6 sets to failure with 90% of their 1 repetition maximum in the squat, bench press and latissimus dorsi pull-down. Relative changes (∆) from pre- to 24 and 48 h post-RT were calculated for CMJ height (derived from force plate computed take-off velocity) and mean concentric barbell velocity (derived from a linear position transducer) in the barbell squat with loads corresponding to 1.0 (V1.0) and 0.8 m/s (V0.8). Differences in variables across time were assessed with repeated measures analysis of variance (for CMJ) or Friedman’s test (for V1.0 and V0.8). Associations among ∆ variables were quantified with Pearson’s correlations.

**RESULTS:** Squat V1.0 was significantly reduced at 24 (median ± interquartile range, 0.95 ± 0.30 m/s, p = 0.04) and 48 h (0.93 ± 0.31 m/s, p = 0.03) post-RT. Squat V0.8 was also significantly reduced at 24 (0.70 ± 0.09 m/s, p < 0.01) and 48 h (0.75 ± 0.04 m/s, p = 0.03) post-RT. CMJ height was significantly reduced at 24 (mean ± standard deviation, 33.66 ± 5.20 cm, p = 0.02) but not 48 h (34.51 ± 5.12 cm) relative to pre-RT (36.50 ± 5.26 cm). No significant associations (all p < 0.05) were observed between ∆CMJ and ∆V1.0 or ∆V0.8 at 24 (r = -0.06 - 0.29) or 48 h (r = 0.17 - 0.37) post-RT.

**CONCLUSIONS:** Recovery of CMJ performance did not parallel recovery of barbell squat performance. CMJ height should not be used to predict daily barbell squat performance.

**PAPER**

**PAPER**

**Purpose:** The injury burden within Major League Baseball (MLB) is significant in terms of events, days missed and financial cost. The types of injuries experienced by MLB players is diverse and differs by position; likely reflecting different running, throwing and batting-related workload demands. Understanding in-game demands is critical to athlete preparation, monitoring and management as well as return to play following injury however, little is known about the workload demands of position players in Major League Baseball across each of the key activity-domains. This study seeks to describe the physical demands of position players within Major League Baseball to inform physical preparation, monitoring and return to play. Given the uniquely demanding MLB playing schedule (6.3 games per week), demands across a single game, typical 5-day and worst 5-day periods are presented.

**Methods:** Total and high-speed running distance (>75% Vmax), high-speed running count, hard accelerations (>3.0 m/s/s), defensive and baserunning minutes, total and hard throws (>90% Vmax), and bat swings were calculated from the Statcast Data provided by MLB to each club. Data were limited to players with 100 games or more in the 2018 championship season. 129 players met the inclusion criteria including: 18 1B, 17 2B, 20 3B, 21 SS, 12 C, 16 CF, 10 LF, 12 RF, and 3 DH. Levene’s test was used to assess for heteroscedasticity. Between groups (position) differences were assessed using ANOVA (Bonferroni adjustment; criterion Alpha p = 0.05).

**Results:** Significant positional differences were evident across running and throwing but not bat swing metrics. Outfielders did more total (941.9 ± 135.5 yds per game), and high-speed running (87.3 ± 16.9 yds per game) than other positions. First-basemen did more hard accelerations (33.4 ± 8.7 per game). Middle infielders made more throws (3.5 ± 0.6 per game), and shortstops (0.9 ± 0.3 per game) made more hard throws. Bat swings were similar across positions (7.6 ± 1.0 per game).

**Conclusions:** This is the first description of workload demands for position players in Major League Baseball. This information can inform pre-season physiological preparation, in-season monitoring and management and return to play for injured professional baseball players.

**Purpose:** Surf is a sport that presents variations of intensity and duration during its practice. Therefore, strategies that contribute to muscle buffering in periods of high intensity, may be efficient to improve the performance of practitioners of this modality.

**Objective:** To evaluate the efficiency of sodium bicarbonate in the performance of surfing athletes.

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**Objective:** To evaluate the efficiency of sodium bicarbonate in the performance of surfing athletes.
CONCLUSIONS: The administration of sodium bicarbonate positively impacted the performance of the surfer athletes, leading to a maximum paddle time test improvement and an increase of the blood lactate.

INTRODUCTION: Gross efficiency (GE) is a crucial factor in endurance cycling performance. Elite cyclists have superior pedaling technique, maintaining a greater average power output (PO) through the pedaling cycle than non-elite cyclists. Previous studies have demonstrated that pedaling technique can be improved with visual feedback (FB), however, the effect of feedback on GE and PO has not been investigated. PURPOSE: Determine the effect of FB from pedaling technique software on GE and PO during a 20-km time trial completed with feedback (WF) and without feedback (WO). METHODS: Eight recreationally-trained males (39 ± 1 year) were instructed to shoot at a maximum speed of 20 ft/s, consistent cycling or triathlon training completed three 20-km TT. The first TT served to familiarize subjects with the FB software and cycle ergometer. During the other two sessions, subjects completed the time trial in the fastest time possible in both WO and WF conditions in randomized order. For WF, subjects received feedback regarding the smoothness of their pedal stroke cycle and attempted to optimize their pedaling technique real-time. Both GE and PO were calculated at 25, 50, 75, and 100% completion time. Statistical analyses of GE and PO for all stages of both WO and WF were completed using a 2x4 repeated measures ANOVA. RESULTS: GE and PO tended to be greater in all stages of WF when compared to WO (GE: 25%: 20.2 vs. 19.1%, 50%: 19.0 vs. 16.9%, 75%: 19.0 vs. 17.1%, 100%: 19.7 vs. 19.0%); PO: 25%: 195 vs. 194 W, 50%: 203 vs. 171 W, 75%: 203 vs. 195 W, 100%: 221 vs. 213 W). GE and PO were statistically significant (GE = p = 0.084, PO = p = 0.119). The biggest differences in GE and PO between the WF and WO conditions were at 50 and 75% completion. CONCLUSIONS: The monitoring of pedaling technique with FB of pedaling technique during a 20-km TT may lead to an improvement in GE without a reduction in PO during a single session using FB.

RESULTS: See table 1.

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Bicarbonate</th>
<th>Placebo</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lactate</td>
<td>16.43±3.3</td>
<td>14.83±2.7</td>
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<tr>
<td>Maximum time</td>
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<td>10.88±0.6</td>
<td>0.05</td>
</tr>
<tr>
<td>Shots</td>
<td>16.35±5.2</td>
<td>16.35±5.2</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Description, by the Student’s t-test, of mean and standard deviation of lactate values; maximum time; and number of shots in relation of the use of bicarbonate and sodium chloride (placebo). The accepted significance level was p≤0.05.

POSSIBLE DISCUSSION: The current study tested this question through a pre-registered, randomized, and placebo-controlled training intervention, conducted with 4 collegiate baseball players at two Division 1 universities. Athletes were randomized into two groups and received either active dynamic vision training consisting of stereoscopic, anticipatory training and eye tracking or paired drills stylized after control procedures in previous vision therapy studies. Visual-motor and batting performance data were collected and compared between the two cohorts to test the transfer of training effects, while controlling for covariates such as expectations and site. Generalized near-transfer of training was tested with a digital visual-motor task battery, while sports-specific intermediate and far transfer of training were evaluated through tracking metrics collected during structured batting practice and box score performance in NCAA-sanctioned games, respectively. Participants averaged 8.5 hours of training with no significant group differences in adherence, expectations, or baseline assessments.

RESULTS: Analysis of covariance revealed no group differences in measures of generalized visual-motor skills or NCAA game statistics. However, structured batting practice results revealed consistent gains in batting performance, with significant improvements in the Launch Angle (delta = 8°, p < 0.001, Cohen’s d = 0.66) and Hit Distance (delta = 41 ft, p < 0.001, Cohen’s d = 0.61) for the active cohort relative to the control group. This finding was present at each individual study site and in both the complete-case and intent-to-treat analyses.

CONCLUSIONS: These findings indicate that the use of sports vision training programs can result in improved performance beyond the direct skills trained, warranting further study and creating new opportunities for training baseball athletes.
CT and athletic performance. This may be due to the most common chronotyping method, the Morningsness-Eveningness Questionnaire (MEQ), lacking validity for athletic populations.

**PURPOSE:** The purpose of this study was to develop and validate an athletic specific CT index (ACTi). METHODS: 297 athletes completed a CT questionnaire in MEQ (19) and newly-developed questions (15). Principle component analysis (PCA) was used to identify common themes and reduce the final number of questions. 10 respondents from each CT category, as determined by the PCA, were selected for the study. Twelve athletes from each category completed 11 questions that explained DLMO (r=0.81), forming the final ACTi. DLMO CT differences were observed between MEQ morning-type (MT) and intermittent-type (IT) (64±16.1 min, p<0.02) and MT and evening-type (ET) (114±17.2 min, p<0.002). No CT differences were observed in CBT for MEQ or ACTi. Cohen’s RPI revealed moderate CT classification changes between MEQ and ACTi (0.62). CONCLUSION: The ACTi is an 11-point index that enhances CT determination of athletes versus MEQ, based on the criterion measure DLMO. The ACTi may be used in team-sports to examine the impact of CT upon performance, monitoring of training responsiveness and athletic wellbeing.

**3830 Board #147 May 30 8:00 AM - 9:30 AM**

**Effects Of Yoga On A Vibration Platform With Or Without Blood Flow Restriction**

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(No relevant relationships reported)

**PURPOSE:** To investigate acute effects of yoga performed on a vibration platform (VP) with and without blood flow restriction (BFR) on hemodynamics, flexibility, and locomotor muscle oxygenation.

**METHODS:** Total 17 healthy subjects, 8 males (age= 22 ± 4.2 years) and 9 females (age= 24.2 ± 2.9 years), were screened by questionnaires, read and signed informed consent, and participated in the study. Subjects completed 4 separate randomized yoga sessions (on the floor, on the floor with BFR (FL+BFR), on the VP, and on the VP with BFR (VP+BFR)) with at least 48-hr in between. The sessions in VP+BFR consisted of application of specialized cuffs on the upperportum of both thighs restricting blood flow. All sessions started with the measuring of resting heart rate (HR) and blood pressure (BP), followed by a 5-min treadmill warm-up session. Then vertical jump performance (VJ) and flexibility were assessed. The yoga sessions consisted of a series of 8 different yoga poses (Garland pose, Downward dog, Lunge, Chair pose, Twisted chair, Warrior, Squat and Lord of the dance), each lasting 30-sec with 1-min of rest in between poses. Each pose, breathing was monitored by using a metronome to prevent subjects from holding their breath during exercise. VJ and flexibility were again tested immediately post-exercise. HR and BP were also measured immediately after and every 5-min for 25-min following completion of the yoga session.

**RESULTS:** Two-way ANOVA showed significant condition main effect (p<0.05) for flexibility, indicating enhanced flexibility following VP compared to floor (p<0.05) and VP+BFR (p<0.05). Significant time main effects were detected for flexibility (p<0.01), SBP (p<0.01) and DBP (p<0.01) indicating higher post-exercise values. CONCLUSIONS: Enhanced flexibility in response to yoga on VP can be attributed to a vibration-induced activation of Golgi tendon organ causing the related muscle to relax and desensitization of stretch reflex due to activation of muscle spindle fibers by the rapid changes in muscle length. However, no significant improvements in flexibility following the VP+BFR session could be due the placement of BFR cuffs on the upperportum of thighs, interfering with vibration-induced muscle length alteration and excitation of Golgi tendon organs.

**3831 Board #148 May 30 8:00 AM - 9:30 AM**

**GLOBAL PERFORMANCE INDEX IN TRIATHLON**

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(No relevant relationships reported)

**PURPOSE:** The aim of this study is to evaluate the relative importance of each modality in the result of the IRONMAN® World Championship race at Kona.

**METHODS:** All the analyses were made from 1981 until 2018, considering just the male professional triathletes that appeared, at least, 5 times between the TOP 10 finishers. 24 triathletes were selected. Their racing times were converted into seconds. The analysis was made in a global way and by modalities (swimming, cycling and running). A global performance index (GPI) and a specific performance indexes were created for the triathletes for each modality: swimming performance index (SPI), cycling performance index (CPI) and running performance index (RPI). Afterwards, we calculated the correlation between the stages and made a regression with the overall performance as an independent variable and the relative performance in each stage (SPI, CPI and RPI) as dependent variable. In the regression analysis, we used the “Enter” method to force the entry of all the dependent variables.

**RESULTS:** The final equation to evaluate the Global Performance was: GPI= (0.324 x SPI) + (0.871 x CPI) + (1.07 x RPI). When the correlation between the stages was analyzed, we observed a negative correlation between SPI and RPI (0.403). This finding contradicts most of the studies that put cycling as the crucial stage in a long term triathlon race like IRONMAN®

**CONCLUSIONS:** This results can confirm that in triathlon races, being a good swimmer can be very important, despite the swimming stage be less representative. In general, the running stage is the most important of the race, based in the analysis of the correlation between the 3 modalities. Running is crucial, but this analysis is very complex, because the 3 stages are not independent as far as the effort made in one stage tends to impact the performance on the next one.
Osteoarthritis (OA) is among the most prevalent and debilitating chronic diseases worldwide affecting the general population as well as athletes. Despite that, no therapies have been proven to modify disease progression or to be highly effective for symptomatic relief, other than joint replacement surgery. Accordingly, recent efforts have been aimed to define a classification of OA phenotypes for the purpose of better identifying individuals at higher risk of progression and to better delineate subpopulations attributable to distinct risk factors and disease mechanisms that may be suitable for targeted treatment and prevention strategies. Purpose: To characterize using the Dell’Isola criteria, the frequency of knee OK (KOA) phenotypes (6 in total) in new patients presenting to a single tertiary care institution. Methods: Following IRB approval, patients were phenotyped by the senior author (TMB) at their initial visit. Kellgren-Lawrence (K-L) readings were evaluated by the senior author and verified by a board certified MSK radiologist. Results: We successfully characterized 242 patients (30 - 70 years of age) with the Dell’iosa system. Due to requirements for specific biomarkers for the classification of the bone and cartilage metabolism phenotype, we were only able to classify five phenotypes (chronic pain, inflammatory, metabolic syndrome, mechanical overload, minimal joint disease). The most common phenotype was minimal joint disease (30% or 73 patients) followed by metabolic (6.3% or 15). For both the minimal joint disease and chronic pain phenotypes, there was unequal distribution of Latino to non-Latino subjects (70% vs. 30%). Discussion: OA is a complex disease increasingly recognized to be a disorder of multiple phenotypes. This study begins to phenotype a culturally and ethnically diverse population of patients with KOA in an academic Sports Medicine clinic. Ongoing investigations include validated functional evaluation (KOOS, WOMAC) of our subjects to determine if certain phenotypes are associated with poorer functional outcomes. Reference: Dell’isola A et al. MJBm. Identification of clinical phenotypes in knee osteoarthritis: a systematic review of the literature. 2016: 17(1): 425.

Women’s lacrosse is an ‘incidental contact’ sport meaning that intentional contact with an opponent is not permitted by the game’s rules. Despite this, women’s lacrosse played at the high school and collegiate varsity levels of competition carry a risk of repetitive head impact exposure and sport-related concussion. Head impact exposure at the collegiate club level of women’s lacrosse has not yet been described. Purpose: To characterize the anticipated and observed incidence of head impacts in women’s collegiate club lacrosse. Methods: Experienced women’s collegiate club lacrosse players (n=10) filled out questionnaires reporting how often they sustained head impacts (per game exposure) during the past year. Headband-mounted head impact sensors were worn by athletes (n=11) during eight collegiate club lacrosse games sanctioned by the Western Women’s Lacrosse League. The sensors reported the peak linear acceleration (PLA) and peak rotational acceleration (PRA) associated with each recorded accelerative event. Head impacts were confirmed by two researchers independently reviewing video time-synced with sensors. Video review was also used to determine the mechanisms of confirmed impacts. Results: Athletes had a median 4 (range: 0.25 - 8) years of lacrosse experience and expected to sustain a median 0 (range: 0 - 3) head impacts per game. 75 accelerative events resulted from contact with an opponent’s body and two impacts resulted from contact with the opponent’s stick. Only one head impact incurred a penalty against the opposing player. Conclusions: Athletes anticipate and sustain infrequent head impacts in women’s collegiate club lacrosse relative to lacrosse and contact sports played at the high school and collegiate varsity levels of competition. Those impacts that are sustained are of relatively low magnitude. Head impact sensors are prone to high false positive rates and the use of video recordings to filter sensor data is necessary.
(1) Average % of games missed due to injury (APGM) using 2 sample T test and (2) % of players who sustained at least 1 major injury (%MI) using one-tailed Fisher’s exact test.

**Results:**
APGM was lower in the NFL MS group (11.4±0.7% vs 19.7±2.3%; p<0.01) but not in the MLS MS group (5.1±1.9% vs 5.8±1.0%; p=0.377) [Figure 1].

%MI was also lower in the NFL MS group (5.4±2.8% vs 9.7±1.5%; p<0.01) but not in the MLS MS group (11.7±3.5%; p=0.4528) [Figure 2].

**Conclusion:** Adolescent MS specialization contributes to a reduction in injury predisposition in NFL athletes but not in MLS athletes.

There are approximately three-million four-hundred thousand registered student athletes in middle and high school in Japan. Despite a large number of participants, health and safety policies for student athletes in Japan are at its infancy and there is paucity of data-driven policies to reduce catastrophic and fatal injuries from sports. Despite a large number of participants, health and safety policies for student athletes in Japan are at its infancy and there is paucity of data-driven policies to reduce catastrophic and fatal injuries from sports. Although student athletes in middle and high school in Japan. Despite a large number of participants, health and safety policies for student athletes in Japan are at its infancy and there is paucity of data-driven policies to reduce catastrophic and fatal injuries from sports.

**PURPOSE:** The context in which physical activity is performed may affect self-reported indicators of pain. Using the Melbourne Collaborative Cohort Study, we examined associations between occupation, household, transport, and leisure physical activity with pain interference and muscle pain after activity. M ETHODS: Data submitted to Japan Sport Council (JSC) Injury and Accident Mutual Aid Benefit System between 2005-2016 were retrieved from JSC website for further analysis (n=1,137). Case information on fatal incidents occurred during organized school sports in middle and high school students were extracted for further analysis (n=198).

**RESULTS:** Fatalities were reported in practice (n=120/198, 60.6%), scrimmage (n=16/198, 8.1%), game (n=10/198, 5.1%), training camp (n=16/198, 8.1%), and other (n=36/198, 18.2%). The average incidence rate of sport related fatality was 0.39 death per 100,000 athlete-years (95% CI= 0.31-0.47).

Most fatalities were in male student athletes (n=149/162, 92%), which yielded to 7.5 times greater fatality rate in male than female student athletes (male, 0.60 death per 100,000 athlete-years, 95% CI= 0.46-0.73; female, 0.08 death per 100,000 athlete-years, 95% CI= 0.03-0.13). Baseball (n=25/162, 15.4%), judo (n=24/162, 14.8%), soccer/futsal (n=20/162, 12.3%), and basketball (n=18/162, 11.1%) accounted for 53.7% of fatalities. Sudden cardiac death (n=68/162, 42.0%), head trauma (n=32/162, 19.8%), and heat related injury (n=25/162, 15.4%) were the top three diagnosis of fatality. Only three cases (2%) reported of having trained medical personnel on-site at the time of incident. CONCLUSIONS: Sports-related fatality among Japanese student athletes was highest in male baseball players during practice due to sudden cardiac death. Almost no incidents had trained medical personnel on-site at the time of catastrophic injuries during school organized athletics in Japan.
Form. Pain interference was assessed using SF-12, and muscle pain after activity was assessed using SF-36. Ordered logistic regression was used to estimate odds ratios (OR) and 95% confidence intervals (CI), and restricted cubic splines were used to graphically represent the dose-response association between each physical activity domain and pain outcome. RESULTS: Compared to those in the lowest quartile, participants in the highest quartile for transport activity had less pain interference (workers OR: 0.84, 95% CI: 0.74, 0.95; non-workers OR: 0.80, 95% CI: 0.71, 0.89) and muscle pain after activity (OR: 0.82, 95% CI: 0.69, 0.98; non-workers OR: 0.81, 95% CI: 0.71, 0.93). Similarly, participants in the highest quartile of leisure activity had less pain interference (workers: OR: 0.82; 95% CI: 0.69, 0.98; non-workers: OR: 0.81, 95% CI: 0.71, 0.93). CONCLUSIONS: The transport and leisure domains, physical activity was inversely associated with pain-related outcomes, whereas more household physical activity was positively associated with pain scores within the working sample.

3842 Board #159 May 30 8:00 AM - 9:30 AM Characterizing Impacts In Girls' High School Lacrosse Using Video Analysis Samantha L. Hacher1, Patricia M. Kelshaw1, Andrew E. Lincoln2, Heather K. Vincent, FACSM3, Daniel C. Herman, FACSM3, Shane V. Caswell1. 1George Mason University, Fairfax, VA; 2MedStar Sports Medicine, Baltimore, MD; 3University of Florida, Gainesville, FL. (Sponsor: Heather K. Vincent, FACSM)

Participation in high school girls’ lacrosse is increasing, commensurate with concerns of risks for head impacts. Wearable sensors coupled with video analysis have characterized the incidence of head impacts in girls’ lacrosse. However, due to high sensor measurement error, the true incidence of game-related impacts remains unclear. PURPOSE: Characterize the incidence of impacts in girls’ high school lacrosse using video analysis. METHODS: Forty participants volunteered in 16 games during the 2019 lacrosse season. All games were filmed using a digital camera affixed to a tripod to capture impacts. Descriptive statistics were reported for all video-identified game-related impacts (VIGI), including impact rates (IR) and 95% confidence intervals (CI). RESULTS: There were 208 VIGI, for 297 player-games (IR=.70 impacts/player-game, CI: 0.61, 0.80). Overall, midfielders had the most impacts (n=88, 42.3%) followed by attackers (n=79, 38%) and defenders (n=41, 19.7%). The most common impact mechanisms were player (n=105, 50.5%), stick (n=88, 42.3%), and ground (n=13, 6.3%) contact. Most impacts occurred during offense-defense transitions (n=44, 21.2%) and settled game play (n=39, 18.8%), defending (n=33, 15.9%) and shooting (n=34, 16.3%). Of all impacts, 29 (13.9%) were direct head impacts (IR=.10, CI: 0.06, 0.13). The most common head impact mechanisms were contact with stick (n=24, 82.8%), ground (n=8, 26.6%), and ball (n=1, 3.4%). The most common game play impact characteristics were shooting (n=7, 24.1%), settled game play (n=7, 24.1%), offense-defense transitions (n=4, 13.8%) and defending (n=4, 13.8%). A penalty was called by the referee for 17 (58.6%) head impacts. RESULTS: To determine the association between football exposure, quantified using snap count data, and concussion within the regular season in the National Football League (NFL), and how this varies by playing position. METHODS: Weekly snap count and injury report data were obtained for every player who participated in the 2012 through 2017 NFL regular seasons, using the Football Outsiders database. Exposure was quantified as the cumulative total number of snaps that a player participated in for a given season, and used as the time-dependent variable in a Cox proportional hazard model. Concussion status (concussed vs. not-concussed) served as the event variable. If an individual received multiple concussions within a season, only the first within a season was included in the model. The effect of playing position on time to concussion were independently assessed as a categorical covariate. Hazard ratios (HR) were computed, with special teams positions (kicker, punter, and long snapper) as the reference category. RESULTS: A total 5,289,149 player-snaps were analyzed from 4231 distinct players, representing 12,004 player-seasons. Position was significantly associated with concussion hazard (p<0.001), with defensive backs [HR (95% confidence interval); median (interquartile range) number of snaps to first concussion = 2.8 (1.2, 6.3); 324 (377)], running backs [3.0 (1.5, 6.9); 200 (225)], tight ends [3.5 (1.5, 8.2); 290 (334)], and wide receivers [2.7 (1.2, 6.1); 227 (251)] having significantly greater hazard than outsiders. Across positions, the median number snaps before first concussion was 295 (355). CONCLUSIONS: Survival analysis using snap count to quantify football exposure provides similar results to other epidemiological studies regarding which positions are at greatest risk of concussion. Future research should examine whether using this metric of exposure provides any additional insight into other potential risk factors for concussion or concussion-related outcomes.

3843 Board #160 May 30 8:00 AM - 9:30 AM How Many Snaps Are Too Many? Survival Analysis Of Concussions In The National Football League. James M. Smoliga, FACSM1, Zachary Binney2. 1High Point University, High Point, NC; 2Binney Research, Analytics, and Sports Services, LLC, Atlanta, GA.

Current methods used to estimate concussion risk in American football generally do not account for within-season variation in exposure between individual players. Thus, utilizing individual snap count data to quantify exposure may be beneficial for epidemiologic studies evaluating concussion risk in football.

Impaired quality of life (QoL) has been reported in different clinical populations such as patients suffering from cancer (CA), multiple sclerosis (MS) or cardiovascular diseases. A growing body of evidence indicates that physical activity (PA) affects subjective QoL, while there is a dose-response relationship between the volume of exercise and its health benefits. PURPOSE: The present study assessed and compared PA levels and QoL of different clinical populations and age-matched healthy adults. METHODS: One hundred and thirteen volunteers, i.e., 29 with CA under chemotherapy (age: 56.0 ± 10.4 yrs, BMI: 27.2 ± 5.4 kg/m²), 20 with MS (age: 53.3 ± 14.4 yrs, BMI: 25.9 ± 5.3 kg/m²), 14 with hypertension (HYP) (age: 55.0 ± 11.0 yrs, BMI: 31.0 ± 6.0 kg/m²) and 50 healthy controls (CON) (age: 51.3 ± 6.5 yrs, BMI: 25.3 ± 3.1 kg/m²), participated in the study. Levels of PA and QoL were self-estimated with the International Physical Activity Questionnaire and the SF-36 Health Survey questionnaire or the EORTC-QLQ30, respectively. RESULTS: The weekly energy expenditure was higher (p<0.01) in the CON group (2684.8 ± 2763.6 METs) compared with all other groups (n=4, 21.2%) settled game play (n=7, 24.1%), offense-defense transitions (n=4, 13.8%) and defending (n=4, 13.8%). A penalty was called by the referee for 17 (58.6%) head impacts. Conclusion: The incidence of overall VIGI was considerably greater than previously reported studies using a sensor driven approach to identify and subsequently verify impacts using video. However, the rate of head impacts was lower, but similarly stuck and ground contact remained the most common mechanisms despite their prohibition in the sport. Our findings reinforce the need for rule enforcement of prohibited game play behaviors. Prospective video analysis of head impacts in girls’ lacrosse may assist with characterizing impacts and their incidence, especially as the sport shifts toward the intervention of headgear.

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(NO relevant relationships reported)
Migraine headaches is a common disabling disorder which affect daily activities and academic performance in college students. There is disagreement in published research whether exercise triggers or prevents migraine. PURPOSE: The purpose of this study was to identify the relationships of migraine, regular exercise, sleep and stress in college students. METHODS: An online survey was sent to 9,675 students at a mid-sized university. A total of 675 students responded to the survey, with 557 respondents (5.7%) completing the entire survey [age: 21.01±3.46 y.o., females: 80.9% (n=451); males: 18.1% (n=101); other: 0.9% (n=5)]. Prevalence of migraine headache, self-reported triggers, exercise habits and perception of exercise in relation to migraine, and relationship between sleep (PSQI), stress (PSS) and migraine impact (HIT-6) were present. Supported by Slovenian Research Agency (research core funding no. L5-15245).

RESULTS: Prevalence of self-reported migraine headache in the past six months was 63.5% (n=354) while prevalence of migraine after exercise. Participants who exercised regularly were less likely to get migraines (~21% less likely). Interestingly, those with migraines exercised more than those who did not have migraines (38.4% versus 23.7%). A higher sleep quality was inversely correlated with prevalence of migraine (r=-0.335). Impact of the headache on daily life was also correlated with perceived stress (r=0.239), and inversely correlated with sleep score (r=-0.208). CONCLUSION: Stress and lack of sleep are the most common self-reported migraine triggers in college students. Our study found that currently migraineurs do more regular exercise than those who did not report migraines.

Quality of sleep is an important factor in migraine prevention. Regular exercise has the potential to prevent migraines but further studies need to be done to examine the exercise frequency, duration, intensity to determine long term outcomes.

Exercise, Sleep And Stress
Migraine In College Students: Relationships Of
Nauris Tamulevicius1, Tanju Wadh1, Jung Jung Tien2, Guillermo R. Oviejo3, Claudia Aguado Loi1, Jeanne M. Ortiz1, Zaynah Rodriguez1, Mary P. Martinasek1. 1University of Tampa, Tampa, FL. 2University of Central Florida, Orlando, FL. 3University Ramon Llull, Barcelona, Spain. Email: ntamulevicius@ut.edu (No relevant relationships reported)
Injuries among high school and college football players are recorded on a game-by-game basis; however, the prevalence of hand injuries is often overlooked in lieu of more prominent football trauma. Presently, few football studies have been published comparing specific high school and college hand injuries. PURPOSE: To quantify the incidence, mechanism, and severity of specific game-related high school and college football hand injuries. METHODS: Hand injury cases were divided into two groups by level of play (high school, college), involving 783 FBS university and 1,921 high school games over 9 competitive seasons. Outcomes of interest included total and specific hand injury rates, injury mechanism, and severity. Data were subject to multivariate analyses of variance (MANOVA) and Wilks’ λ criteria using general linear model procedures. Injury incidence rate (IIR) was determined by the formula: (number of injuries/number of team games) x 10. RESULTS: Of the 2,704 total games documented, a total of 270 hand injuries were reported with 167 (62.0%) occurring in college competition, and 103 (38.1%) in high school games. MANOVA’s (Wilks’ λ) indicated no significant main effect by total hand extremity (F2,267 = 0.230; P = 0.505). There was a trend, however, for greater IIRs of Boutonniere deformity (F2,267 = 0.123; P = 0.276), gamekeeper’s thumb (F2,267 = 0.124; P = 0.726), and mallet finger (F2,267 = 0.121; P = 0.505). There was a trend, however, for greater IIRs of Boutonniere deformity (0.95% CI, 0.0-0.2 vs 0.55% CI, 0.4-0.7), gamekeeper’s thumb [0.3 (95% CI, 0.2-0.4) vs 1.1 (95% CI, 0.9-1.4)], and mallet finger [0.05 (95% CI, 0.0-0.1) vs 0.4 (95% CI, 0.3-0.6)] during high school play when compared to collegiate competition, respectively. Blocking (10.3 vs 14.8%) and tackling (8.8 vs 18.9%) were the primary mechanisms of injury in both high school and college, respectively. CONCLUSION: A substantial number of hand injuries were documented between high school and college games, which may ultimately lead to long-term articular compromise. Therefore, further studies are warranted to reduce predisposition of hand trauma at all levels of football competition.

Participation in athletic teams, especially those that involve difficult stunts and acrobatic maneuvers increase the risk for injury. With this emerging sport and the skills needed to participate, it is important to identify those athletes at risk. Yet, it is unknown whether a functional screening or proprioceptive tool can be used to predict injury in this population. PURPOSE: To determine if compensatory movement patterns predispose acrobatics and tumbling athletes to injury, and to determine if a functional movement screening (FMS) and Lower Quarter Y Balance Test (LQ-YBT) could predict potential injury risk in the sport population. METHODS: 22 participants (age 19.2±4.1 years, height 161.97±7.0cm, weight 62.53±8.71kg) from one academic and tumbling team were used in the study. All participants that volunteered for the study were current student-athletes at a NCAA DII institution on a NCATA recognized Acrobatics and Tumbling team. The participants were asked to complete the seven movement patterns and three clearing tests of the FMS along with the LQ-YBT test in three directions (anterior, posterolateral and posteriormedial) for both limbs. A total of three practice trials were used. Screening data was gathered over a two-week period at the beginning of the season. A self-report demographic and injury questionnaire was also used. RESULTS: FMS score was 15.9±1.87, while the LQ-YBT was 98.36±11.63 for the right and 99.24±12.01 for the left. Cox Snell R² was used to determine the percentage of the variables used to fit the model. The best fit was for FMS Cut (R²=0.235) with a non-significant FMS Final OR= 1.983 (95% CI 1.045 to 3.763, p=0.36). All other results were not significant. CONCLUSIONS: An effective fundamental movement screening tool, in conjunction with the injury history, can increase the risk of injury. A score of 14 or less on the FMS paired with a higher number of previous injuries resulted in a 28-fold increase in risk of injury.
Sport-related concussions (SRC) represent approximately 9% of high school athletic injuries. This high incidence has contributed to participation reduction, concussion legislation, and rule modifications. With these changes becoming more frequent, it is unknown if SRC trends are decreasing.

**Methods:** To examine trends in contact sport participation and SRC clinical incidence in high school athletes during the 2015-16 to 2018-19 athletic seasons. METHODS: A total of 724,784 athletes (male = 436,409; female = 288,275) participated in 15 sponsored teams in the state of Michigan during the 2015-16 to 2018-19 athletic seasons. Sport participation and diagnosed SRCs were reported by athletic trainers, coaches, or administrative officials using the Michigan High School Athletic Association Head Injury Reporting System. Clinical incidence was calculated for each sport by dividing the number of SRCs by the number of participants and is expressed per 100 athletes (95% CI). Linear regression was used to examine annual trends in participation and SRC clinical incidence for each sport. Results: Football (144,708), boys’ basketball (85,288), and girls’ volleyball (76,950) had the highest sport participation. A total of 15,300 SRCs were reported yielding an overall clinical incidence of 2.1 (95% CI, 2.0-2.14) SRCs. Football (4.52 [95% CI, 4.41-4.62]), boys’ ice hockey (3.51 [95% CI, 3.20-3.82]), and 8-person football (3.35 [95% CI, 2.85-3.85]) had the highest SRC clinical incidence. Trends in overall sport participation significantly decreased over time (P < .05). Only girls’ basketball (18.4%) and volleyball (11.4%) had a significant participation reduction (P < .001) compared to football (5.4%), while trends in 8-person football (18.2%; P < .003) and boys’ lacrosse (151.2%; P < .03) increased. No significant trends were identified for overall SRC incidence (P > .10). Only girls’ basketball had an increase in SRC incidence (P = .02). CONCLUSIONS: Contact sport participation, especially in football, may be decreasing due to concerns over athlete safety. With SRC incidence not declining, stakeholders should re-evaluate current initiatives to improve a more successful approach to reducing these injuries. Improving contact sport safety may then assist in increasing high-school sport participation.

**Examining Acute Effects Of Concussion On The Child Scat5**

Patricia M. Kelshaw1, Nathan E. Cook2, Grant L. Iverson3, Nelson Cortes3, Shane V. Caswell1. 1George Mason University, Fairfax, VA. 2Harvard Medical School, Boston, MA. Email: pkelshaw@gmu.edu (No relevant relationships reported)

The Child Sport Concussion Assessment Tool 5th Edition (Child SCAT5) is recommended for the clinical assessment of concussion in children. To date, no studies have investigated how children perform on the Child SCAT5 acutely following SRC. PURPOSE: To compare PA engagement and body composition between women with ACLR and healthy controls. METHODS: Ten women with ACLR (less than 5yrs post-ACLR, age=21.4±3.8yrs, BMI=26.1±1.3kg/m²) and 10 healthy women (age=21.9±1.3yrs, BMI=21.8±2.5kg/m²) completed the Tegner Activity Scale to assess current PA level. Body fat percentage (%BF) was estimated using air displacement plethysmography. Objective PA was assessed using hip-worn accelerometers for 10 hours/day for 7 days and Freedson Adult VM3 cut points were used for PA data processing. Groups were compared using Mann-Whitney U tests due to limited sample size. Time (minutes/week) spent in moderate-to-vigorous PA (MVPA) and step count (steps/day) were compared between groups using a one-way ANOVA with total wear time as a covariate. RESULTS: Women with ACLR had significantly higher %BF than controls (ACLR=32.7±6.7%, healthy=22.6±4.9%; p<0.01) and higher fat mass (ACLR=25.4±9.0kg, healthy=13.7±4.1kg; p<0.01). Healthy women participated in significantly more steps per day (ACLR=6650±3227 steps/day, healthy=9361±2626 steps/day; p<0.02) than women with ACLR, but no differences in MVPA time (ACLR=367±226 mins/week, healthy=448±9164 mins/week; p=0.34) were observed. CONCLUSIONS: Women with ACLR engage in similar levels of MVPA compared to controls, but they may exhibit greater %BF and fat mass than women who have not experienced ACLR. Compared to controls, women with ACLR also have lower step counts, which is consistent with previous studies. Lack of PA, high %BF, and overweight status increase the risk of premature mortality and morbidity. Therefore, it is crucial to further assess these characteristics and determine potential interventions that would promote PA and maintenance of healthy body composition in the months following ACLR.

**Regulating Lipid Metabolism In Skeletal Muscle**

Lifang Zheng1, Peijie Chen1, Weihua Xiao2, Zhijian Rao1, Yifan Guo1. 1Shanghai university of sport, shanghai, China. 2Shanghai Normal University, shanghai, China. Email: 15800896302@163.com (No relevant relationships reported)

Abnormal skeletal muscle lipid metabolism is associated with insulin resistance in people with type 2 diabetes. Recent studies have indicated that high-intensity interval training (HIIT) lowers blood glucose and improves insulin resistance in individuals with type 2 diabetes. However, the physical mechanism is largely unknown.

**METHODS:** This study aimed to investigate whether HIIT improves insulin resistance in T2DM mice by regulating lipid metabolism in skeletal muscle. Abnormal skeletal muscle lipid metabolism is associated with insulin resistance in people with type 2 diabetes. Recent studies have indicated that high-intensity interval training (HIIT) lowers blood glucose and improves insulin resistance in individuals with type 2 diabetes. However, the physical mechanism is largely unknown.

**RESULTS:** This study aimed to investigate whether HIIT improves insulin resistance in T2DM mice by regulating lipid metabolism in skeletal muscle. Abnormal skeletal muscle lipid metabolism is associated with insulin resistance in people with type 2 diabetes. Recent studies have indicated that high-intensity interval training (HIIT) lowers blood glucose and improves insulin resistance in individuals with type 2 diabetes. However, the physical mechanism is largely unknown.

**Board #170 May 30 8:00 AM - 9:30 AM**

**Sport Participation And Sport-related Concussion Trends In High School Athletes**

Kyle M. Petit, Morgan Anderson, Christopher P. Tomczyk, Aaron J. Zynda, Tracey Covassin. Michigan State University, East Lansing, MI. Email: pettiky@msu.edu (No relevant relationships reported)

Women are 4 to 6 times more likely to sustain an anterior cruciate ligament (ACL) injury than men. Women with ACL reconstruction (ACLR) are also 2.6 times less likely to be active than healthy individuals. In addition to reductions in physical activity (PA), it has been reported that BMI remains elevated up to 2 years post-ACLR, but the effects of ACLR on body composition profiles following surgery is unclear. PURPOSE: To compare PA engagement and body composition between women with ACLR and healthy controls. METHODS: Ten women with ACLR (less than 5yrs post-ACLR, age=21.4±3.8yrs, BMI=26.1±1.3kg/m²) and 10 healthy women (age=21.9±1.3yrs, BMI=21.8±2.5kg/m²) completed the Tegner Activity Scale to assess current PA level. Body fat percentage (%BF) was estimated using air displacement plethysmography. Objective PA was assessed using hip-worn accelerometers for 10 hours/day for 7 days and Freedson Adult VM3 cut points were used for PA data processing. Groups were compared using Mann-Whitney U tests due to limited sample size. Time (minutes/week) spent in moderate-to-vigorous PA (MVPA) and step count (steps/day) were compared between groups using a one-way ANOVA with total wear time as a covariate. RESULTS: Women with ACLR had significantly higher %BF than controls (ACLR=32.7±6.7%, healthy=22.6±4.9%; p<0.01) and higher fat mass (ACLR=25.4±9.0kg, healthy=13.7±4.1kg; p<0.01). Healthy women participated in significantly more steps per day (ACLR=6650±3227 steps/day, healthy=9361±2626 steps/day; p<0.02) than women with ACLR, but no differences in MVPA time (ACLR=367±226 mins/week, healthy=448±9164 mins/week; p=0.34) were observed. CONCLUSIONS: Women with ACLR engage in similar levels of MVPA compared to controls, but they may exhibit greater %BF and fat mass than women who have not experienced ACLR. Compared to controls, women with ACLR also have lower step counts, which is consistent with previous studies. Lack of PA, high %BF, and overweight status increase the risk of premature mortality and morbidity. Therefore, it is crucial to further assess these characteristics and determine potential interventions that would promote PA and maintenance of healthy body composition in the months following ACLR.

**Board #171 May 30 8:00 AM - 9:30 AM**

**Examining Acute Effects Of Concussion On The Child Scat5**

Patricia M. Kelshaw1, Nathan E. Cook2, Grant L. Iverson3, Nelson Cortes3, Shane V. Caswell1. 1George Mason University, Fairfax, VA. 2Harvard Medical School, Boston, MA. Email: pkelshaw@gmu.edu (No relevant relationships reported)

The Child Sport Concussion Assessment Tool 5th Edition (Child SCAT5) is recommended for the clinical assessment of concussion in children. To date, no studies have investigated how children perform on the Child SCAT5 acutely following concussion.

**Purpose:** We examined Child SCAT5 performance and symptom reporting among concussed middle school children assessed on the day of injury.

**Methods:** Certified Athletic Trainers diagnosed middle school student athletes (ages 11-13) with a sports-related concussion using the Child SCAT5 between 2017-2019. All assessments were administered on the day of injury (“day-of-concussion”). Day-of-concussion performance was compared to normative reference values derived from over 1,300 unjured middle school athletes who underwent baseline, preseason Child SCAT5 assessments.

**Results:** There were 46 middle school student-athletes diagnosed with concussions (17 boys, 29 mean age=12.4±0.7yrs). The most commonly endorsed acute symptoms were: “I have a headache” (95.6%), followed by “I feel dizzy” (73.9%), and “I have problems remembering what people tell me” (63.0%). Middle school student-athletes day-of-concussion scores on the Child SCAT5 were: Total Symptoms (n=44, 10.4±5.9), Symptom Severity (n=44, 19.0±13.3), Immediate Memory (n=45, 13.0±2.6), Digits Backwards (n=45, 2.8±1.0), Concentration (n=45, 3.7±1.0), Total Balance (n=39, 8.5±5.9), Delayed Recall (n=44, 3.1±1.6), and Standardized Assessment of Concussion-Child Version (SAC-C n=44, 19.9±4.3). The mean number of total balance errors and the mean symptom severity scores were elevated relative to normative reference values.

**Conclusion:** Our results describe day-of-concussion Child SCAT5 scores in middle school children. The total symptom severity scores and total errors on the balance appeared to be most reflective of the acute effects of concussion. Further research is needed to establish the sensitivity and specificity of the Child SCAT5 to the acute effects of concussion in children.
group, which was markedly alleviated in the HIIT group (p<0.05). In the skeletal muscle, HIIT treated mice showed significantly decreased protein expression related to lipogenesis, including reductions in ACC (0.39-fold, p<0.01) and HMGCGR (0.52-fold, p<0.01). Expectedly, the protein expression level of Cpt-1α (1.6-fold, p<0.01) and CD36 (1.78-fold, p<0.01) was significantly enhanced by HIIT.

CONCLUSION: HIIT improves insulin resistance, at least partly, through deduces lipogenesis and increases lipolysis in skeletal muscle in the T2DM mice.

CONCLUSIONS

The Nuclear Hormone Receptor 4A family of genes have been observed to play a role in proper metabolic function in various tissues, including skeletal muscle.

PURPOSE: To analyze the effect of the Nr4a3 gene on respiratory capacity of mitochondria in skeletal muscle of mice on a normal or high fat diet.

METHODS: Nr4a3−/− and WT mice were fed a normal chow (NC) or high fat diet (HF) for at least 20 weeks. After euthanasia, soleus muscle was harvested and weight was measured. Muscle fibers were teased apart and permeabilized with saponin in preparation for respirometry. Mitochondrial respiration was evaluated using an Oroboros Oxygraph-Respirometer. Respiratory chain measurements were made with a two-way ANOVA and Tukey multiple comparison test.

RESULTS: Oxygen consumption is reported as pmol/μg mtDNA (pmol/mg wet tissue) and statistics are represented as mean ± SEM. In the WT male mice there was a decrease in coupled complex I supported respiration in HF vs. NC diet (25.9 ± 7.3 vs. 64.5 ± 6.0, p=0.004). In the HF WT group there was also a decrease in coupled complex I and II supported respiration (57.2 ± 13.4 vs. 102.5 ± 7.0, p<0.0005) and uncoupled respiration (61.4 ± 15.0 vs. 107.8 ± 7.1, p=0.0004) compared to NC WT. In female mice there was also a decrease between HF WT and NC WT in complex I (28.2 ± 3.7 vs. 57.4 ± 5.7, p<0.0005) and complex I and II (78.2 ± 6.1 vs. 108.8 ± 6.7, p=0.0003) supported respiration as well as in uncoupled respiration (87.1 ± 7.1 vs. 119.4 ± 8.9, p=0.0001). However, there was no significant difference between the WT NC mice and either of the Nr4a3−/− groups. Complex I, complex I and II and uncoupled respiration states in both Nr4a3−/− groups were not significantly different from WT.

CONCLUSIONS: The Nr4a3 gene plays a role in mitochondrial function in mouse skeletal muscle. Feeding mice a high fat diet impairs proper mitochondrial function in muscle when compared to a normal chow diet. The decrease in respiration from the HF diet is dependent upon the function of the Nr4a3 gene, as no decrease was observed in Nr4a3−/− mice. A limitation of this study is that this effect could be due to the lack of Nr4a3 in the skeletal muscle, or a secondary effect of lacking the gene in other parts of the body.

Insulin resistance (IR) increases the risk for Alzheimer’s disease and other dementias; however, the underpinning mechanisms for this increased risk remain to be fully defined. Impaired mitochondrial function is one component contributing to cognitive impairment. PURPOSE: As insulin resistance impairs mitochondrial oxidative metabolism and increases reactive oxygen species (ROS) in skeletal muscle, we considered whether similar events occur in the brain, which like muscle is rich in insulin receptors and mitochondria. Further, we sought to determine whether aerobic exercise (AE) could prevent the hypothesized deficits in mitochondrial function accompanying diet-induced IR. METHODS: 12-week-old, male, C57BL/6 mice were fed a standard (Chow) or high fat diet (HFD) (60% kcal from fat) for four-weeks and provided access to running wheels (EX) or sedentary (SED) conditions (n = 9-10 per group). Following treatment, mitochondria were freshly isolated from the cerebrum to assess mitochondrial respiration, ROS production, and ATP production. Insulin resistance was determined ex vivo in the hippocampus by the ability of insulin to stimulate Akt-phosphorylation. mtDNA copy number, mRNA expression, and proteomic measurements were performed on isolated hippocampal tissue. RESULTS: HFD induced hippocampal insulin resistance (p < 0.001), which was corrected by AE. HFD decreased ATP production 12% (p = 0.01) and increased ROS emission 79% (p < 0.01) in isolated cerebral mitochondria, which were rescued with AE. Impairments in mitochondrial function with HFD were paralleled by reductions in mtDNA copy number (1.00 ± 0.06 vs 0.85 ± 0.06; p = 0.02) and mRNA expression of mitochondrial genes, such as PGC1α (1.00 ± 0.05 vs 0.78 ± 0.07; p = 0.03) and TFAM (1.00 ± 0.08 vs 0.62 ± 0.11; p = 0.03), which were corrected by AE. Proteomic analysis of the hippocampus showed that HFD led to oxidative post-translational modifications (PTMs) to 17 mitochondrial proteins (corrected p-value ≤ 0.05 and absolute log2 fold change ≥ 0.5); however, this increase in oxidative PTMs to mitochondrial proteins with HFD was almost completely reversed by AE. CONCLUSIONS: HFD induces IR in the cerebrum and hippocampus, which associates with mitochondrial dysfunction. Brain IR and mitochondrial dysfunction accompanying HFD are prevented with AE.

Abstracts were prepared by the authors and printed as submitted.
**PURPOSE:** To determine the role of the Nr4a3 gene in mitochondrial respiration in mouse liver, as well as how its role changes in obesity-induced diabetes (OID).

**METHODS:** This study was designed using Nr4a3+/+ (WT) and Nr4a3-/- (KO) mice that were fed a normal chow (NC) or a high-fat (HF) diet from the age of 4 weeks to ~24 weeks. Mitochondrial respiration was measured in liver tissue using high-resolution respirometry (HRR). Mitochondrial health was assessed by stimulating the different complexes of the electron-transport chain: glutamate, malate and ADP (complex I), cytochrome c (membrane integrity), succinate (complex II), FCCP (uncoupled respiration), and antimycin A (background respiration). Data were analyzed using a two-way ANOVA followed by a Tukey Multiple Comparisons Test.

**RESULTS:** Oxygen consumption is reported as pmol/(s*mg wet tissue) and statistics are represented as mean ± SEM. In female WT mice, uncoupled maximal respiration was increased by a HF diet compared to NC (141.0 ± 9.8 vs. 95.3 ± 12.3, p<0.001). This increase was absent in KO mice, which indicates that Nr4a3 may be partially responsible for the increase in respiration in HF WT female mice. In males this trend was reversed, with a decrease in coupled complex I and II respiration in HF WT vs. NC WT (96.6 ± 5.1 vs. 98.7 ± 6.3, p<0.05), but an increase in HF KO vs. NC WT control (122.3 ± 8.3 vs. 97.8 ± 6.3, p<0.01). In an uncoupled state, KO mice were greater than NC WT (control) (129.2 ± 8.4 vs. 103.7 ± 7.8, p<0.001). No difference was observed between NC WT and HF WT. This indicates that the Nr4a3 gene plays a role in oxidative phosphorylation when male mice are fed a HF diet.

**CONCLUSIONS:** This study shows that OID caused an Nr4a3-dependent increase in respiration in females, and an Nr4a3-dependent reduction in respiration in males. As part of this study, muscle, kidney and adipose respiration are also being investigated, as well as glucose-stimulated insulin secretion of the pancreatic beta-cells. It is unclear if the observed changes here are due to a direct effect of knocking out Nr4a3 in the liver, or to a secondary effect because of the full-body KO. Therefore, further investigation is warranted.
Exercise contributes to both caloric expenditure and nutrient partitioning. We have shown that lean sedentary (LS) male mice had lower levels of insulin and Interleukin-6 (IL-6) when compared to their high-fat fed sedentary (HFS) counterparts. Further, both exercise groups, lean (LX) and high-fat fed (HFX) demonstrated lower ghrelin, a hormone that regulates appetite and energy homeostasis levels compared to their sedentary counterparts. However, there is little work done in understanding the female response to blood biomarkers and exercise. PURPOSE: Therefore, the purpose of this study was to replicate our previous study in female mice to ascertain which biomarkers are similar across gender, and further evaluate any potential differences. We hypothesized that female mice would have a similar inflammatory biomarkers response as males, but a different hormonal profile. METHODS: Thirty-six, 6-week old C57BL/6NTac female mice were fed a normal or high-fat diet for 12-weeks and randomly assigned to exercise or sedentary groups. After 12 weeks animals were sacrificed, and blood was collected for metabolic hormone analysis using a magnetic bead-based multi-analyte panel. A total of seven biomarkers were analyzed including: insulin, peptide-YY (PYY), ghrelin, amylin, IL-6, tumor necrosis factor alpha (TNF-a), and pancreatic polypeptide (PP). RESULTS: HFS female mice had the highest body weight, kcai per day and percent weight increase compared to all other groups (p<0.05). Exercise attenuated the body weight gain in HF-fed mice (24.7g vs. 30.3g). Exercised groups had significant decreases in levels of insulin (1286.92 pg/ml, 2819.29 pg/ml, p=0.021) and amylin (67.23 pg/ml, 95.08 pg/ml, p=0.009), and increased levels of PYY (18.840 pg/ml, 61.688 pg/ml, p=0.031) compared to sedentary groups. Groups fed HF diets also had increased levels of PYY (64.673 pg/ml, 15.978 pg/ml, p=0.018) compared to normal diet groups. CONCLUSION: Exercise attenuates body weight gain and the rise in insulin in mice fed high fat diet and this is consistent between genders. Further, appetite/glucose regulating hormones like amylin and PYY are significantly altered in females but display different responses in males. This continues to add to the exciting story of metabolic differences between males and females.

PURPOSE: To explore the effect of exercise on localisation and expression of KISS-1 and GPR54 in the growth period (PND 21st to 56th day) of high-fat diet rat testes. METHODS: 210 old weaning rats were randomly divided into group HC (n=32) and group HE (n=32). HE group took 5-weeks trained (60-70% vVO2max, 1h/day, 5days/week). Groups HC and HE were fed with high-fat feed, which was purchased from Beijing Huafukang Biotechnology Co. LTD (Lot NO: D121451). The rats of two groups were killed on the 21st D, 35th D, 43rd D, and 56th D old. The localization, mRNA expression and protein expression of KISS-1/GPR54 in the testis of each group were tested. RESULTS: The high-fat diet intervention resulted in a decrease in testicular index (~27% higher in HE vs. HC group, p<0.05). The localization of KISS-1 and GPR54 mRNA was observed in Leydig cells (p<0.05). The expression of KISS-1 and GPR54 mRNA in HE group was higher than that in HC group (~43% higher, p<0.05). The expression of KISS-1 and GPR54 protein was observed in Leydig cells (p<0.01). The KISS-1 protein expression had no obvious change(p<0.05). CONCLUSION: High-fat diet can inhibit the testicular development of male rats in the growth phase, and can also down-regulate the protein and gene expression levels of KISS-1/GPR54 system in testis tissue, and change the expression of KISS-1/GPR54 system, and its role needs further study. 60~70% VO2max moderate-intensity aerobic exercise change the inhibitory effect of high-fat diet on testicular development in male rats, and up-regulate KISS-1/GPR54 in prepubertal stage and whether KISS-1/GPR54 in testicular tissue participates in its regulation remains to be further study.

Type 2 diabetes mellitus (T2DM) has become the most common metabolic disease in Western society, leading to significant health problems and financial burdens. Numerous researchers have investigated different therapies to target T2DM, but the underlying molecular mechanisms are still not completely understood. Our laboratory and others have demonstrated consistent downregulation of the microRNA-16 (miR-16) in skeletal muscle across human, rodent, and tissue culture models of T2DM. PURPOSE: To investigate how deletion of miR-16 gene affects insulin sensitivity and exercise capacity during insulin resistance. METHODS: 10 wildtype (WT) and 12 muscle miR-16 knockout (KO) male mice were used for this study. At 9 wks of age, bodyweight, graded exercise test (GXT), glucose tolerance test (GTT, at 0, 15, 30, 60, and 120 min) and insulin tolerance test (ITT; at 0, 15, 30, and 60 min) were measured. At 10 wks of age, half of the mice were given high-fat diet (HFD; 45% calories from fat) to induce insulin resistance, while the remainder were fed normal diet (LFD). Insulin sensitivity was measured using the GXT, GTT, or ITT. Glucose uptake in muscle was assessed 36-hours after final exercise session (or rest). Respiration protocols included lipid (octanoyl-carnitine+malate) and non-lipid (glutamate+succinate) substrates. RESULTS: At sedentary mice, WD had higher body weight and fat mass than LFD (p<0.0001), but only in males. WD had lower in-cage respiratory exchange ratio than LFD (p<0.05) regardless of sex, indicating greater whole-body reliance on lipids. In males, WD+Ex stimulated mitochondrial lipid respiration more so than WD alone (p<0.05). Females had no significant changes in mitochondrial lipid respiration. Non-lipid supported mitochondrial respiration was not significantly altered by WD or WD+Ex regardless of sex. CONCLUSION: In agreement with our hypothesis, WD stimulated lipid-specific mitochondrial respiration that further increased with Ex, but only in male mice. There were apparent sex differences such that females were protected against WD-induced weight gain alongside limited changes in mitochondrial lipid respiration.
Pilot study, the type of food did not significantly affect the increase in weight gain (P < 0.05). The base study of the research showed that the treatment with liraglutide associated with physical activity compared to saline had a significant reduction in the mass of adipose tissue (CEL-0.32±0.03 g; CES-0.48±0.05 g; p < 0.01). The base study of the research showed that the treatment with liraglutide associated with physical activity compared to saline had a significant reduction in the mass of adipose tissue (CEL-0.32±0.03 g; CES-0.48±0.05 g; p < 0.01). The base study of the research showed that the treatment with liraglutide associated with physical activity compared to saline had a significant reduction in the mass of adipose tissue (CEL-0.32±0.03 g; CES-0.48±0.05 g; p < 0.01). The base study of the research showed that the treatment with liraglutide associated with physical activity compared to saline had a significant reduction in the mass of adipose tissue (CEL-0.32±0.03 g; CES-0.48±0.05 g; p < 0.01).
Activation of AMP-activated kinase (AMPK) in skeletal muscle increases FA oxidation by inducing Acetyl-CoA Carboxylase (ACC) deactivation. However, the upstream signal molecules that activate AMPK/ACC signaling remains unclear. It is expected that Fatty Acid Translocase (FAT/CD36) will become another potential target for diabetic therapy after AMPK.

**Purpose:**
To explore the role of CD36, as a signal molecule, in regulating the upstream signaling pathway of AMPK/ACC in skeletal muscle under HFD conditions.

**Methods:**
First, siRNA interference was used to knock down CD36 gene in C2C12 cells to investigate the effect of CD36 deficiency on the phosphorylation of AMPK/ACC signaling in skeletal muscle cells. Then, two-week-old C57BL/6 male mice were randomly divided into two groups: control group (CON; n = 6), and high-fat diet group (HFD; n = 6). The expression levels of CD36 protein and phosphorylation of AMPK/ACC signaling under HFD conditions were detected by Western blotting method; the translocation of Liver kinase B1 (LKB1) in nucleus was detected by immunofluorescence; the ultrastructural changes of skeletal muscle were detected by transmission electron microscopy; and the activity of mitochondrial respiratory chain enzyme was detected by colorimetry.

**Results:**
The CD36 deficiency activated AMPK (0.129 ± 0.009 vs. 0.417 ± 0.055, p < 0.05), ACC (0.044 ± 0.008 vs. 0.081 ± 0.010, p < 0.05) signaling in skeletal muscle cells. Compared with the CON group, the expression levels of CD36 protein in HFD group were significantly increased (0.225 ± 0.041 vs. 0.56 ± 0.022, p < 0.01), the phosphorylation levels of AMPK (0.142 ± 0.020 vs. 0.079 ± 0.010, p < 0.05) and ACC (0.229 ± 0.023 vs. 0.119 ± 0.028, p < 0.05) were significantly decreased, and induced LKB1 translocation from cytoplasm to nucleus. In addition, electron microscopic results showed that HFD induced damaged the mitochondrial structure of skeletal muscle to a certain extent, and significantly decreased CS activity (411.32 ± 22.15 vs. 310.20 ± 44.09, p < 0.01).

**Conclusion:**
CD36, as a signaling molecule, promotes LKB1 to translocate from cytoplasm to nucleus, which inhibits AMPK/ACC signaling activation, thereby regulating FA oxidation under HFD condition.

Supported by the National Natural Science Foundation of China (No. 31600966).

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**Board #190**
May 30 9:00 AM - 10:30 AM
**Regulation Of CD36/LKB1/AMPK On Fatty Acid Oxidative Metabolism Under High-fat Diet Conditions**
Jingyu Sun, Yajuan Su, Jingmei Dong. Tongji University, Shanghai, China.
Email: jingyusun@126.com
(No relevant relationships reported)

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**Board #191**
May 30 9:00 AM - 10:30 AM
**Insulin Action And Body Composition In Aged C57bl/6 Mice: A New Model For Obesity**
Dakemby Hoyte, Katy Ehnstrom, Noa Mills, Thomas H. Reynolds, Skidmore College, Saratoga Springs, NY (Sponsor: Donald R. Dengel, FACSM)
(No relevant relationships reported)

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**Board #192**
May 30 9:00 AM - 10:30 AM
**Four Week Detraining Promotes Fat Gain But Not Inflammation On Adipose Tissue Of Obese Rats**
Patricia Monteiro Seraphim, Marcelo Conrado Freitas, Marcos Fernando Souza Teixeira, Maria Tereza Nunes, Facultad of Sciences and Technology - Sao Paulo State University - UNESP, Presidente Prudente, Brazil. Institute of Biomedical Sciences I University of Sao Paulo, Sao Paulo, Brazil.
Email: pm.seraphim@unesp.br
(No relevant relationships reported)
to C and T (50% higher), and HFD-T (40% higher) groups (P<0.05). HFD-T group presented higher levels of PPARY protein and gene compared to C (60% higher), T (50% higher) and HFD (50% higher) groups (P<0.05). HIF-1α mRNA expression was reduced in HFD-T rats compared with HFD (P<0.05). Detraining caused increase on the weight gain (50% higher) and fat mass (44% higher) compared to HFD-T (P<0.05). HIF-D maintained protein expression of TNFa and PPARY elevated compared to HFD and reduced HIF-1α mRNA expression compared to HFD (P<0.05). CONCLUSION: Therefore, RTr can attenuate HIF-1α and TNFa gene expression, and prevent reduction of PPARY independent on the ingestion of a high-fat diet. Additionally, TNFa expression remained lower, and PPARY expression remained increased in detrained rats, even with increased fat mass. These results suggest that four-week detraining can accelerate the gain of fat mass, without eliciting an inflammatory response in the adipose tissue. Supported by CAPES - Finance code 001.

Previous data in our lab has shown that high concentration (200 µM) H2O2 exposure induces iron dysregulation in muscle cells. It is known that following strenuous exercise, oxidative stress is induced in tissues, leading to iron dysregulation, and generation of reactive oxygen species. Due to the unstable nature of H2O2 in solution and the critical role of the liver in iron homeostasis, we sought to see how human hepatocytes would respond to a 12-hour low-dose H2O2 exposure that mimics the generation of reactive oxygen species. We observed a significant increase in FTL, but only in the 10 µM group (C=1±0.1 vs. 10 µM: 3.6±1.0; P<0.01; n=11). We saw no significant change in FTL at 50 and 100 µM. H2O2 treatments driven by GOX and CAT produced concentrations of 5-10 µM, mimicking neutrophils during inflammatory response. The addition of a low concentration H2O2 stress resulted in a 9-fold increase of FTL content at all iron exposure concentrations (C=1±0.3 vs 9.3 ±0.9 10 µM; p<0.01; n=4). Groups of 50 and 100 µM also showed similar results, with an increasing trend.

CONCLUSION
A low concentration exposure of H2O2 and iron to human hepatocytes results in a significant increase in FTL when compared to iron exposure alone. This suggests that liver cells have a robust defense against iron-dysregulation induced by oxidative stress. We are still evaluating changes that occur in other iron regulatory proteins.
Central adiposity, and particularly visceral fat, is tightly associated with metabolic health. Gold standard measures for visceral fat, MRI and CT, are impractical for widespread use. Ultrasound, DXA, and bioimpedance are useful alternatives, although their associations with metabolism are less understood.

OBJECTIVE: To test associations of abdominal adipose by ultrasound (US), DXA, and bioimpedance (BIA) with insulin sensitivity (IS), β-cell responsivity, physical activity, and adiponectin (AdipN), an adipokine tightly associated with visceral fat.

METHODS: After overnight fast, 41 normoglycemic young women (Age 20.9 ± 2.7; BMI 27.8 ± 3.5) were scanned by DXA (GE Lunar) and BIA (InBody 770) for VAT, SAT, and the subcutaneous adipose thicknesses (SAT-US) measured 1 cm superior to umbilicus; circumferences: 2-hr OGTT (75g); and 5-day accelerometer (Steps; ActiGraph GT3X). Plasma insulin, c-peptide, and AdipN were determined by ELISA. IS was calculated using Matsuda Index from insulin and glucose at 0 and 120 min. First phase β-cell responsivity (β Cell) was estimated as ∆C-peptide/∆glucose from 0 to 30 min.

RESULTS: V AT-DXA correlated strongly with V AT-BIA (r = .80), SAT-US (r = .78), Waist (r = .81; p < .01 for all), and weakly with VAT-US (r = .35) and Steps (r = .38; p < .05 for all), but not AdipN (r = .31; p = ns). VAT-US correlated with AdipN (r = .52), V AT-DXA (r = .35), Waist (r = .50; p = .05 for all), but not SAT-US (r = .02) or V AT-BIA (r = .31; p = ns for all). IS was associated with VAT-US (r = .42), V AT-DXA (r = .44), and AdipN (r = .46; p < .05 for all), controlled for age and race, and these persisted when further controlling for BMI. Only SAT-US was associated with β-cell (r = .38; p < .05), controlled for age and race, but attenuated when controlling for BMI. Steps correlated with SAT (r = .36), V AT-DX (r = .38), and V AT-BIA (r = .39; p = .05 for all), but not IS, β Cell, VAT-US, or AdipN (p = ns for all). In multiple regression analysis with V AT-DX and BIA, and BMI included in the model, V AT-US was the only independent predictor of IS (β = .36; p < .05).

CONCLUSION: VAT by DXA and BIA are strongly related to SAT and overall adiposity, and less to VAT by US and AdipN. While VAT by DXA and ultrasound were both predictors of poor metabolic health in this population, VAT by ultrasound was the strongest independent predictor of IS.

Resting metabolic rate (RMR) ratio has been shown to be an indicator of energetic status as indicated by significant correlations with total triiodothyronine (T₃) concentrations in exercising women. However, it is unknown whether the relationship between RMR ratio and TT, remains constant over time. PURPOSE: To examine the relationship between RMR ratio and TT, in exercising, ovulatory, weight-stable women for a 12-month observational period. METHODS: We performed a 12-month longitudinal analysis of data from exercising women (n=14). Dual-energy X-ray absorptiometry (DXA) and indirect calorimetry provided data on anthropometrics and energy expenditure. Harris-Benedict DXA, and Cunningham (1980 and 1991) equations estimated RMR and RMR ratio. Repeated-measures analysis assessed changes over time (ANOVA and Friedman). Intraclass correlation coefficient (ICC) and Cronbach’s Alpha measure agreement over 12-months for RMR ratio and energy availability (EA) were utilized. Generalized linear modeling tested whether RMR ratios predicted TT, to be above or below two thresholds (TT >73.2ng/dL and TT >30ng/mL) over 12-months. RESULTS: Women were 25 ± 9 ± 5.4y, and at baseline, weighted 59.6 ± 5.2 kg with BMI 22.3 ± 1.4 kg/m², which remained unchanged during the study (weight: p = 0.52; BMI: p = 0.51). Over 12-months, RMR (p = 0.88), TT (p = 0.89), EA (p = 0.21), and RMR ratio (Harris-Benedict: p = 0.85; DXA: p = 0.60; Cunningham: p = 0.75; Cunningham: p = 0.73) remained consistent for 12-months. Each RMR ratio threshold, the alpha threshold of less than 0.90, indicating excellent reliability of repeated measures, while ICC of energy availability of 0.75 and Cronbach’s alpha of 0.73, indicated moderate reliability. When TT >73.2ng/dL, each RMR ratio threshold (Harris-Benedict: p = 0.02; DXA: p = 0.019; Cunningham: p = 0.019; Cunningham: p = 0.016) significantly predicted participants as energy replete; however, when using a more lenient clinical TT, threshold of >70ng/mL, only the DXA ratio threshold yielded a significant model (ρ < .001). The relationship between RMR ratio and TT, remains constant over time with excellent reliability helping to validate the use of RMR ratio for the longitudinal characterization of energetic status in exercising women (i.e. prospective serial monitoring).

PURPOSE: To find out the characteristics of accurate fat distribution of healthy adolescent in China and compare the differences between different genders.

METHODS: We recruited 36 healthy adolescents, without obesity or malnutrition. (12-17 years old, 3 men and 3 women of each age; height: 155.24±14.66 cm; mass: 48.60±14.41 kg). Scanning the whole body by MRI (1 cm apart). The visceral fat, subcutaneous fat and intramuscular fat of trunk, upper and lower limbs were calculated by gray area. The definite index of the above indicators is obtained by dividing the square of the height. SS2.20 was used for t-test.

RESULTS: 1) Fat mass. The visceral fat, the intramuscular fat of trunk and the subcutaneous fat of upper and lower limbs were higher in women than in men. But there was no significant difference in fat quality between men and women (p < 0.05). 2) Fat mass index. There was a significant difference between the female and the male in the subcutaneous fat index of the upper extremity(en.5:31.04;12.40.63±0.16;p=0.048), and a significant difference between the female and the male in the subcutaneous fat index of the lower extremity(m:1.94±0.61; f:2.52±0.51;p=0.002). There was no gender difference in muscle mass between upper and lower limbs (P = 0.05). The visceral fat index of female was higher than that of male (m:0.43±0.12;f:0.53±0.17;p= 0.042).

3) The trunk fat mass of male accounted for 38.89% of the total fat mass, which was lower than that of female(41.77%), but there was no significant difference (p = 0.05). The visceral fat mass of male accounted for 10.10% of the total fat mass, which was higher than that of female (9.11%). The upper limb fat mass of male accounted for 12.17% of the total fat mass, which was significantly higher than that of female(10.72% p<0.048). There was no significant difference between male(47.93%) and female(47.50) in the proportion of lower limb fat mass. (P = 0.95)

CONCLUSIONS: There was no gender difference in muscle mass of different parts of adolescent. The subcutaneous fat index and visceral fat index of women were higher than that of men, but there was no gender difference in muscle fat index. The centripetal accumulation of puberty fat was not obvious, but the proportion of upper limb fat was relatively high.

As with any weight loss program, losing fat while maintaining muscle is a desirable outcome. We sought to determine how different types of habitual activity influenced the retention of muscle mass with a decrease in body fat.

PURPOSE: As a preliminary analysis to guide future research, the purpose of this study was to determine whether self-reported frequency of aerobic, strength, and stretching exercise (days per week) associates with body composition changes in response to weight loss in overweight and obese adults. METHODS: Adults (n=23), 18-70 years old with a minimum waist circumference of 35 inches for women and 40 inches for men participated in an 8-week study diet intervention. Participants were asked to maintain habitual physical activity during the intervention. All participants reported their habitual exercise frequency for aerobic, stretch, and strengthening activities within a typical 7-day period. Body composition was assessed using bioelectrical impedance analysis (mBCA). After post testing, correlations (nonparametric, Spearman) between days reported for each activity and changes in body mass, percent body fat, visceral adipose tissue (VAT) and muscle mass were determined in participants who had a reduction in body mass during the intervention. RESULTS: The
average number of days per week reported for each activity was 4.3 for aerobic, 1.8 for strength, and 3.3 for stretching. Change in body mass pre to post intervention was from 94.6 ± 22.3 kg to 92.9 ± 21.4 kg. The range in change for muscle mass was from -2.31 kg to +1.1 kg. There was a correlation (r = 0.603, p = 0.029) between days per week of aerobic activity and change in muscle mass.

CONCLUSIONS: While all individuals of the analysis lost some weight during the intervention, some of them lost and some of them gained muscle mass. Individuals who reported more days of aerobic activity per week as their habitual activity level were more likely to retain muscle mass. Supported by the USA Dry Pea & Lentil Council

PURPOSE: Female college students become a high-risk group of normal weight obesity (NWO) because of their lifestyle and psychological status. NWO can have an impact on the health of students. We analyze the characteristics of the body’s physical form and basal metabolism to add a new basis for the evaluation of female college students’ physical condition.

METHODS: A stratified cluster sampling method was used to extract 2000 samples from the two universities. Excluding those who did not meet the ten criteria, eventually included 1,937 female college students. The subject’s body mass index (BMI), body fat percentage (BF%), skeletal muscle percentage (SM%), waist-to-hip fat ratio, basal metabolic rate, waist circumference (WC), hip circumference (HC), and thigh circumference (TC) were measured. One-way ANOVA was used to compare the differences in body shape indicators between NWO and normal weight lean (NWL) female college students. Compare the incidence of central obesity among NWO and NWL female college students.

RESULTS: 1) Among female college students, the incidence of NWO was 33.3%, accounting for 66.02% of female college students with excessive body fat. Among NWO female college students, 4.19% belong to the group with BMI <18.5 (kg/m²), accounting for 66.02% of female college students with excessive body fat. Among NWO female college students, 4.19% belong to the group with BMI <18.5 (kg/m²), compared with NWL, NWO had higher BF% and lower SM% (33.22 ± 5.29 vs 26.49 ± 2.70%; 35.79 ± 1.53 vs 39.79 ± 1.69%, p < 0.01); NWO had higher waist-to-hip fat ratio (0.83 ± 0.02 vs 0.81 ± 0.02, p < 0.01); NWO had lower basal metabolic rate (1192.07 ± 75.99 vs 1240.71 ± 77.93 kcal/d, p < 0.01). 3) In the circumference analysis, compared with NWL, WC, HC and TC of NWO were larger (69.38 ± 4.62 vs 67.07 ± 4.95 cm, p < 0.01; 94.16 ± 5.10 vs 92.09 ± 4.84 cm, p < 0.01; 55.97 ± 3.14 vs 54.56 ± 3.13 cm, p < 0.05); There are 19 central obese female college students, 68% of whom are from NWO population.

CONCLUSIONS: NWO female college students have a big difference in physical form compared with NWL. NWO has a larger circumference and its fat distribution is characterized by more fat accumulation in the waist and had lower basal metabolic rate. We need to pay attention to the status of female college students with NWO. Supported by Thirteenth Five-Year Plan for scientific research of Chinese society of Higher Education (712006), Basic scientific research business fund project of Central University (2008X030).

Inflammatory markers are a well-known and reliable predictor of all-cause mortality in individuals as they are associated with disease-specific processes. It has also been established that individuals with higher adiposity have higher levels of inflammatory markers during exercise than lean individuals. It is currently not known whether there is any relationship between resting inflammatory markers and levels of fat oxidation during exercise.

PURPOSE: To examine the relationship between inflammatory phenotype and fat utilization in obese adults during a graded exercise test.

METHODS: Healthy overweight and obese (OB/OW) adults (n=34) were classified utilizing in obese adults during a graded exercise test.

PURPOSE: Healthy overweight and obese (OB/OW) adults (n=34) were classified utilizing a calorically reduced meal plan (500kcal/d) with 1.2g/kg protein to protect against muscle loss. Fourteen follow-up sessions were conducted. Body weight (BW) and skeletal muscle mass (SMM) were monitored utilizing InBody770. Post program interviews were audio-recorded, transcribed and analyzed using constant-comparative analysis. A 35-item weight loss strategy inventory was completed and analyzed utilizing descriptive statistics.

RESULTS: Ninety-two percent (n=11) of participants lost weight, with mean weight loss of 6.8% ± 4.4 of BW. Seventy-five percent of participants had weight loss of >5% of BW. Mean SMM loss was 0.009±0.031 of BW with 33.3% (n=4) of participants increasing or maintaining SMM. Participants used a mean 15 ± 6 weight loss strategies four or more times/week. Themes for successful weight loss included using personal behavioral strategies such as measuring portion sizes, biochemical and anthropometric motivators, personalized support, and accountability feedback and monitoring. Barriers included consuming the additional protein in the diet and taking of others. CONCLUSION: Results of this study provide considerations for the development of strategies to achieve clinically significant weight loss (>5%) while maintaining SMM in older adults. A higher intake of protein to protect against muscle loss was reported to be difficult for participants. Both personal strategies, as well as external strategies provided through the counseling relationship, contributed to success.
using ELISAs. RESULTS: There were no group differences in body weight, BMI, or appetite stimulating hormones prior to the exercise interventions. Fasting plasma concentrations of ghrelin (37±8 vs. 42±11 pg/ml), insulin (1,176±424 vs. 1,179±442 pg/ml), leptin (20,200±2,891 vs. 16,617±2,734 pg/ml), and peptide YY (51±6 vs. 54±7 pg/ml) did not change with the swimming exercise intervention (all p>0.05). Similarly, cycling exercise had no effect on ghrelin (36±10 vs. 44±8 pg/ml), insulin (978±321 vs. 964±311 pg/ml), leptin (29,261±5,438 vs. 26,308±8,771 pg/ml), or peptide YY (58±15 vs. 63±16 pg/ml) concentrations (all p>0.05). CONCLUSIONS: Our present results indicate that fasting levels of appetite stimulating hormones did not change with 12 weeks of swimming exercise intervention in obese participants with osteoarthritis and that there were no group differences in changes in these hormones between swimming and cycling exercise interventions.

### 3888 Board #205 May 30 9:00 AM - 10:30 AM

**Rapid Weight Loss Adversely Affects Muscle Damage Markers In Elite Judo Athletes**

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(Related no relationships reported)

**PURPOSE:**

To evaluate the effects of 7-day RWL intervention on muscle damage markers in seven elite judokas during a pre-competition period.

**METHODS:** The participants voluntarily participated in this study. RWL was induced in accordance to personal preference previously practiced by judo athletes. Most frequently reported methods of RWL were increased exercise volume, fluid and caloric restriction and heated environment exposure.

**RESULTS:** RWL induced a significant drop in weight within all seven participants (93.07± 10.69 kg at baseline vs. 88.12 ± 10.30 kg at follow-up; P < 0.001). Regarding biochemical changes, myoglobin levels significantly increased on the last day of intervention (P < 0.01) (day 7). In addition, creatine kinase levels were also elevated in accordance to personal preference previously practiced by judo athletes. Most frequently reported methods of RWL were increased exercise volume, fluid and caloric restriction and heated environment exposure.

**CONCLUSIONS:** Based on the obtained results, RWL methods caused alterations in myoglobin and creatine kinase levels in elite judokas. This indicates that although RWL is perceived as helpful in achieving success in competition, it can produce muscle tissue damage that can further impact fitness profile of elite judokas. This project was partly supported by the Serbian Ministry of Education, Science and Technological Development (175037 and 170911), the Provincial Secretariat for Higher Education and Scientific Research (142-451-2473 and 114-451-710) and the Faculty of Sport and Physical Education, University of Novi Sad (2019 Annual Award).

### 3889 Board #206 May 30 9:00 AM - 10:30 AM

**Baseline Characteristics Of Older Hispanics With Type 2 Diabetes Participating In An Intervention Study**

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(Related no relationships reported)

Type 2 Diabetes mellitus (DM2) affects 9.3% of the U.S. population. Health disparities are evident in DM2; twice as many Hispanics as non-Hispanic Whites have DM2. **PURPOSE:** The goal of this study was to describe the baseline characteristics of older Hispanics with DM2 participating in a diet and exercise study in 3 senior centers. **METHODS:** Data from 38 older Hispanics with DM2 was collected. The variables included age, body mass, height, waist circumference, Hemoglobin A1C, glucose, blood pressure, chair stands in 30s, grip strength, balance, and preferred gait characteristics. **RESULTS:** The characteristics of the 38 participants (29 women, 9 men) that completed the baseline assessments to date are: age = 79±7.1 years (78±7; 80±7), body mass = 75±16 kg (73±13; 81±5), height = 157±10 cm (154±8; 160±8), body mass index = 31±6 kg/m² (30±5; 32±7), waist circumference = 100±11 cm (99±10; 101±11), A1C = 7.1±0.9%; (7.1±0.9; 7.2±0.9), non-fasting blood glucose = 140±47 g/dl (135±5; 157±30), systolic = 140±19 mmHg (139±18; 145±20; 210±110 mmHg (118±10; 135±30). Their physical characteristics presented in Table 1 indicate frailty (e.g. chair stands ≥38, grip strength ≥ 22, ≥52 kg, and gait velocity ≤80 cm/s). **CONCLUSION:** The results indicate that at baseline the participants had high prevalence of obesity (abdominal and total), low levels of glycemic control, borderline high blood pressure, and have low levels of physical function that are indicative of frailty. Supported by Wetherim Innovation Faculty Grant from the FW; Nicole Wetherim College of Nursing and Health Sciences.

### 3890 Board #207 May 30 9:00 AM - 10:30 AM

**Substrate Utilization Differences Between Overweight And Obese Men And Women During Exercise**

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(Related no relationships reported)

As exercise intensity and duration increase, substrate utilization typically shifts to carbohydrates over fats. However, individuals with higher levels of adiposity have been shown to rely more heavily on carbohydrate during higher intensity exercise than their leaner counterparts. Currently, there is limited research on how carbohydrate and fat oxidation differ in men compared to women at different exercise intensities.

**PURPOSE:** To examine the difference in substrate utilization of fat and carbohydrate between men and women at different exercise intensities. **METHODS:** Participants (n=34) between 18-55 years old (Women: 35.9 ± 11.3 years; Men: 36.1 ± 7.7 years) with a BMI between 25-35 kg/m² (Women: 30.5 ± 1.7 kg/m²; Men: 30.6 ± 2.2 kg/m²) completed a modified Bruce protocol on a treadmill for a measured VO2Max at their age-predicted heart rate max. To be included in the analysis these participants were required to reach 85% age predicted heart rate max. **RESULTS:** Women utilized a higher (p<0.05) percentage of fat at 65% (Women: 42.9 ± 16.9%; Men: 24.8 ± 17.7%), and 80% (Women: 14.7 ± 18.2%; Men: 2.7 ± 7.9%) of their VO2Max and greater (p<0.05) usage of overall Kcal from fat per kg of body mass at 80% (Women: 0.02 ± 0.02 kcal/kg; Men: 0.01 ± 0.01 kcal/kg) of VO2Max. Men relied more heavily (p<0.05) than women on carbohydrates per kg of body mass at 50% (Women: 0.03 ± 0.02 kcal/kg; Men: 0.06 ± 0.03 kcal/kg), 65% (Women: 0.07 ± 0.06 kcal/kg; Men: 0.13 ± 0.09 kcal/kg) and 80% (Women: 0.16 ± 0.08 kcal/kg; Men: 0.26 ± 0.08 kcal/kg) of VO2Max. **CONCLUSIONS:** Women oxidized more fat than men at 65% and 80% VO2Max, but not 35% and 50% VO2Max. As exercise intensity increased, the gap between women and men fat oxidation levels became larger. **Funding:** Montana State University Research Initiative 51040-MUSRI2015-03 and USDA-NIFA 2017-67018-26367.

### 3891 Board #208 May 30 9:00 AM - 10:30 AM

**Whole-body Electromyostimulation Enhances Submaximal Performance And Leg Fatigue In Obese Women After Bariatric Surgery**

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(Related no relationships reported)

Bariatric surgery (BS) is the most effective treatment for morbid obesity. Early rehabilitation strategies may be able to improve functional capacity (f) and body composition that are impaired after the surgical procedure. In this sense, the whole-body electromyostimulation (WB-EMS) added to dynamic exercises may enhance these benefits for this population.

**PURPOSE:** To evaluate if WB-EMS would enhance dynamic exercises on f, dyspnea and leg fatigue, and body composition. **METHODS:** Randomized double-blinded controlled clinical trial. Twenty-six obese women (37±7 years; BMI=37±4 kg/m2) were randomized after bariatric surgery into two groups (WB-EMS, n=13; ShamG, n=13). Before and after training protocol, the patients performed body composition analysis (Inbody 720) and the two minutes step test (2MST) for functional capacity evaluation with portable ergometer (Oxycon Mobile®), with Borg scale evaluation for effort perception. The WB-EMS (Mihal...
Body electrolyte was applied at motor level (endurance training: 3x/week; frequency=85Hz, pulse duration=350µs, cycle on= 6"; cycle off = 4"; strength training: 2x/week; frequency=100Hz, pulse duration=350µs, cycle on = 4"; cycle off = 10"), associated with dynamic exercises during 30 days, one week after BS. The ShamG performed the same exercises, but with the electric current turned off. After confirmation of normal data distribution (Shapiro-Wilk) a two-way ANOVA was performed (p<0.05).

RESULTS: Weight loss was similar between groups after the intervention (p=0.002), and higher values of up and down cycles were observed (WB-EMSG pre: 47, post: 57 vs ShamG: pre 44, post: 54; p<0.001) and relative VO2 (WB-EMSG pre: 11.3, post: 14.1 vs ShamG: pre: 10.3, post: 13.5; p<0.001) in both groups after the intervention. In addition, we observed lower values of ventilation per minute (pre: 37.1, vs: 32.7, vs: 43.7, vs: 43.5, P<0.002) and leg fatigue (pre: 1.0, vs: 0.79 vs: 1.9, p = 0.01) at the 2MST peak in WB-EMSG compared to ShamG, respectively.

CONCLUSIONS: Early intervention composed of WB-EMS and dynamic exercises improved minute ventilation and leg fatigue in 2MST, which may reflect in a faster and quality recovery for these patients.

Purpose: To examine the effects of different therapies (lifestyle, medication) on microvascular function.

3892 Board #209 May 30 9:00 AM - 10:30 AM
PREDIABETES PHENOTYPE DOES NOT EXACERBATE MICROVASCULAR INSULIN SENSITIVITY IN METABOLIC SYNDROME
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(No relevant relationships reported)

Microvascular syndrome (MetS) and elevated glucose each promote microvascular dysfunction. Whether in combination these two conditions create increased dysfunction is not clear. Here, we tested whether glucose status worsens microvascular insulin sensitivity in MetS. Thirty-two sedentary, obese adults (54±2.1±2yr; 35.9±1.3kg/m2; VO2max: 19.9±1.3ml/kg/min) with MetS (≥3 ATP III criteria) were classified as normal glucose tolerant (NGT, n=8; 6F), impaired fasting glucose (IFG; n=10; 7E) or IFG+IGT (n=14; 11F) according to ADA criteria using a 75g OGTT. Capillary perfusion (microvascular blood volume, MBV), filling rate (microvascular flow velocity, MFV) and blood flow (MBF=MBV*MFV) were assessed as the change before and after a 2hr euglycemic-hyperinsulminemic clamp (90mg/dl, 40mU/min) using contrast enhanced ultrasound. Glucose infusion rate (GIR) was used to determine microvascular insulin sensitivity while carbohydrate oxidation (CHOox) was measured before and after the clamp to understand nutrient utilization. T-tests, repeated measures ANOVAs and correlations were used when appropriate. Significance was accepted as P<0.05. There were no differences in age, BMI, VO2max or GIR (NGT: 2.26±0.48 vs. IFG: 2.66±0.46 vs. IFG+GT: 1.91±0.37mg/kg/min, p<0.44) among groups. Insulin did not stimulate capillary perfusion (NGT: 0.16±0.19 vs. IFG: -0.02±0.14 vs. IFG+GT: -0.08±0.12; P=0.40), filling rate (NGT: 0.003±0.004 vs. IFG+GT: 0.004±0.004sec-1, P=0.11) or blood flow (NGT: 0.02±0.02 vs. IFG+GT: 0.01±0.01sec-1, P=0.21). CHOox was likewise unresponsive to insulin (P=0.34). Although age, BMI, fasting and 2hr glucose concentrations did not relate to insulin effects on microvascular function, fasting triglycerides was related to insulin-stimulated MBF (r=0.39, P=0.03). Prediabetes phenotype does not worsen microvascular insulin sensitivity in adults with MetS. Future work is warranted to examine the effects of different therapies (lifestyle, medication) on microvascular function.

Funding was supported by the National Institutes of Health RO1-HL130296.

3893 Board #210 May 30 9:00 AM - 10:30 AM
Elevated Circulating Asprosin Impedes Low Intensity Exercise-induced Weight Loss in Obese Individuals
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Email: (No relevant relationships reported)

PURPOSE: Circulating Asprosin is elevated in obese men and mice and mainly produced in white adipose tissue (WAT) to trigger hepatic glucose release into the bloodstream maintaining energy standards between meals, and hence was suggested as pharmacological target to battle obesity and T2D. We hypothesized a mechanistic link to the empirical observation, why a predominant part of obese individuals mainly fail to lose depot-stored body fat despite their commitment to participate in aerobic exercise programs, and followed the research question if stress induced secretion of Asprosin during aerobic exercise counteracts the metabolic consumption of body fat through stimulating insulin triggered refueling of WAT.

METHODS: After overnight fasting 7 obese men and women (age 59.7±5.6; BMI 40.2±8.4) and 7 age and sex matched lean counterparts (age 59.5±5.2; BMI 22.9±1.5) performed a treadmill protocol for 25 min at 90% of an individual’s VT1 and RQ of ≤0.82 (controlled and adjusted if needed) to ensure that body fat as energy source was used. Venous blood samples (pre-, post-, +30 min post-, and +60 min post-exercise) were drawn to analyze Asprosin, Cortisol, Proinsulin, and acetylated Ghrelin using commercial ELISA kits.

RESULTS: Asprosin baseline data were significantly increased in obese compared to lean subjects (p<0.013) and further raised significantly during the course of the exercise trial only in obese. Stress marker Cortisol was comparable between groups at baseline (p=0.38) but significantly augmented in corpulent participants only, while it significantly decreased in lean subjects during the exercise test. Proinsulin increased significantly from baseline to +30 min post-exercise in obese (p<0.013) but remained unaffected in normal weight subjects (p>0.99) while their baseline data were comparable (p=0.06). Hunger hormone Ghrelin was already significantly increased at baseline in obese vs. lean subjects (p<0.015) but raised even significantly further in obese at +30 min post-exercise vs. baseline.

CONCLUSIONS: The stress induced aberrant hormone reaction of obese individuals counteracts the metabolic consumption of body fat through stimulating the refueling of WAT. This observation helps to explain the difficulty of obese persons to lose excess body fat when performing low intensity exercise.

ACSM May 26 – May 30, 2020
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3894 Board #211 May 30 9:00 AM - 10:30 AM
Associations Of Dietary Acid Load On Physical Function And Body Composition In Older Obese Adults
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(No relevant relationships reported)

Acid-base balance affects muscle quality in older adults leading to less muscle mass and strength. Individuals with knee osteoarthritis (OA) have less muscle mass and strength. It is unknown if OA’s effect on function and strength is mediated by acid-base balance.

Purpose: This study examined associations between dietary acid production, physical function, muscle strength, and body composition in older obese adults with knee osteoarthritis. Higher acid load is hypothesized to be associated with lower physical function, muscle strength and lean body mass (LBM).

Methods: Baseline data from the Intensive Diet and Exercise for Arthritis (IDEA) trial were used for this analysis. Measurements from IDEA included a 3-day food record to calculate daily potential renal acid load (PRAL), 6-min walk distance, LBM via dual energy x-ray absorptiometry, and concentric knee extension and flexor strength. Estimated potential renal acid load (PRAL in mEq H+-ions) = (0.49*mg protein) + (0.37*mg phosphorus) - (0.021*mg potassium) - (0.026*mg magnesium) - (0.013*mg calcium). Associations were determined by Pearson correlations.

Results: Data obtained from 388 participants (age=65.8±6.1 yrs; 70.4% female; body mass index=33.7±3.8 kg/m2) were used in the analysis. Mean values were: PRAL (1,955±1,779 mEq H+-ions), 6-min walk distance (476.5±82.6 m); concentric knee extension (60.2±14.7 Nm) and knee flexor (30.2±14.7 Nm) strength. PRAL showed significant positive associations with concentric knee extension strength (r=0.19; p<0.01), knee flexor strength (r=0.19; p=0.012), and LBM (r=0.22, p<0.001).

Conclusion: The physiological importance of the statistical relationship observed for high PRAL (higher acid load) and high physical function and knee extensor and flexor strength, although minimal (r=0.2), opposes our hypothesis. These discrepant findings may be from using an indirect measure acid production, presence of OA in this cohort, and the accuracy of self-reported dietary records.
Purpose: Pediatric obesity has been linked to negative social outcomes in childhood. Minimal information is known about social outcomes in adulthood for obese pediatric patients and if they are linked with pediatric fitness. Methods: A retrospective chart review was performed evaluating all pediatric (<18 year old) youth with obesity who presented to the HealthWorks! pediatric weight management program from 1999-2009 and had a formal cardiopulmonary exercise testing (CPET), which was a requirement for clinic enrollment. Demographic and public record collection included body habitus, death records, real estate transactions and criminal conviction history was collected with baseline data compared to published lifetime criminal prevalence (Shannon SKS, et al, Demography 2017) and home ownership rates (US Census). Statistical analysis was performed using JMP®, Version 14 with differences between groups assessed using an unpaired t-test where a p-value <0.05 was considered significant. Results: A total of 719 pediatric youths with obesity (12.2±12.9 years) performed exercise testing with all patients now adults (28.5±7.7 years). There was a 1.5% mortality rate (11.719), and mortality was not associated with body habitus or any CPET parameter. Only 28.6% (206/719) of patients were able to complete a maximal effort CPET. On review of the criminal records, 9.7% (70/720) of these young adult patients were convicted of a felony compared to ~6% lifetime prevalence in Ohio during this period of time (p=0.004). There was no difference between incarceration rates of these new adult pediatric youths with obesity and the reported lifetime prevalence in Ohio (3.6% vs 3%), p=0.5. In addition, 14.7% (106/719) of study patients purchased a home in adulthood compared to 56.8% of Midwest adults <35 years of age (p=0.0001). Inability to complete a maximal effort CPET was associated with age, weight and future home ownership. History of criminal conviction was not associated with any study parameter. Conclusions: Children with obesity have higher social risk than their peers in adulthood as evidenced by higher rates of criminal behavior and lower rates of home ownership. Pediatric patients with obesity have low rates of exercise test completion and pediatric exercise capacity is not associated with mortality or social outcomes.

Substantial exercise-induced weight loss is unachievable by many people. With no dietary modifications, a person of average size and fitness requires 60+ hours of moderate intensity exercise to lose 5 kg of fat. Individuals who are overweight or obese might not have the cardiorespiratory and muscle health necessary for successful exercise-induced weight loss, but it has yet to be determined if individuals with different patterns of weight gain (gradual vs fluctuation vs rapid) have different cardiorespiratory and muscle health levels. PURPOSE: This pilot study’s aim was to determine if weight gain since the age of 20 and recent weight history is related to current cardiorespiratory and muscular fitness. METHODS: A retrospective health and weight history questionnaire was completed by 23 overweight and obese, but otherwise healthy adults (47.4±9.5 yrs, BMI 29.70 ±3.36). Weight gain since age 20 and weight history (loss & gain) in the previous 5 years were self-reported. Total fat and lean mass, cardiorespiratory fitness, and skeletal muscle strength were determined through dual energy x-ray absorptiometry, metabolic gas analysis during a graded exercise test, and upper and lower body strength measurements. RESULTS: Participants had an average body fat of 39.2 ± 5.4% having gained 9.3 ± 4.4 kg since the age of 20 years. Maximal oxygen consumption was 2.18 ± 0.5 L/min. No relationship existed between percentage of weight gain since 20 (25.96 ± 11.10%) and current maximal oxygen consumption (r = -0.08).

CONCLUSIONS: Based on this pilot data it does not appear that fitness determines weight gain after age 20. Future studies will determine if type of weight progression over time (e.g. gradual vs fluctuation) and weight loss history are related to cardiorespiratory and or muscular fitness and if fitness can predict success in exercise-induced weight loss programs in overweight or obese individuals.

Background: In Kansas, 10% of adults have type one or type two diabetes (T1D, T2D). Although Federal physical activity (PA) guidelines including aerobic and strength training exercises are recommended for T2D; guidelines lack for T1Ds. A better understanding of differences in exercise behaviors amongst between populations is needed. Purpose: This study compared exercise behaviors of T1D, T2D, and non-diabetics (ND). Methods: Male (n=68) and female (n=267) participants ages 18-64 were recruited via social media (e.g. Facebook, Instagram) and newsletters and indicated consent prior to participation in the online survey. Data were collected for demographics, anthropometrics, diabetes status, and exercise (PA) behaviors. One-way ANOVA’s, with Games-Howell post hoc tests were used to determine differences in aerobic activity and strength training between T1D, T2D, and ND participants. Results: Participants included 48 T1Ds, 24 T2Ds, and 240 NDs. Statistically significant differences existed for moderate aerobic PA between groups, f(2,304)=3.9, p<0.021, where T2D reported fewer weekly minutes (109.2±8.8). ND (215.7±186.5; p=0.021). T1D (179.0±171.7) were not significantly different. No significant vigorous PA differences were found (p=0.242; T1D=63.8±30; T2D=41.7±60.5; ND=73.8±94.8 min/week). Strength training days/week differed between groups, f(2,314)=3.6, p=0.028 with T1D (1.8±2.0) reporting significantly more than T2D (0.7±1.0; p = 0.024); no significant differences for ND (1.5±1.7). Conclusion: Although statistically similar to T2D/ND, T1D’s mean moderate activity was over the recommended 150 min/week. T1D did report significantly more strength training days/week than T2D approaching recommended 2 days/week. Participants’ most popular PAs were walking (51%), and strength training (18%), thus Kansans should consider walking and strength training exercises.

Purpose: The aim of this study was to characterise the effects of 4-week MC supplementation on vascular function in healthy adults and provide potential mechanistic evidence from urinary metabolite profiling. Methods: Twenty three healthy non-smoking individuals took part in a study in which they consumed either 30 mL of MC concentrate or an isocaloric placebo (PLA) bi-daily for 4 weeks. The study employed a randomised, double-blind, placebo-controlled, parallel design; mean ± SD age was 25.4 ± years in the MC group (n = 12) and 22 ± 2 years in the PLA group (n = 11). Blood pressure, arterial stiffness (pulse wave velocity and digital volume pulse) were measured pre- and post- supplementation. Spot urine samples were also collected at the corresponding time points to determine the effect of the intervention on the urinary metabolite profiles. Results: There were no differences in blood pressure or arterial stiffness following the 4-week supplementation with MC compared to PLA. However, metabolite profiling highlighted changes to the urinary metabolome following MC consumption (P < 0.001 within and between groups). Several discriminatory metabolites of interest were putatively identified as metabolites of the tryptophan and histidine pathways. Conclusions: These findings suggest that bi-daily MC supplementation for 4-weeks has no influence on blood pressure or arterial stiffness in healthy individuals, but does exert distinct metabolic changes. Specifically, MC concentrate appears to influence amino acid metabolism which warrants further investigations.
of a low nutrient dense diet, such as too much intake of added sugars, low intake of omega-3 polysaturated fatty acids and folate, and only meeting the recommended intakes of five or fewer nutrients.

**L-Proplyon-carnitine**, a propionyl ester of L-carnitine, is known to scavenge the superoxide anion, inhibit lipid peroxidation, and protect against H$_2$O$_2$-induced DNA strand scission. While exogenous L-proplyon-carnitine supplementation modulates lipid peroxidation in humans, the endogenous metabolic response following exercise is currently unknown. **PURPOSE**: To investigate the metabolic profile of L-proplyon-carnitine following exercise in hypoxia. **METHODS**: Twenty-four (n=24) apparently healthy male participants were recruited (age 28 ± 5 years; mass 74 ± 8 kg; stature 177 ± 6 cm; max hypoxia 45 ± 2 ml·kg$^{-1}$·min$^{-1}$; normoxia 60 ± 9 ml·kg$^{-1}$·min$^{-1}$), and completed 1 hr of exercise at a workload corresponding to 75% of pre-determined $\dot{V}O_2_{max}$ in hypoxia (F$\dot{O}_2$= 0.16%), and repeated in normoxia (F$\dot{O}_2$= 0.21%). Serum L-proplyon-carnitine was quantified using a LC ESI-qTOF-MS untargeted metabolomics approach at pre-, post-exercise and 3 hr post-exercise (Recovery).

**RESULTS**: Exercise performed in hypoxia and normoxia independently increased L-proplyon-carnitine metabolism (p<0.05, pre vs. post-exercise), and hypoxia per se did not induce a selective metabolic change when compared to normoxia (p<0.05). Recovery from exercise was similar for both hypoxia and normoxia (p=0.05, post vs. 3 hrs post-exercise). There was a main effect for time observed for pooled hypoxia and normoxia values (pre vs. post-exercise vs. 3 hrs post-exercise, p<0.05).

**CONCLUSION**: This is the first data to show a metabolic response in L-proplyon-carnitine following exercise. As such, we propose the increased mobilisation of L-proplyon-carnitine may be beneficial to counteract deleterious free radical production and protect against vascular exercise-induced oxidative stress.
Previous studies have demonstrated that perturbations in body weight result in modified resting metabolic rate (i.e. metabolic adaptation) that attempts to return the body to its customary weight (i.e. the set-point theory). How body weight changes during pregnancy impacts resting metabolic rate (RMR) and subsequently affects oxygen consumption for Warfighter tasks.

METHODS: RMR and body composition were measured after an overnight fast in 26 women (mean age, 34 range, 26-40; mean BMI 28.1±6.0 kg/m²) at 3, 6, 9 and 12 months postpartum. Energy balance over the postpartum period was calculated as the sum of the change in both fat mass (FM) and fat-free mass (FFM) multiplied by their respective energy densities. The ratio of RMR to FFM was used to assess the degree of metabolic adaptation. The degree of linearity between weight change and energy balance with metabolic adaptation was assessed using Pearson correlation. RESULTS: Weight loss (mean weight loss: -3.4±3.6 kg) was positively associated (p = 0.4, p < 0.03) with metabolic adaptation (mean RMR: 31.8±2.8 kcal/kg). Total energy balance (mean energy balance: 28719±2946 kcal/kg) was positively associated (p = 0.5, p = 0.01) with metabolic adaptation, indicating that a greater negative energy balance is associated with a lower resting metabolic rate relative to metabolically active fat-free mass (i.e. a greater metabolic efficiency). This relationship was independent of whether or not women had returned to their pre-pregnancy (i.e. set-point) body weight. CONCLUSION: The acute perturbation in body weight away from the set-point as a result of pregnancy contributes to the presence of metabolic adaptation during the postpartum period. The increase in metabolic efficiency in relation to greater weight loss during this time may contribute to difficulty in continuing to lose weight, or maintaining lost weight, after childbirth.

Physical inactivity represents a public health problem in an endemic obesity scenario worldwide. Therefore, it is relevant to estimate the energy cost of daily activities for nutritional and physical activity assessment and guidance. PURPOSE: To measure the energy expenditure (EE) of sedentary (typing) and daily activities (organizing bookshelves, climbing up and walking on stairs, and going up and down stairs) during exercise (walking on the treadmill at three speeds for pleasure, -0.8 km/h, and exercise) on different visits to the laboratory. RESULTS: The measured (SD) age of 29.9 (10.4) years with a mean BMI of 23.8 (3.8) kg/m² and Body Mass Index (BMI) of 30.0 (8.8) kcal/min of typing was 1.41 (0.48) and it was the only nonsignificantly different value in comparison to either method of estimation. The EE of going up stairs was underestimated by 3.01 (1.69) kcal/min by both methods. CONCLUSIONS: Based on the measured values, it can be concluded that the values described in the CAF or FAO/WHO overestimate the EE, except for the sedentary activity of typing, even when BMR or MET are measured. Health professionals should be aware of the inaccuracy of their activity EE of daily activities.

Military leaders require accurate information on the physiological stress induced by modern equipment loads in order to optimize planning for dismounted operations. PURPOSE: To evaluate the effects of heavy rucksack loadings on physiological responses of Soldiers during incremental treadmill walking. METHODS: Six male US Army Soldiers (age, 20 ± 1 years; height, 176 ± 6 cm; body mass (BM), 74 ± 5 kg) performed incremental treadmill walking while unloaded and carrying three proportional rucksack loads (22%, 44%, and 66% of BM). Treadmill speed was initially set at 4.2 km/h for 3 min then increased by 0.3 km/h every 2 min. Tests were terminated if volunteers completed the highest treadmill speed (7.1 km/h), reached volitional fatigue, or if their respiratory exchange ratio (RER) exceeded 1. Volunteers wore a chest-strap heart rate monitor and breathed into a metabolic cart that measured oxygen consumption. RESULTS: Volunteers completed all walking speeds while unloaded (7.1 km/h). While speed did not decrease significantly when carrying 22% BM (6.9 ± 0.3 km/h; p = 0.09), volunteers finished at significantly slower speeds when carrying 44% BM (6.2 ± 0.5 km/h; p < 0.01) and 66% BM (5.5 ± 0.6 km/h; p < 0.01). Peak heart rate during the unloaded walk (133 ± bpm) was significantly lower than load carriage with 22% BM (157 ± 12 bpm; p < 0.01), 44% BM (162 ± 14 bpm; p < 0.01), and 66% BM (161 ± 16 bpm; p < 0.01). Peak oxygen consumption for the unloaded walk (1.85 ± 0.25 L/min) was significantly lower than when carrying 22% BM (2.25 ± 0.36 L/min; p = 0.02) but not 44% BM (2.27 ± 0.55 L/min; p = 0.09) or 66% BM (2.40 ± 0.65 L/min; p = 0.06). CONCLUSION: Heavy military rucksack loads severely impair marching pace and induce considerable cardiovascular and metabolic stress. Our results provide preliminary evidence that heart rate may be a superior work intensity indicator than oxygen consumption for Warfighter tasks. The views expressed in this abstract are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government.
Caloric surplus has been associated with issues in body composition and weight management. In Mexico, 36% of women over 18 years of age reported performing some type of physical activity (PA). This troubling data are related to the overweight/obesity prevalence among female Mexican adults. Dance like, Latin, Zumba, and Twerk appears as an attractive form of PA for women. However, the effect they may have on energy expenditure and body composition remains unknown.

**Purpose**

To investigate energy expenditure and body composition in Mexican female recreational dancers of Latin, Zumba, and Twerk.

**Method**

77 women agreed to participate: Latin, 36, age 32.64 ± 13.16, BMI 24.41 ± 6.53, Zumba, 18, age 42.78 ± 16.55, BMI 26.63 ± 4.92, and Twerk, 23, age, 24.39 ± 5.38, BMI 22.57 ± 1.45. Inclusion criteria included participation for more than 4 weeks and at least 4 times per week. Body fat percentage and fat-free mass were calculated using bio impedance (BIA). Total Kcal spent during the session were measured with a pedometer. The BMI was calculated using weight and height. The analysis consisted of ANOVA.

**Results**

Based on BMI standards, all (but the Zumba participants) were classified as normal. Body fat percentage: Latin 22.62 ± 7.63, Zumba 27.68 ± 7.86 and Twerk 23.59 ± 4.53 (p = 0.043). Fat-free mass: Latin 23.62 ± 7.65, Zumba 23.23 ± 3.92, and Twerk 28.63 ± 9.58 (p = 0.031). Total Kcal spent: Latin 62.84 ± 15.47, Zumba 67.22 ± 16.91, and Twerk 32.18 ± 7.90 (p = 0.000).

**Conclusion**

The overweight/obesity prevalence in Mexican women and their health implications have precipitated an increased awareness in the value of exercise prescription and adherence. These preliminary results show that Zumba generates greater energy expenditure. They also reveal that Zumba is more popular among older participants with higher BMI and fat percentage. Further studies should be longitudinal, investigate the effects of intensity of exercise and dietary habits on weight loss, and include participants of other weight classifications and dance fitness classes. Possible limitations include small sample size and unequal sample sizes.
There are 27 million adults in the U.S. with type II diabetes mellitus, a condition associated with significant morbidity and mortality. Existing therapies can be costly, have side effects and may not achieve adequate disease control. Therefore, it is useful to identify lifestyle factors such as physical activity (PA) that may mitigate insulin resistance. Key clinical indicators of insulin resistance include fasting blood glucose (FBG), hemoglobin A1c (HbA1c) percentage, and the homeostatic model assessment of insulin resistance (HOMA-IR).

RESULTS: To evaluate the associations between insulin resistance indicators, body composition, and objective measures of habitual physical activity in older adults. METHODS: In 82 generally healthy non-diabetic adults (≥58 years, 23 m/59 f), body composition (bioelectrical impedance), fasting blood glucose (glucometer), serum insulin (enzyme-linked immunosorbent assay), HbA1c (HbA1c Analyzer), objective PA (7-day accelerometry), and subjective PA (Community Healthy Activities Model for Seniors (CHAMPS)) were measured. Controlling for age and body fat percentage, partial correlations between insulin resistance indicators and biomarkers were determined (Significance was set as α < 0.05).

RESULTS: Mean values were (mean ±sd): age (68.5 ±6.3 y), BMI (26.2 ±6.0 kg/m²), visceral fat (119.6 ±68.4 cm²), FBG (96.9 ±8.3 mg/dL), HOMA-IR (2.6 ±0.8), HbA1c (5.3 ±0.2%), and sedentary activity (cts/min: 114.1 ±56.5; sedentary-to-moderate ratio: 12.8 ±6.1). FBG was significantly correlated with serum insulin (r = 0.26), visceral fat area (r = 0.40), cts/min (r = 0.29), and sedentary-to-moderate PA ratio (r = 0.24). HOMA-IR was significantly correlated with visceral fat (r = 0.41). No significant correlation was found between HbA1c and any measured variable.

CONCLUSIONS: These preliminary data support previous findings that serum markers of insulin resistance are associated with physical activity and body composition. These findings suggest a potential role for using body composition and physical activity as clinical end points when managing patients with insulin resistance. Randomized controlled studies are needed to more rigorously assess the impact of physical activity on clinical indicators of diabetes mellitus in older adults.

Leptin has been established as an energy-controlling hormone because of its role in activating the JAK-STAT3 pathway. Temperature has its own prominent role governing appetite regulation and thus, energy expenditure. Previous research has demonstrated consistent decreases in leptin while in a fasted state. Exercising in the heat (1-hour consumption was measured at 1-, 2-, and 3-hr time-points. Additionally, in the AEx condition, a greater hunger and appetite consumption compared to the RDA and NKF (RDA = 72-78 kg/m², NKF = 2.4-6.9 kg/m², p = 0.036); however, after adjustment for plasma volume shifts (-7.5%) the interactive effect dissipated (-1.79%, p = 0.080).

CONCLUSIONS: The addition of heat stress increased energy expenditure and attenuated the leptin reduction. These data may have implications for appetite control and weight management.

Leptin intake (β = 1.20, p = 0.001), weight (β = 0.42, p < 0.033), and daily caloric intake (β = -0.36, p = 0.045). CONCLUSION: When compared to the RDA and NKF KDOQI guidelines, CKD patients had poor nutritional quality. Increased protein intake and BFRs were the strongest predictors of reduced eGFR. Future interventions in CKD patients should improve diet quality to concomitantly improve body composition and eGFR.

POURPOSE: The research aims to find out the relationships between temperature and energy intake in peri-urban Kenya. METHODS: We randomly selected 70 households who were former of vegetable and crop cultivation and mixed farming (vegetable and crop cultivation and husbandry) (male: 46 ± 10 yrs, n=35, female: 41.1 ±9 yrs, n=35) in Wangige region peri-urban setting, Republic of Kenya. Participants Data on body characteristics, daily activity by wearable devices, food consumption by the 24-hour recall, and weight and blood pressure were collected by trained enumerators. RESULTS: In the research, there were positive correlations between body weight (M = 72.1 kg, SD = 14.8) and intake of home garden foods in men (M = 37.2% SD = 16.5), r = 0.35, p < 0.05, n = 35. And weight (M = 74.2 kg, SD = 14.8) and intake of home garden foods (M = 37.8 %, SD = 13.3) r = 0.27, p < 0.05, n = 37, and Body Mass Index(BMI) (M = 28, SD = 5) and intake of home garden foods (M = 37.8 %, SD = 13.3) r = 0.28, p < 0.05, n = 37, in women.

CONCLUSIONS: In the Peri-Urban setting in the Republic of Kenya, the cause of increasing weight and BMI suggested that affect the decreasing intake of home garden foods and the number of agricultural fields in the female. Much of people works agriculture of main or side job in Kenya. Agricultural activity of role in peri-urban settings might affect daily activities and food consumption for the prevention of non-communicable diseases. The research was supported by academic cloud funding "Academicist", Doctor support fund in Tokyo University of Agriculture, Global readership program at United Nations University, Research Fund, Resilience at Works.

PRACTICE: Compare energy intake and appetite regulation responses between men and women following acute bouts of aerobic (AEs) and resistance exercise (REs). METHODS: Men and women (n=12 each) with overweight/obesity matched on age (32.3 ±2 vs. 36.8 ±2 yrs, p=0.14) and BMI (28.1 ±1.2 vs 29.0 ±1.5 kg/m², p=0.64) completed 2 conditions; 1) AEx (65-70% of age-predicted maximum heart rate for a 1-hour) and at Room Temperature (RT, 20°C) at 60% humidity. Blood draws were taken before intervention and after 3 hours for analysis of leptin and adiponectin. Oxygen consumption was measured at 1-, 2-, and 3-hour time-points.

RESULTS: IT trial temperatures were greater than RT for both core (mean ± SEM; 37.17 ± 0.08 vs. 36.89 ± 0.08°C, p = 0.002) and skin (37.59 ± 0.10 vs. 32.65 ± 0.48°C; p < 0.001). Oxygen consumption in HT was greater than RT during the 24° (4.37 ± 0.4 vs. 4.13 ± 0.15 mg/kg/min, p = 0.037) and 3-hours (4.95 ± 0.26 vs. 4.28 ± 0.19 mg/kg/min, p = 0.002). Fasting leptin concentrations in HT decreased to a greater extent than in HT (mean ± 95% CI; 2.05 ± 1.72 vs. 0.89 ± 1.67 mg/ml; p = 0.036, respectively). In the Peri-Urban setting in the Republic of Kenya, the cause of increasing weight and BMI suggested that affect the decreasing intake of home garden foods and the number of agricultural fields in the female. Much of people works agriculture of main or side job in Kenya. Agricultural activity of role in peri-urban settings might affect daily activities and food consumption for the prevention of non-communicable diseases. The research was supported by academic cloud funding "Academicist", Doctor support fund in Tokyo University of Agriculture, Global readership program at United Nations University, Research Fund, Resilience at Works.

Abstracts were prepared by the authors and printed as submitted.
in AUC for ghrelin, PYY, and GLP-1 were noted between men and women following either AEX or REX (all p<0.05). However, significantly higher ghrelin was observed in women vs. men (150 [807:6377 vs. 652.2 ± 141.8] pg/ml, respectively, p<0.01) and 180 min (812.4±39 vs. 677.5±49 pg/ml, respectively, p<0.05) post-prandial time points.

CONCLUSIONS: The data suggest that men report greater hunger and PFC than women following acute AEX, and that women have higher ghrelin levels than men following acute REX. Future work is needed to examine if sex-based differences in appetite regulation and energy intake are present with chronic exercise of differing modalities.

3915 Board #232 May 30 9:00 AM - 10:30 AM Reliability And Validity Of A Mobile SetUp For Metabolic Syndrome Diagnosis Using Point-of-care Analyzers

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(No relevant relationships reported)

The metabolic syndrome (MetS) is a worldwide public health concern and is characterized by having three or more of these risk factors: blood glucose (Glc), increased waist circumference (WC), high blood pressure (BP), reduced serum high-density lipoprotein (HDL) and increased serum triglycerides (TG). As certain rural regions lack the required infrastructure for optimal medical care, mobile diagnostics using point-of-care (POC) devices could help by identifying people at risk for MetS.

PURPOSE: Test the reliability and validity of MetS risk factor analysis using point-of-care analyzers in a mobile examination unit.

METHODS: Fifty participants (18 test-retest; 52±7 y; 170±10 cm; 80±19 kg) were enrolled in the study. Agreement of Glc, HDL and TG of three point-of-care analyzers (A, B, C) against a reference lab (REF) were analyzed by Bland-Altman (bias, Limits of Agreement (LoA) and McNemar’s test (MN)). Further, MetS diagnosis by the mobile setup was tested for inter-session reliability by Spearman’s rho and test-retest variability (TRV%).

RESULTS: The range of systematic bias was for Glc -21 to -8 mg/dl, for TG -90 to 3 mg/dl and for HDL -8 to 9 mg/dl. Device C was excluded from further analyses due to missing values. Device A was chosen for additional analysis based on smallest bias and LoA for Glc (8 [LoA -27 to 11] mg/dl), TG: 3 [LoA -40 to 46] mg/dl; HDL: -3 [LoA -16 to 11] mg/dl) and best agreement of MetS diagnosis with REF (MN: A vs. REF: p<0.05; B vs. REF: p<0.05). Test-retest analysis for risk factor classification and MetS diagnosis was performed in a mobile examination unit using device A. No inter-session differences for risk factor and MetS diagnosis were shown (MN day 1 vs. p>0.05). Spearman’s rho and TRV for risk factors were: TG: r =.734 (p<0.05); 3.3%; HDL: r =.076; 1.9%; systolic BP: r =.372; 1.7%; diastolic BP: r =.457; 3.3%; and WC: r =.950 (p<0.05; 1.1%).

CONCLUSIONS: The mobile setup showed no inter-session difference in MetS diagnosis. TRV was low for all risk factors and test-retest reliability was acceptable for TG, good for HDL and excellent for WC. Inter-session variations in Glc and BP did not influence the overall risk factor classification and MetS diagnosis. A mobile setup using a point-of-care analyzer for blood analysis is a valid and reliable method for a near-to-home MetS screening.

3916 Board #233 May 30 9:00 AM - 10:30 AM Abstract Withdrawn

3917 Board #234 May 30 9:00 AM - 10:30 AM Nutritional Group Counseling Or Individualized Prescription? Anthropometric, Metabolic, Nutritional And Mental Health Responses: A Longitudinal Study

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PURPOSE: The aim of this study was to investigate short- and long-term compensatory effects on dietary intake following high intensity interval training (HIIT) compared with usual care moderate intensity continuous training (MICT) during and following a cardiac rehabilitation (CR) program.

METHODS: Ninety-three patients with coronary artery disease enrolled in a 4-week CR program and were randomised to 1) 4x4-minute HIIT; or 2) 40-minutes of MICT (usual care). Patients were instructed to complete 3 weekly sessions (2 supervised, 1 home-based) for 4-weeks, and 3 weekly home-based sessions thereafter for 48-weeks. Only CR group-based dietary advice was provided. Dietary intake was measured by a computer-based 24-hour recall over two days at baseline, 4-weeks, 3-months, 6-months, and 12-months. The Three-Factor Eating Questionnaire was used to measure dietary behavioral, and fasting appetite was assessed by a 100mm visual analogue scale. Appetite hormones (ghrelin, PYY, leptin) were also analysed at baseline and 3-months. Data are mean change (95% confidence interval).

RESULTS: There was no change over the study period or differences between HIIT and MICT for daily energy intake at 4-weeks [-0.1(-0.8,0.5) vs -0.4(-1.0,0.2) MJ; p=0.549] or 12-months [0.4(-0.6,1.3) vs 0.1(-0.9,1.0) MJ; p=0.848]. There were also no group differences for macronutrients, saturated fat, or fibre. Over 4-weeks, an increase in dietary intake for both HIIT and MICT [7(-1.15) vs 6(-2.16); time effect: p=0.028], coincided with an increase in hunger [6(1.10) vs 5(1.10); time effect: p=0.028].

CONCLUSIONS: Both nutritional interventions combined with concurrent exercise were effective in promoting improvements in anthropometrics, body composition, food intake and some mental health parameters. Therefore, the choice of the method of nutritional intervention should be based on the preference of the participants.
Currently, there is equivocal knowledge concerning the effects of ketone salt supplementation on short distance running time trial (TT) performance in well-trained subjects. **PURPOSE:** To determine the effects of one-week exogenous ketone salt supplementation on 800m running TT performance during non-fatigued and pre-exhaustive states in endurance-trained subjects. **METHODS:** In a randomized, double-blind, placebo-controlled study, endurance-trained male and female participants were allocated to one of the following treatment groups for 8 days following an initial familiarization visit: Ketone supplementation (KET) (n=16) or placebo control (CON) (n=16). Subjects underwent two consecutive 800m TT before and after the 8-day treatment period on a self-propelled, non-motorized treadmill. Time-to-completion of the first (TT1) and second (TT2) TTs, the average time-to-completion across both TTs, and blood lactate response during the TTs were measured pre- and post-treatment. A mixed factorial ANOVA was used for data analysis. **RESULTS:** KET alone exhibited a significant increase in blood β-hydroxybutyrate from pre-post-treatment (p<0.05). A group x time interaction was only detected for TT2 performance (p=0.05) but not TT1. There was no pre- to post-treatment change in TT1 performance in either group. CON demonstrated no change in TT2 performance from pre- to post-treatment; however, KET improved TT2 performance as reflected by a 3.7% faster time-to-completion from pre- to post-treatment (p<0.05). When examining the average time-to-completion across both TTs, there was a significant group x time interaction (p=0.04). CON showed no change while KET demonstrated a faster average time-to-completion from pre- to post-treatment (p<0.05). Blood lactate response to TTs decreased (p<0.05) in KET but not CON. **CONCLUSIONS:** In endurance-trained subjects, ketone salt supplementation does not appear to affect short-distance running TT performance in a non-fatigued state reflective of competition scenarios. However, ergogenic effects may be observed in high-intensity exercise when some level of exhaustion or energy substrate depletion is experienced prior, such as during training or prolonged, intermittently high-intensity sporting bouts.
Effects Of Extra-Virgin Olive Oil And Exercise Training On Inflammation In Rats Fed A High-fat Atherogenic Diet

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(No relevant relationships reported)

Extra-virgin olive oil (EVOO), commonly seen in Mediterranean diet, has been shown to exert anti-inflammatory effect in chronic disease prevention. Long-term high-fat diet increases chronic inflammation, which leads to cardiovascular diseases and metabolic syndrome. PURPOSE: The purpose of the study is to evaluate the effects of 12-week EVOO supplementation and exercise training on circulatory inflammatory markers in rats fed a high-fat diet. METHODS: Female Sprague-Dawley rats (age 4 week, n=36) were randomly divided into 3 groups. One group was fed a basal diet (C, N=12) with added cholesterol (1.25%) and cholic acid (0.5%) for 12 weeks. While on the basal diet, two groups were supplemented with 20% EVOO, half group being trained (T, N=12) on treadmill for 12 weeks (25/min, 10% grade for 60 min/day, 5 days/wk), and the other half being sedentary (S, N=12). Plasma inflammatory cytokines were measured by Multiplex immunoassays on Luminex 200. Data were analyzed using two-way ANOVA. RESULTS: EVOO supplementation elevated 1.91-fold on macrophage colony stimulating factor (M-CSF) levels (p=0.05), but this effect was decreased 3.34-fold by T (p<0.05). A significant increase in granulocyte-macrophage colony stimulating factor (GM-CSF) was found in EVOO vs. C (5.9-fold, p<0.05). Monocyte chemotactic protein-1 (MCP-1) level in plasma was decreased 1.46-fold in EVOO/T vs. C (p<0.05). Plasma interleukin-1β (IL-1β) and tumor necrosis factor-alpha (TNF-α) levels did not change in EVOO (p>0.05), but TNF-a was found in EVOO (p<0.05) vs. C (5.9-fold, p=0.05). CONCLUSION: Dietary supplementation of EVOO resulted in an augmentation of plasma inflammatory cytokines levels in the sedentary rats fed a high-fat atherogenetic diet, but these adverse effects were significantly reversed by chronic exercise training.

Exercise Priming: Effect Of Morning Exercise On Fat Oxidation During Afternoon Walking

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Reduced fat oxidation is emerging as a predictor for obesity-related diseases; therefore, interventions that increase fat oxidation may have clinically important health benefits. Previous research suggests that exercise priming may provide a novel solution by augmenting fat oxidation during subsequent exercise. PURPOSE: To investigate the effects of morning Reduced-Exertion High-intensity Interval Training (REHIT) on fat oxidation during afternoon Low-intensity Steady State (LISS) walking. METHODS: Twelve sedentary or recreationally active university students (7 male, 5 female) participated in 2 randomly assigned morning interventions, REHIT (two 20-second sprints on a cycle ergometer separated by 4-minutes of active recovery) or rest, on two separate days. On both occasions, participants returned to the lab in the afternoon (4 hours later) to complete a 45-minute treadmill walk at 5.6 km/h. Participants remained fasted for both morning and afternoon trials. Blood and gas samples were collected pre-, during, and post-LISS exercise. RESULTS: After 45 minutes of LISS walking, plasma non-esterified fatty acids (NEFA) was greater in the REHIT trial compared to control (REHIT 1.03 ± 0.39 mmol/L, Control 0.75 ± 0.43 mmol/L, p=0.03; Cohen’s d = 0.67). Furthermore, plasma glucose, carbohydrate oxidation, respiratory exchange ratio (RER) and energy expenditure remained consistent between the trials across all time points (p=0.40; p=0.98; p=0.92; p=0.81, respectively). CONCLUSION: Exercise priming may not influence fat oxidation during subsequent exercise. However, plasma NEFA may be greater suggesting changes in substrate availability. Relatively long rest intervals between the morning and afternoon trials and insufficient exercise workload could explain similarities in substrate oxidation. Isotopic research is required to understand the metabolic fate of the elevated substrate concentrations.
Metabolic flexibility (MF) is the ability of the body to alter its reliance on fat or carbohydrate for energy purposes in response to a stimulus. The inverse, metabolic inflexibility, has been associated with type II diabetes and obesity. Given the prevalence of these disorders, assessing and improving MF is important. However, MF during exercise, particularly with respect to fat metabolism, in children remains poorly understood. PURPOSE: This study examined MF with respect to fat metabolism during exercise in lean (n=11; 10.9±0.9 years) and overweight/obese (OW/OB; n=8; 10.4±1.2 years) children. It was hypothesized that MF with respect to fat metabolism during exercise would be impaired in the OW/OB group as indicated by reduced use of fat as an energy source.

METHODS: Participants were grouped based on BMI percentiles for age and sex (Lean<85th percentile, OW/OB≥85th percentile). On the experimental visit, participants completed two 20-minute exercise bouts separated by a 10-minute rest. Bout 1 consisted of 20 minutes at 50% VO2max. Absolute fat oxidation rate (FOR; [mg·min⁻¹], FOR relative to body mass [mg·kgBFM⁻¹·min⁻¹]), and proportional fat use (%Fat) were measured at 10 minutes of Bout 1 and 5, 10, 15, and 20 minutes of Bout 2. RESULTS: There was a main effect for time for %Fat and for each expression of FOR, with fat oxidation values generally higher during the second bout, suggesting that exercise can be used to assess MF in children. Absolute FOR was higher in the OW/OB group (range: 121.6±57.6 to 213.7±45.7 mg·min⁻¹). On Day 1, there was no significant difference in the PP glucose, insulin, or differences (p<.05) between the bouts were determined using a one-way, repeated measures ANOVA followed by Bonferroni post-hoc test. RESULTS: Average work (Watts) was similar between MCC (122.5±25.4) and HIIC (110.3±14.7) (p=.091, ES = .51). On Day 1, there was no significant difference in the PP glucose, insulin, or TG response between the 3 bouts. On Day 2, MCC reduced the TG AUC (442.9±76.9mg·dl⁻¹·hr⁻¹) when compared to rest (407.8±104.4mg·dl⁻¹·hr⁻¹) (p=.02, ES = .43). HIIC elicited a non-significant reduction the TG AUC (454.8±72.3mg·dl⁻¹·hr⁻¹), however the reduction was trending towards significance (p=.076, ES = -.33).

CONCLUSION: A brief bout of MCC and HIIC does not influence the PP response when completed just prior to a mixed meal. There may be a delayed response to exercise as MCC and (to a lesser degree) HIIC appear to reduce the PPTG response when completed just prior to a mixed meal. The lack of change in the PP glucose and insulin response might be explained by a wide inter-individual variance as half of the participants appeared to have responded to the exercise bouts based on their PP glucose and insulin concentration.

The relative exercise intensity at maximal fat oxidation (FATmax, %VO2max) is used for exercise prescription for weight loss and metabolic health. In young men, FATmax is affected by exercise duration, with more prolonged testing protocols leading to higher values. PURPOSE: Since no data exist on post-menopausal women, we determined the effect of exercise duration on FATmax in this population. METHOD: 18 non-obese women (54±4 years; 4±3 years from menopause; 22.3±3 BMI) performed a cycle ergometer test and 30-minute steady-state trials at 40, 50, 60, 70 and 80% of the pre-determined VO2max. Based on VO2 and respiratory exchange ratio we calculated and compared (2-way RM ANOVA) absolute fat oxidation (FO, g·min⁻¹) across intensities and duration. We compared FATmax derived from ramp (FATmax'), 5 (FATmax') and 30-min data (FATmax') as independent explanatory variables. RESULTS: FO was significantly affected by exercise duration, intensity and their interaction (for all p < 0.001). Any exercise between 40 and 70% VO2max > 30 min, lead to an identical MFO (overall 0.21±0.09 g·min⁻¹). FATmax occurred at a significantly higher %VO2max (57±10%) than FATmax' and FATmax' (44±6 and 49±9%, not different). FATmax can be predicted from the linear combination of exercise duration (p<0.001) and FATmax' (p=0.01) as independent explanatory variables (r=0.69, SEE=8.8%). CONCLUSIONS: In post-menopausal women exercising at 40-80%VO2max of longer durations are associated with higher FATmax compared to ramp or short, steady-state sessions. Moreover, any intensity greater than FATmax will maximize fat oxidation for exercises > 30 min. Finally, the intensity that maximizes fat oxidation can be predicted by exercise duration and FATmax'. This approach offers a valid approach for individualized exercise intensity prescription for weight loss and metabolic health in postmenopausal women.
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3931 Board #248 May 30 9:00 AM - 10:30 AM
Wild Blueberries Increase Fat Oxidation Rate During Moderate Intensity Exercise
Jessie Armendariz1, Boe Burrsu2, Kari Pilolla3, David Baston3, Taylor Blooden1, Humboldt State University, Arcata, CA.1 Gonzaga University, Spokane, WA. California Polytechnic State University, San Luis Obispo, CA.

(Fruit and vegetable intake in the diet can reduce body fat mass and increase the rate of fatty acid oxidation during exercise. Previous studies have shown the effect of blackcurrants and acai berries on fat oxidation. However, there is a lack of research on the effect of wild blueberries on fat oxidation during exercise. PURPOSE: To examine the effect of freeze dried WBs on the rate of FA-ox and lipid peroxidation during moderate intensity exercise. METHODS: 11 healthy, acclimated to exercise, young men (23 ± 5 yrs, 77 ± 8 kg, 10.2 ± 3.4% BF) performed an incremental cycle protocol to determine VO2peak (54.7 ± 7.9 ml/kg/min) following a 2-wk washout avoiding foods high in anthocyanins. Participants completed a control (C) protocol of cycling at 65% of VO2peak for 40 min. Urinary F2-isoprostanes (~ 50 mL) and capillary blood FA, glycerol, creatinine and intensity may have been too low to see significant changes in urinary F2-isoprostanes. With blood sample preparation may have led to unreliable results. Further, the exercise variables.

0.13 g/min; p=0.012). No differences were found between C and WB trials for all other variables.

3932 Board #249 May 30 9:00 AM - 10:30 AM
Exercise Training Adaptations In Metabolic Syndrome Individuals On Chronic Statin Treatment
Felix Morales-Palomo, Miguel Ramirez-Jimenez, Juan F Ortega, Alfonso Moreno-Cabañas, Laura Alvarez-Jimenez, Ricardo Mora-Rodriguez, UCLM, Toledo, Spain.

(No relevant relationships reported)

Statin use reduces the risk of cardiovascular events and improves markers of systemic inflammation and insulin resistance in metabolic syndrome (MetS) patients. However, there are conflicting reports about whether statin use can interfere with training adaptations. PURPOSE: To determine the therapeutic impact of an exercise-training program on fat metabolism and cardiorespiratory fitness (CRF) in a group of MetS individuals chronically medicated with statins in comparison to a well-matched control group statin-naïve.

METHODS: One hundred and six MetS were divided into statin users (STATIN group, n=46) and statin-naïve (CONTROL group, n=60). Groups were matched by age, weight, and MetS components. All subjects completed 16 weeks of high intensity interval training (HIIT). Before and after HIIT, muscle biopsies were collected to assess mitochondrial content (citrate synthase (CS) activity) and the activity of the rate limiting β oxidation enzyme (3-hydroxyacyl-CoA dehydrogenase (HAD)). Fasting plasma glucose, insulin, TG, HDL-c and LDL-c concentrations were measured. Exercise maximal fat oxidation (FOmax) and oxygen uptake (VO2peak) were determined.

RESULTS: Training improved MetS components similarly in both groups (MetS Z-score: +0.26±0.38 vs -0.22±0.31; P<0.001 for time and P=0.60 for time x group). Before training, STATIN had reduced muscle HAD activity and whole body FOmax compared to CONTROL (P=0.038 and P=0.002 for group, respectively). 16-weeks of HIIT increased HAD and FOmax in both groups (32% and 20% in STATIN and 3% and 10% in CONTROL; both P<0.03 for time and P=0.05 for time x group, respectively). VO2peak improved less in STATIN than in CONTROL group (12% vs 19%; P=0.013 for time x group). Conversely STATIN did not prevent the increases in CS with HIIT (38%; P=0.001 for time, P=0.199 for time x group).

CONCLUSIONS: Our findings suggest that chronic statin use in MetS does not interfere with exercise training improvements in fat oxidation and neither with the muscle enzyme mediators of these responses (i.e., CS and HAD). However, STATIN attenuated the improvements in VO2peak with training. ClinicalTrials.gov identifier: NCT03019796

3933 Board #250 May 30 9:00 AM - 10:30 AM
Effect Of Aerobic Exercise On The Proteins Of Ubiquitin System In Different Adipose Tissues Of Obese Rats
Yi Yan, Changfu Li, Qishu Zhou, Chunyu Liang. Beijing Sport University, Beijing, China.

(No relevant relationships reported)

PURPOSE: To observe character of the different adipose tissue ubiquitin system in obese rats and explore the role of ubiquitin system in regulation of 6-week moderate intensity aerobic exercise on the adaptability of different adipose tissue of obese rats.

METHODS: After 8 weeks high fat feeding (D12450B), 20 obesity 11weeks SD were randomly assigned to sedentary (OS, n=10) and exercise (OE,n=10) groups; 20 normal weight also were randomly assigned to sedentary (CS, n=10) and exercise (CE, n=10) group. During the following 8 weeks, CS and OS groups were CE and OE groups did the 60%–70% VO2max treadmill training (5 days/week, 1 hour/day). The (V0max, Omax treadmill training) of each group were remeasured every two weeks. The protein expressions of LC3II,LC3I,ATG7,ATG8,ATG12 and ATG2-ATG12 in white adipose tissue of and brown adipose tissue of scapular were measured by Western blotting.

RESULTS: (1) In the white adipose tissues, the protein expressions of ATG7,ATG5,ATG12,ATG12-ATG5 (p<0.05) and LC3II/I (p<0.01) in OS group were significantly increased than CS group, but the protein expressions of ATG7,ATG5,ATG12,ATG12-ATG5 in CE group increased significantly (p<0.05), but the LC3II/I (p<0.01) and ATG5-ATG12 (p<0.05) in OS group decreased significantly. The ATG7,ATG12,ATG12-ATG5 and LC3II/I of CE group were significantly higher than OS group (p<0.05).

CONCLUSIONS: There was tissue specificity of adipose tissue autophagy in obese rats. The ubiquitin system of ATG5-ATG12 involved in activation of white fat autophagy. 8 weeks moderate intensity aerobic exercise can inhibit the autophagy of subcutaneous white fat and strengthen the autophagy of scapular brown fat.
Hypoxic training combined with magnesium supplementation may promote liver lipolysis and fatty acid beta oxidation by activating liver PPARs and its downstream factors, improve liver lipid metabolism in obese mice.

**3936 Board #253**

**May 30 9:00 AM - 10:30 AM**

**Association Of Leptin And RMR In Obese Elderly Adults With Different Levels Of Physical Activity**

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**PURPOSE:** The aims of this study were 1) to examine potential sex-related differences in leptin, resting metabolic rate (RMR) and metabolic markers2) to assess differences in leptin, RMR and metabolic markers between low MVP group and high MVP group3) to assess whether being physically active may play a role in the associations between leptin, RMR and physical activity.

**METHODS:** The subjects were 73 women (age=64±1.6 years, percent body fat=39.1±4.8%) and 37 men (age=66±3.5 years, percent body fat=29.7±4.7%). RMR was measured by indirect calorimetry (Metamax 3B-R2 Metabolic Measurement system, German) and body composition by the DXA (GE Lunar Prodigy, USA). Serum leptin and lipid and glucose metabolism markers’ levels were determined by radioimmunoassay. Waist-mounted triaxial accelerometer Actigraph GT3X-BT was used to make objective 7-day recordings of physical activity. Based on the mean of the minutes spent in MVP (180 min/week), subjects were divided into low MVP group (n=50, percent body fat=37.1±7.0%) and high MVP group (n=56, percent body fat=34.5±6.1%).

**RESULTS:** Leptin and HDL cholesterol levels were higher in women than men (both p<0.01), while men presented higher fat free mass and RMR (both p<0.01) than women. Leptin, insulin, HOME-IR, percent body fat were higher in low MVP than high MVP group (both p=0.05), RMR and metabolic markers, however, were not found significant differences (all p>0.05). Leptin levels was associated with RMR negatively and PBF positively (r=−0.36, p=0.013;r=0.645,p=0.0001) in low MVP group, leptin levels was associated with RMR negatively and PBF positively (r=−0.51, p=0.001;r=0.631,p=0.0001) in high MVP group. The negative association of RMR with proportion of sedentary (r=−0.34, p=0.027) and the negative association of leptin with proportion of MVP (r=−0.303, p=0.023) were only found in high MVP group.

**CONCLUSIONS:** Leptin may play a role in energy metabolism in overweight and obese elderly adults. Obesity is associated with energy metabolism and metabolic markers both in women and men. The relationship of leptin with energy metabolism and insulin resistance might be mediated by levels of physical activity.

**Acknowledgements:** This work was supported by Ministry of Science and Technology of the People’s Republic of China (Grants No.2013FY114700).

**3937 Board #254**

**May 30 9:00 AM - 10:30 AM**

**Cyclooxygenase 2 Regulates Isoprenaline Induced Adipolysis In Brown Adipocytes**

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**PURPOSE:** By converting fat into heat, brown adipocytes (BAC) play as an energy expenditure in mammalian. Cyclooxygenase 2 (COX2) is a key factor of Uncoupling protein 1 (UCP1) with its regulation for dissipates energy into heat via adipolysis. Isoprenaline (ISO) can induce adipolysis in brown adipocytes (BAC); however, whether COX2 takes part in ISO induced adipolysis remains unclear.

**METHODS:** C13H17O3, cells were differentiated into brown adipocytes. BACs were treated with 10µM ISO or 10µM ISO and 100µM NS-398 (COX2 inhibitor) for 0 (as control), 1, 3, 6, 12 or 24 hours. For lipid droplet (LP) size analysis, cells were fixed and stained with Oil Red O. Images were captured with a Leica CTR 4000 microscope with 10x objectives. All images were thresholded for LPs signal and watershed for LPs size analysis and size frequency distribution. BACs were collected for UCP1 expression detection after 6-hour-incubation (beta tubulin as loading control). All results are presented as means ± std. error of mean. Statistics were performed in SPSS using Student’s t-test.

**RESULTS:** Average LP size decreased as ISO incubation time prolonged (113.67 ± 2.40, 115.69 ± 2.21, 83.61 ± 1.69, 35.00 ± 0.88, 31.60 ± 0.69, 34.28 ± 0.77 µm2 after 0, 1, 3, 6, 12, 24 hours, respectively). Isoprenaline incubation of ISO and NS-398 slowed down the rate of LP size reduction (95.08 ± 1.65, 107.73 ± 2.26, 85.22 ± 1.87, 56.97 ± 1.49, 41.32 ± 0.87, 37.43 ± 0.65 µm2 after 0, 1, 3, 6, 12, 24 hours incubation, respectively; slope (-53.04 ± 1.21 vs. -65.45 ± 1.33) LP size frequency distribution showed a shift of LP size towards smaller LPs following incubation with ISO. Inhibition of COX2 activity can delay the occurrence of left shift (became smaller) of LP size frequency distribution (12h vs. 3h). UCP1 expression was lower following ISO and NS-398 incubation than those treated with ISO only (0.74 ± 0.08 vs. 1.00 ± 0.06, p<0.05).

**CONCLUSION:** COX2 inhibition can repress ISO induced adipolysis in BACs and may related to a decrease in UCP1 expression.

**Acknowledgements:** Funded by FRF for the Central Universities of China (2018G0107).

Maximal fat oxidation (MFO, in g. min⁻¹) is an index of metabolic flexibility and the relative exercise intensity at MFO (FATmax, as % maximum oxygen consumption (VO2max)) is used for exercise prescription for weight loss and metabolic health. The time-consuming, steady-state protocol required for MFO/FATmax determination hinders the extensive use of these indexes. Alternative, ramp testing has been validated for MFO/FATmax determination in healthy, young males only. **PURPOSE:** To validate ramp testing for MFO/FATmax measure in postmenopausal women.

**METHODS:** 18 sedentary, postmenopausal women (54±4 years; 41±3 years from menopause; 22±3 BMI) performed a cycle ergometer: i) a ramp incremental test; ii) steady-state trials at 40, 50, 60, 70 and 80% of the VO2max as determined by the incremental test. We measured VO2, respiratory exchange ratio (R) and heart rate (HR). Based on VO2 and R from the ramp test (breath by breath data) and steady-state protocol (5 minute each of trial) we measured absolute fat oxidation (FIO, in g. min⁻¹); then, we determined MFO in absolute units (in g.min⁻¹) and the relative intensity corresponding to MFO, i.e. FATmax, that was expressed relative to VO2max and directly determined maximal HR (HRmax). MEO and FATmax from the ramp (MFO and FATmax) were compared to the values from the steady-state protocol (MFO and FATmax) by paired t-Test.

**RESULTS:** The MFO was significantly lower than MFO (0.39±0.13 vs 0.19±0.07 g.min⁻¹ p<0.001). On the contrary, the FATmax and FATmax occurred at an identical %VO2max (45±6 vs 47±5%VO2max p=0.17) and %HRmax (61±6 vs 62±6% HRmax p=0.54).

**CONCLUSIONS:** In agreement with other studies conducted in young males, our data confirm that only steady-state protocols allow accurate MFO quantification. On the contrary, accurate measures of FATmax can be obtained indifferently from both ramp and steady-state protocols in postmenopausal women. Therefore, ramp testing offers a valid alternative to more time-consuming steady-state protocols for the identification of...
Cycling at 85% PPO separated by 75 s recovery. HIIT increased exercise at 10–50% PPO during which gas exchange data were acquired to calculate separate days after a minimum 6 h fast, they completed five stages of progressive expression compared the SD (0.44 vs. 1.58 AU, p<0.05), and E to the SD (1.58 vs. 1.15, p<0.05), and E treatment of treadmill exercise (25 minutes/day at 40 cm/s for 5 days/week (Ex)) or

**METHODS:** Female Wistar rats were fed a standard diet (SD) or a high-fat diet (HFD) for 10 weeks. A subset of the rats had their ovaries removed via ovarioectomy (OVX). The rats were given treatment of treadmill exercise (25 minutes/day at 40 cm/s for 5 days/week). The end of the study, the liver was removed and homogenized in cell extraction buffer, and the protein was isolated. Western blot analyses were performed to measure the expression of the following proteins involved in lipid metabolism and mitochondrial function: acetyl-coA carboxylase (ACC), fatty acid synthase (FAS), hormone sensitive lipase (HSL), lipoprotein lipase (LPL), citrate synthase, and cytochrome c oxidase (COX) IV. RESULTS: The HFD decreased the ACC expression compared to the SD (0.49 vs. 0.93 AU, p<0.05), and E treatment restored these values (0.81 AU, p<0.05). Similarly, the HFD decreased the FAS expression compared to the SD (0.44 vs. 1.58 AU, p<0.05), and E treatment restored these values (0.75 AU, p<0.05). The HFD increased the LPL expression compared to the SD (1.35 vs. 1.15, p<0.05). Treatment of treadmill exercise increased the ACC and FAS expression, and decreased the LPL expression, and the expression of HSL, citrate synthase, and COX IV did not change with diet. E2 treatment, or Ex. CONCLUSION: Two proteins that stimulate de novo fatty acid synthesis (ACC and FAS) decreased with the HFD, likely due to the exogenous intake of fats. Notably, E2 treatment increased the ACC and FAS expression, even though the HFD was still being consumed. LPL is a protein that stimulates fat storage. Consumption of the HFD increased the LPL expression to increase fat storage, and E2 treatment decreased the LPL expression. Thus, E2 may provide benefits by decreasing fat storage. Supported by NIH Grant 2P01HD030443 and NSF Grant IIA-1355423.

**CONCLUSION:** These preliminary data obtained in inactive women suggest that ethnicity may alter changes in energy metabolism observed in response to short-term interval training. Further work is needed to examine the mechanisms underpinning this potential effect of ethnicity on adaptation to training. This work was funded by a Research and Scholarly Activity Grant.
collected before (PRE) and after (POST) intervention. **Results:** Women maintained calories (PRE: 1938 kcal vs POST: 1836 kcal) and protein levels (PRE: 17% vs POST: 20%) but decreased dietary carbohydrate (PRE: 36% vs POST: 13%) and increased dietary fat (PRE: 45% vs POST: 65%) PRE to POST (p < 0.05). Weight (PRE: 73.9 kg vs POST: 72.3 kg) and body fat (PRE: 56.9 kg vs POST: 54.8 kg) significantly decreased but there were no differences in lean body mass PRE to POST (p > 0.05). **BG** (PRE: 94.0 mmol/L vs POST: 89.9 mmol/L) decreased significantly, with 73% of women decreasing BG by at least 10% POST (p < 0.05). Ketone increased significantly and 58% of women reached nutritional ketosis by POST testing (p < 0.05). There were no differences in cholesterol panel except for LDL, which increased from (PRE 111.1mg/ dl) to POST (124.2mg/dl) (p < 0.05). **Conclusion:** Women’s metabolic health is an immediate concern for the silent killer known as CVD in this population. Finding safe, systemic interventions to this pandemic is imperative. WKFD improved some, but not all, metabolic markers within 21 days. This highlights the initial shifts in metabolic health related to WKFD nutritional interventions and calls for additional research to help better understand the underlying mechanisms of WKFD on metabolic health, especially as it relates to cholesterol metabolism, and the timeline of these events.

**3943** Board #260 May 30 9:00 AM - 10:30 AM Effects Of Ketogenic Diet Containing Medium-chain Triglyceride And Endurance Training On Metabolic Enzyme Adaptations. Ayumi Fukazawa, Atsuko Koike, Takuya Karasawa, Mornoko Tsuchi, Saki Kondo, Shin Terada. The University of Tokyo, Tokyo, Japan. Email: fukazawa.a01@gmail.com (No relevant relationships reported)

**Purpose:** Long-term intake of very low-carbohydrate, high-fat (ketogenic) diets enhance production and utilization of ketone bodies, which are more energy-efficient fuels for skeletal muscle. However, adaptation to the extremely low-carbohydrate diet has been shown to upregulate pyruvate dehydrogenase kinase 4 (PDK4) content in skeletal muscle, which is a negative regulator of glycolytic flux, resulting in the impaired high-intensity exercise capacity. Because medium-chain triglyceride (MCT) can produce more ketone bodies than long-chain triglyceride (LCT), incorporating MCT into the diet may allow more carbohydrates yet preserving ketosis and exert less inhibitory effect on muscle glucose metabolism. The purpose of this study was therefore to examine the effects of long-term feeding of ketogenic diet containing MCT on the endurance training-induced adaptations in metabolic enzymes of rat skeletal muscle.

**Methods:** Male Sprague-Dawley rats (7-week-old) were placed on a standard diet (PFC ratio = 21:16:63), LCT-containing ketogenic diet (LKD, PFC ratio = 12:87:1) or MCT-containing ketogenic diet (MKD, PFC ratio = 16:66:18) for 8 wks. Half the rats in each group performed 2-h swimming exercise, 5 days a week for 8 wks. After the 8-wk intervention, protein expressions of 3-oxoacid CoA transferase 1 (OXCT, a ketolytic enzyme) and PDK4 in epididymal muscles were measured.

**Results:** Despite the lower lipid content in the diet, plasma hydroxybutyrate concentration in the MKD-fed rats increased to a level similar to that attained in the rats fed the LKD (17 ± 7 vs 83 ± 18 mmol/L/d, p = 0.99). Endurance training significantly increased OXCT protein content in epididymal muscle and moreover, intake of the MKD additively enhanced the endurance training-induced increase in OXCT protein content. PKD4 protein level in skeletal muscle was substantially increased after the LKD consumption. However, such increase in the PKD4 was not observed in the MKD-fed rats regardless of endurance training status.

**Conclusion:** Long-term intake of ketogenic diet containing MCT may additively enhance endurance training-induced ketone bodies utilization capacity in skeletal muscle without exerting inhibitory effects on glucose metabolism.

**3944** Board #261 May 30 9:00 AM - 10:30 AM Beta-hydroxybutyrate (bhb) Ketone Salt Supplement Alters Energy Metabolism, Blood Glucose And Ketone Levels. Miranda Thompson, Svetlana Nepocatych. Elon University, Elon, NC. (Sponsor: Eric Hall, FACSMS) (No relevant relationships reported)

Ketone supplements were found to produce acute nutritional ketosis (defined as having a blood ketone level of 0.5-3.0 mM), suppress appetite, lower plasma ghrelin levels and perceived hunger. **PURPOSE:** To determine the acute effect of beta-hydroxybutyrate (BHB) ketone salt (KS) on appetite profile, energy metabolism, blood glucose and ketone levels and subsequent energy intake. **METHODS:** Twenty-two healthy females (age: 26 ± 7 y, BMI: 28.6 ± 8.2, BMI: 26.1 ± 8.6 kg/m2) were randomly assigned to consume either 0.25g/kg of KS or flavor matched placebo (PL). During each visit, participants completed an appetite profile survey using a visual analogue scale (VAS) before, at 0, 30, 60 and 90 minutes. Indirect calorimetry using ventilated hood technique was used to measure thermic effect of a supplement at 30-45 and 75-90 minutes. Blood glucose, ketone levels and affect were measured before, at 0, 45 and 90 minutes. Energy intake following an ad libitum breakfast was recorded. A repeated measures ANOVA was used for analysis with significance accepted at p < 0.05. **RESULTS:** A significant difference over time (p > 0.001) but not between supplements (p > 0.05) was observed for appetite profile. A significant interaction supplement over time was observed for VO2 (p = 0.007) but not RQ (p = 0.28). A significant supplement effect was observed for blood glucose (KS: 83±10, 84±8, 82±8 mg/dl and PL: 88±10, 89±8, 86±9 mg/dl, p = 0.04) and ketone levels (KS: 0.3±0.2, 0.5±0.2, 0.4±0.2 mM and PL: 0.3±0.3, 0.2±0.2, 0.2±0.2 mM, p < 0.001) at 0, 45 and 90 min, respectively. However, no significant difference in energy intake at breakfast (p=0.04) was observed between KS: 200±116 kcas and PL: 203±107 kcas. **CONCLUSIONS:** Ketone salt supplement caused modest elevation in blood ketone levels and reduced glucose, suggesting improved glycemic control, however, did not have an effect on perceived satiety or energy intake.
Decline in mitochondrial function is associated with a decrease in lifespan. We have previously demonstrated that a long-term ketogenic diet (KD) improves mitochondrial function and longevity. However, a life-long KD is difficult to maintain and an intermittent KD might be more viable long term.

**PURPOSE:** Determine how long it takes before a ketogenic diet alters muscle metabolism so that intermittent diets can be developed.

**METHODS:** Four C57BL/6 mice were fed a control diet or 1 or 7 days of continuous KD. At the end of the metabolic rate (MRR) prescribed in an indirect way. This measure would be very helpful in the nutritional counseling, because many people don’t have access to the Metabolic Rest Rate (MRR) Prediction By Linear Regression

**RESULTS:** Following one day of KD, neither acetylated, nor mitochondrial proteins were different than control diet. By seven days of continuous KD diet, total acetylated proteins increased in the liver, kidney and gastrocnemius muscle. Specifically, acetylation of p300 was 3.4±0.8-fold greater following 7 days of KD. Unlike the other tissues the brain showed no difference in acetylated proteins by 7 days. An increase in mitochondrial mass was only seen in the liver at 7 days of KD.

**CONCLUSIONS:** A short term ketogenic diet can be used to rapidly alter protein acetylation in the liver, kidney and muscle. These data suggest that an intermittent keto diet may be useful in promoting a biochemical change in muscle that promotes mitochondrial function and may benefit long-term muscle function.
BACKGROUND: Indirect calorimetry (IC) is the gold standard method to assess individual resting energy expenditure (REE). However, due to its high cost and time demand, predictive equations are largely used to estimate energy requirements, which may vary according to different body compositions and health status. Crossfit® is a training program created by Greg Glessman in 1995 and consists of performing high-intensity functional movements. Some studies have already reported increase of metabolic rates in this population.

PURPOSE: To measure REE in Crossfit® practitioners, using IC, and verify the most appropriate predictive equation to estimate this variable.

METHODS: 142 Crossfit® practitioners, 91 female (64.1%), aged between 16-59 years, underwent nutritional assessment, including weight, height, waist circumference (WC) and body mass index (BMI). Body composition was measured by a portable bioelectrical impedance analyzer. REE was measured by IC (inREE) and predicted by six different equations (pREE): Harris-Benedict, World Health Organization (WHO), Henry and Rees Cunningham (1980), Cunningham (1991), and MiFFlin-St.Jeor. Statistical analysis were carried out by Kolmogorov-Smirnov Test, Student’s t test and Bland and Altman plots.

RESULTS: The mean age was 33.0 ± 6.3 years of age, without difference between men and women. The mean BMI was 24.7 ± 3.5 kg/m². The mean inREE was 1583.2 ± 404.4 kcal, and the pREE ranged from 1455.5 ± 230.9 kcal to 1711.3 ± 285.5 kcal. The best REE predictive equations for Crossfit® practitioners were the Cunningham (1991) (P=0.338), WHO equation (P=0.494) and Harris-Benedict (P=0.705). Harris-Benedict presented the smaller difference comparing with IC (12.9 ± 307.6 kcal). Cunningham (1991) showed better adequacy (102.5%) and WHO equation presented greater percentage of accuracy (95.3%). The same equations remained adequate when data were stratified by gender.

CONCLUSIONS: This study showed that Cunningham (1991, 1985) and Harris-Benedict (1919) equations were the most appropriated REE equations for Crossfit® practitioners. Further studies should investigate more suitable methods to determine the energy requirements in Crossfit® and should, perhaps, create and propose a specific equation for this population.

Exercise is a modality that may result in an elevation of resting energy rate (RMR) due to homostatic demands. Sprint Interval Training (SIT) exercise is widely recognized as a time efficient, low-volume, high-intensity alternative to endurance training and, in acute phases, may elevate RMR for longer durations. PURPOSE: To compare the effects of an acute bout of SIT vs. steady state (SS) vs. control (CON) on 24-h RMR in recreationally active college-aged males. METHODS: In this randomized crossover design, 13 recreationally active males ages 18-30 yrs. (24.1 ± 2.3) participated in three exercise sessions using an electronically braked cycle ergometer: SIT (5, 30-sec. sprints, interspersed with 4-min. active recovery), SS (70% VO2max for 30 min.) and CON. Exercise sessions were separated by one week. All sessions included 7 RMR measurements taken at the same times over a 24-h period (6:30am resting, 8:30pm resting, 11:30pm post-ex, 12:00am 2-h post-ex, 1:00pm 3-h post-ex, 4:00pm 6-h post-ex and 10:10am the following morning 24-h post-ex). RMR comparisons were made using two-way ANOVA with repeated measures. RESULTS: There was a significant main effect for group with regard to RMR (F=5.706; p=0.043) with no effect of time (F=5.351; p=0.113) or group x time interaction (F=1.486; p=0.066). There was a significant difference between SS (2136 kcal) and CON (1891 kcal) (p=0.009) and SIT (2105 kcal) and CON (1891 kcal) (p=0.012). SS (2166 kcal) and SIT (2105 kcal) were not different (p=0.994). There was a significant effect for time between combined exercise (CE) condition vs. CON when comparing rest to pre (ACE = 582 kcal vs. ∆CON = 498 kcal) (p=0.002), rest to post-ex (ACE = 628 kcal vs. ∆CON = 211 kcal) (p=0.034), and rest to 6-h post (ACE = 716 kcal vs. ∆CON = 193 kcal) (p=0.016). There was a significant group x time interaction for CE vs. CON (p = 0.043). Post-hoc analysis revealed statistical differences in measurements 2-h post (p=0.018; 455 kcal), 3-h post (p=0.002; 599 kcal) and a trend towards statistical significance at 6-h post (p=0.076; 340 kcal) and 24-h post (p=0.103; 313 kcal). CONCLUSION: A single bout of SIT may significantly elevate post-exercise RMR, and if repeated regularly, may confer longer-term benefits similar to that produced by 30 minutes of SS exercise.

Decrease in energy availability (EA) theoretically reduce basal metabolic rate (BMR) with sacrificing reproduction or bone health. However, research in EA of Asians is scarce and there is no data of EA as a determinant of BMR in adolescent athletes. PURPOSE: To reveal the relationship between BMR and EA in free-living Japanese competitive girl runners. METHODS: Consecutive 14 girl runners (16.6 ± 0.7 y/o, 161.0 ± 6.3 cm, 45.2 ± 5.4 kg) in the same competitive high school team were evaluated without control on food and exercise. Each runner was asked to report dietary records with photos and training logs for 7 days. Energy intake (EI) was assessed by registered nutritionists. The runners were tested on treadmill with indirect calorimeter to yield individual prediction equations for VO2 by running velocity. Exercise energy expenditure (EEE) was calculated by the equations based on the training log. EA was calculated by subtracting EEE from EI for each day. The daily means of those variables were calculated. BMR was measured by whole room calorimeter in the early morning after overnight sleep at the night of the last day of the assessment inside the calorimeter. Body composition was measured by DXA. Bivariate correlation analyses and t-test were used to examine the relationships and the difference between variables and groups, respectively. RESULTS: Percent body fat (%BF), fat free mass (FFM), and bone mineral density of TBLH (BMD) were 13.3 ± 4.9%, 39.0 ± 3.5 kg, and 1.013 ± 0.044 cm², respectively. BMR, EI, EEE, and EA were 26.5 ± 2.4 kcal/kgFFM/day, 2330 ± 479 kcal/day, 892 ± 245 kcal/day, and 37.4 ± 10.7 kcal/kgFFM/day, respectively. EA was significantly lower in Japanese than in others. EA was positively correlated with EI (r=0.58, p=0.010) and BMR (r=0.59, p=0.009) and negatively correlated with VO2max (r=-0.51, p=0.025). There was no significant difference between groups in EI, BMR, or VO2max. CONCLUSIONS: Despite similarities in SM, women with elevated %fat experienced lower SM contribution and higher BMR contribution to REE. As adiposity increases, REE increases; FM may explain more of the variance in REE between women of different levels of adiposity.
correlated with BMR (r=0.60, p<0.02). However, EA was not correlated with either %BF (p=0.25) or BMI (p=0.16) and did not differ between runners with oligo/amenorrhea (n=7; 40.8 ± 11.9) and eumenorrhea (n=6; 34.0 ± 9.8) (p=0.29).

CONCLUSIONS: The strong linear correlation between EA and BMR supports the theory that decrease in EA leads to compensatory adaptation in metabolism which may suppress reproduction or bone mineral accrual. However, arbitrarily evaluated EA in short-term was not related to the triad associated conditions. Those results were consistent with the evidences from adult Caucasian population.

G-41 Free Communication/Poster - Thermogenic Dietary Supplements

VALUES: Table 1. Summary of values over time. Table 1. Summary of values over time.

BACKGROUND: Global increases in the incidence of obesity and the ensuing clinical co-morbidities has increased interest in the use of thermogenic supplements formulated to increase resting metabolism to increase energy expenditure and fat utilization. PURPOSE: The purpose of this study was to assess the effect of new capsaicin-based thermogenic supplements on resting oxygen consumption (VO2), carbon dioxide production (VCO2) and respiratory quotients (RQ).

METHODS: Twenty-two untrained females (21.1 ± 4.2 years) visited the lab on six occasions for measurements of pre-supplementation (PRE) resting energy expenditure (REE) for 30-60 min followed by the ingestion of a placebo or supplement (Shred, Shred 2.0, Capsimax 50, Capsimax 100, Capsimax 200) with at least three days separating conditions. Resting VO2, VCO2, and RQ were re-assessed for 90-120 minutes post-supplementation (POST). Changes in metabolic markers between treatment groups and over time were assessed in 5-minute intervals over the course of the 90-minute assessment using a two-way repeated measures ANOVA. RESULTS: PRE VO2 (2.5 ± 0.3 ml•kg⁻¹•min⁻¹), VCO2 (0.18 ± 0.03 L•min⁻¹) and RQ (0.85 ± 0.06) were lower than any given 5-minute interval POST (p<0.05). VO2 (ml•kg⁻¹•min⁻¹) was elevated at 5 min POST (2.99 ± 0.5 ml•kg⁻¹•min⁻¹) compared to each subsequent 5 min interval (p<0.05) with no differences noted after 10 minutes (2.7 ± 0.4 ml•kg⁻¹•min⁻¹). VCO2 and VO2 (L•min⁻¹) were elevated at 5 min POST compared to subsequent 5-minute intervals until 80 min (VCO2; 0.22 ± 0.04 to 0.19 ± 0.03 L•min⁻¹) and 70 min (VO2; 0.25 ± 0.04 to 0.23 ± 0.03 L•min⁻¹; p<0.05). There were no changes in VO2 at 10 minutes (0.19 ± 0.03 L•min⁻¹) compared to any other time point POST. VO2 (L•min⁻¹) briefly increased from 35-45 minutes POST (0.23 ± 0.04 L•min⁻¹) compared to 20 min POST (0.22 ± 0.03 L•min⁻¹; p<0.002); no further changes occurred after 45 minutes. There were no changes in RQ during POST. There were no interaction effects (treatment) or treatment differences in metabolic markers.

CONCLUSIONS: Observed time effects are postulated as a result of the elevated REE caused by changes in subject position during supplement consumption, rather than supplementation. This study suggests that new thermogenic supplement has no effect on metabolism.

3954 Board #271 May 30 9:00 AM - 10:30 AM

The Effect Of Thermogenic Nutritional Supplementation On Resting Metabolism In College-age Females

Elizabeth P. Kelley¹, Kolton M. Cobb², Wes D. Dudgeon¹, Michael J. Webster, FACSM³. ¹College of Charleston, Charleston, SC. ²Valdosta State University, Valdosta, GA. ³Sponsor: Michael J. Webster, FACSM

Email: kelleyep@vcu.edu

(No relevant relationships reported)

BACKGROUND: The purpose of this study was to assess the effect of new capsaicin-based thermogenic supplements on resting energy expenditure (REE) for 30-60 min followed by the ingestion of a placebo or supplement (Shred, Shred 2.0, Capsimax 50, Capsimax 100, Capsimax 200) with at least three days separating conditions. Resting VO2, VCO2, and RQ were re-assessed for 90-120 minutes post-supplementation (POST). Changes in metabolic markers between treatment groups and over time were assessed in 5-minute intervals over the course of the 90-minute assessment using a two-way repeated measures ANOVA. RESULTS: PRE VO2 (2.5 ± 0.3 ml•kg⁻¹•min⁻¹), VCO2 (0.18 ± 0.03 L•min⁻¹) and RQ (0.85 ± 0.06) were lower than any given 5-minute interval POST (p<0.05). VO2 (ml•kg⁻¹•min⁻¹) was elevated at 5 min POST (2.99 ± 0.5 ml•kg⁻¹•min⁻¹) compared to each subsequent 5 min interval (p<0.05) with no differences noted after 10 minutes (2.7 ± 0.4 ml•kg⁻¹•min⁻¹). VCO2 and VO2 (L•min⁻¹) were elevated at 5 min POST compared to subsequent 5-minute intervals until 80 min (VCO2; 0.22 ± 0.04 to 0.19 ± 0.03 L•min⁻¹) and 70 min (VO2; 0.25 ± 0.04 to 0.23 ± 0.03 L•min⁻¹; p<0.05). There were no changes in VO2 at 10 minutes (0.19 ± 0.03 L•min⁻¹) compared to any other time point POST. VO2 (L•min⁻¹) briefly increased from 35-45 minutes POST (0.23 ± 0.04 L•min⁻¹) compared to 20 min POST (0.22 ± 0.03 L•min⁻¹; p<0.002); no further changes occurred after 45 minutes. There were no changes in RQ during POST. There were no interaction effects (treatment) or treatment differences in metabolic markers.

CONCLUSIONS: Observed time effects are postulated as a result of the elevated REE caused by changes in subject position during supplement consumption, rather than supplementation. This study suggests that new thermogenic supplement has no effect on metabolism.

3955 Board #272 May 30 9:00 AM - 10:30 AM

Effect Of Energy Drink Consumption On Heart Rate Variability And Blood Glucose In Relation To Exercise

Quinn M. Mertens, Greg Mulligan, Lynneth A. Stuart-Hill. University of Victoria, Victoria, BC, Canada.

(No relevant relationships reported)

BACKGROUND: Energy drinks are commercially available beverages reported to increase resting metabolism to increase energy expenditure and fat utilization. PURPOSE: To determine if ingesting one 5-hour Energy Shot® compared to a placebo causes measurable improvement in performance related to physiological variables during a simulated driving task (SDT). METHOD: Nineteen (11 males, 8 females), college-aged (21.8 ± 1.55 yrs; 1.72 ± 0.11 m in ht; 72.9 ± 13.83 kg in wt), volunteers participated in a double-blind, cross-over, placebo-based study. The participants were tested prior to and then at 5 consecutive 1-hour intervals after ingesting either a randomly assigned non-coffermented placebo (PL) (59 ml; 5 kocal) or the 5-Hour Energy Shot® (5HES) (59 ml; 4 kcal). The SDT was a solo-timed road race (Forza Horizon game) on an Xbox 360 gaming system. During each of the 6-data collection trials, heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), ear temperature (ETemp), skin temperature (STemp), drive time (DT), and number of crashes (CR) were recorded. Subjects were also evaluated for alertness and drink effectiveness at each of same time points. A 2-way repeated measures ANOVA was utilized to determine differences between the PL and the 5-HES treatments across the six test periods of the driving task. Significance was established at p < 0.05. SUMMARY OF RESULTS: There was no statistically significant difference between PL and 5-HES across the six time periods relative to HR, SBP, DBP, ETemp, or CR driving task. However, the 5-HES group had a significantly lower STemp than the PL group at each time interval; with a 5-hour post-ingestion STemp of 89.52 ± 2.30°F in the 5-HES group compared to 90.27 ± 1.96°F in the PL group. The 5-HES group had a faster DT compared to the PL group at each of the time intervals; with a 5-hour post-ingestion DT of 197.47 ± 50.39 sec in the 5-HES group compared to 201.09 ± 52.38 sec in the PL group. CONCLUSIONS: When compared to a placebo, 5-Hour Energy Shot® did significantly improve driving time, along with a concomitant reduced skin temperature in college-aged participants during a simulated driving task.

The 5-Hour Energy Shot® continues to be one of the more popular energy drinks on the market. The maker claims that it improves work and/or exercise performance. PURPOSE: To determine if ingesting one 5-Hour Energy Shot® compared to a placebo causes measurable improvement in performance related to physiological variables during a simulated driving task (SDT). METHOD: Nineteen (11 males, 8 females), college-aged (21.8 ± 1.55 yrs; 1.72 ± 0.11 m in ht; 72.9 ± 13.83 kg in wt), volunteers participated in a double-blind, cross-over, placebo-based study. The participants were tested prior to and then at 5 consecutive 1-hour intervals after ingesting either a randomly assigned non-coffermented placebo (PL) (59 ml; 5 kocal) or the 5-Hour Energy Shot® (5HES) (59 ml; 4 kcal). The SDT was a solo-timed road race (Forza Horizon game) on an Xbox 360 gaming system. During each of the 6-data collection trials, heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), ear temperature (ETemp), skin temperature (STemp), drive time (DT), and number of crashes (CR) were recorded. Subjects were also evaluated for alertness and drink effectiveness at each of same time points. A 2-way repeated measures ANOVA was utilized to determine differences between the PL and the 5-HES treatments across the six test periods of the driving task. Significance was established at p < 0.05. SUMMARY OF RESULTS: There was no statistically significant difference between PL and 5-HES across the six time periods relative to HR, SBP, DBP, ETemp, or CR driving task. However, the 5-HES group had a significantly lower STemp than the PL group at each time interval; with a 5-hour post-ingestion STemp of 89.52 ± 2.30°F in the 5-HES group compared to 90.27 ± 1.96°F in the PL group. The 5-HES group had a faster DT compared to the PL group at each of the time intervals; with a 5-hour post-ingestion DT of 197.47 ± 50.39 sec in the 5-HES group compared to 201.09 ± 52.38 sec in the PL group. CONCLUSIONS: When compared to a placebo, 5-Hour Energy Shot® did significantly improve driving time, along with a concomitant reduced skin temperature in college-aged participants during a simulated driving task.

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Conclusions: While small changes were found in some biomarkers, in all cases values remained within normal clinical limits. This suggests that DYM alone or in combination with TCR consumed at the dosages used in this study does not appear to negatively impact blood biomarkers associated with health.

Compound Solutions, Inc. grant
Vitamin D deficiency has been previously associated with impaired metabolic functions which may impact the acute effects of resistance exercise (RE) on insulin sensitivity, inflammation, and muscle damage. The effects of exogenous vitamin D on the metabolic, inflammatory, and muscle damage responses to an acute bout of RE in vitamin D deficient subjects have yet to be explored. PURPOSE: To evaluate the effects of a single vitamin D3 injection on the metabolic, inflammatory and muscle damage responses to an acute bout of RE in vitamin D-deficient resistance-trained males. METHODS: Blood samples from 14 vitamin D-deficient resistance-trained males were obtained during two separate trials: lower vitamin D (LVD, after saline injection) and higher vitamin D (HVD, after vitamin D3 injection). Metabolic, inflammatory, and muscle damage markers were evaluated at baseline and immediately then one hour after RE. Differences in mean values for each variable between trials were compared by repeated measures ANOVA followed by LSD test for pairwise comparisons. RESULTS: There were significant trial x time interactions for serum insulin and Homeostatic Model Assessment (HOMA) of Insulin Resistance which were both lower (p<0.05) at 1-hour post-RE in the HVD compared to LVD trial. There was a significant decrease (p<0.05) for blood sugar and increase (p<0.05) for creatine kinase, lactate dehydrogenase, and interleukin 6 1-hour post-RE across both trials with no interaction of time. There were no significant changes in other inflammatory and cardiovascular markers following either trials. A single injection of vitamin D3 demonstrated efficacy in reducing insulin resistance following RE in previously vitamin D-deficient resistance-trained males. Conversely, muscle damage and inflammatory response to acute RE were not altered. CONCLUSION: Intramuscular vitamin D replacement in vitamin D-deficient resistance-trained males may have key implications for the promotion of glucose metabolism and lowering the risk of diabetes in this population.
Experiential learning programs require rigorous academic preparation often taught in traditional classroom and lab settings. However, situated learning theory views learning as action in a community of practice, where the elements of social interaction, connectedness, and participation transform traditional understanding into meaningful knowing. Situated learning can have a complex effect on exercise science students’ connectedness, understanding, theory application, and professional skills. Additionally, social networks (like Facebook) can provide a modern educational community in which students can engage in reflection in the classroom.

**PURPOSE:** The purpose of this quantitative research was to examine the relationship between learning environment type (situated versus traditional) and the use of Facebook on undergraduate exercise science students’ perceived sense of overall classroom community, connectedness, and learning. **METHODS:** 69 undergraduate exercise science students (age [yrs] = 22.5 ± 2.1, males = 57.7%, females = 42.3%) who had participated in either a traditional course, traditional course with Facebook, a situated course, or a situated course with Facebook completed Rovai’s (2002) Classroom Community Survey at the end of their course experience. Multiple Regression was performed to determine if there were any significant differences between the four groups (α = .05). **RESULTS:** Results demonstrated a situated learning classroom and a situated learning classroom with Facebook were significant positive predictors of students’ perception of overall classroom community (R² = .181, F(3, 65) = 4.794, p < .004), connectedness (R² = .130, F(3, 65) = 3.232, p = .028), and learning (R² = .186, F(3, 65) = 4.965, p < .004). **CONCLUSIONS:** This research supports situated learning as a best practice for increasing classroom community in undergraduate exercise science programs. Students perceived higher levels of overall classroom community, connectedness, and learning when participating in a situated classroom and to an even greater extent a situated classroom with Facebook.

**Corporation:** Incorporation of these types of learning environments and teaching strategies in exercise science degree programs may enhance professional skill development and successful employment within the field.

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**G-43 Free Communication/Poster - Pedagogy Related to Exercise**

**Board #281 May 30 8:00 AM - 9:30 AM Community, Connectedness, And Learning In Exercise Science: Does Classroom Context Matter?**


Email: acrawley@uwf.edu

(No relevant relationships reported)

Exercise science programs require rigorous academic preparation often taught in traditional classroom and lab settings. However, situated learning theory views learning as action in a community of practice, where the elements of social interaction, connectedness, and participation transform traditional understanding into meaningful knowing. Situated learning can have a complex effect on exercise science students’ connectedness, understanding, theory application, and professional skills. Additionally, social networks (like Facebook) can provide a modern educational community in which students can engage in reflection in the classroom.

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**Corporation:** Incorporation of these types of learning environments and teaching strategies in exercise science degree programs may enhance professional skill development and successful employment within the field.
An Exercise-based Didactic Strategy In Physical Education Increases Motor Skills In Preschool Children: A Pilot Study

Iván Rentería, Ernesto Alonso González Castillo, Giovanna Arambula Barba, Concepción Danee Juárez Hernández, Patricia Concepción García Suárez, Alberto Jerínz Malondano. Universidad Autónoma de Baja California, Ensenada, Baja California, Mexico.

Email: irenteria@uabc.edu.mx

Purpose: Physical education (PE) in preschool aims for the corporal and motor skills development in children, nevertheless the evaluation strategies of acquired skills has been neglected in Mexican preschools. Therefore, we explored a didactic strategy for physical education PE teachers. Methods: 100 MA-dependent individuals were randomized to aerobic exercise group (AE) or resistance exercise group (RE). The group AE were trained over 8 weeks, 3 times/week, 90 minutes each time, which include formal training (70 minutes), warm-up (10 minutes) and recovery (10 minutes). The aerobic exercise intensity was 65% ± 8% HRmax and the muscle strength by 1-repetition maximum (1-RM) and endurance at 85% resistant exercise group. Results: After 8 weeks of exercise intervention, the β-endorphin levels in the group AE and group RE were significantly increased (p<0.05). Inside, the level of β-endorphin in the high-intensity group was increased from 154.8 pg/ml to 181.7 pg/ml, the rate of change was 14.76%. It is suggested that the effect of aerobic exercise on plasma β-endorphin is more effective than that of resistance exercise. Conclusion: Both aerobic and resistance exercise can increase the level of β-endorphin in MA-dependent individuals, promote the formation of euphoria compensation mechanism, and reduce the desire for speed. The effect of aerobic exercise on plasma β-endorphin in methamphetamine dependent individuals was more obvious.

Pedagogical Considerations In Exercise Physiology Laboratory Courses

Marc Apkarian. Biola University, La Mirada, CA.

Purpose: To explore how pedagogical approaches in an undergraduate exercise physiology laboratory course may reflect test results. Methods: A retrospective analysis was conducted using three course sections taught in two separate semesters (six total sections, taught by the same instructor), with 31 students enrolled per semester (N = 62). Didactic (lecture and discussion) and practical (demonstration, in-class skills practice) instruction was provided for exercise physiology laboratory theory and procedures. Additional skills practice throughout the course was achieved via fitness assessments performed on five peer subjects recruited by each student in the class of the semester. Fitness assessments required testing for height, weight, resting blood pressure, four site skinfolds (4SKF), YMCA Step Test, YMCA Bench Press Test, 1-Minute Curl-Ups, and Sit-and-Reach. Tests were selected to cover a spectrum of fitness attributes and skills, as well as in accordance with pragmatic considerations of available practice opportunities. Course assessment included two written examinations covering multiple choice and short response questions, administered at the middle and end of the course, covering different sets of theoretical content, and a practical skills examination scored by rubric conducted individually by the instructor at the end of the course.

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Email: irenteria@uabc.edu.mx

Purpose: Physical education (PE) in preschool aims for the corporal and motor skills development in children, nevertheless the evaluation strategies of acquired skills has been neglected in Mexican preschools. Therefore, we explored a didactic strategy for physical education PE teachers. Methods: 100 MA-dependent individuals were randomized to aerobic exercise group (AE) or resistance exercise group (RE). The group AE were trained over 8 weeks, 3 times/week, 90 minutes each time, which include formal training (70 minutes), warm-up (10 minutes) and recovery (10 minutes). The aerobic exercise intensity was 65% ± 8% HRmax and the muscle strength by 1-repetition maximum (1-RM) and endurance at 85% resistant exercise group. Results: After 8 weeks of exercise intervention, the β-endorphin levels in the group AE and group RE were significantly increased (p<0.05). Inside, the level of β-endorphin in the high-intensity group was increased from 154.8 pg/ml to 181.7 pg/ml, the rate of change was 14.76%. It is suggested that the effect of aerobic exercise on plasma β-endorphin is more effective than that of resistance exercise. Conclusion: Both aerobic and resistance exercise can increase the level of β-endorphin in MA-dependent individuals, promote the formation of euphoria compensation mechanism, and reduce the desire for speed. The effect of aerobic exercise on plasma β-endorphin in methamphetamine dependent individuals was more obvious.

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RESULTS: Scores for both sets of written examination scores were combined, resulting in an average score of 21.6 ± 4.1 points out of 30 possible points, or 72.1%. The practical exam average equaled 13.6 ± 1.3 points out of 15 possible points, or 90.4%. Accordingly, it was noted that scores for student performance on the practical exam were higher than those for the written examinations (p < 0.05).

CONCLUSIONS: While pedagogical approaches differ for theoretical and practical instruction due to the nature and need for specific instruction in an undergraduate exercise physiology laboratory course, it appears that additional instructional practices may result in higher test scores and improved learning, as reflected by practical examination. Thus, adequate skills practice opportunities, in conjunction with traditional didactic instruction, are recommended to enhance student learning and competence in laboratory content.

G-44 Free Communication/Poster - Genetics, Immunology and Endocrinology in Athletes
Saturday, May 30, 2020, 8:00 AM - 10:30 AM
Room: CC-Exhibit Hall

3972 Board #289
May 30 9:00 AM - 10:30 AM
Association Between Muscle Stiffness And Esr1 Rs2234693, Rs9340799 And Actn3 R577x Polymorphisms In Collegiate Athletes
Hiroki Homma, Mika Saito, Naoki Kikuchi. Nippon Sport Science University, Tokyo, Japan.

Previous studies have reported that distinct gene polymorphisms (e.g. ACTN3 R577X, ESIR rs2234693, Rs9340799) are associated with muscle stiffness, amongst which ESIR rs2234693 and Rs9340799 polymorphisms are also associated with instances of muscle injury. PURPOSE: To investigate the association between muscle stiffness and ESIR rs2234693, Rs9340799 and ACTN3 R577X polymorphisms in collegiate athletes. METHODS: In this study, 40 athletes (33 men and 7 women), who had undergone resistance training, were evaluated for the occurrence of muscle stiffness (hamstring: biceps femoris, semitendinosus, and semimembranosus) by ultrasound shear wave elastography. Additionally, ESIR rs2234693, Rs9340799 and ACTN3 R577X polymorphisms were analyzed using the TaqMan SNP Genotyping Assay. Comparisons of muscle stiffness between the genotypes were performed using one-way ANOVA. The Hardy-Weinberg equilibrium was determined for the ESIR rs2234693, Rs9340799 and ACTN3 R577X polymorphisms using a Chi-square test. RESULTS: Genotype frequencies of the ESIR rs2234693 (CC 13%, CT 55%, TT 33%), Rs9340799 (GG 3%, GA 25%, AA 73%) and ACTN3 R577X (RR 18%, RX 64%, XX 18%) polymorphisms were consistent with the Hardy-Weinberg equilibrium (p = 0.36, p = 0.90, p = 0.08, respectively). However, there was no significant difference in muscle stiffness between ESIR rs2234693 and ACTN3 R577X genotypes. Furthermore, the GG or GA genotype of ESIR rs2234693 polymorphisms did not exhibit greater muscle stiffness of the hamstring muscles compared with the AA genotype in collegiate athletes (27.2 ± 7.0kPa vs. 22.4 ± 6.7kPa; p = 0.054). CONCLUSIONS: Our results suggested that ESIR rs2234693, Rs9340799 and ACTN3 R577X polymorphisms are not associated with muscle stiffness in collegiate athletes.

3973 Board #290
May 30 9:00 AM - 10:30 AM
Self-reported Stress And Well-being Impacts Immune Response To Maximal Exercise In Collegiate Swimmers
Barley M. Theall1, Haoyan Wang2, Connor Kuremsky1, Bailey M. Theall1, Haoyan Wang1, Connor Kuremsky1, Eunhan Márta Szmodis1.

Exposure to acute psychological and physiological stressors is associated with impairments in immune function including reduced exercise-induced mobilization of naïve (NA) T-cells and increased mobilization of antigen-specific, highly differentiated T-cells following maximal exercise. However, the impact of sustained stressors on the immune response to maximal exercise is unknown. PURPOSE: To characterize the impact of self-reported stress and well-being on lymphocyte responses to acute bouts of exercise in collegiate swimmers over six months. METHODS: Blood samples were collected from fifteen NCAA D1 swimmers (7 M, 6 F; 19.8 ± 0.7 y) before and after maximal swim times at two timepoints (V1: immediately post-season 1 and V2: early season 2). An additional mid-off season timepoint (V3) was collected in a subset of nine swimmers. T-cells were quantified by flow cytometry, and self-reported measures of sleep quality (PSQI), symptoms of upper respiratory tract infection (URTI, WURRS-21), and overtraining (DALDA) were collected. Linear mixed models were used to determine the effects of exercise, season timepoint, and their interaction on lymphocyte percentages (p = 0.05). Pearson’s correlation coefficients were used to assess correlations between lymphocyte percentages and stress measures. RESULTS: Lower sleep quality was correlated with greater resting and post-exercise senescent CD4+ T-cell percentages (r = 0.44, p = 0.01; r = 0.47, p = 0.004, respectively). Low sleep quality was also correlated with lower post-exercise NA CD4+ T-cells (r = 0.35, p = 0.04). Higher ratings of self-reported symptoms of URTI (r = 0.38, p = 0.02) and overtraining (r = 0.3, p = 0.02) were correlated with greater post-exercise senescent CD4+ T-cell percentages. Compared to pre-exercise, post-exercise NA CD4+ T-cell percentages were lower at V1 and V3, while CD8+ T-cell percentages were higher post-exercise (p < 0.01). CONCLUSIONS: Sustained stress adversely impacted immune response to maximal exercise in collegiate swimmers. Impaired sleep quality and higher URTI and overtraining symptoms were associated with an exacerbated exercise-induced mobilization of senescent CD8+ T-cells, highlighting the importance of monitoring athlete stress level and overall well-being throughout the competitive season.

3974 Board #291
May 30 9:00 AM - 10:30 AM
Acute And Chronic Brain-Derived Neurotrophic Factor Responses During One Season Training In Young Swimmers
Dimitra NAFAKITIOTOU1, Anastassios PHILIPPOU1, GEORGE VAGIAKAKOS1, NIKOS VAGIAKAKOS2, MARKOS MANTALOUFS2, Michael KOUTISIERS1, THEODOROS PLATANOU3, 4NATIONAL AND KOPODISTRIAN UNIVERSITY OF ATHENS, ATHENS, Greece. 1NATIONAL TECHNICAL UNIVERSITY OF ATHENS, ATHENS, Greece.

It has been demonstrated that Brain-Derived Neurotrophic Factor (BDNF) is a mediator of neuroprotective and neuroplastic processes, and that serum BDNF is representative of central concentrations as well. Interestingly, there is evidence that BDNF levels are elevated in response to exercise.

PURPOSE: This study aimed at investigating the acute and chronic effects of a full swimming season training on serum BDNF, both at rest and after a maximal exercise bout in young athletes.

METHODS: Twelve well-trained male swimmers (14.08±1.0 yrs) practiced in the study. Measurements were carried out at the beginning of the training season (T1) as well as pre- and post- taper of each of the two competitive periods (i.e., T2, T3 for the first macrocycle, and T4, T5 for the second macrocycle, respectively). At each of the above time points, blood samples were collected pre- and 1 hour post a maximal, 400m swimming test. Serum BDNF levels were measured by ELISA. Adjustment for exercise-induced plasma volume changes was performed before data analysis. Two-way ANOVA with repeated measures was used for statistics.

RESULTS: A significant pre-post testing difference was observed at T2 (p = 0.048). In addition, a main effect of time was found among the 5 time points (T1-T5; p < 0.001). Moreover, both pre- and post- testing responses had a similar profile exhibiting decreases from T1 to T3 (pre: 30,421±1,955 pg/ml vs 23,004±3,410 pg/ml and from T4 to T5 (pre: 19,428±1,097 pg/ml vs 11,993±969 pg/ml; post: 22,111±1,455 pg/ml vs 12,838±1,763 pg/ml) and an increase from T3 to T4 (pre: 3,433±669 pg/ml vs 19,428±1,097 pg/ml; post: 2,743±550 pg/ml vs 22,111±1,455 pg/ml).

CONCLUSIONS: To the authors’ best knowledge this is the first study examining the acute and chronic BDNF responses during one season training in young athletes. These findings indicate that long-term swimming training can affect the resting and acute (pre-post testing) circulating BDNF in young swimmers.

3975 Board #292
May 30 9:00 AM - 10:30 AM
Hormonal And Heart Rate Changes To Maximal Exercise In Elite Adolescent Athletes
Gábor Almás1, Edit Bosnyák1, Ákos Móra2, Annamária Šzáki2, Pirosha Fehér3, Dorina Ánnari4, Nikiwol Nağy5, Máté Tóth, Márta Szmodis1.

One of the main biomarkers of stress is the steroid hormone cortisol (C), while testosterone (T) and estrogen (E) steroids are associated with physical activity.

PURPOSE: To determine the relationship between a maximal swimming exercise and hormonal level changes and acute training’s influence on the stress level in elite adolescent athletes.

METHODS: The study was conducted with 31 participants (boys: n=19, mean age±SD: 16.34±1.12 years; girls n=12, 15.17±0.81 years) from the

Abstracts were prepared by the authors and printed as submitted.
It is documented that intense periods of soccer can induce oxidative stress, the negative effects of which can impair performance. However, few studies have explored the potential association between exercise-induced oxidative stress and training load intensity. PURPOSE: The aim of the study was to quantify oxidative stress relative to indicators of high-intensity training load in a cohort of professional soccer players throughout different phases of a competitive in-season. METHODS: Ten professional soccer players (age: 23±2yrs; body mass: 85.5±6.2 kg; stature: 181±3.5 cm; V_{O2max} 57.2±6.7 mL·kg·min⁻¹, kg⁻¹), representatives from an English Football League One team, participated in the study. Training load was assessed as three time points throughout a competitive in-season (T1: early in-season; T2: mid-season; T3: end of in-season participations in the study. Training load was assessed at three time points throughout the competitive in-season and was significantly higher at T2 compared to T1 (HETL: 18.56 ± 7.30 m.min⁻¹ vs. 6.72 ± 2.62 m.min⁻¹, an increase of 37%Time > 80% HRmax, p=0.004; T2 vs. T1, respectively). Urinary MDA concentrations were measured. Results showed a significant increase of MDA from T1 to T2 (0.176 ± 0.134 μMol/L vs. 0.233 ± 0.279 μMol/L; p=0.001) and at T3 (0.426 ± 0.319 μMol/L; p=0.001) measured results. Rise in girls’ C level was not significant (p=0.057), however their C2 (r=0.71) and C3 (r=0.60) levels correlated with their peak HR in swimming test. Boys’ T levels decreased significantly after the exercise (0.046±0.0023 μMol/L) compared to basal levels (0.060±1.0028 μMol/L) and T/C ratio also decreased (basal: 0.47±0.032 μMol/L; after exercise: 0.02±0.015 μMol/L). There was no significant difference in girls C levels however, their C3 levels correlated with their happiness (r=0.62), and C3 - C1 concentration difference correlated also with happiness (r=0.68) and calmness (r=0.71) items of the Brunei scale.

CONCLUSION: These results justify the application of the swimming field test to monitor maximal performance induced hormonal changes in adolescent athletes. Changes in T and C levels go against the experienced trend in literature therefore we feel the need of further analysis of our results. Moreover, the repeated measures might be an effective way to register the alarming symptoms of the common overtraining syndrome in swimming. Supported by the ministry of human capacities [UNKR-18-3-1-TE-6].

3976  

Board #293  
May 30 9:00 AM - 10:30 AM  
Assessment Of High-intensity Training Load And Exercise-induced Oxidative Stress In Professional Soccer Players.  
Camilla R. Holland, Michael G. Roberts, Matthew W. Fubner, Lindsey S. Kass, Lindsay Bottoms. University of Hortfordshire, Hatfield, United Kingdom.  
Email: c.holland@herts.ac.uk  
(No relevant relationships reported)

3977  

Board #294  
May 30 9:00 AM - 10:30 AM  
Effects Of Recovery Using Cryotherapy On The Athlete’s Immune System After Repetitive Aerobic Exercise  
Astrid Reif1, Christoph Triska1, Bernhard Koller-Zeisler2, Norbert Bach1, Barbara Weissen2.  
1University of Vienna, Vienna, Austria.  
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(No relevant relationships reported)

3978  

Board #295  
May 30 9:00 AM - 10:30 AM  
Increased Risk Of Symptomatic Respiratory Viral Infections In Athletes During Nordic World Ski Championships 2019  
Maurit Valtonen. KIHHU Research Center for Olympic Sports, Jyväskylä, Finland.  
(Sponsor: Raija Laukkanen, FACSAM)  
Email: maari.valtonen@ikihhu.fi  
(No relevant relationships reported)

3979  

Board #296  
May 30 9:00 AM - 10:30 AM  
The Effects Of Acute Antigravity Treadmill Exercise On Inflammatory Markers In Elite Athletes  
Muaz Belvirani, Muhammed Salih Kiriska, Nilsef Okudan. Faculty of Medicine Selcuk University, Konya, Turkey.  
Email: mbelvirani@yahoo.com  
(No relevant relationships reported)

PURPOSE: The aim of this study was to compare the responses of interleukin-8 (IL-8), tumor necrosis factor-α (TNF-α) and C reactive protein (CRP) to antigravity treadmill exercise and normal treadmill exercise in male football players. METHODS: Eleven male football players aged between 18-22 years, with at least 2 years of football history and regularly trained were included in the study. VO2max values of the athletes were calculated with 20 Meter Shuttle Test. The participants were randomly allocated to two groups. Half of the participants were exercised on the antigravity field of water sports (swimming: n=10; water polo: n=21). The young elite athletes completed a maximal freestyle swimming test (200 meter) after a 25 minutes unified warm-up. Saliva samples were collected between swimming test. Heart rate (HR) was measured throughout the whole procedure (Polar V800). We used the Brunel questionnaire to determine the participants’ moods states after the field test. RESULTS: There was significant rise in boys’ C levels conparing to the C1 (0.176±0.134 μMol/L) with C2 (0.339±0.278 μMol/L; p=0.030) and C3 (0.426±0.319 μMol/L; p=0.001) measured results. Rise in girls’ C level was not significant (p=0.057), however their C2 (r=0.71) and C3 (r=0.60) levels correlated with their peak HR in swimming test. Boys’ T levels decreased significantly after the exercise (0.046±0.0023 μMol/L) compared to basal levels (0.060±1.0028 μMol/L) and T/C ratio also decreased (basal: 0.47±0.032 μMol/L; after exercise: 0.02±0.015 μMol/L). There was no significant difference in girls C levels however, their C3 levels correlated with their happiness (r=0.62), and C3 - C1 concentration difference correlated also with happiness (r=0.68) and calmness (r=0.71) items of the Brunel scale.

CONCLUSION: These results justify the application of the swimming field test to monitor maximal performance induced hormonal changes in adolescent athletes. Changes in T and C levels go against the experienced trend in literature therefore we feel the need of further analysis of our results. Moreover, the repeated measures might be an effective way to register the alarming symptoms of the common overtraining syndrome in swimming. Supported by the ministry of human capacities [UNKR-18-3-1-TE-6].

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Assessment Of High-intensity Training Load And Exercise-induced Oxidative Stress In Professional Soccer Players.  
Camilla R. Holland, Michael G. Roberts, Matthew W. Fubner, Lindsey S. Kass, Lindsay Bottoms. University of Hortfordshire, Hatfield, United Kingdom.  
Email: c.holland@herts.ac.uk  
(No relevant relationships reported)
The human gut microbiome is a dynamic ecosystem with prolific health connotations. Physical activity is emerging as a potent regulator of human microbiome composition. PURPOSE: This study examined changes in the gut microbiome of a world-class ultramarathon runner before and after competing in the Western States Endurance Run (WSER), a 163 km mountain footrace. METHODS: Anthropometrics and body composition were assessed and the ultramarathoner’s submaximal and maximal performance profiles were evaluated. Gut microbiome analyses were performed at four time-points: 21 wk and 2 wk before and 2 h and 10 d after WSER. RESULTS: Aerobic power (VO2max) was 4.24 L/min (66.7 mL/kg/min), and running economy (51.1 ml/kg/min at 268 m/min) and lactate threshold (~83% VO2max) values were comparable to that of highly trained distance runners. Two hours post-race, considerable changes in the ultrarunners gut microbiome were observed. Alpha diversity (Shannon Diversity Index) increased from 2.73 to 2.80 and phylum-level bacterial composition in the ultrarunners gut microbiome were observed. Alpha diversity (Shannon index) increased from 2.73 to 2.80 and phylum-level bacterial composition in the ultrarunners gut microbiome were observed. Alpha diversity (Shannon index) increased from 2.73 to 2.80 and phylum-level bacterial composition in the ultrarunners gut microbiome were observed. Alpha diversity (Shannon index) increased from 2.73 to 2.80 and phylum-level bacterial composition in the ultrarunners gut microbiome were observed. Alpha diversity (Shannon index) increased from 2.73 to 2.80 and phylum-level bacterial composition in the ultrarunners gut microbiome were observed. Alpha diversity (Shannon index) increased from 2.73 to 2.80 and phylum-level bacterial composition in the ultrarunners gut microbiome were observed. Alpha diversity (Shannon index) increased from 2.73 to 2.80 and phylum-level bacterial composition
Heart, kidney and liver transplanted patiences (HTR, KTR and LTR) suffer from a reduced exercise capacity. Several studies pointed out the impairments of both central and peripheral factors as responsible for the decreased peak oxygen consumption (\( V'O_2peak \)) and diminished peak work rate (\( WR_{peak} \)), however, if the main limitation comes from central origin it is still unclear (McWilliams and Keighty, 2012). In healthy humans, \( V'O_2peak \) is mainly constrained by central factors with peripheral factors playing a minor role, indeed endurance training (ET) involving small muscle mass fails to increase whole-body \( V'O_2peak \) (Rud et al., 2012). Given the skeletal muscle abnormalities reported in HTR, KTR and LTR the limitation imposed by peripheral factors might be important as the central one. PURPOSE: The study investigated if ET of small muscle mass, e.g. single leg cycling (SL), induces higher increase in \( V'O_2peak \) and \( WR_{peak} \) than ET with large muscle masses, e.g. double leg cycling (DL), in HTR, KTR and LTR.

METHODS: 33 sedentary patients were enrolled and divided into SL group (SLG) (\( n=17; \) HTR=6, KTR=6 and LTR=5) and DL (DLG) (\( n=16; \) HTR=7, KTR=5 and LTR=4). Subjects completed DL incremental tests to determine \( V'O_2peak \) and \( WR_{peak} \); peak cardiac output (\( Q'_peak \)) was assessed by cardiac-impedance and peak systemic arterio-venous O\(_2\) difference (\( C_{O2}\_av \)) was calculated as: \( V'O_2peak \times Q'_peak \). All subjects were asked to attend 24 ET sessions: the DLG performed traditional cycling and the SLG the first half of the session with the one leg and the second half with the other limb. RESULTS: SLG and DLG increased \( V'O_2peak \) by \( 97.1 \pm 12.4 \) degree and \( 99.0 \pm 11.5 \) degree, respectively; \( WR_{peak} \) increased by \( 19.7 \pm 2.7 \) and \( 17.7 \pm 6.2 \) in SLG (\( n=11 \)) and DLG (\( n=10 \)), respectively; however, if ET of DL was found \( Q'_peak \) and \( C_{O2}\_av \) improved by \( 17.6 \pm 6.5 \) and \( 12.7 \pm 6.2 \) in SLG (\( n=11 \)) and DLG (\( n=10 \)) (Time effect: \( p<0.001 \)). CONCLUSIONS: Given the absence of improvement in \( Q'_peak \) after ET, the acerotion of \( V'O_2peak \) and \( WR_{peak} \) seems to be induced by a greater Ca-v\( O_2\) peak; suggesting a key role of peripheral factors in impaireing exercise capacity in HTR, KTR and LTR.

### Effects of Transcutaneous Vacuum Treatment on Joint Mobilization on Leg

Mitsuharu KAYA1, Tonomari Shibutani2, Masanori Takemura1, Koji Kurita3, Arjijt Banerce4, Junzo Tsujita5 Hyogo University of Health Sciences, Kobe, Japan. 1MJ Company, Okayama, Japan. 2Ichihashi Clinic, Kobe, Japan. 3Physical Conditioning Production, Osaka, Japan. 4Amagasaki Education Board, Amagasaki, Japan. 5Institute of Health & Sports Medical Science, Nishinomiya, Japan. Email: kaya@huh.s.ac.jp

**Purpose:** Understand the conditions surrounding rhabdomyolysis in extreme conditioning programs such as CrossFit to prevent new cases.

**Methods:** Blood tests, abdominal ultrasound and urine summary of a 36-year-old Crossfit athlete (5'9" and 154 pounds) were analyzed after suffering an injury during the world competition of Crossfit (Reebok CrossFit Games, 2018).

**Results:** On the same day of the injury it was already possible to notice great abdominal distension and the creatine kinase (CK) values were 42,040 U/L, and after 24 hours reached 82,463 U/L. After 6 days, abdominal ultrasound was performed, identifying areas of hemorrhage and rupture in the rectus abdominis, bilaterally, and throughout. After 8 days, blood tests showed elevated values of enzymes other than CK, such as oxaclatic glutamin transaminase (TGO) and pyruvic glutamin transaminase (TGP): 456 U/L (reference value 5 to 40 U/L) and 513 U/L (reference value 10 to 40 U/L respectively). In addition, elevations in lactate dehydrogenase (555 U / L; reference value: 120 to 246 U/L) and again CK (18,962 U/L) were also seen. The urine summary showed an increase in red blood cell levels and the presence of hemoglobin. After 15 days the examinations were repeated and TGO levels decreased by 92.6% (29 U/L; reference value 10 to 40 U/L) and TGP by 72.7% (140 U/L; reference value 10 to 40 U/L). Lactate dehydrogenase decreased to 157 U/L and CK to 284 U/L (99.6% reduction).

**Conclusions:** Thus, it is possible to conclude that an athlete’s susceptibility to rhabdomyolysis is real, especially when in conditions that are determinant for it, such as sports competitions, heat, dehydration and other factors. Early diagnosis that requires clinical suspicion associated with laboratory confirmation is important in order to avoid further damage to the athlete, as well as to prevent future cases.

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Mitsuharu KAYA1, Tonomari Shibutani2, Masanori Takemura1, Koji Kurita3, Arjijt Banerce4, Junzo Tsujita5

**Purpose:** The purpose of this study was to investigate the effects of transcutaneous vacuum treatment on posterior thigh with straight leg raising angle, compared with passive static stretching of hamstrings.

**Methods:** Seven volunteers who had not undergone any prior orthopedic treatment for the lower legs participated in this study. The left and right legs were used for the experiment. Transcutaneous vacuum treatment (CVT) (vacuum and rolling [approximately 0.5Hz]) was applied to posterior thigh (ischial tuberosity to upper area of popliteal region) for 30 seconds 3 times with 15 second intervals between sets (n=7). Passive static stretching of hamstrings (PSS) was applied by pulling the heel using a hand held goniometer to the final angle of movement for 30 seconds 3 times with 15 second intervals between sets at supine position with knee extended (n=7). We measured straight leg raising (SLR) angle with active and passive hip flexion and immediately after CVT or PSS. **Results:** After PSS, the SLR angle statistically increased at active (99.9 ± 9.2 to 97.1 ± 12.4 degree) and passive (92.2 ± 11.5 to 99.0...
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Abstracts were prepared by the authors and printed as submitted.
the blood cDNA in response to physical activity stems exclusively from neutrophils, with a large difference in its amount following various types of exercise. We are currently attempting to understand the physiological mechanisms of this exercise induced elevated cDNA, including heart rate, blood pressure, type of muscle activity, blood oxygen levels, body temperature etc. Our findings open an exciting window into inflammatory and other physiologic processes taking place during exercise, and shed light on new aspects of cDNA biology.

**Results:**

HIT4 increased VO2peak with 2.0 ± 3.4 mL/kg/min (P=0.020) compared to both HIT1 (185 ± 25%, P=0.043, and 184 P=0.040) and Non-Ex (P=0.003, 45 ± 52%). Non-Ex had a higher VO2peak compared to Non-PCOS (96 ± 126%) and PCOS (96 ± 126%) (P=0.541, p = 0.542; post-detraining: ∆ -8.8%, p = 0.182) and mean glucose (MG) values (baseline: ∆ 3.3%, p = 0.541; post-detraining: ∆ -9.0%, p = 0.182) between INT and SIT experimental conditions. An unfavorable effect was observed for the SIT condition from baseline to after the detraining period, with higher values for 7h-AUC (P = 10.6%, p = 0.014) and MG (P = 11.7%, p = 0.015). No changes were observed in the response to INT condition between baseline and after detraining in PPG values (7h-AUC: A 4.4%; p = 0.535; MG: A 5.2%, p = 0.523).

**Conclusion:** Frequent interruptions in SB had no effect on PPG, prior to or after a 2-week detraining period, when compared to prolonged SB in active older adults. On the contrary, older adults experiencing a short-term detraining period can use strategies, such as breaking up SB, in order to potentially improve glycemic control during these intermissions.

**Purpose:**

Experimental data suggest that frequent interruptions in sedentary behavior (SB) promote improvements in postprandial glucose (PPG) responses. However, little is known about the impact of these interruptions before and after a detraining period in active older adults. The main purpose of this investigation was to examine the acute effects of interrupting prolonged SB in a sample of trained older adults, before and after 2-weeks of detraining, on PPG.

**Methods:**

Older active adults performing structured exercise at least 2/week for the past 6 months (n=14; aged between 65 and 90 years-old), were enrolled in a randomized crossover trial. Participants performed two conditions before and after 2-weeks of detraining (i.e. refrain from structured exercise): 1) uninterrupted sitting, where participants remained seated throughout 7 hours (SIT); 2) Sitting + moderate intensity breaks (INT), where participants were instructed to sit for 7 hours, while interrupting this behavior with 2 minutes of moderate-intensity physical activity (PA) every 30 minutes. The primary outcome was changes in PPG, while body composition and cardiorespiratory fitness (CRF) were considered secondary outcomes. Generalized estimating equations (GEE) were used.

**Summary of Results:** Both at baseline and after detraining, no differences were observed for 7-h total area under the curve (7h-AUC) for glucose (baseline: ∆ -3.1%, p = 0.542; post-detraining: ∆ -8.8%, p = 0.182) and mean glucose (MG) values (baseline: ∆ 3.3%, p = 0.541; post-detraining: ∆ -9.0%, p = 0.182) between INT and SIT experimental conditions. An unfavorable effect was observed for the SIT condition from baseline to after the detraining period, with higher values for 7h-AUC (A 10.6%, p = 0.014) and MG (A 11.7%, p = 0.015). No changes were observed in the response to INT condition between baseline and after detraining in PPG values (7h-AUC: A 4.4%; p = 0.535; MG: A 5.2%, p = 0.523).

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**The use of wearable activity monitors in patient populations is gaining popularity with researchers and clinicians. Because much of the research describing their accuracy has been completed with healthy participants, investigating the error in daily steps in patient populations, the most intuitive physical activity metric, is necessary.**

**Purpose:**

To investigate the step count error of four wearable activity monitors compared to StepWatch (SW) steps across the day for days when patients attended phase II cardiac rehabilitation (CR) and days when they did not attend. **Methods:** Nineteen phase II CR patients (mean ± SD; age, 68 ± 7 yr; BMI, 31.7 ± 14.7 kg/m2) wore an SW monitor (Fitbit Charge 2 [Charge] or Apple Watch series 2 [Apple]) and one waist- and/or upper arm-worn monitor (Fitbit Zip or ActiGraph GT3X [AG]) were randomly assigned, per participant, for wear during the first two days and the other wrist and waist monitors were worn during the second two days. Each monitor was worn for one day where participants attended CR (ACR) and for one day they did not attend (NCR). AG steps were processed with and without the low-frequency extension (AGLFE and AG, 15 Hz) and cardiorespiratory fitness (CRF) were considered secondary outcomes. Generalized estimating equations (GEE) were used.

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**Methods**

The Bruininks-Oseretsky Test of Motor Proficiency (BOT-2) was used to assess motor proficiency in youth with Down syndrome. The BOT-2 is a standardized test that evaluates motor proficiency in children and youth from ages 6 to 18 years. It consists of 20 subtests that measure various motor skills, such as balance, coordination, and fine motor abilities.

**Results**

The average BMI of the participants was 29.7±7.6 kg·m⁻² (91% obese). Average RMR was 4.1±1.8 ml·kg⁻¹·min⁻¹. The average standard BOT-2 score was 26.8±3.8, average percentile was 1.4±0.7. All youth were classified as "Well-Below Average." There were no significant correlations among the variables (p=0.05).

**Conclusions**

RMR does not appear to be impaired in this sample. However, in this sample, the extremely low motor proficiency scores may contribute to limited PA participation and obesity levels. PA programs and interventions should consider addressing strategies to improve motor proficiency in youth with DS.

**Purpose**

To determine exercise timing differentially affects sleep quality in men and women.

**Methods**

Thirty subjects were an Actiwatch (Actiwatch 2, Phillips Respironics), which measured sleep duration, sleep efficiency and wake after sleep onset (WASO) for three consecutive nights at home, followed by a testing day of either no exercise (NOEx), morning exercise (AMEx) or nighttime exercise (PMEx). Morning exercise occurred at 0700 h and the nighttime exercise occurred at 2000 h on the respective study night. For each exercise bout, the subject exercised on a treadmill at 55% of their VO₂max for 45 minutes. The order in which they completed each condition was randomized, and study nights were separated by about one month. For the study nights, subjects arrived at the hospital at 1700 h and were given a standard meal at 1800 h. Lights were turned off by 2230 h and turned back on at 0700 h.

**Results**

Sleep duration significantly increased on the study nights (7.9±0.16 h) compared to the nights of sleep at home (7.4±0.13 h, p=0.02), but was not affected by exercise. There were no differences in the sleep efficiency between study nights (84.8±1.6%) and non-study nights (83.4±1.1%, p=0.33) or between exercise conditions; NOEx (82.0±2.2%), AMEx (85.7±1.1%), and PMEx (84.5±1.5%, p=0.14). WASO was not different by study nights (0.8±0.13 h) and non-study nights (0.7±0.09 h, p=0.15), or between exercise conditions; NOEx (0.87±0.21 h), AMEx (0.55±0.05 h), and PMEx (0.78±0.22 h, p=0.14).

**Conclusions**

Sleep quality was maintained from the home setting to the research setting. Exercise did not improve sleep duration, efficiency or WASO in our subjects between the exercise and no exercise day and exercise timing had no effect on these variables.
Cancer survivors have unique physical and psychological challenges that can affect exercise adherence. While many factors play a role in regular exercise for cancer survivors, adherence may be improved by increased exercise self-efficacy (ESE), exercise support (ES), and exercise outcomes (EO). Purpose: To determine the impact a community-based, individualized exercise intervention on exercise adherence, ESE, ES, and EO following the completion of a tailored exercise intervention. Methods: Six cancer survivors (mean age 60.2±11.5) were enrolled in a 12-week feasibility study. Baseline measures included the following tests: 1-rep max, treadmill, sit-and-reach and the ESE survey. Participants attended three, weekly, one-hour session led by a Cancer Exercise Specialist (CES). Training included cardiovascular, strength, and flexibility exercises tailored to the participant’s fitness and physical needs. Measures were repeated immediately post-intervention (week 6) and at week 12. Exercise adherence was determined by the percentage of the 36 sessions completed. Paired t-tests were used to compare baseline and follow-up assessments. Results: Exercise adherence was 87.9%. Total ESE was not significantly higher at week 6 (4.1±2.1, vs 4.2±2.1, p=0.90) or week 12 (5.4±2.0, vs. 15.6±5.0, p=0.06). ES was not significantly higher at week 6 (18.8±8.2 vs. 26.3±7.5, p=0.35) but demonstrated a statistically significant increase at week 12 (18.8±8.2 vs. 23.2±12.3, p=0.03). EO was not significantly different at week 6 (41.8±3.9 vs. 46.5±5.4, p=0.09) or week 12 (41.8±3.9 vs. 43.8±3.7, p=0.16). Conclusion: This study demonstrated feasibility of a community-based, CES-led 12-week exercise intervention. Improved ES and adherence were demonstrated among participants. Study outcomes are being used to guide an exercise intervention focused on adolescent and young adult survivors of cancer, a traditionally understudied group.

Purpose: To assess the feasibility, safety, and preliminary efficacy of a supervised high-intensity interval training (HIIT) program in rectal cancer patients undergoing 5-6 weeks of neoadjuvant chemoradiotherapy (NACRT). Methods: Thirty-six rectal cancer patients scheduled to receive NACRT followed by surgery were randomized to either exercise training (n=18) or usual care (n=18) in the Exercise During and After Rectal Cancer Treatment (EXERT) Trial in Edmonton, Alberta. Patients in the exercise group were asked to complete 3 supervised HIIT sessions/week for the duration of NACRT. Feasibility was determined by eligibility rate, recruitment rate, follow-up rate and exercise adherence. Safety was assessed by tracking serious adverse events related to exercise. The primary outcome was cardiorespiratory fitness (VO2 peak) assessed immediately post-NACRT by a graded exercise test. Secondary efficacy outcomes included functional fitness assessed by the Sener’s Fitness Test. Results: From June 2017 to August 2019, 205 rectal cancer patients were screened, 131 (64%) were eligible, and 36 (27%) were recruited. Follow-up fitness testing post-NACRT was completed in 75% (exercise n=14; control n=13). Reasons for missed testing were medical issues. Median attendance for the supervised HIIT sessions during NACRT was 82%. No serious adverse events were observed; however, 2 patients in the exercise group experienced musculoskeletal events which resulted in 4 missed exercise sessions. Analyses of covariance showed no statistically significant or clinically meaningful difference between groups for the primary outcome of VO2 peak (adjusted between-group mean difference, 0.9 ml/kg/min; 95% CI -1.6, 3.3; p=0.47). The 8-foot up-and-go was significantly better in the exercise group post-NACRT (adjusted between group mean difference, -0.4 seconds; 95% CI -0.7, 0.0, p=0.031). No other significant group differences in functional fitness were observed. Conclusions: Supervised HIIT during NACRT for rectal cancer was feasible and safe. Further research is needed, however, to better understand the feasibility of completing fitness testing immediately following NACRT and whether HIIT can produce meaningful improvements in fitness in this challenging clinical setting.
characterize cardiorespiratory fitness and physiological changes in fatigue in men with prostate cancer who participated in an exercise training program during External Beam Radiation Therapy (EBRT). Methods: Subjects were eight men with prostate cancer (age 65.75±8.84 years; BMI 25.31±2.62 kg/m²) scheduled to receive EBRT. Subjects completed eight weeks of vigorous supervised exercise [either continuous training (30 minutes at 70-80% of peak heart rate) or high intensity interval training (eight one-minute intervals of 95% peak heart rate)] three times a week during EBRT. Subjects also completed a treadmill cardiopulmonary exercise test (CPET) to exhaustion before and after eight weeks of EBRT. CPET results were compared before versus after completing the training regimen and EBRT. Results: Pre: (28.2±5.07 ml/kg/min) and post (28.7±6.08 ml/kg/min) peak oxygen consumption (VO₂) were not significantly different. Conversely, a significant increase in time to anaerobic threshold (AT) before and after exercise training. Conclusion: While the construct of fatigue is complex and multidimensional, AT provides an objective measure of endurance that is not influenced by perception or motivation. The National Comprehensive Cancer Network (NCCN) recommends moderate exercise programs during and after completion of cancer treatment to reduce cancer-related fatigue. In this study, vigorous exercise training performed during EBRT, maintained cardiorespiratory fitness and increased the time to AT in these men undergoing prostate cancer therapy.

Funding: This study is fully supported by the Division of Intramural Research of the National Institute of Nursing Research and the Clinical Center, Rehabilitation Medicine Department of the National Institutes of Health, Bethesda, Maryland.

4003 Board #320 May 30 9:00 AM - 10:30 AM Exercise Triage And Program Adaptations For Cancer Survivors With Multiple Myeloma: A Case Series.

Graeme M. Purdy1, Chris M. Sellars1, Chris P. Venner2, S. Nicole Culos-Reed1, Margaret L. McNeeley1, 1University of Alberta, Edmonton, AB, Canada. 2Cross Cancer Institute, Edmonton, AB, Canada. 3University of Calgary, Calgary, AB, Canada. Email: gmurdy@ualberta.ca

(No relevant relationships reported)

Multiple myeloma (MM) is associated with fracture risk and deconditioning. Exercise training can attenuate functional declines, but the safety of exercise in this population remains unclear. PURPOSE: This case series explores the clinical history, considerations for triage, program adaptations, and functional changes in patients with MM taking part in the Alberta Cancer Exercise (ACE) study.

METHODS: An exercise physiologist screened cases using a cancer-specific intake and the PAR-Q+. Due to MM diagnosis, physician approval was required for entry into the ACE study. ACE involved 60 mins of community or clinic-based exercise 2x/wk for 12 weeks. Pre/post measures included the 6-Minute Walk Test (6MWT), 30s sit-to-stand, sit and reach, and optional max bench press (1RM) and plank tests.

RESULTS: CASE 1: 54-year old male on chemotherapy with a history of lytic lesions throughout the thoracic cage and pelvis, and radiation therapy (RT) to large lytic lesions in the pelvis and left clavicle. Goal: improve fitness for upcoming stem cell transplantation (SCT). Physician recommendation: controlled low loading due to fracture risk. Approved for community (1x/wk) and clinic-based (1x/wk) exercise. CASE 2: 37-year old female diagnosed with MM without bone involvement, receiving chemo and targeted therapy. She had undergone surgery and was recovering from a SCT: Goal: reduce fatigue and improve fitness. Approved for clinic-based exercise with transition to community after 12 wks. CASE 3: 54-year old female on maintenance chemo with multiple lytic lesions, history of cervicothoracic decompression, reduction and instrumentation C5-T3, and prior RT to spine and pelvis. Goal: improve fitness, strength and health. Approved for clinic-based exercise. Physician recommendation: low intensity exercise due to fracture risk and pain. No adverse events occurred and increases were seen across cases in 6MWT (8.2%, 5.6%, 9.5%), sit-to-stand (0%, 18.8%, 5.9%), sit and reach (18.6%, 56.7%, 42.2%), 1RM (4.1%, 21.4%, N/A), and plank (36.8%, 50%, N/A). CONCLUSIONS: The cases presented with unique complications and apprehension towards exercise. Presence and location of lytic lesions, fracture history and risk, surgical history, and treatment stage were key considerations for exercise triage and adaptations within the ACE program.

Epidemiological data shows that regular physical activity is associated with reduced risk of developing the blood cancer Myeloma. Myeloma is preceded by the asymptomatic stages Monoclonal Gammapathy of Undetermined Significance (MGUS) and Smouldering Myeloma (SM). International guidelines do not advocate treatment for MGUS and SM, instead disease biomarkers are routinely monitored. The effect of exercise training on MGUS and SM disease activity has not yet been investigated despite evidence that an active lifestyle may reduce Myeloma risk.

PURPOSE: Determine the feasibility of a progressive exercise programme for MGUS and SM patients, for subsequent investigation of its effect on disease activity. METHODS: 62 patients (21 MGUS, 41 SM) were invited to participate in a single-arm trial. The exercise programme comprised 2 supervised and 1 home-based session per week for 16 weeks. Supervised exercise involved treadmill walking (30 mins progressing from 40% to 80% VO₂MAX). At home participants completed a moderate intensity walk for ≥40 mins. Results are mean ± SD. RESULTS: Uptake was 31% and retention was 79%. Ten participants (2 MGUS, 8 SM, 50% male, 60 ± 11 years) have completed the trial to date. Adherence was higher for supervised (91 ± 7%) than home-based (74 ± 20%) sessions. In supervised sessions, compliance to duration was high (98 ± 3%) but compliance to intensity was low (61 ± 20%) due to a drop-off at intensities >70% VO₂MAX. The 45-min home-based walk target was exceeded (47 ± 11 mins). No severe adverse events occurred. CONCLUSION: Exercise is safe for patients with MGUS and SM. Adherence to supervised exercise was high, as was compliance to 30 mins of walking at 40-70% VO₂MAX. Walking exercise >70% VO₂MAX was not feasible. Future studies could evaluate interval training to maximise exercise intensity with the aim of delaying disease progression from MGUS and SM to Myeloma.

Grants: Physiological Society & University of Bath Alumni Fund
Following radical prostatectomy, patients are generally advised to engage in no strenuous exercise for 4-6 weeks. Beyond that time range, the rapidity with which a patient may return to high-level aerobic activity is not known.

**Purpose:** To examine the recovery following radical prostatectomy (RP) of an endurance-trained 65-year-old man with localized prostate cancer and single-vascular bladder base disease.

**Methods:** A maximal incremental exercise test and a one-hour steady-state test were performed just prior to and three months following robotic RP to determine maximal oxygen consumption (VO2max) and other cardiorespiratory variables. The patient recorded his training as he prepared for an endurance event that was to occur three months after RP, the Norwegian Foot March (NFM), a 30-km road march carrying 11.4 kg.

**Results:** In the month prior to RP, the patient performed 2-3 hours of vigorous-intensity aerobic exercise per week, fast walking carrying an 11.4-kg pack, with the longest individual session being a 16-km road march. Just prior to surgery, VO2 max was 36.7 mL/min/kg, heart rate during 30 min was 7.2 km/h and 0% grade was 77% of heart rate reserve (HRR), and during 30 min at 5.3 km/h and 10% grade was 92% HRR. On post-surgery day 44, he did a 19-km road march carrying 11.4 kg, exceeding the training level of the month pre-surgery. Three months post-surgery, VO2 max was 42.7 mL/min/kg, and heart rates during the flat and uphill 30-min sessions at the same absolute-intensity as pre-surgery were 70% and 83% HRR, respectively. He completed the NFM 93 days post-surgery in 4:24:37, with an average heart rate of 72% HRR.

**Conclusions:** This case study demonstrates that an aerobically trained prostate cancer patient can return to high-level aerobic training in as little as seven weeks post-radical prostatectomy, and even exceed pre-surgery fitness. This finding has implications for prognosis given the beneficial effect of vigorous-intensity exercise on prostate cancer progression.

**Purpose:** The hematopoietic stem cell transplant (HSCT) is considered for patients who are non-responsive to first intention treatments. This process can last between 4-6 weeks and requires complete isolation of the child. Intensive chemotherapy is given to the patient to suppress completely the immune system before transplant. Past studies have reported major motor-developmental and growth deficiencies post-transplant. In this case study, we reassessed the patient after one-year.

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on a subjective exertion perception scale (PSE) of 9-13 and with a consumption of 3 to 6 METs, performing 3 sets of 6 to 10 repetitions, with 2-3 weekly sessions, up to 48h apart. Over-load was applied weekly, initially by volume (repetitions); after reaching 10 repetitions the intensity was increased, returning to the six repetitions. Stretching and strength exercises were selected. RESULTS: Table 1 presents the results before and after participation in the program. Table 1. Results before and after participation in ONCOCOMATIN.

- CONCLUSION: It is believed that ONCOCOMATIN can fill a gap in physical activity issues for cancer patients with a view to health promotion, protection and recovery, and care delivery, ensuring a comprehensive approach to the health-disease process with an emphasis on primary care.

### Table 1

<table>
<thead>
<tr>
<th></th>
<th>Fat percentage *</th>
<th>Cardiorespiratory Resistance **</th>
<th>Muscular endurance ***</th>
<th>Muscle strength ****</th>
<th>Flexibility *****</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Men</strong> (pre)</td>
<td>18.73 (±0.83)</td>
<td>332.92 (±32.66)</td>
<td>11.7 (±3.79)</td>
<td>54.8 (±18.48)</td>
<td>83.3 (±5.69)</td>
</tr>
<tr>
<td><strong>Mens</strong> (post)</td>
<td>16.39 (±0.81)</td>
<td>471.25 (±24.62)</td>
<td>19 (±3.57)</td>
<td>62.7 (±19.06)</td>
<td>87.9 (±5.97)</td>
</tr>
<tr>
<td><strong>Women</strong> (pre)</td>
<td>30.13 (±1.16)</td>
<td>280 (±21.76)</td>
<td>12.6 (±3.18)</td>
<td>16.4 (±11.05)</td>
<td>80.7 (±7.12)</td>
</tr>
<tr>
<td><strong>Women</strong> (post)</td>
<td>26.58 (±0.94)</td>
<td>434.81 (±23.22)</td>
<td>21.3 (±4.18)</td>
<td>24 (±12.55)</td>
<td>91.8 (±6.5)</td>
</tr>
</tbody>
</table>

Units: *%; ** Meters in 6 minutes; *** Repeats per minute; **** kg; *****Degrees

More than 60% of black women in the U.S. are obese. Evidence suggests black women are exposed to more obesogenic microenvironments. To address this issue, research calls for exploration of bold, new obesity intervention approaches to discover unconventional tactics to address weight loss disparities.

### CONCLUSION

Research indicates black women experience 50% less weight loss through behavioral counseling programs when compared to white women. Examining context may reveal factors associated with weight loss differences. Ecological Momentary Assessment (EMA) via digital devices enables data collection from participants as they move through their daily routine. In this project, we asked participants to respond to prompts about their eating, physical activity and social copresence up to eight times per day over a 30-day period.

### PURPOSE

To identify characteristics associated with EMA response rates.
CONCLUSIONS: These data indicate that in diverse populations with different SES, CMO risks are essentially the same. This allows for the possibility that healthy lifestyle choices maybe a critical element contributing to the development of CVD.
AcsM May 26 – May 30, 2020 San Francisco, California
Authors listed next to each presentation number associated with the presentation.
Networks listed next to each individual represent the presentation number associated with the presentation. Bold numbers represent primary author.
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