69 Board #1 May 27 9:30 AM - 11:30 AM
Kinetic Asymmetry During Squatting And Landing Are Associated In Anterior Cruciate Ligament Reconstructed Patients
Robin Queen, FACSM1, Alexander T. Peebles1, DS Blaise Williams, III, FACSM2. 1Virginia Tech, Blacksburg, VA. 2Nike, Beaverton, OR.
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Reported Relationships: R. Queen: Industry contracted research; DJO Global.

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; 6.0 ± 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 for 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>
<thead>
<tr>
<th>Squat</th>
<th>Stop Jump</th>
<th>Peak KEM LSI</th>
<th>GRFI LSI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>45.8% ± 24.6%</td>
<td>42.8% ± 26.0%</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>34.8% ± 25.4%</td>
<td>p &lt; 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>14.5% ± 10.5%</td>
<td>p = 0.012</td>
<td>p = 0.004</td>
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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.

71 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.
Email: audrey.elias@umontana.edu
(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) were recruited to perform 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 uninvolved 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±36%, p=0.005). Changes in joint flexion and VGRF were retained for at least 8 weeks after the final training session. Symmetry in knee moment 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. Quadriceps neuromuscular dysfunction is ubiquitous after anterior cruciate ligament reconstruction (ACL-R) 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-ACL-R. 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 kinetics were recorded and completed 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=0.01, 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%. 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 95.4±9.7% and mean RTD was 85.1±8.3%.

CONCLUSIONS: Both peak and rapid knee extensor torque development are strongly associated with symmetrical sagittal plane CMJ knee mechanics. CMJ knee
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 pre-injury level 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, 20.1 ± 5.9 years, 22.3 ± 2.1 BMI, Pre-injury Tegner 8.1 ± 2.1) (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 criterion. p-values presented here are based on the main effect significance tests from the selected model. No significant relationships were found for any of the measures tested using a multilinear regression analysis.

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.

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 p < 0.05. 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.

Purposes: To determine the relationship between return to sport measures and quadriceps strength in individuals with ACL reconstruction (ACLR) and healthy controls.

Methods: Thirty-three individuals with ACLR (22F/11M, 19.9±2.2 years, 68.3±10.9 kg, 170.4±8.4 cm, 22.7±23.3 months post-surgery) and 29 healthy individuals (18F/11M, 20.1±1.5 years, 70.0±9.9 kg, 172.7±7.8 cm) completed isokinetic quadriceps strength testing using a Biodynamometer at 180 degrees/ sec on both legs then completed vertical jump (VJ) testing with and without countermovement (NCM) on a jump mat. All participants completed an incremental treadmill test to determine maximal oxygen consumption testing (VO2max). Initial running velocity was self-selected and increased 0.5mph every 2 minutes until volitional fatigue. Knee extensor torques and VO2max were normalized by mass. Bivariate Pearson’s correlations were calculated between strength and performance variables. Significant correlations were retained for a regression analysis.

Results: In ACLR, peak torque was correlated with VJ (r = 0.45, P < 0.01), NCMJ (r = 0.44, P = 0.01), and VO2max (r = 0.52, P < 0.002). The only variable retained in the regression model was VO2max, which explained 26.7% of the variance in strength. In healthy individuals, peak torque was correlated with VJ (r = 0.72, P < 0.001), NCMJ (r = 0.62, P < 0.001), and VO2max (r = 0.55, P < 0.002). Two variables were retained in the regression model, including VJ (R2 = 52.2%) and VO2max (R2 = 6.8%) which together explained 59.0% of the variance in strength.

Conclusions: Quadriceps strength was associated with a VJ, a powerful quadriceps movement, in healthy individuals, while strength in individuals with ACLR was associated with aerobic fitness. Although VO2max was a significant predictor of strength after ACLR, it explained a small amount of variance which suggests other factors contribute to strength after ACLR.

Purposes: To determine the effects of vibration-induced hamstrings fatigue intervention on quadriceps weakness after ACL reconstruction.

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. During which 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-1RM 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.

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). However, 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 (DLHOP) 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 hop (SLHOP) task with subjective limb confidence in athletes who have had an ACLR. RESULTS: Of the 23 subjects, 62% returned to sport at their pre-injury level. Subjects criterion. p-values presented here are based on the main effect significance tests from the selected model. No significant relationships were found for any of the measures tested using a multilinear regression analysis.

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.

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Purposes: To determine the effects of vibration-induced hamstrings fatigue intervention on quadriceps weakness after ACL reconstruction.

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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 < 0.008). 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 clearing 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 Glaiser, FACSM, Kiran Chopra, Ana Pereira De Sena, Cassie Sternbach, Yiannis Mavrommatis. St Mary’s University, Twickenham, United Kingdom.
Email: mark.glaiser@stmarys.ac.uk (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 VO2pulm. 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 VO2max followed by a time trial (~ 30 mins). 95% confidence limits (CL95) were calculated for all estimates. RESULTS: Relative to placebo, caffeine led to a 2% greater reduction in time to complete the time trial (caffeine: 29.21 ± 1.60 mins; placebo: 30.30 ± 1.96 mins); but there was no effect of genotype. During submaximal exercise, caffeine resulted in significant reductions in heart rate (mean difference: 2.4 b min-1; CL95: 1.1 - 3.8 b min-1), with effects dissipating as exercise intensity increased. Caffeine also led to submaximal exercise reductions in ratings of perceived exertion (mean difference: 0.5; CL95: 0.2 – 0.8) and significant increases in respiratory exchange ratio (mean difference: 0.013; CL95: 0.002 – 0.025), minute ventilation (mean difference: 3.4 L min-1; CL95: 0.4 – 6.4 L min-1), and blood lactate concentration (mean difference: 0.24 mmol·L-1; CL95: 0.11 – 0.37 mmol·L-1) conditions (P > 0.05 for all comparisons). CONCLUSION: Caffeine ingestion (5 mg kg-1) improved the upper-body intermittent endurance and maximal isometric strength of combat sports athletes without altering psychophysiological responses.
ANOV A was used for analysis with significance accepted at p<0.05. RESULTS: A significant time (p<0.001), but not condition effect was observed in hunger (p=0.31), satiety (p=0.15), desire to eat (p=0.11) and prospective food consumption (p=0.19). No significant condition effect was observed in blood glucose levels (p=0.12), energy intake at breakfast (C1: 440 ± 213; C2: 400 ± 158; C3: 440 ± 226; C4: 386 ± 138 calories, p=0.43) or over 24-hours (C1: 16773 ± 532; C2: 1486 ± 434; C3: 1503 ± 321; C4: 1662 ± 505 calories, p=0.28). However, a significant interaction effect was observed in tiredness, calmness, energy and tension (p<0.02). In addition, a significant time (p<0.001) but not condition effect (p=0.05) was observed in TM, ST and state anxiety. Participants’ time to complete cognitive tasks decreased and state anxiety increased over time. CONCLUSIONS: Coffee volume may not have an effect on appetite suppression and perceived hunger, however, may modulate affective responses.

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 peak torque (PT) and contraction force (CF) in isometric conditions (i.e. torque integrated to time) of the plantar fl exors using a Biodes 4 dynamometer. Participants were familiarized with testing procedures on the first day, and the experimental protocol was applied on two other days (2-7 days apart), which consisted of four maximal isometric contractions before and after 60-min post a coffee drink (6.3±1.6 g) or placebo (cellulose). The total exercise-bout time was compared between caffeine (bout 1: 83 ± 15 bpm; bout 6: 183 ± 14 bpm) and placebo condition (bout 1: 83 ± 15 bpm; bout 6: 183 ± 14 bpm; P > 0.05). Furthermore, the [La] increased linearly over the test in both conditions (P < 0.05), but with no differences when caffeine condition (rest: 74 ± 17 bpm; bout 6: 179 ± 14 bpm) was compared with placebo condition (bout 1: 83 ± 15 bpm; bout 6: 183 ± 14 bpm; P > 0.05). In addition, a significant interaction effect was observed for rapid torque output (i.e. CI0-50 and CI100-200) in young (ES = 0.41) and older (ES = 0.24).

CONCLUSIONS: Caffeine ingestion increases the glycolytic flux but does not alter the performance during a repeated-bout agility test in handball players.

The effects of caffeine on athletic and cognitive performance have been previously studied, however, less research is available on taste perception and appetite suppression. PURPOSE: The purpose of this study was to evaluate the effects of caffeine on taste perception, perceived caffeine amount, affect, energy metabolism and appetite profile. METHODS: 18 college-aged females (age 21.1±1 yrs; BMI 23.4±4.0 kg/m2; caffeine 24±6.8 mg) who were habitual caffeine consumers participated in the study. Participants reported to the laboratory fasted on two separate occasions and were provided with (355 ml) caffeinated (C) or decaffeinated (D) coffee test drink. Appetite profile, The Stanford Sleepiness (SSS), Feeling (FS) and Felt Arousal (FAS) scales were administered at pre-, 0, 25 and 45 minutes post-coffee drink. In addition, palatability and perceived caffeine amount were assessed via visual analog scales at pre- and post-sugar addition. Sugar addition to the coffee drink was recorded. An indirect calorimetry method using ventilated hood technique was used to measure oxygen consumption (VO2) and respiratory quotient (RQ) at pre- and post-25 minutes. A repeated measures ANOVA and t-test were used for analysis with significance accepted at p<0.05. RESULTS: A significant interaction effect was observed for fullness (p=0.04) and amount (p=0.03), but not for hunger (p=0.16), satiety (p=0.29) or desire to eat (p=0.11). A significant interaction effect was observed for RQ (C: 0.83±0.06 and D: 0.89±0.07; P = 0.04) and significant condition effect was observed for VO2 (C: 3.0±0.5/m/kg/min; D: 3.7±0.5/m/kg/min, p<0.01). A significant interaction effect was observed for perceived caffeine amount (C: 3.2±0.5; D: 3.7±0.5; P = 0.007), and bitterness (p=0.02), but not astringence (p=0.23), sweetness (p=0.21) or pleasantness of taste (p=0.19). A significant interaction effect was observed for FAS (p=0.04) and condition effect for SSS (p=0.003) and FS (p=0.03). In addition, significantly (p=0.004) more sugar was added to decaffeinated drink (6.3±3.6 g) compared to decaffeinated (3.0±1.9 g). CONCLUSIONS: Although, palatability and pleasantness of taste was not significantly different, caffeinated coffee was perceived bitterer leading to more sugar added to the drink.

Caffeine may diminish the immediate blood pressure (BP) reductions that occur after an exercise bout, termed post-exercise hypotension (PEH). Neither PEH nor the influence of caffeine on PEH have been studied in firefighters (FF), who have a disproportionate high risk of sudden cardiac death on the job, partially due to its strenuous nature and poor nutrition. PURPOSE: To examine the influence of caffeine intake (CAF) on PEH after a maximal graded exercise stress test (GEST) in FF. METHODS: FF (n=15) completed a non-exercise control (CONTROL) and GEST in random order on separate non-work days. They left the laboratory attached to ambulatory BP (ABP) monitor for 19 hr. CAF tended to be positively correlated with resting SBP (r=.50, p=.06). Among the total sample, the systolic ABP (S) and GEST in random order on separate non-work days. They left the laboratory attached to ambulatory BP (ABP) monitor for 19 hr. CAF tended to be positively correlated with resting SBP (r=.50, p=.06) and DBP (r=.50, p=.06). Among the total sample, the systolic ABP (ASTBP) (18.0±4.8mmHg, p<.01) and diastolic ASTBP (ADDUR) (9.1±1.5mmHg, p<.01) changes from baseline were greater after GEST vs CONTROL over 19 hr, independent
of CAF (P<0.05), but with significant interactions among ASBP, ADBP, and CAF over 19hr (P>0.05). These interactions revealed ASBP was consistently greater after GEST vs CONTROL over 19hr in high CAF (p=-0.01 GEST vs CONTROL), whereas in low CAF the difference in ASBP after GEST vs CONTROL was variable over 19hr (p=0.03 GEST vs CONTROL x Time). By contrast, the ADBP response after GEST vs CONTROL over 19hr tended to be greater in low (15.3±4.5 mmHg, p=0.08) than high CAF (4.4±2.4 mmHg, p=0.05). DISCUSSION: This small sample of FF exhibited post-exercise hypertension and CAF seemed to modulate this adverse response. Further study is needed in a larger sample of FF to confirm our findings and better establish the relationship of these associations. Supported by the University of Connecticut Institute for Collaboration on Health Intervention and Policy and the United States Department of Agriculture (SAES, HATCH Project No. CONS00954).

### A-20 Thematic Poster - Cognition, Function, and Aging

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

**Room: CC-2000**

### Board #1

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

**Impact Of Neuromuscular Electrical Stimulation On Quality Of Life In Older Adults**

Nigel C. Jiwang, Kyndall P. Ramirez, Monica A. Mendoza, Mitchell S. Kace, Lindsay E. Kipp, Joni A. Mettler. (Texas State University, San Marcos, TX. (Sponsor: Tinker Murray, FACSM)

Older adults often suffer from sarcopenia, the age-related loss of muscle mass and strength, which negatively impacts physical function and quality of life (QoL). 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: Eight 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 stimulation frequency set at 60 Hz. During the treatment, subjects were seated on an isokinetic dynamometer with the leg positioned at a 60° angle. The subjects were given a pre and post survey assessing indicators of QoL: self-efficacy for physical function (0-100 scale), perceived competence in physical domains (e.g., strength, coordination, 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 = 0.17, d = 0.83), intention (5.91 ± 0.72 vs 6.59 ± 0.27, p = 0.38, d = 0.49), coordination (5.10 ± 0.20 vs 5.30 ± 0.20, p = 0.12, d = 0.36), and physical activity (3.64 ± 0.54 vs 4.22 ± 0.39, p = 0.20, d = 0.29), pre vs post, respectively. Physical self-concept showed no effect (4.58 ± 0.44 vs 4.67 ± 0.36, p = 0.74, d = 0.07), indicating this global dimension may take longer to change. There was a significant decrease in time to complete TUG (8.38 ± 0.60 vs 7.40 ± 0.45s, p = 0.02, 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 physical function from NMES treatment may help improve overall QoL by increasing.

### Board #2

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

**Predictors Of Functional Performance Among Older Adults**

MinHyuk Kwon1, Monica J. Geiser2, Christopher W. Sundberg2, Bonnie Schliinder-Delap3, Sandra K. Hunter, FACSM. 1California State University, Pomona, Pomona, CA. 2Marquette University, Milwaukee, WI. (Sponsor: Sandra K. Hunter, FACSM)

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 (x5), 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 (1/3 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<0.001). Faster chair-rise time (x5) was associated with younger age, less body fat, and lower fatigability (R²=0.44, P<0.001). Both a faster stair-climb (R²=0.3, P<0.001) and a higher Berg balance score (R²=0.43, P<0.001) were associated with younger age and less body fat. **CONCLUSIONS:** Our findings demonstrate that younger age, greater peak 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.

### Board #3

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

**Higher Fitness Levels Influence Association Between Cognition And Mobility In Older Adults With Hypertension And Dementia Risk**

Narlon C. Boa Sorte Silva, Andrea FM Petrella, Robert J. Petrella, FACSM. Western University, London, ON, Canada. (Sponsor: Robert Petrella, FACSM)

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 cognitive 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(1,25)=14.3, p<0.001, R²=.35), as well as step length in high CF (F(1,25)=10.8, p<0.003, 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<0.003, R²=.17). For dual-task gait, cognition was positively associated with gait velocity in both high CF (F(1,25)=9.15, p<0.006, 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

Abstracts were prepared by the authors and printed as submitted.
MANIFESTATION OF MILD COGNITIVE IMPAIRMENT (MCI) IS AN EARLY SIGN INDICATIVE OF ACCELERATED DECLINE IN COGNITIVE FUNCTION DURING AGEING THAT PRECEDES THE DEVELOPMENT OF DEMENTIA. ITS PREVALENCE RATE IN OLDER ADULTS IN CHINA (≥ 65 YEARS) RANGES FROM 10% TO 20%. TO DATE, THERE IS NO DOCUMENTED PHARMACOLOGICAL INTERVENTION FOR DEMENTIA. PRELIMINARY STUDIES, HOWEVER, HAVE SHOWN THAT EXERCISE CAN IMPROVE COGNITIVE FUNCTION.

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-BLIND RANDOMIZED CONTROLLED TRIAL, 20 CHINESE ADULTS AGED ≥50 YEARS WITH MCI [SCORE OF MONTREAL COGNITIVE ASSESSMENT HONG KONG VERSION (MoCA-HK) BELOW 7TH 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.

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 A/B 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.

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.

Systolic Blood Pressure And Heart Rate Recovery Are Related To Cognition In Healthy Older Adults

Brittany Intzandt1, Tudor Vincereanu1, Kristell Pothier1, Anil Nigam2, TT Minh Vu2, Karen Li1, Nicolas Berryman2, Claudine Gautieri1, Louis Buerer1, Concordia University, Montreal, QC, Canada. 1University of Montreal, Montreal, QC, Canada. 2University of Tours, Tours, France. Montreal Heart Institute, Montreal, QC, Canada. Bishop’s University, Sherbrooke, QC, Canada.

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(Synopsis: Attenuated heart rate recovery (HRR) and systolic blood pressure recovery (SBPR) after a maximal exercise test (VO2 peak) 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 HR 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 VO2 peak test in older adults.

Methods: Prior to enrollment in an intervention, a total of 68 participants (70-66 years; 45 women) completed neuropsychological tests and a VO2 peak 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: VO2 peak 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 inhibition 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.

Association Of Cognitive Function With BMI And Physical Function In Older Adults: The CogEx Study

Audrey M. Collins, Renee J. Rogers, FACSM, Fabrisia Ambrosio, Kirk Erickson, Marissa L. Marcini, Andrea C. Kozai, Katherine A. Collins, Nalingna Yuan, John M. Jakicic, FACSM, University of Pittsburgh, Pittsburgh, PA. (Sponsor: John M. Jakicic, FACSM)

Email: amc234@pitt.edu

(Synopsis: Aging negatively impacts cognitive function and physical function in older adults. Physical activity may protect or improve the brain and physical functions that are crucial for multiple health outcomes in older adults, whereas obesity may negatively impact these outcomes. Purpose: To examine the association between cognitive function with BMI and physical function in underweight older adults.

Methods: Baseline data were examined from sedentary older adults (N=31; age=70.3±3.7 years; BMI=28.8±4.6 kg/m2) prior to engaging in a 12-month physical activity intervention. Assessments included height, weight, physical function, and cognitive function. Cognitive function was assessed using the Modified Mini-

ACSM May 26 – May 30, 2020

San Francisco, California
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=−0.18; p=0.397) or 400-Meter Walk Test performance (r=−0.15; p=0.415). Similarly, the RBANS Sum of Index Score (209.0±21.1) was not significantly correlated with BMI (r=−0.297; p=0.105) or 400-Meter Walk Test performance (r=−0.164; p=0.378). When examining this relationship by cognitive domain, a higher BMI was associated with a poorer RBANS Immediate Memory Index Score (r=−0.412; p=0.021). We also observed that worse performance on the 400-Meter Walk Test was associated with poorer RBANS Immediate Memory Index Score (r=−0.314, p=0.08). Neither BMI nor 400-Meter Walk performance were significantly associated with RBANS Visual-Spatial/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 immediate 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

**94 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: sctsaf6@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 cognition 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. For the benefit of two different exercise, only the performance of Schulte table was significantly better in the circuit training exercise, only the performance of Schulte table was significantly better in the circuit training exercise and a seated rest control. The cognitive parameters were compared using the time to complete the 400-Meter Walk Test (minutes).

**Conclusion:** 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. For the benefit of two different exercise, only the performance of Schulte table was significantly better in the circuit training exercise, only the performance of Schulte table was significantly better in the circuit training exercise and a seated rest control. The cognitive parameters were compared using the time to complete the 400-Meter Walk Test (minutes).

Supported by MOST Grant 107-2410-H-845-018-MY3.
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; VO₂max 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% VO₂max) 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 areas 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 SIT, RESIST reduced 26-iAUC for CGM by 3.04 mmol·L⁻¹·h⁻¹ [95%CI (0.94-6.3)] (p = 0.046). Compared with SIT, WALK and RESIST reduced the CGM iAUC by 3.80 mmol·L⁻¹·h⁻¹ [0.19-7.40] (p = 0.036) and 7.37 mmol·L⁻¹·h⁻¹ [4.08-10.66] (p <0.001) during the 9 h activity period, respectively. The iAUC was lowered by 3.57 mmol·L⁻¹·h⁻¹ [0.06-7.08] (p = 0.045) in RESIST compared to WALK. Upon adjusting for EE, the only effect that remained was the comparison between RESIST and SIT 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).
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 physical education (PE) classes on academic and behavioral outcomes. **METHODS:** Seventy children (40 boys & 30 girls; age 8-10 yrs. old) enrolled in Accelerations Academy were assigned into one of three conditions during a one-week period: control (n = 23), High Intensity Interval Training (HITT) (n = 25), and muscular strength (MS) condition consisted of 4 days of strength sessions (3 sets/10-12 reps for 3 min/session; 30 sec on:30 sec off) followed by X min of standard PE activities; Low volume: 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 HITT-low volume (n=29) in 22 min sessions that included six intervals at a load of 90% of maximum oxygen consumption (VO2max) for 1 min followed by 2 min at 50% of VO2max. The control group received MICAT (n=31) at an intensity of 60% of VO2max in sessions of 36 min. **RESULTS:** patients had a mean age of 50.8±6.0 years, body mass index of 30.6±4.0 kg·m-2, 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, HITT-low volume was not superior in reducing Ln of IR (marginal mean difference: 0.083 [95% CI -0.092–0.257]; Cohen’s d: 0.249; p-value=0.346) or increasing Ln of total lean mass (kg) (0.004 [-0.014–0.023]; Cohen’s d: 0.120; p=0.637) and Ln of thigh lean mass (g) (0.008 [-0.020–0.038]; Cohen’s d: 0.154; p=0.599). After the intervention, the HITT-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:** HITT-low volume, compared to MS, is not superior in reducing IR or increasing skeletal muscle mass in adults with MS. Colciencias 111562638757; Interinstitucional 2016-13041; Doctoral scholarships 727-2015.

**Table 1. Metabolic syndrome risk factors, baseline to 1 year**

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Change</th>
<th>P-value</th>
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<tbody>
<tr>
<td>WC</td>
<td>-0.5</td>
<td>-2.3</td>
</tr>
<tr>
<td>BP systolic</td>
<td>0.6</td>
<td>1.7</td>
</tr>
<tr>
<td>BP diastolic</td>
<td>0.6</td>
<td>1.7</td>
</tr>
<tr>
<td>HDL</td>
<td>-0.1</td>
<td>0.4</td>
</tr>
<tr>
<td>TG</td>
<td>-0.1</td>
<td>0.5</td>
</tr>
<tr>
<td>Glucose</td>
<td>-0.2</td>
<td>0.6</td>
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</table>

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, glycaized 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 a load of 90% of maximum oxygen consumption (VO2max) for 1 min followed by 2 min at 50% of VO2max. The control group received MICAT (n=31) at an intensity of 60% of VO2max in sessions of 36 min. **RESULTS:** patients had a mean age of 50.8±6.0 years, body mass index of 30.6±4.0 kg·m-2, 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, HITT-low volume was not superior in reducing Ln of IR (marginal mean difference: 0.083 [95% CI -0.092–0.257]; Cohen’s d: 0.249; p-value=0.346) or increasing Ln of total lean mass (kg) (0.004 [-0.014–0.023]; Cohen’s d: 0.120; p=0.637) and Ln of thigh lean mass (g) (0.008 [-0.020–0.038]; Cohen’s d: 0.154; p=0.599). After the intervention, the HITT-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:** HITT-low volume, compared to MS, is not superior in reducing IR or increasing skeletal muscle mass in adults with MS. Colciencias 111562638757; Interinstitucional 2016-13041; Doctoral scholarships 727-2015.
Although international recommendations corroborate the antihypertensive effects of regular habitual training (ET), interindividual responses are likely 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: Baseline cardiac autonomic 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, 3 days/week at 60-70% heart rate reserve). Pre and post ET 20 min beat-to-beat BP waveform were recorded by finger photoplethysmography and the 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 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 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 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 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 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 BP waveforms were recorded by finger photoplethysmography and ANS was assessed by heart rate (HR) variability (HRV) recorded from HR monitor and analyzed.

RESULTS: Ten individuals were considered RE (Δ=15.6±7.6 mmHg) and 34 NR (Δ=4.3±7.9 mmHg). SBP changes were correlated with: SDNN (r=0.395; p=0.008), RMSSD (r=0.384; p=0.010), LF (r=0.318; p=0.036) and HF (r=0.348; p=0.002). SDNN was able to predict 15.6% of variance in SBP changes (p=0.39; p=0.008). Compared to RE, NR demonstrated greater SDNN (29.6±21.4 vs. 16.1±7.6 mmHg, p=0.09), RMSSD (160±71 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=0.80, sensitivity=80%, specificity=76%, p=0.03).

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

Cerebral vasoactivity (CVR) disruptions have been observed following concussion, which may exacerbate concussion-related symptoms. These CVR disruptions may also influence the cerebral blood flow (CBF) responses during aerobic exercise and thus limit exercise capacity post-concussion. PURPOSE: To examine the relationships between concussion-related symptoms, cerebral vasculature’s ability to respond to changes in CO2 (vasoactivity), and CBF responses during sub-maximal aerobic exercise in adolescents post-concussion. METHODS: Six adolescents less than two weeks post-concussion completed the Post-Concussive Symptom Checklist (PCSC), cerebral vascular assessments, and a modified YMCA exercise protocol. CVR at rest was estimated from the slope (cm/s/mmHg) of the relationship between the 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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via transcranial Doppler ultrasonography at the M1 segment of the middle cerebral artery unilaterally during the air re-breathing task and during the aerobic exercise test.Only physical activity-related symptoms were included in analysis: headache, nausea, balance problems, dizziness, fatigue, and % activity level. Two stepwise linear regressions were conducted to test (1) if concussion symptoms are related to CVR and (2) if CVR predicted relative change in CBF velocity during the aerobic exercise test. RESULTS: The majority of the variance in CVR was explained by symptoms of nausea, dizziness, current physical activity levels, age, sex, BMI, resting heart rate, balance, and fatigue also contributed to a lesser degree. Exercise caused a significant increase in MCA blood flow (P<0.001). This exercise induced increase in CBF was largely explained by CVR and estimated VO2peak, with resting heart rate, prior concussion(s), and time since injury also contributing.

CONCLUSIONS: Our findings suggests that symptom burden is related to disruptions in CVR in adolescents in the early weeks after a concussion. In turn, the cerebral blood flow response to exercise was related to both CVR and aerobic capacity, suggesting that disruptions in CVR may impact exercise tolerance post-concussion.

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: 21.2 ±1.4 kg/m², BP: 112 ±3/74 ±3 mmHg) and 12 CW (23 ±1 years, BMI: 23.4 ±0.9 kg/m², BP: 113 ±2/70 ±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: 205 ±26 vs. CW: 346 ±60), OV (AAW: 156 ±28 vs. CW: 356 ±64), and ML (AAW: 184 ±35 vs. CW: 329 ±49) (P<0.05). 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 ±42) (P<0.05).

CONCLUSION: AAW are experiencing an 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.

High-intensity chronic endurance training has chronotropic and inotropic effects on the heart; however, adaptations of the ascending aorta which is directly exposed to cardiac pulsations remain unclear. PURPOSE: We investigated the functional and structural properties of the thoracic aorta, including the ascending and descending locations, in elite endurance athletes. METHODS: Fourteen young endurance-trained men (21 ±1 years, peak oxygen uptake=69.6±3.1 ml/kg/min) were compared with 19 sedentary control men (21 ±2 years). The ascending and descending aortic cross-sectional areas and aortic properties of the thoracic aorta, including the ascending and descending locations, in elite endurance athletes. METHODS: Fourteen young endurance-trained men (21 ±1 years, peak oxygen uptake=69.6±3.1 ml/kg/min) were compared with 19 sedentary control men (21 ±2 years). The ascending and descending aortic cross-sectional areas were measured by 2D CINE phase-contrast magnetic resonance imaging (MRI), and the aortic strain, compliance, and distensibility were calculated. Aortic blood pressure was measured during MRI using the general transfer function method. Two-way mixed analysis of variance was used to determine the effects of exercise status and aortic locations. RESULTS: Endurance athletes had similar body mass index and aortic blood pressures to sedentary control subjects. At rest, heart rate was slower (58±9 vs. 68±5 bpm, P=0.001) and stroke volume was greater in athletes (82±10.8 vs. 95±8.15 ml/beat, P=0.012) while cardiac output was similar between the groups. The aortic cross-sectional areas were increased in athletes compared with sedentary subjects (ascending: 6.32±0.99 vs. 6.95±1.00 cm², descending: 4.08±0.64 vs. 4.85±0.83 cm², P=0.012). The diastolic aortic areas (P=0.002) and the aortic compliances (P=0.069) showed a trend of elevations in athletes. The greater ascending aortic strain and compliance were associated with slower heart rate (r=0.56 and -0.43 respectively) and higher stroke volume (r=0.44 and 0.35 respectively) across all participants (P<0.05). CONCLUSIONS: Our findings suggest that endurance athletes have dilated thoracic aorta and better recollapsing function of the ascending aorta due to increased systolic expansion and a longer time of relaxation with slower heart rate.

This study was supported by the JSPS(19K19570, TT) and the ARITHP Cooperative Grant (University of Tsukuba, TT)

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, 3h, 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 (Šidak correction).

RESULTS: Mean (±SD) resting shear rate across timepoints was significantly lower in the SIT condition (32.2 ± 23.3 s⁻¹ relative to SRA3 (42.2 ± 27.9 s⁻¹, P<0.001) and SRA6 (44.6 ± 29.1 s⁻¹, P<0.001). 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, P<0.001) and SRA6 (85.0 ± 61.7 ml/min, P<0.001). There were no condition differences in the temporal change in femoral artery FMD measurements across the 7h day (P<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.

High-intensity chronic endurance training has chronotropic and inotropic effects on the heart; however, adaptations of the ascending aorta which is directly exposed to cardiac pulsations remain unclear. PURPOSE: We investigated the functional and structural properties of the thoracic aorta, including the ascending and descending locations, in elite endurance athletes. METHODS: Fourteen young endurance-trained men (21±1 years, peak oxygen uptake=69.6±3.1 ml/kg/min) were compared with 19 sedentary control men (21±2 years). The ascending and descending aortic cross-sectional areas were measured by 2D CINE phase-contrast magnetic resonance imaging (MRI), and the aortic strain, compliance, and distensibility were calculated. Aortic blood pressure was measured during MRI using the general transfer function method. Two-way mixed analysis of variance was used to determine the effects of exercise status and aortic locations. RESULTS: Endurance athletes had similar body mass index and aortic blood pressures to sedentary control subjects. At rest, heart rate was slower (58±9 vs. 68±5 bpm, P=0.001) and stroke volume was greater in athletes (82±10.8 vs. 95±8.15 ml/beat, P=0.012) while cardiac output was similar between the groups. The aortic cross-sectional areas were increased in athletes compared with sedentary subjects (ascending: 6.32±0.99 vs. 6.95±1.00 cm², descending: 4.08±0.64 vs. 4.85±0.83 cm², P=0.012). The diastolic aortic areas (P=0.002) and the aortic compliances (P=0.069) showed a trend of elevations in athletes. The greater ascending aortic strain and compliance were associated with slower heart rate (r=0.56 and -0.43 respectively) and higher stroke volume (r=0.44 and 0.35 respectively) across all participants (P<0.05). CONCLUSIONS: Our findings suggest that endurance athletes have dilated thoracic aorta and better recollapsing function of the ascending aorta due to increased systolic expansion and a longer time of relaxation with slower heart rate.

This study was supported by the JSPS(19K19570, TT) and the ARITHP Cooperative Grant (University of Tsukuba, TT)
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 vs. 62±5 beats/min), SV (89±5 vs. 92±5 ml/beat), CO (5.4± 0.4 vs. 4.4±0.5 L/min), and MAP (92±6 vs. 86±3 mmHg) were not different between BA and WA, respectively (all, p>0.05). The peak PLM-induced changes in HR (62±4 vs. 11±3 Beats/min, p = 0.06), SV (7.3±1.6 vs. 11.4±1.9 ml/beat, p < 0.04), and CO (0.7±0.2 vs. 1.0±0.2 Al/min, p = 0.09), while MAP (5.3±1.4 vs. 6.0±0.8 ΔmmHg, 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 Δ%), 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 at BASE. 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, CD62R 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 vs 3991±1232; p=0.03), and elevated oxidative burst (4495±651 vs 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=0.04) 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=0.76). 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).
Conclusions: CPET differentially induced specific immune responses in patients with HFrEF compared to age and gender matched controls. The prolonged immune response in these patients suggests differences in immune resolving mechanisms which deserve further research.

Recent findings in immunometabolism have demonstrated that the function of immune cells is largely dictated by their metabolism, with mitochondrial characteristics reflecting distinct metabolic phenotypes. A limitation of previous exercise immunology studies is the failure to describe the effect of exercise on specific immune cell subsets. Since exercise may have differential effects that vary by cell population according to metabolic phenotype, analyzing peripheral blood mononuclear cells as a whole may mask adaptations. Purpose: To determine the effect of aerobic training on mitochondrial characteristics of specific T cell subsets. Methods: Non-smokers 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 membrane potential (MMP) of CD4+ and CD8+ naïve (CD45RA+CCR7+) and effector memory (CD45RA-CCR7+) cell subsets were assessed by mean fluorescence intensity (gMFI) of Mitotracker Green FM and TMRE, respectively. Results: Preliminary statistical analyses (n=11 each group) revealed that ACTIVE had higher cardiopulmonary fitness than INACTIVE (60.0±9.9 vs 43.6±8.2 mL/kg/min respectively, independent t-tests, p<0.001). There was no difference in cell counts between ACTIVE and INACTIVE T cell subsets. Although gMFI indicating mitochondrial mass of CD8+ naïve T cells approached significance between groups (594±77.5 vs 494±70.1; p=0.035, independent t-tests), this difference was not statistically significant after correcting for multiple comparisons. Mitochondrial mass and MMP of CD8+ naïve T cells were, however, significantly correlated with relative VO2max (r=0.537±0.534; p=0.0099 and 0.0104, respectively, Pearson correlation). Conclusion: These preliminary data suggest that mitochondrial adaptations in certain immune cell subsets may be associated with aerobic fitness and lay the groundwork for follow-up studies to directly evaluate differences in cellular respiration of these subsets.

Funding provided by the ACSM Nasa Space Physiology Research Grant.
High-fat diet (HFD) feeding disrupts the intestinal barrier integrity, inducing the translocation of bacteria into the portal circulation, leading to the whole-body pathologies, as such; improving mitochondrial content is an enticing therapeutic target. 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 males 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 2X2 ANOVA with a 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, MuRF-1 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 MuRF-1 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 proteasome 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 NIA.
CONCLUSIONS: 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. 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 supplemental 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 total testosterone were assayed to assess phosphorylation status, total protein and gene expression using Western blotting and RT-qPCR. Biopsies were collected at the end of the overnight fasted state infusion was employed during ~60 min of rest and unilateral knee-extension exercise. Blood was sampled repeatedly during trials and muscle biopsies were collected at rest and at 0, 90, 180 min and 24 h after exercise. Oral D2O ingestion was used to determine FSR during 24 h of recovery. RESULTS: With saline, blood lactate levels reached 3.0 mmol/l post exercise, while lactate infusion resulted in 130% greater lactate levels post exercise that also remained higher than at rest and saline up to 90 min of recovery. Post exercise muscle levels of lactate were 20% higher with lactate compared to saline infusion (32 vs 27 mmol/kg d.w). Lactate infusion had an alkalizing effect in blood with pH being 7.44 after exercise with 0.06 units after exercise in both trials. Exercise increased the phosphorylation of mTORC2 (40%), S6K1T389 (~3-fold) and S6S240/244 (~9-fold) during recovery, without any differences between trials. Effects of exercise without any influence of lactate infusion was also noted for EF2T194, AMPK172, PRAS401246 and p40252704. FSR over

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Testosterone Supplementation Upregulates Myogenesis And Attenuates Proteolytic Gene Expression During Severe Energy Deficit
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Effects Of Lactate Infusion On Resistance Exericse Induced MTORC1-signaling And Protein Synthesis In Human Muscle
Marcus Moberg1, William Apr01, Hans-Christer Holmberg2, Gerrit van Hall3, Björn Ekblom1. 1Swedish School of Sport & Health Sciences, Stockholm, Sweden. 2Swedish Winter Sports Research Centre, Östersund, Sweden. 3Clinical Metabolomics Core Facility, Copenhagen, Denmark.

Cancer is a debilitating disease that is often accompanied by decreased physical activity and chronic energetic stress that disrupts muscle proteostasis. Muscle protein turnover is highly sensitive to changes in feeding and activity. Raptor serine 792 and TSC1/2 are phosphorylation sites which, when activated, can inhibit mTORC1 activation leading to suppressed anabolic signaling, and has been implicated in the regulation of skeletal muscle wasting with cancer. PURPOSE: To examine the effect of a 12-h fast on the phosphorylation of Raptor and TSC1/2 in male ApcMin/+/ mice, and if voluntary wheel activity can alter the fasting response. METHODS: Male C57BL6/N (B6, N=24) and ApcMin/+(MIN, N=31) mice were either sacrificed under ad libitum conditions (B6-fed, M-fed), fasted, fed 12hrs (B6-fast, M-fast), or fasted for 12hrs following 4wks of voluntary wheel running (B6+W, M+W). TSC1/2 serine 1387 and Raptor serine 792 were measured in the gastrocnemius muscle as phosphorylation to total ratio by western blot. Protein synthesis was measured by puromycin incorporation. RESULTS: All MIN mice exhibited body weight loss (p<0.001) and reduced gastrocnemius mass (p<0.001) when compared to all B6 mice. Raptor phosphorylation (pRaptor) was induced in M-fast compared to M-fed (p=0.019), but there was no change in B6+W compared to B6 fed (p=0.414). TSC1/2 phosphorylation was induced in M-fast compared to M-fed (p=0.001) and in B6-fast compared to B6 fed (p=0.030). Puromycin was ranging to be reduced in M-fast compared to MIN-fed (p=0.070), but there was no change in B6-fast to B6-fed (p=0.323). Raptor phosphorylation was not different in M-fast compared to M+W (p=0.302), however pRaptor was reduced in B6+W compared B6-fast (p=0.028). TSC1/2 phosphorylation (p=0.001) and puromycin (p=0.016) were induced in MIN+W compared to M-fasted, with no changes in the B6-fast to B6+W (p=0.360, p=0.196; respectively). Conclusions: Our results provide evidence that the cancer environment disrupts anabolic suppression of mTORC1 in skeletal muscle. Interestingly, TSC1/2 phosphorylation was sensitive to fasting independent of the tumor environment. Wheel activity induced protein synthesis independent of Raptor phosphorylation therefore, further studies are warranted to determined this specific mechanism.

Lactate has recently been highlighted as a potential signaling molecule. In myostat, lactate concentration induces mTORC1-signaling, reduce myostatin expression and induce myotube growth. This indicates that lactate could be a potential mediator of muscle adaptations to resistance exercise. PURPOSE: Here we wanted to study the acute molecular response in human skeletal muscle to resistance exercise performed with or without a venous infusion of lactate. The primary outcomes of the study was intracellular signaling, rate of protein synthesis (FSR) and blood/muscle levels of lactate and pH. METHODS: 16 healthy females and males participated in the study which consisted of two resistance exercise sessions performed under venous infusion of sodium lactate or saline, in a randomized, blinded and counterbalanced fashion. In the overnight fasted state infusion was employed during ~60 min of rest and unilateral knee-extension exercise. Blood was sampled repeatedly during trials and muscle biopsies were collected at rest and at 0, 90, 180 min and 24 h after exercise. Oral D2O ingestion was used to determine FSR during 24 h of recovery. RESULTS: With saline, blood lactate levels reached 3.0 mmol/l post exercise, while lactate infusion resulted in 130% greater lactate levels post exercise that also remained higher than at rest and saline up to 90 min of recovery. Post exercise muscle levels of lactate were 20% higher with lactate compared to saline infusion (32 vs 27 mmol/kg d.w). Lactate infusion had an alkalizing effect in blood with pH being 7.44 after exercise with 0.06 units after exercise in both trials. Exercise increased the phosphorylation of mTORC2 (40%), S6K1T389 (~3-fold) and S6S240/244 (~9-fold) during recovery, without any differences between trials. Effects of exercise without any influence of lactate infusion was also noted for EF2T194, AMPK172, PRAS401246 and p40252704. FSR over
24h of recovery did not differ between saline (0.067 %/h) and lactate infusion (0.060 %/h). CONCLUSIONS: In this model blood lactate levels did not modulate resistance exercise induced mTORC1-signaling or FSR. As only small differences were noted for muscle levels of lactate, its potential role as signaling molecule should not be discarded.

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. In soleus 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.

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:
5yr old F with PFM significant for hip dysplasia. Presented to clinic in June 2017 for recurrent R hip pain. Sxs began in Feb 2016 when her hip subluxed. She had intermittent sharp pains to medial hip that radiated down to the toes with varied hip ROMs; without paresthesias.

Prior to eval, dx with anterosuperior labral tear. Tx with PT with home exercise program (HEP), two intra-articular steroid injections, and a greater trochanteric bursa injection. Steroid injections improved pain and relieved some of the “catching,” but sxs still persisted.

PHYSICAL EXAMINATION:
Mild valgus knee alignment.
Guarded FADIR, not clearly positive
Tenderness to palpation, posterolateral troch/ greater trochanter.

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 (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.

FINAL WORKING DIAGNOSIS:
R hip anterosuperior degenerative labral tear with sx of catching

TREATMENT AND OUTCOMES:
1. R hip intra-articular steroid injection (2/21/18); pain control only.
2. Pubic apophysitis at adductor insertion
3. At 4 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. Hip labral tear
5. 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

TREATMENT AND OUTCOMES:
1. Patient was made NWB on crutches for 2 weeks at her MRI 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.

HPI:
14 y/o male soccer player presents to clinic with 12 months of right gluteal pain when active or sitting for a prolonged time. He described the pain as dull with normal activity and sharp with low levels of exertion particularly in hip flexion. His pain is maximal during soccer while kicking the ball with his opposite foot. In addition, he reports point tenderness over the proximal right hamstring and while sitting down on hard surfaces. He was evaluated roughly 1 year ago by an outside physician with a normal XR of the pelvis. Per patient and father reported an “injury to the Sits bone”. Patient was subsequently taken out of sports for 6 months and had a non-US guided corticosteroid injection into the posterior thigh 3 months prior to clinic visit. The injection provided short term relief, no additional treatment (PT) was prescribed.

ROS:
CONSTITUTIONAL: No fevers, chills, sweats, night pain or weight changes.
CARDIOVASCULAR: No chest pains, palpitations, orthopnea and paroxysmal nocturnal dyspnea.
RESPIRATORY: No dyspnea on exertion, no wheezing or cough.
MUSCULOSKELETAL: per HpINEUROLOGIC: No numbness, tingling or weakness.

Physical exam:
Gait: Able to bear weight with a normal gait
MSK: No swelling, ecchymosis
ROM: Full ROM intact both actively and passively. No pain on deep flexion during squat

DIFFERENTIAL DIAGNOSIS:
Chronic hamstring strain
Bone contusion
Tumor
Osteomyelitis

Initial Testing In clinic:
X-Ray Hip AP/lateral: Irregular lucency along inferolateral aspect of right ischium. Correlates to insertion of the hamstring. However, the appearance is not typical for an avulsion injury or tendon strain. MRI pelvis w/o contrast: Findings consistent with Asymmetric incomplete fusion of the ischiopubic chondrosis with stress reaction.

FINAL WORKING DIAGNOSIS:
Healing avulsion fracture over right ischial tuberosity, clinically improving with PT
Rare Case Of Avascular Necrosis In A Dodgeball Player

Steven C. Liu1, Alpha Anders2, Kenneth Vitale, FACSM3,  
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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°, internal 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 0-II.  
- 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.

Bilateral Hip Pain - Soccer Player

Samantha Lucrezia, Danielle Hirsch, Patrick Mularoni. Johns Hopkins All Children’s Hospital, St. Petersburg, FL. (Sponsor: Dilipkumar R. Patel, MBBS, MBA, MPH, FACSM)  
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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 Exam: 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

- 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 and symphysis with significant surrounding soft tissue edema  
- Bone biopsy: focally degenerated bone, mixed chronic inflammation, fibrosis with reactive changes. No microorganisms present on special stains  
- Bone aerobic/anaerobic cultures: negative  
- Quantiferon gold: POSITIVE, mycobacterium sputum PCR: POSITIVE  
- Chest x-ray: negative

Final/Working Diagnosis:  
Tuberculosis 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 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 non-mobile. 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 describe any swelling around the knee itself and there was no history of locking or buckling of the knee. The bump did not limit his ambulation or mobility. He endorsed a mild decrease in his ability to flex the knee. He denied any other bumps or masses, 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 patella. No knee effusion was noted bilaterally. There was a palpable defect 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 dislocationPatellar dislocationQuadriceps tendon ruptureMedial collateral ligament tear ACL tear

TESTS & RESULTS:
No immediate imaging available in medical tent, ER X-ray was carried to the sideline. On sideline he had a grade II Lachman's with his exam Lachman's tests were negative bilaterally. There was no crepitus in the bilateral knees. The range of motion was non-tender to palpation along the medial and lateral joint lines as well as the patellar facets. There was 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.

DIFFERENTIAL DIAGNOSIS:
1. Tumor (Osteosarcoma)
2. Ganglion Cyst
3. Parameniscal Cyst
4. Soft Tissue Sarcoma

TESTS AND RESULTS:
Left Knee X-ray: No acute fracture or traumatic malalignment. No bone mass visualized.
Left Knee Bedside Ultrasound: Hypoechoic mass superficial to medial joint line and posterior to MCL.
Left Knee MRI : 1.1 x 2.3 x 1.9cm multi-loculated parameniscal cyst. Tear in the posterior horn of the medial meniscus connecting to the parameniscal cyst.

FINAL/WORKING DIAGNOSIS:
Multi-loculated parameniscal cyst secondary to a medial meniscus tear

TREATMENT AND OUTCOMES:
1. Referred to orthopedic surgery to rule out any surgical intervention
2. Consideration of ultrasound-guided percutaneous drainage of the parameniscal cyst
3. Instructed to current activity and exercise as tolerated
4. Counseled to report any pain or changes in symptoms
5. Follow up in 2 months
Bone Injury - Gymnastics

HISTORY: A 14-year-old female level 10 USA 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 paresthesias. 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
CT scan of the Knee: Cortical break in the lateral tibial plateau anteriorly

FINAL WORKING DIAGNOSIS:
Non-operative treatment: crutches until free of symptom (3 weeks) then progressive functional brace, but did not return to football

TREATMENT AND OUTCOMES:
1. 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 pectoral 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 C5-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.

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 his 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:

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 xray 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 supraspacular nerve proximal to the level of the supraspinatus muscle and distal to the brachial plexus.

Final Diagnosis:
Supraspacular Nerve Entrapment

Treatments and Outcomes:
Patient was referred to orthopaedic surgery and recommended shoulder arthroscopy for supraspacular 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.

History: A 59-year-old recreational runner presented to the office with right sided foot pain and weakness, which began insidiously 3 weeks prior and mostly noticed with plantar flexion while running and improved but not resolved by non-weightbearing. He noticed diffuse, minimal swelling around the foot, but no bruising or numbness. 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 evasion and dorsiflexion of the foot. His resisted dorsiflexion was 3/5 and evasion was 4/5.

Follow up exam 5 weeks later demonstrated 1/5 strength with resisted dorsiflexion and 3/5 with evasion, 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 tendinitis
3. Peroneal tendon strain
4. Osteoarthritis

Tests and Results:
X-ray, right ankle/foot: minimal osteoarthritic changes diffusely in the tarsal bones. Calculations within the Achilles tendon.

Ultrasound - swelling around the anterior tibial tendon and hypoechoic signal in the peroneal tendon.

Final Working Diagnosis: peroneal nerve palsy secondary to periaricular ganglion

MRI - periaricular ganglion extending into proximal calf

Treatment:
1. Ultrasound guided aspiration of the ganglion, with corticosteroid injection following aspiration
2. Repeat physical therapy course following aspiration
3. Medical weight loss program
4. Gait assessment prior to return to running

The patient experienced a full recovery 3 months after aspiration and has resumed running at his previous level.

HISTORY: Patient is a 17 year old right hand dominant male soccer player with history of infectious mononucleosis. He complains of spontaneous, progressive distal right upper limb weakness and cramping for one year. His cramping pain is 1-4/10 in severity, worse with exercising. He has early fatigue and approximately 30% of his baseline strength in his elbow, wrist and finger extensions; he denies neck pain, numbness, paresthesias or history of “stingers.” He reports no lower limb involvement, incontinence or gait disturbances.

PHYSICAL EXAMINATION: MSK-ROM: Neck, bilateral upper limb ROM intact
-Strength: RUL: 5/5 SAB; 5/5 EF; 5/5 WE; 4+/5 WE; 3+/5 FE; 5/5 FF LUL, RLL, LLL: 5/5 in all muscles -Pulpal: No palpable mass, edema in forearm/arm
-Neuro: -Provocative: +Tinel along dorsal aspect of RUL brachium -Sensation: grossly intact -Cranial nerves: grossly intact -Reflexes: 1+ biceps, triceps, brachioradialis bilaterally

DIFFERENTIAL DIAGNOSIS: -Radial nerve neuropathy -Posterior cord brachial plexopathy -Peripheral nerve sheath tumor (eg schwannoma, neurofibroma) -Diffuse neuritis -Soft tissue mass

TEST AND RESULTS: -MRI R wrist, forearm, arm (with and without contrast): Area of mild enlargement around the spiral groove (possible cyst vs tumor) -PET scan: No suspicious focal uptake or other evidence of malignancy -NCS/EMG 4/2018: severe right radial neuropathy proximal to the brachioradialis and distal to the triceps brachii/ anconeus innervation -Ultrasound 4/2018: Enlargement of the radial nerve near the
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:** Neuromuscular Amyotrophy: Aka Pan-sensory 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 neuromuscular amyotrophy; ultrasound revealed mostly motor axonal involvement. He opted for conservative management, monitoring for spontaneous improvement. He did not seek further follow up.

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**May 27 11:10 AM - 11:30 AM**

**Hockey Player With Weakness In His Extremities**

Ima Vera Jonkeheethe, D.O., MSc, Philip F. Skiba, D.O., Ph.D., Advocate Lutheran General Hospital, Park Ridge, IL.

(No relevant relationships reported)

**HISTORY:** A 63 yo M hockey player w/ PMhx of OA, HLD, kidney stones, & chronic pupillary anisocoria presented to the ED after 24 hours of LE weakness & paresthesias in both hands. He also reported difficulty ambulating. He denied trauma, 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 which he recovered with no apparent sequelae.


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

**TEST AND RESULTS:**

CXR Neg, CT Head Neg, CT Chest/Abd/Pelvis Neg, MRI Neg, EMG Neg, NCS Neg, CSF normal. Serum: Creatine Kinase: 186 units/L, CK: 625 units/L, DDimer: 0.70 mg/L, IMAGING:

**IMAGING:**

CXR Neg, CT Head Neg, CT Chest/Abd/Pelvis Neg, MRI Neg, EMG Neg, NCS Neg, CSF normal. Serum: Creatine Kinase: 186 units/L, CK: 625 units/L, DDimer: 0.70 mg/L.

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

**TREATMENT AND OUTCOMES:** 1. Neurology assessed in the ED, w/ hx of hypertension/tachycardia representing dysautonomia, recommended LP. 2. LP w/ hematology, neurology, & neurosurgeons. 3. LP showed positive findings w/ positive cerebrospinal fluid changes consistent w/ AIDP w/ elevated protein, admitted & started on IVIG 2g/kg divided over 3 days monitored in Neuro Tele Unit. 3. PT/OT while inpatient & PM&R admission 4. Underwent prolonged course of PT for LE/UE weakness for 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 1 year initially requiring assistive devices including walker/cane, slowly normalizing gait over time. 6. Continues to follow w/ Neuro, Sports Med, & PM&R for intermittent weakness.

**A-40**

**Free Communication/Poster - Recovery**

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

**Room:** CC-Exhibit Hall

**185**

**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 Ning Chang, Cheng Hsiu Lai. University of Taipei, Taipei City, Taiwan.

(No relevant relationships reported)

**Abstract**

**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 ± 1 min and 45°C ± 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 meter 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) of the CWT group showed significantly higher value than the CON group (81.5 ± 11.6 bpm, 18.5 ± 9.0 μV, P<0.05), the mean R-R intervals (636.8 ± 78.8 ms), the standard deviation of normal R-R intervals (114.6 ± 6.6 ms) and the root mean square differences between adjacent R-R intervals (17.2 ± 7.7 ms) for CWT showed significantly lower than that of CON (749.3 ± 10.5 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-related activation in cardiac autonomic regulation, but the effect only lasting for 10 mins.

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

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**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, Andres LiFortune, Dlsa L. R. Field, John A. McConnell, Jacob E. EARp, University of Rhode Island, Kingston, RI.

(Reported Relationships: S. Lateef: Industry contracted research; Solid Advocate Lutheran General Hospital, Park Ridge, IL.

**Purpose:** The purpose of this study was to determine if the contrast with compression (CwC) 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 ± 8.5cms; weight = 88 ± 19.5kg; body fat = 17.2±7%) completed two separate single-arm elbow flexor workouts on an isokinetic dynamometer. After one workout each participant received contrast with compression (CwC) 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 CwC 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 assess timepoint differences in between interventions in recovery post eccentric exercise. A p<0.05 was used for all analysis.

**RESULTS:** CwC 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 CwC 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. CwC 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 CwC therapy.

**CONCLUSION:** Contrast with compression therapy significantly increases the recovery rate of muscle strength and power post eccentric exercise. CwC is also effective at reducing exercise associated muscle damage, delayed onset muscle soreness and mitigates the loss of range of motion post intense exercise.

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**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 Skaggs, Andrew Gutierrez, Caitlin Tagle, Kevin Canales, Mayra Limas, Gabriel Figueroa, Ulku Karabulut, Murat Karabulut, FACSM. University of Texas Rio Grande Valley, Brownsville, TX.

(No relevant relationships reported)

**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 at each laboratory visit. Subjects warmed 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...
(Likert Scale; LS) measured. Participants received a randomized treatment 24 and 48 hr. after their respective exercise session for a 20-minute period. VJ tests identical to the pretest were executed prior to treatment and 24 and 48 hr. after each treatment. A leg extension endurance test was performed until failure 48 hr. after treatment.

RESULTS: Significant main effects (p<.05) were indicative for subjective and objective pain perception. VJ values were significantly lower 48 hr. after inducing DOMS compared to the values recorded on the first day (p<.05). Our results also demonstrated that the significantly increased muscle performance when compared to the BFR treatment (p<.05) and there was a trend for improved endurance performance for FR compared to control (p<.06). Furthermore, a trend for a better endurance performance existed when using BT treatment as opposed to control (p=.06).

CONCLUSION: This study suggests that FR was a more effective treatment method compared to BFR. Prior research suggests that applying external pressure to muscle following DOMS may aid in muscle adhesion separation, promote vasodilation and O₂ delivery, and stimulate mitochondria and energy production due to increased blood volume. Therefore, our findings also indicate that FR and BT may serve as practical modes of treatment for DOMS due to one or a combination of factors such as improved O₂ delivery, increased waste product removal from the muscle, and augmented restoration of the muscles' length-tension relationship.

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Board #4
May 27 9:30 AM - 11:00 AM
Effects Of Different Non-pharmacological Methods On Recovery From Delayed Onset Muscle Soreness
Tabitha Abraham, Zulema Mendez, Roel Ruiz, Marcos Cruz, Robert Martinez, Sael Elizondo, Concepcion Chapa, Ulku Karabulut, Murat Karabulut, FACSM. University of Texas Rio Grande Valley, Brownsville, TX.
Email: tabithaabraham5@gmail.com
(No relevant relationships reported)

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 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 extensions, which consisted of 1 warm-up set and then 4 sets at 80%-85% of one repetition maximum (1-RM) until failure to induce DOMS. Rest tempo involved 1-sec concentric and 3-sec eccentric contractions. Subjects returned on day 2, which included 5-min rest followed by RSBP and HR measurements, then soreness levels were measured with Likert scale and Forge Gage. The subjects warmed-up on a treadmill, followed by the recovery method chosen for that session. VP consisted of 10 1-min sets with 1-min rest in between. FR and TGUN were used for 10-min on each side of the lower limb with 1-min rest in between. Following recovery methods, subjects repeated VJ test and leg extension exercises and number of reps were recorded. The exact procedure of day 2 was performed on day 3. RESULTS: A significant main effect for condition with the VP method showing higher RSBP values than the TGUN (p<.01). There were significant condition*time interaction and condition and time main effects for the total number of reps (p<.03). A higher number of reps performed following TGUN compared to VP and higher number of reps were performed on day 1 compared to day 2 (p<.03), with no contrast between day 1 and day 3. Significant time main effect was also seen in VJ values, suggesting day 1 values were higher compared to day 2 (p<.05) and day 3 values (p<.05). CONCLUSION: The results suggest that TGUN is an effective recovery method for reducing soreness, which can be attributed to higher muscle adhesion breakdown, and/or increased blood flow and O₂ delivery to the muscle, and/or reduced pain perception due to inhibition of nociceptor activity.

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Board #5
May 27 9:30 AM - 11:00 AM
The Influence Of Flotation Restricted Environmental Stimulation Therapy On Recovery From High Intensity Resistance Exercise
Lydia K. Caldwell, Emily M. Post, Matthew K. Beeler, Brian C. Focht, FACSM, Jeff S. Volek, Carl M. Marlesh, FACSM, William J. Kraemer, FACSM. The Ohio State University, Columbus, OH.
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Flotation-restricted environmental stimulation therapy (flotation-REST) attenuates afferent nervous system signaling to promote relaxation of the body and mind. Despite limited research, the intervention has become increasingly popular among high performance populations (e.g., athletes, military) seeking to accelerate recovery and enhance performance readiness. PURPOSE: to determine whether flotation-REST augments recovery from high intensity resistance exercise induced to decrease significantly metabolic, adrenergic and mechanical stress. METHODS: Eleven resistance trained males (age: 22.5±2.3 years; height: 176.4±6.0 cm; weight: 85.7±6.2 kg; back squat 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 1. Results of military performance tasks for baseline, foam roll, and passive recovery sessions (mean ± SD).
<table>
<thead>
<tr>
<th>Recovery method</th>
<th>Task</th>
<th>Time (s)</th>
<th>Foam roll</th>
<th>Passive</th>
<th>p</th>
<th>n_paired</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC Peak</td>
<td>Mean</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>
</tr>
<tr>
<td></td>
<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>
</tr>
<tr>
<td>CC Peak</td>
<td>Mean</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>
</tr>
<tr>
<td></td>
<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>
</tr>
<tr>
<td>AC Peak</td>
<td>Mean</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>
</tr>
<tr>
<td>SR Peak</td>
<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>
</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'
method for mitigating the negative performance effects associated with DOMS. Given the importance of military readiness, practitioners should consider including FR after strenuous exercise.

**Board #7**

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

**The Effects Of Foam Rolling On Exercise Induced Muscle Damage**

Lauren M. Visconti, Brandon Beimbora, Kurt Escobar, Joshua A. Cotter, FACSMS, Evan E. Schick. California State University, Long Beach, Long Beach, CA.

**Purpose:** In the present study, we investigated whether the whole body bath with CO₂ may imply the facilitation of muscle fatigue recovery.

ECG were recorded continuously throughout the experiment. The subjects performed measuring the highest power output during 30 seconds. Core temperature (CoreT) and seconds were used to estimate anaerobic power with leg pedaling exercises. Exercise after an acute bout of high volume resistance training. This study suggests that despite CON were found for any measures. No significant differences between FR and 19.6±0.41, p<0.01). At 10 min in recovery, in the CO₂-water compared with the tap-water, SR significantly decreased (0.91±0.25 vs. 0.91±0.25, p<0.01). However, there was no significant difference in CoreT, BLA and VAS between these two water types. **Conclusions:** We reported previously that the muscle blood flow in the immersed part was larger in CO₂-water than tap-water of a same temperature. In addition to a local effect of CO₂ suppression of muscular sympathetic activity may also contribute to the increase in local blood flow. Facilitation of muscle hardness recovery shown in this study might be caused by the increased muscle blood flow. The present results suggested that CO₂-water immersion may contribute to rapid recovery from the muscular hardness induced by high intensity exercise.

**MEDICINE & SCIENCE IN SPORTS & EXERCISE®**

**Board #9**

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

**Neuromuscular, Endocrine, And Perceptual Recovery Following A Youth American Football Game**

Jon K. Davis, Anthony S. Wolfe, Steven A. Basham, Eric C. Freese. GSSI Frisco, Frisco, TX.

**Purpose:** American football is a high-intensity intermittent sport consisting of various movements and repeated collisions which makes recovery from a game challenging to adequately prepare for the next competitive specific event. The purpose of this study was to determine the time course of recovery assessed by neuromuscular function, salivary biomarkers, and perceptual fatigue following a youth American football game.

**Methods:** Thirteen male American football youth athletes were monitored for 7 days following a single football game. Baseline measures were taken at 28h pre-game for lower body neuromuscular function via countermovement jumps (CMJ) to determine peak power (PP), jump height (JH), flight time (FT), and takeoff velocity (TOV). Saliva was analyzed for cortisol, testosterone, and C-reactive protein (CRP). Perceptual recovery was assessed by modified profile of mood states (POMS), perceived recovery status (PRS), and a daily wellness questionnaire consisting of four very strong) to chart scale questions, muscle soreness, sleep quality, and energy. These measures were repeated immediately post-game (30min), and at 20h, 44h, 68h, 92h, 116h, 140h post-game. **Results:** Compared to baseline values there was a significant decrease (p<0.05) in CMJ PP, JH, TOV up to 68h post-game and FT 44h post-game. No significant difference existed among time points for salivary testosterone and CRP. Salivary cortisol concentration significantly increased following the game (baseline 0.12±0.09ug/dl post-game 0.34±0.25ug/dl; p<0.05). Daily wellness ratings for energy were significantly decreased (baseline 7.2±1.6, post-game 4.7±2.4; p<0.05) while daily wellness ratings for soreness were significantly increased (baseline 4.6±2.6, post-game 6.3±1.3 (p<0.05) immediately following the game. POMS total mood disturbance and CRP and C-reactive protein concentrations following the game (baseline 1.5±0.7, post-game 15.6±9.4; p<0.05) following the game. Athletes PRS exhibited a significant decrease in recovery up to 44h post-game (p<0.05), similar to the decrease in neuromuscular function. **Conclusion:** Neuromuscular function and PRS are impaired for up to 44-68h post-game. Coaches should consider the time course of post-game recovery when implementing practices and strength training to ensure adequate recovery from competition.
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. 

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: +3.3 ± 1.8 cm; CTL: +4.1 ± 2.1 cm) and decrease in RSI (FR: -9.9 ± 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 (r=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.

**RESULTS:** Participants reported no pain (0.0) and had a vertical jump test.

**CONCLUSIONS:** This study supports previous studies that have found delayed-onset muscle soreness (DOMS) is common 24-72 hr after engaging in resistance training. Manufacturers of percussion massage devices have stated that such devices decrease muscle soreness. **PURPOSE:** To determine the effects of percussion massage on pain and performance in those with DOMS. **METHODS:** Twenty untrained college-aged adults (16 women and 9 men; 22.9±0.9 yr; 69.1±7.2 kg; 155.0±14.6 cm) participated in the study and were instructed to refrain from exercise and consuming or applying any type of anti-inflammatory medication 24 hr before, and throughout the duration of the study. Participants initially rated leg pain using a visual analog scale ranging from 0 (no pain) to 10 (pain as bad as it could be) and performed a vertical jump test. Then, after determining 1-RM, they performed 10 sets of 10 repetitions of barbell back squats at 60% of their 1RM to elicit DOMS. Squats were performed to a predetermined depth using stacked 5-cm spacers so the femurs were parallel to the floor at the end of the eccentric phase. 48 hr later, participants, rated leg pain, performed the vertical jump test, and then had percussion massage applied to each leg (5 sets of 1 min per quad for 10 min total). Following this, participants again rated leg pain and repeated the vertical jump test. **RESULTS:** Participants reported no pain (0.0) and had a vertical jump height of 61.33 cm at baseline. 48 hr later, pain was rated as 6.55 (severe pain) and had 8.00 lower (p=0.05) vertical jump height (56.42 cm) compared to baseline. After percussion massage, pain declined (p=0.01) to 3.80 (mild pain) and vertical jump height increased (p=0.05) by 4.2% to 58.77 cm, although this was still lower (p=0.05) than baseline. **CONCLUSIONS:** This study supports previous studies that have found that a single bout of resistance training can inflict severe DOMS. Results also indicate that percussion massage reduction pain and improves performance in those with DOMS.

Delayed-onset muscle soreness (DOMS) is common 24-72 hr after engaging in resistance training. Manufacturers of percussion massage devices have stated that such devices decrease muscle soreness. **PURPOSE:** To determine the effects of percussion massage on pain and performance in those with DOMS. **METHODS:** Twenty untrained college-aged adults (16 women and 9 men; 22.9±0.9 yr; 69.1±7.2 kg; 155.0±14.6 cm) participated in the study and were instructed to refrain from exercise and consuming or applying any type of anti-inflammatory medication 24 hr before, and throughout the duration of the study. Participants initially rated leg pain using a visual analog scale ranging from 0 (no pain) to 10 (pain as bad as it could be) and performed a vertical jump test. Then, after determining 1-RM, they performed 10 sets of 10 repetitions of barbell back squats at 60% of their 1RM to elicit DOMS. Squats were performed to a predetermined depth using stacked 5-cm spacers so the femurs were parallel to the floor at the end of the eccentric phase. 48 hr later, participants, rated leg pain, performed the vertical jump test, and then had percussion massage applied to each leg (5 sets of 1 min per quad for 10 min total). Following this, participants again rated leg pain and repeated the vertical jump test. **RESULTS:** Participants reported no pain (0.0) and had a vertical jump height of 61.33 cm at baseline. 48 hr later, pain was rated as 6.55 (severe pain) and had 8.00 lower (p=0.05) vertical jump height (56.42 cm) compared to baseline. After percussion massage, pain declined (p=0.01) to 3.80 (mild pain) and vertical jump height increased (p=0.05) by 4.2% to 58.77 cm, although this was still lower (p=0.05) than baseline. **CONCLUSIONS:** This study supports previous studies that have found that a single bout of resistance training can inflict severe DOMS. Results also indicate that percussion massage reduction pain and improves performance in those with DOMS.
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 ± 7.2 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=13.7±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 larger applications of percussion vibration may improve ROM.

Interest in effective methods to reduce recovery time related to athletic performance is an area of interest in competitive sports. Many of the methods purported to enhance recovery and improve repeat performances are unproven. These methods include foam rolling and more recently, percussive massage. PURPOSE: The purpose of this study was to compare repeated running performance under the conditions of no massage (NM), foam roller massage (FM) and percussion massage (PM) in recreationally active college-aged students (age: 22.5 ± 2.8 yrs., height: 176.2 ± 8.0 cm, body mass: 70.8 ± 11.1 kg, 11 % body fat) to simulate the time between races in a track event. Finger stick blood lactates were taken three minutes post run, as well as before the second run. During the 30 minute recovery the subjects received one of the three treatments NM, FR, and PM. For PM the treatment was applied bilaterally, for a total of 16 minutes with 2 minutes per muscle group (calves, hamstrings, quadriceps, and upper arms). Results: The period between runs in a track event. Finger stick blood lactates were taken three minutes post run, as well as before the second run. During the 30 minute recovery the subjects received one of the three treatments NM, FR, and PM. For PM the treatment was applied bilaterally, for a total of 16 minutes with 2 minutes per muscle group (calves, hamstrings, quadriceps, and upper arms). Results: For the first vs second bout of each trial, male times were 52.3 ± 2.3 vs 52.7 ± 2.7 sec, 52.2 ± 2.7 vs 52.3 ± 2.6 sec, and 52.5 ± 2.3 vs 52.4 ± 2.6 sec and female times were 63.7 ± 3.6 vs 63.8 ± 3.8 sec, 63.4 ± 3.9 vs 63.8 ± 3.8 sec and 63.9 ± 4.0 vs 63.0 ± 3.8 sec for FM, PM, and NM trials, respectively. Statistical analysis by dependent T-test (P<0.05) revealed NSD (p=0.05) vs pre post between trials, except that the second swim was slower than the first swim in the male FM trials. Mean BL values post first swim were 85.3 ± 3 mmol, 8.8 ± 2.56 mmol, and 9.1 ± 2.2 mmol, and pre second swim lactate values were 3.4 ± 1.8 mmol, 3.9 ± 1.6 mmol, 4.0 ± 1.7 mmol. Conclusion: The mode of recovery did not improve velocity in repeat 91 meter swim bouts or alter the time course for post-swim BL recovery. Supported, in part by a grant from Theragun®.
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 Theragun®.

**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 analyzes reaching 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 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 UQYBTs 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.McCue2, Derek C. Monroe1. 1University of California Irvine, Irvine, CA. 2Sibley 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 only recently validated to measure home-cage EE in rodents. It has not yet been used to measure EE in humans.

**PURPOSE:** To evaluate an RQ-free method for measuring EE at rest and during submaximal and maximal intensity treadmill running.

**METHODS:** A convenience sample of 27 physically-active college students (17 women, 10 men) were recruited to perform a maximal treadmill test until volitional exhaustion (Bruce protocol). EE (kcal/min) was measured continuously at 10 Hz using an open-flow respiratory system (Sibley Systems Int., Las Vegas, NV). EE was down-sampled and averaged at rest (EErest), during the first stage (EE1), during the last completed stage (EEMax) and during the final stage (EEend). The intensity (VO2 max, ml/kg/min) of the last completed stage and the final stage were calculated based on speed and incline using ACSM equations. Heart rate (HR) was measured at rest and every minute during the test. Participants rated their perceived exertion (RPE) at the end of each stage. VO2max was estimated based on the total time spent walking/running on the treadmill. Four multiple regression models were used to predict EE from participant traits (PT; gender, age, weight), stage intensity, HR, RPE, and estimated VO2max (EEmax only).

A repeated-measures ANOVA was used to test the degree to which changes in EE were explained by changes in HR (treated as a time-varying covariate).

**RESULTS:** EErest was predicted by PT and resting HR [p<.001, R2 = .685], EE1 was predicted by PT and HR and RPE in Stage 1 [p<.001, R2 = .871]. EEend was predicted by PT, the intensity of, and HR and RPE response to, the last completed stage [p<.001, R2 = .444]. EEmax was predicted by PT, VO2max and the intensity of, and HR and RPE response to, the final stage [p<.001, R2 = .746]. 83% of the increase in EE, from rest to the final stage, was explained by increasing HR.

**CONCLUSIONS:** The reliability (R’) of our models for predicting EE at rest and during exercise are comparable to published RQ-dependent models, supporting the utility of an RQ-free method for measuring EE during submaximal exercise.

**205 Board #21**

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

**Comparison Of Sweat Vs. Serum Lactate And Glucose Concentrations During Exercise**

Corey T. Ungaro, Kelly A. Barnes, Adam J. Reimel, Ryan P. Nuccio, Shaqia D. Brown, Lindsay B. Baker, FACSMM. Gatorade Sports Science Institute, Barrington, IL.

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(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 ± 14.5 kg, VO2 max 45 ± 7.7 ml/kg/min) completed 90 min of cycling at 78 ± 5% HRmax in the heat (31°C, 50% RH). Prior to exercise, the forehead was cleaned with alcohol and deionized water, then three absorbent pads (10 cm², absorbent pad, 2M Tegaderm® + Pad) were applied sequentially (at 0, 30, and 60 min) and each patch was removed after 30-min increments of exercise alongside 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 relation between sweat and serum [Lac] and [Gluc] at the 90-min collection period. Due to limited sample volume the final n = 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 ± 0.64, 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 mM, and serum [Gluc] was 69 ± 15, 73 ± 16, 73 ± 13 mg/dL, at 30, 60, and 90 min, respectively. There was a moderate, but non-significant, positive correlation between sweat and serum [Lac] and [Gluc]. **Conclusion:** Sweat [Lac] and [Gluc] explain only 28% 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**

Jana Woroncyzova1, Miroslava Novaković2, Martin Leniček3, Emil Bolek4, Renata Clikov4, Libor Vlček5. 11st Faculty of Medicine, Charles University and Sports Research Institute of Czech Army Forces, Prague, Czech Republic. 2Sports Research Institute of Czech Army Forces, Prague, Czech Republic. 31st Faculty of Medicine, Charles University, Prague, Czech Republic. 4Center for Cardiovascular Prevention, 1st Faculty of Medicine and Thomayer Hospital, Prague, Czech Republic.

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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. Searce 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-1989 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.
bilibinum concentrations in the elite athletes were substantially higher compared to the general population (11.7 ± 9.6 µmol/L, p < 0.001), and this substantial difference was observed in both men (13.0 ± 11.2 µmol/L, p < 0.006) and women (10.29 ± 8.3 µmol/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 antioxidant in the plasma. 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 260156/2020 provided by Charles University.

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 may still be useful in situations where laboratory testing may not be available or practical.

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%, respectively. The test was over 18.0%, 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 both intra- and inter-individual variation is minimal. 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 may still be useful in situations where laboratory testing may not be available or practical.

Fitness trackers track a wide range of fitness and physiological metrics, including muscle oxygen saturation and lactate threshold (LT). The Humon Hex (HH) is a low-cost wearable device that uses continuous-wave near-infrared spectroscopy (NIRS) to monitor muscle oxygen saturation. The HH estimates LT based on muscle oxygen saturation during a threshold test. Purpose: The purpose of this study was to determine the validity and accuracy of predicting LT from continuous-wave NIRS compared to lab-based measurements. Methods: 15 healthy, recreational runners (6 male, 9 female, 26.1 ± 6.4yrs, 67.9 ± 16.3kg, 173.3 ± 9.5cm, 31.6 ± 21.5km/week) participated in a single threshold test on a treadmill. The protocol was dictated by the HH device ("Threshold Test" in the app) and involved increasing treadmill velocity by 0.22 m/s (0.5 mph) every 3 min until volitional exhaustion. At the end of each stage, participants would straddle the treadmill while researchers collected and analyzed the blood lactate levels using a Lactate Scout portable lactate analyzer (Lactate.com). The HH LT estimate was provided by the Humon website.

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

**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 yrs) (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 clinical lactate analyzer (Abbott iSTAT) measures taken at 12 time points from venous blood, drawn 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 mM/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 an intrapopulation between blood lactate measurement, was 1.4 µmol/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 VO2 were observed among the three A VRGs (F (1, 28) = 9.128, p = .005; range = 13.53 - 23.04 ml kg/min). However, there were no differences between settings in VO2 or enjoyment (p > .05). CONCLUSIONS: Different A VRGs elicit different exercise intensities, yet the setting in which they are played does not affect VO2 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.

211 Board #27 May 27 9:30 AM - 11:00 AM
A SuperJump® Into ACSM Guidelines
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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: 1.7±0.1 m; weight: 66.2±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 collected. Percentages of age-predicted maximal HR (%HRmax) were utilized to quantify intensity. %HRmax data were categorized according to the American College of Sports Medicine (ACSM) classes of intensity (very light: <55%HRmax; light: 55-65%HRmax; moderate: 65-76%HRmax; vigorous: 77-95%HRmax; near maximal to maximal: >90%HRmax). Repeated measures ANOVA was used to evaluate differences (p<.05) in relation to gender and exercise intensity. Post hoc analysis was applied using Bonferroni correction. RESULTS: No difference emerged for gender for HR and sRPE data. Frequency of occurrence of %HRmax was significantly higher (p<.005) for the moderate intensity (48.9±34.9%) and very light intensity (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-impact aerobic exercise. Further studies should investigate the long-term effects of SJ training on health-related physical fitness parameters.

212 Board #28 May 27 9:30 AM - 11:00 AM
A Lower Limb Functional Screening Tool For Predicting Lower Limb Injury: A Prospective Cohort Study
Shimeng Shi1, Xiaojian Shi1, Zonghan Yang1, Peng Song2, Gordon Waddington3, Roger Adams4, Jeremy Witchalls3, Doa El-Ansary5, Oren Tirosh5, Sam Wu5, 1KBR, Houston, TX. 2University of Sydney, Sydney, Australia. 3University of Melbourne, Melbourne, Australia. 4Downs4, Andrew Abercromby4, 5KBR, Houston, TX. (Sponsor: Carl Foster, FACSM)
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(No relevant relationships reported)

PURPOSE: The purpose of the current study was to assess the usefulness of the lower limb functional screening tool (LoLiFST) for predicting low back and lower limb injury in active athletes.

METHODS: Fifty athletes (32M,18F; mean age: 19.4 ± 2.5 yrs) from six different sports volunteered. Athlete injury history and general information were recorded. The LoLiFST is based on five lower limb movements in different movement planes, their exposure to sport and injuries were recorded. Independent samples t-tests were 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: 1.7±0.1 m; weight: 66.2±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 collected. Percentages of age-predicted maximal HR (%HRmax) were utilized to quantify intensity. %HRmax data were categorized according to the American College of Sports Medicine (ACSM) classes of intensity (very light: <55%HRmax; light: 57-65%HRmax; moderate: 65-76%HRmax; vigorous: 77-95%HRmax; near maximal to maximal: >90%HRmax). Repeated measures ANOVA was used to evaluate differences (p<.05) in relation to gender and exercise intensity. Post hoc analysis was applied using Bonferroni correction. RESULTS: No difference emerged for gender for HR and sRPE data. Frequency of occurrence of %HRmax was significantly higher (p<.005) for the moderate intensity (48.9±34.9%) and very light intensity (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-impact aerobic exercise. Further studies should investigate the long-term effects of SJ training on health-related physical fitness parameters.

CONCLUSIONS: The inter-rater reliability was 0.900 and the intra-rater reliability was 0.955. Fourteen participants experienced injury within the following 12 months. Injured athletes had significant lower scores than non-injured in both technique and symptom scores of the LoLiFST (df=48, t=1.419, P<0.05; df=16.402, t=2.979, P<0.05). When technique or symptom score alone was included in the ROC analysis, the area under the ROC curve (AUC) scores were 0.793 (P=0.05, 95%CI: 0.649-0.936) and 0.761 (P=0.05, 95%CI: 0.599-0.923), respectively. When both technique and symptom scores combined, the AUC discrimination score was 0.835 (P=0.05, 95%CI: 0.709-0.962). When injury history was added into the variable set, the AUC discrimination score was 0.860 (P<0.05, 95%CI: 0.746-0.974), resulting in 86.0% of cases being correctly predicted as low back or lower limb injured/non-injured.

CONCLUSIONS: The new functional assessment tool LoLiFST had excellent intra-rater and inter-rater reliability. The findings from the current study suggest that the technique, reported symptoms, and injury history should be used in combination to maximize its capacity for predicting injuries. Future larger sample size research is warranted to explore the validity of the LoLiFST in predicting low back and lower limb injury in various sports.

213 Board #29 May 27 9:30 AM - 11:00 AM
An Automated Excess Minute Ventilation Method To Detect The Respiratory Compensation Point
Kyoung Jae Kim1, Roxanne Buxton2, James Crowell3, Meghan Downes4, Andrew Abercromby3, 1KBR, Houston, TX. 2University of Houston, Houston, TX. 3MEI Technologies, Houston, TX. 4NASA Johnson Space Center, Houston, TX.
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(No relevant relationships reported)

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 VCO2 (ExCO2) concept used to detect VT (Gaskill et al. 2001) and calculated ExVE as (VE-[VE-ExCO2/2]). RESULTS: The new functional assessment tool LoLiFST had excellent intra-rater and inter-rater reliability. The findings from the current study suggest that the technique, reported symptoms, and injury history should be used in combination to maximize its capacity for predicting injuries. Future larger sample size research is warranted to explore the validity of the LoLiFST in predicting low back and lower limb injury in various sports.
Sixteen women (mean age: 22.5±6.4yrs BMI: 22.5±2.7kg/m2) who has back endurance.

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. For the prevention of overhead shoulder injuries. Additionally low back strength and flexibility of upper extremity in scapular dyskinesis needs to future studies for handball players.

**Purpose:**

- Handball players performed a series of 3 resisted "make-test" isometric hamstring curls against a recording of EMG and sMMG by sensors applied to the right hamstrings. Subjects: Healthy, active individuals (mean age= 30.0 ±10.77 y, n=9, 6 males, 3 females) underwent hamstrings electromyography (EMG).
- The purpose of this study is to assess 1) the relationship of sMMG's at each contractile level to force generation, and 2) sMMG detection of hamstrings contraction timing compared to the clinical standard method of muscle bulk displacement measurement to force generation and 2) sMMG detection of hamstrings contraction timing.

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

<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>
</tr>
</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>

**Corr. t df Sig.**

- **RCP VO** | 0.920 -1.402 348 0.162 0.097 0.014 -0.228 0.038
- **RCP Time** | 0.934 -0.511 348 0.610 6.959 1.181 -33.137 19.471

**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.

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

**Effect Of Scapular Dyskinesia On Scapular Functionality And Back Endurance In Elite Women Handball Players**

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(No relevant relationships reported)

**Choice Upper Extremity Stability Test (CKCUEST) were used for the measurement of scapular functionality and Sorensen Test for the measurement of back extensor endurance. Mann-Whitney U test was used to compare the raw values between the groups. Results:**

- There were not statistically significant differences in CKCUEST 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).

**Conclusion:**

Endurance of the trunk extensor muscles seems to have influence in scapular dyskinesis in elite female handball players. Besides, functionality of upper extremity in scapular dyskinesia needs to future studies for handball players.

**Board #31 May 27 9:30 AM - 11:00 AM**

**Fitness Readiness For Yoga Poses Scale (fryps): Development And Validation**

Liven Ju. Nanjing sport institute, nanjing, China. (Sponsor: Weimo Zhu, FACSM)

(No relevant relationships reported)

**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:**

After a comprehensive literature search and consulting with a number of experts, 101 healthy college students (male = 27.72%, age = 20 ± 3.9 years) were recruited for the study. Specifically, their performance of 7 common yoga poses was evaluated, including mountain pose, bend back, bend forward, riding horse, upward facing dog, downward facing dog and flowing cobra, and their fitness were tested by 6 fitness tests, including sit-up, push-up, squat, cow-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 basing 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 operation 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, riding type, snake strike type 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.

**Board #32 May 27 9:30 AM - 11:00 AM**

**Novel Surface Mechanomyography Sensor Assessment Of Hamstrings Contraction During A Neuromuscular Control Screening Task**


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**Reported Relationships:** S.E. Linderman: Salary, Figur8, Inc.

**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 a muscle group provide a novel measurement of physical muscle output during a contraction. The purpose of this study is to assess 1) the relationship of sMMG’s muscle bulk displacement measurement to force generation and 2) sMMG detection of hamstrings contraction timing compared to the clinical standard method of electromyography (EMG).

**METHODS:**

Healthy, active individuals (mean age = 30.0 ± 10.77 y, n=9, 6 males, 3 females) underwent hamstrings neuromuscular control assessment with simultaneous recording of EMG and sMMG by sensors applied to the right hamstrings. Subjects performed a series of 3 resisted “make-test” isometric hamstring curls against a hand-held dynamometer (HHD). Raw sMMG data and 6° order Butterworth filter and TKEO processed EMG data were used in timing analyses. Paired T-tests and a Pearson correlation assessed relationships between measurement modalities.

**RESULTS:**

Hamstring muscle bulk displacement detected by sMMG (mean= 4.02 ± 0.04 mm) positively correlated with HHD maximum force generation (mean= 28.84 ± 12.13 lb), r² = 0.880. There was no significant difference in the timing duration of muscle contraction between EMG (mean= 4.443 ± 0.573 s) and sMMG (mean= 4.469 ± 0.623 s), p > 0.279.

**CONCLUSIONS:** Results are consistent with physiologic expectations that increased physical muscle bulk displacement 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 (HHO) and electromyography (EMG) during a resisted isometric hamstring curl. Raw sMMG hamstring muscle displacement (B) aligns with HHO force output (A) and processed EMG data (C) for muscle contraction duration. The timing activation threshold was set at 3 times above the standard deviation of a resting trial for each modality (Soloinik et al., 2010).

### Board #33 May 27 9:30 AM - 11:00 AM

**Reliability Of A Submaximal Cycle Ergometer Verification Phase To Confirm VO_{2max}**

Kirsten Thornhill, MS, Brandon Sawyer, PhD. Point Loma Nazarene University, San Diego, CA. (Sponsor: Robert Pettit, FACSM)

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(No relevant relationships reported)

**Purpose:** To test the reliability of a submaximal cycle ergometer VO_{2max} 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) men (n = 10) and women (n = 10) completed 3 ramp VO_{2max} 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_{2max} tests to verify attainment of a ‘true’ VO_{2max}.

**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_{2max} achieved on the verification phase was similar to the ramp VO_{2max} 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 VO_{2max} (ICC = 0.991; CV = 2.68 ±2.52%). ICC and CV for female participants VO_{2max} demonstrated excellent consistency (ICC = 0.987; CV = 2.5%). Male participants VO_{2max} displayed excellent consistency (ICC = 0.941; CV = 2.2%). Bland-Altman Plots showed no bias based on VO_{2max} value. A 90% submaximal verification phase is a reliable test to confirm a ‘true’ VO_{2max}.

### 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 Castro¹, André Marinho Fernandes², ¹CareClub, Rio de Janeiro, Brazil. ²CareClub, 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 peak and minV) and %FI [(VDO100/PeakV)/time elapsed between peak and minV) were calculated. Data presented as mean ± standard error.

**Results:** Peak V (27.5±7.9 km/s) 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% Time when was considered, FI = 1.2±0.4 km/h/s; %FI=4.1±2.0%. 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 VAT 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 VAT. There were positive correlations in VAT between NPT and VJT (r = 0.620, p < 0.001) between the VAT and VJT (r = 0.399, p = 0.015). Also, there were significant correlation (r=3.5) as -25, p = 0.014, d = 0.51 in MRPP between VAT and VJT, with centered variance between the trials and between the trials:

**LUSION:** There were significant positive correlations between the VAT and NPT in VAT and MRPP. The NPT also showed greater correlation with field test (VJT). So, the NPT can be a good alternative measurement with lesser effort for assessing anaerobic power and predict athletic performance in the field.

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 when individuals are required to exercise at a set workload for as long as possible. The training method consisted of a cognitive task (CON) that was instructed to exercise normally at home, and two groups that exercised in the laboratory either once (1X) or twice (2X) per week. The test was designed to help equal men and women. All subjects were asked to complete a graded exercise test (GXT) to exhaustion and a TTE before and after an 8- week intervention. All tests were completed on a cycle ergometer. The GXT 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 (±0.8±5.4 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 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.

Maximal time trial efforts provide reliable assessments of exercise performance, yet an exhaustive 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 (TTsubmax, n=14) or three maximal (TTmax, n=8) 250k W time trials on a cycle ergometer and a period of four weeks where subjects completed at their selected work rate to maintain Rating of Perceived Exertion (RPE) between 13 and 17 (Somewhat Hard to Very Hard) throughout the trial. TTsubmax was completed as fast as possible to simulate a race effort. Reliability across trials was assessed using the Intraclass 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. Intratrial t-tests were used to assess mean differences between TTsubmax and TTmax. Fisher r-to-z transformation was used to compare ICCs ($\alpha = 0.05$). **Results:** Time to complete 250k at submaximal effort (RPE 15.2 ± 0.5 vs. 16.5 ± 0.7; P < 0.001) was longer than for maximal effort (1961 ± 558 vs. 1463 ± 670, P < 0.005). However, there were no differences in TTsubmax 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 a valid and 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.

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 tempe leve 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 (23yrs) with 17 years of ballet training performed various jumps in two footwear conditions. She was instrumented with reflective markers, and a 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 knee 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 legs. 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.

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:** 302 Chinese college students aged from 16 to 23 years old (1810 males) were recruited from Zhongshan 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 TS200 (produced by Physical Fitness Science and Technology Company). Dependent T-tests were used to compare mean differences of variables 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 recorded in BH, 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 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.
The recently created small respiratory chambers (FLEX rooms) permit a more affordable solution and faster response time than the larger traditional whole room respiratory chambers. Despite the potential for FLEX to employed to assess acute energy expenditure (EE), it has never been validated for submaximal exercise.

**PURPOSE:** To perform concurrent validation and reliability analysis of indirect calorimetry of FLEX against metabolic carts (Cart) during submaximal cycling.

**METHODS:** Ten healthy participants were included in this study (41.5±15.2 years; BMI=25.8±3.3 kg/m²). Energy expenditure was evaluated on FLEX and mixing chamber Cart, simultaneously. FLEX is an 11,000-liter room operated by a push-pull system and mass flow controllers. Participants performed two submaximal exercise bouts of 30-minutes each with the same 30-minute rest period between bouts, each bout had a light and a moderate load; they repeated the same protocol after two days. Oxygen uptake (VO₂) and carbon dioxide production (VCO₂) were derived with the same equation. EE, Net EE, gross efficiency (GE) and net efficiency (NeFET) were calculated for each load (L1=1.2 & L2=1.3). FLEX was validated by the standard deviation of the differences in kcal/min and %. Repeated measures analysis was utilized to explore differences between Cart and FLEX. **RESULTS:** EE and NeFET were not significantly different between cart and FLEX technologies (FLEX=4.29 vs. Cart=4.13 kcal/min, p<0.05). However, significant differences were observed for MSJ (1529.4 kcal/d) and Nelson significantly underestimated RMR when compared to RMRmeas (1703.5 ± 349.5 kcal/d) by 9.3 ± 30.2 kcal/d prediction equations did not differ from the RMRmeas by 9.3 ± 30.2 kcal/d prediction equations did not differ from the RMRmeas by 9.3 ± 30.2 kcal/d by 9.3 ± 30.2 kcal/d. Conclusion: FLEX is a valid and reliable technique to assess energy metabolism during exercise without the cumbersome mouthpiece or mask required by metabolic carts.
may need to be interpreted with caution, especially for female populations. Since no significant differences were observed between HB and WHO compared to RMRmeas, their continued use in estimating RMR in a healthy population of adults is supported.

### Board #44
**May 27-9:30 AM - 11:00 AM**

**INTERRATER RELIABILITY OF ASSESSING THE 1-MINUTE PUSH-UP TEST**

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(No relevant relationships reported)

Many law enforcement agencies, fire departments and military branches often require members to complete a muscular strength and endurance physical fitness test for entry or as a yearly test to assess their ability to perform essential job duties. Push-ups are common components of a muscular fitness assessment, especially in tactical settings. These tests require a certain level of muscular strength, however, the level of strength needed to be successful in essential job duties is widely debated. Because multiple raters are used to test large groups, scoring inconsistencies can occur due to a lack of proper movement standard knowledge between raters. PURPOSE: The primary purpose of this study was to evaluate interrater reliability of the 1-minute push-up test using video motion capture application across a group of fitness professionals and health science students. METHODS: Data collected from 28 video raters (males, n = 10; females, n = 18; age: 24.8 ± 5.5) was analyzed to determine the interrater reliability for the 1-minute push-up test. Raters were recruited from health science courses at the university where this study was conducted. Raters were shown 10 different video recordings of individuals performing the 1-minute push-up tests as a group in a classroom setting. Raters were instructed to score the performance of each video participant based on the testing procedures and criteria that were provided. RESULTS: A Cronbach’s alpha reliability analysis of the entire sample revealed a high degree of interrater reliability for the push-up test (α = 0.97). CONCLUSION: Based on the results of this investigation, it appears that the push-up test can be assessed by different raters with a high degree of reliability. These findings are significant for populations, such as military, fire and police, that frequently perform these assessments as part of their yearly evaluations.

### Board #45
**May 27-9:30 AM - 11:00 AM**

**Can Lateral Weight Shift Be Reliably Observed During The Functional Movement Screen Deep Squat?**


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(No relevant relationships reported)

Bilateral asymmetries of lower extremity strength have been reported in the literature and their existence may influence performance and increase injury risk. Although functional movement screen (FMS) deep squat (DS) scoring criteria does not include lateral weight shift, previous reports have demonstrated weight distribution asymmetry in both adolescent soccer players and active, adult participants. Lateral weight shifts are often observed in FMS DS, however, no previous report has determined the ability to validly and reliably observe this characteristic.

**PURPOSE:** To determine if lateral weight shift could be reliably rated when compared to bilateral vertical ground reaction forces (vGRF) during FMS DS.

**METHODS:** Thirty-seven active subjects (19 F, 18 M, 20.8 ± 1.4 yrs) granted informed consent and performed three FMS DS trials on two force plates (1200 Hz) while video (30 Hz) captured frontal, sagittal plane views. A Matlab script processed vGRF data with a lowpass filter and computed limb symmetry index (LSI) during the descent phase and full squat position. Two sports medicine professionals independently viewed videos and rated asymmetry using a novel, web-based sliding scale scoring rubric. Raters scored trials from 0-100 in interval increments of 1 with 50 representing a symmetric DS. Scores were averaged across trials and intraclass correlations (ICCs) were performed to determine inter-rater reliability. Receiver operator characteristics (ROC) curves determined cut-off scores that maximized sensitivity and specificity of determining substantial weight shifts (>10%, >15%).

**RESULTS:** Subjects demonstrated average LSI of 9.8 ± 6.9% with eighteen subjects demonstrating LSI > 10%. Raters were able to determine correct shift direction (L>R) in 57.7% of all subjects and 68.1% for those with average LSI > 10%. Inter-rater reliability was poor (ICC=0.41, 95% CI=[0.07, 0.69]). All ROC area curves were < 0.61 indicating the scoring rubric failed to accurately diagnose LSI > 10% or >15%.

**CONCLUSIONS:** Although active, adaptive, and demonstrated lateral weight shift during FMS DS, raters weren’t able to reliably observe this shift even in severe cases. Clinicians should demonstrate caution when prescribing interventions based on visual observance of lateral weight shift during the FMS DS.

Avid rock climbers and the research literature commonly agree that body mass (M_b) is the primary determinant of the 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 \text{\scriptsize{L}}/min), should be proportional to both body mass (M_b kg) and the total mass of a climber and their gear (M_g kg) - i.e., VO_2 \text{\scriptsize{L}}/min = a M_b^\alpha M_g^\beta, where a is the theoretical mass exponent value of +1.0. The research literature, however, has never formally addressed the issue of mass exponents for climbing energy expenditure. PURPOSE: To begin understanding the relationship between mass and steady-state climbing VO_2, this study determined M_b and M_g scaling exponents for energy cost during motorized treadmill climbing. It was hypothesized that both M_b and M_g scaling exponents should be +1.0. METHODS: Data from 16 men and 4 women (Mean±SD: 25±4 yrs; 22.7±1.5 kg/m² BMI) from a previously published study (Heil IJPEFS 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 (0º), overhang or negative incline (-5 to -10º), positive inclines (+5 to +10º). Steady-state VO_2 data collected with a portable indirect calorimeter system were analyzed using standard log-linear multiple regression analyses using treadmill speed and grade, as a dummy-coded gender term, and either M_b or M_g as independent variables (α=0.05). Derived mass exponents were then compared to theoretical value of +1.0 using 95% CIs. RESULTS: 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.

**INTRODUCTION:** Combine style assessments provide information regarding athlete’s strengths, weaknesses and abilities. Values 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, 18SU1, 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 ≤ 0.05. RESULTS: Athletes displayed significant increases in back squat (F=4.965, p=0.0005), power clean (F=5.164, 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=0.009), pro-agility right (F=2.555, p=0.028) and 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 left (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). RESULTS: Subsequent assessment had an impact on combine performance results. Further, position categories had differing attributes that will impact combine performance values.
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 blood pressure, but there are fewer investigations exploring the relationship between peripheral circumferences and cardiovascular parameters. PURPOSE: To evaluate relationships between anthropometric measurements calculated by the Fit3D to 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 retstoned 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. Fit3D-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 = 0.033). 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 (β = 0.942, 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 assessments 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 an anaerobic test that includes both “Burst Shape Rating” and “Body Shape Rating” is the anodr given to Plum 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 for two trials of the WAnT total work (T), 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; 159.4 ± 6.4cm; 69.2 ± 13.8kg) completed the study. A high degree of test-retest reliability was found for WAnT total work (ICC = 0.99 [0.98-0.99], p = 0.001). WAnT total work and climbing distance were significantly correlated, r = 0.81, p < 0.001.

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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, back]) and the directional continuous jump measurement method (vertical, forward, backward). METHODS: Subjects included the following two groups: general students (10 male students) and basketball students (10 male students). The conventional single jump (vertical jump, standing long jumps [forward, back]) 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 was not found in the means of the overall standard scores (T-Scores) for conventional single measurements and directional continuous jumps measurement. 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.

PURPOSE: To estimate normative values for eccentric grip strength derived from an original device in general populations and to investigate the relationship between isometric grip strength and eccentric grip strength. METHODS: In the present study, 102 subjects (32 men: age 61.5±11.0 years, height 170.6±6.7 cm, weight 68.2±9.8 kg; 70 women: age 60.7±14.9 years, height 156.0±7.4 cm, weight 52.4±7.2 kg) participated. Isometric grip strength was assessed using a dynamometer (Takei, Co., Ltd, Tokyo, Japan). The peak force of eccentric grip strength was assessed using an original device. The device utilized an AC servo motor (60 W class) to generate eccentric force to unclench the subject’s hand at a constant speed of 32.67 mm/s. Intra-class correlation coefficients (ICCs) and coefficients of variation (CVs) were calculated for the variables of interest.

RESULTS: The isometric grip strength was 39.2±7.8 kg and 25.6±4.7 kg in men and women, respectively. The peak eccentric grip strength was 50.0±12.1 kg and 30.9±7.2 kg in men and women, respectively. The CV tended to be higher in the eccentric grip strength (26-26.6%) than in the isometric grip strength group (18-20.8%). The ICC between isometric and eccentric grip strength was 0.944-0.953 for both groups.

CONCLUSIONS: Based on these findings, it is suggested that the eccentric grip strength device shows good test-retest reliability. In addition, the eccentric grip strength is stronger than the isometric grip strength in the general population.
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 attainment in older adults. 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 – closest neighboring point ≤150 ml/min), a VO2max verification criterion of a VO2 plat not greater than 2% higher than the incremental phase, and two different criteria for HRplat: ≥2 bpm or ≥4 bpm. Secondary criteria for establishing maximal effort were RERmax ≥1.0, HRmax ≥100 bpm of APhRmax, RPE ≥17, and [BLa] ≥ 3 mm. RESULTS: Data are presented (Table 1) as sex-specific percentages. All attained VO2plat on both modalities. The verification criterion was met by ≥ 67% of females and ≥ 25% of males in our sample regardless of modality. HRplat was more frequently attained in older males on both modalities and for females on the TM. HRplat more frequently on TM as compared to CE. CONCLUSION: A verification bout is reliable for confirming VO2max in older males on both modalities and for females on the TM. HRplat may serve as a standalone criterion for TM VO2max attainment for males and females. VO2max was the most robust method for confirming VO2max attainment in older adults. Due to wide variability in the literature regarding VO2max criteria and indirect calorimetry processing methods, agreement on a standardized definition for VO2max and clear data processing procedures are needed. Table 1. VO2max attainment criteria for all tests across sex and modality (N=24)
Using a repeated measures ANOVA. In addition to the human subject measures, a device airflow test was performed using a 3L calibration syringe timed to a metronome at 15.25, and 35 bpm to simulate different respiratory frequencies (RF).

RESULTS: The indoor analysis revealed significant differences in VO2 (2284 vs. 1320 ml/min at jogging pace; 3016 vs. 1880 ml/min at running pace), Ve (51.1 vs. 40.7 ml/min at jogging pace; 71.02 vs. 57.1 ml/min at running pace), and HR (130 vs. 128 bpm at jogging pace; 157 vs. 155 bpm at running pace) between the K5 and VM respectively (p < .05). One-horsepower analysis revealed a significant difference in VO2 (2359 vs. 1354 ml/min at jogging pace; 3295 vs. 1969 ml/min at running pace) and Ve (53.4 vs. 40.4 ml/min at jogging pace; 81.77 vs. 63.01 ml/min at running pace) between the K5 and VM respectively (p < .05). Notably, the outdoor analysis did not show a significant difference in HR or speed (p > .05). For the airflow test, a 2-tailed, paired t-test revealed a significant difference in Ve (46.0 vs. 42.7 ml/min at 15 bpm; 77.2 vs. 69.1 ml/min at 25 bpm; 107.9 vs. 96.2 ml/min at 35 bpm) and TV (3.05 vs. 2.85 L/breath at 15 bpm; 3.07 vs. 2.77 L/breath at 25 bpm; 3.08 vs. 2.75 L/breath at 35 bpm) at all Rf (p < .001).

CONCLUSIONS: These findings indicate that there are significant discrepancies between the VM and the K5.

**Development And Reliability Of A Comprehensive Test Battery For Performance Diagnostic In Team Sports**

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(No relevant relationships reported)

Team sports are characterized by complex coordinative and conditional abilities that are prerequisites for optimal performance and injury prevention of the athletes. To assess these abilities efficiently and reliably, we aimed at developing a test battery to provide further evidence for the need to use a VP with VO2 max testing protocols in populations of different fitness levels. METHODS: 49 participants (M: 27; F: 22; 21.9±2.6 y, 24.3±2.8 kg/m2) 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 104/147 tests (71%), 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 VO2max test was not different than either value attained following the VP at 95% or 105% VO2max testing protocols in populations of different fitness levels. CONCLUSION: 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 = .043) but not amongst the other lower extremity FMS tests (in-line lunge, hurdle step, active straight leg raise, p < .082, 0.78, 0.2) or the upper extremity (no significance). CONCLUSION: While there is no one perfect screening tool to assess optimal 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
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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 = 66.8 ± 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 equivalent) 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
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There are different modes of exercise and equipment to measure maximal oxygen consumption (VO_{2max}). 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 mode to acquire accurate assessment of cardiorespiratory capacity. PURPOSE: The purpose of this study is to compare the relative VO_{2max} elicited from a common treadmill protocol (TM) to a simultaneous arm and leg ergometer protocol (AL). METHODS: Participants completed two VO_{2max} trials, separated by 7-14 days, with the order of the trials randomized. The TM trial set at 50 rpm while the leg rpm was self-selected. The AL protocol utilized an arm ergometer in conjunction with an upright cycle ergometer. Cadence on the arm ergometer was set at 50 rpm while the leg rpm was self-selected. Thirteen apparently healthy college-aged participants completed both TM and AL assessment trials (21 ± 1.8, female n = 9). There was a difference (p < 0.05) between TM and AL in VO_{2max} (ml/ kg/min) (45.0 ± 7.3 vs. 42.1 ± 6.7, respectively), RER (1.18 ± .08 vs. 1.31 ± .06 min, respectively), and completion time (10.9 ± 1.3 vs. 7.5 ± 2.2 min, respectively), with AL values at 6 ± 6.2% and TM values at 8 ± 8.5% 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 VO_{2max}, 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
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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: Trend 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 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 between 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.

252 Board #68 May 27 9:30 AM - 11:00 AM
Metabolic Equations To Estimate VO{sub}2max Of Healthy Active Canadian Men Aged 18-34 Years-old: Preliminary Results
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VO_{2max} 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 VO_{2max} is associated with higher risk of chronic disease and mortality as well as low physical performance while higher VO_{2max} levels predict good performance in aerobic sports. Direct measurement of VO_{2max} 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 VO_{2max} using indirect techniques 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 VO_{2max} comparatively to direct O_{2} 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 VO_{2} measures (mO_{2}kg/min) using a metabolic cart (VYNTUS CPX). VO_{2max} 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 VO_{2max} 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 measures (ACSM: 66.4 ± 7.0; FRIEND: 56.5 ± 5.9; VYNTUS: 53.0 ± 6.3; p < 0.001). The mean ACSM overestimation was 13.4 mO_{2}kg/min while FRIEND equation was only 3.5 mO_{2}kg/min. CONCLUSION: The VO_{2max} 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 VO_{2max} estimation formula.
Hypothetical explanations for the use of music during exercise include that music may provide distraction from the physical effort of the exercise and may enhance athletic performance. However, there is a lack of research that directly examines the effect of music on VO2max, which is the maximum rate of oxygen consumption during exercise. Therefore, the aim of this study was to compare VO2max under different conditions of music with exercise.

Methods: Twenty physically active adults (age 18 - 32; 11 female, 9 male) were randomly assigned to one of three groups: no music, music condition 1, and music condition 2. The music condition groups were asked to listen to music during the incremental treadmill test. VO2max was calculated using the formula: 

\[ VO2max = \frac{\text{peak O2 uptake} \times \text{duration of exercise}}{10} \]

Results: Paired samples t-tests showed no significant difference for TTE (\(\bar{x} = 684.18 \pm 86.07\) vs. \(\bar{x} = 668.1 \pm 181.25\); \(p = 0.12\)), VO2max (\(\bar{x} = 44.45 \pm 5.82\) ml/kg/min; \(\bar{x} = 43.97 \pm 7.27\) ml/kg/min; \(p = 0.36\)), or VT (\(\bar{x} = 27.29 \pm 6.52\) ml/kg/min; \(\bar{x} = 26.93 \pm 7.03\) ml/kg/min; \(p = 0.32\)). However, paired samples t-tests revealed significant difference for RPE (\(\bar{x} = 13.11 \pm 1.58\) vs. \(\bar{x} = 14.13 \pm 1.48\); \(p = 0.05\)) and VAS (\(\bar{x} = 10.85 \pm 2.29\) vs. \(\bar{x} = 9.37 \pm 2.72\); \(p = 0.05\)).

Conclusions: The findings of this study support previous research demonstrating a connection between music and a decrease in perceived exertion during exercise. However, the aftereffects of selected music during a VO2max test on measures of metabolic indices and perceived exertion.

Board #70
May 27 9:30 AM - 11:00 AM
Comparison Of Novel Hop Testing Method To Identify Decreased Performance And Asymmetries
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Hopping performance is used to evaluate athletes that are returning to sport. Evaluating alternative tools that use less repetitive impact could put these vulnerable populations at lower risk for injury during testing. Limited research examines various plyometric tests and traditional hop testing at identifying decreased performance and asymmetries.

PURPOSE: To examine the association between alternative and traditional hop tests in physically active adults.

METHODS: Participants performed a series of seven hop tests in a randomized order including both single and double leg takesoffs for a single, double, and triple jump, and 2-1-2 bound. Three successful trials were performed for each jump. Left and right limbs were combined for all analyses. Spearman’s Rho correlations were performed to investigate the relationship between jump tests.

RESULTS: Twenty physically active individuals (age 18 - 32; 11 female, 9 male) participated. There were large associations between single leg single, double, and triple jumps (r = 0.834-0.960, p < 0.001). There were large associations between double leg single, double, and triple jumps (r = 0.909-0.923, 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).

CONCLUSION: 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 precursor 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.
Established prediction equations, such as those of 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 (RMRpred) against measured (RMRmeas) values in healthy females. METHODS: Female fourteen participants (36.5 ± 16.2 yrs, 166.8 ± 3.6 cm, and 62.7 ± 33.2 kg) 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 RMRpred (Dore, GW, and CH). Additionally, Bland Altman Limits of Agreement (LA) were reported as frequency of subjects outside of agreement compared to RMRmeas. For significant differences of Cohen’s d effect sizes were reported. All results are expressed as M ± 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 ± 93.3 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 when compared to RMRmeas by 23.8 ± 9.3 %. CONCLUSION: Our preliminary data shows that the use of the Dore prediction equation underestimated RMR by 380.9 kcal/day. Therefore, this equation to estimate calories in females 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.

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 cardioregulatory 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 relatively slow, which may not elicit a significant cardiovascular response in healthy individuals. The apparent flaws of these two validated tests may be interpreted with caution. Although not statistically different from the VO2max available in the literature, the VO2max protocol provides a lower level of detail and specificity principle of exercise training, changes on physical fitness are better reflected and improve health outcomes, such as cardiorespiratory fitness. However, according to the specificity principle of exercise training, changes on physical fitness are better reflected

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WEDNESDAY, MAY 27, 2020
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 Jaeger MasterScreen CPX metabolic cart (CareFusion Corporation, San Diego, CA). Energy expenditure was calculated simultaneously from heart rate (Polar FT³, Kempele, Finland), accelerometry (Actigraph wgt 3x-BT, Pensacola, FL) (ACC), and a pedometer (3DActive PDA-100, London, UK) (PED). 27 young, 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. 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 2091±2250.5 steps²; HRM recorded 24.7±7.9 kcal (gross), while ACC recorded 0.8±1.2 kcal (net) during 10 min. Exercise intensity was measured from VO₂ at 1.54±0.23 METs, corresponding to 5.6±2.2 kcal of 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 imiformal 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.

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Background: Physical performance testing is required in Turkey on entry to undergraduate study in physical education (PE). However, there is no standard test battery across academic institutions. PURPOSE: This investigation compared a laboratory cardiorespiratory (CR) fitness evaluation with field testing in a convenient group of first year students at an accredited undergraduate PE program. METHODS: Twelve apparently healthy male undergraduate PE students (mean age=19.5, SD=±1.5) individually performed laboratory cardiorespiratory exercise testing (CPET), the Cooper 12-minute Run (C12RT) and the Shuttle Run (SRT) field tests one week apart. Body composition including detailed segmental analysis was also assessed with a Full Body BIA Analyzer. Results: The mean CPET VO₂ max was 64.21 ml/kg/min (SD=7.3) with a superior age-gender fitness classification (>55 ml/kg/min; >95th percentile). Both the C12RT (Mean=59.54 ml/kg/min, SD=±7.1) and SRT (Mean=60.67 ml/kg/min; SD=2.8) correlated with CPET (r=0.03). The mean Mass of Body Fat and Body Fat% was 10.9, SD=2.4, and 16%, SD=2.8 respectively. The mean Lean Body Mass was 56.76 kg. Conclusions: The field tests were valid and practical methods of measuring CR fitness in this sample group. Future Directions: PE teachers can positively influence students by modeling an active lifestyle to promote physical fitness. The identification of an approved comprehensive physical performance test battery for PE programs in Turkey may provide an opportunity for benchmarking across academic institutions.

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 a 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 experienced (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 or more sessions of orienteering training a week 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/hr vs. 9.5 ± 1.5 km/hr, 10.0 ± 2.0 km/hr, 11.4 ± 2.0 km/hr). However, the second run velocity did not different from AT. The %HRmax of the first run was also significantly lower than that of the second run (85.7 ± 4.3% vs. 89.7 ± 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 orienteers’ competence was developed. It may be helpful for a coach to prescribe individual training plan or select some talent athletes.
266 Board #82 May 27 9:30 AM - 11:00 AM Stroboscopic Vision-induced Sensory Reweighting During Postural Control
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(No relevant relationships reported)

Human postural control is achieved by dynamic reweighting of sensory inputs among visual, vestibular, and somatosensory systems in accordance with an external environment. However, due to experimental limits, little is known how partially disrupted visual inputs affect postural control. PURPOSE: The purpose of this study was to explore the effects of stroboscopic glasses on postural control.

METHOD: 24 healthy people (M: 12, F: 12, Height: 172.1±7.8, weight: 67.5±10.4) performed three conditions: normal vision, 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, 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 = .0012 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 eye-close. 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 stabilized or altered somatosensory function.

267 Board #83 May 27 9:30 AM - 11:00 AM Anaerobic Power Measurement Tests In Athletes
Rodrigo D. Pandelo1, Braulio H M Branco2, Emilion Colomontio1, Romeu Candido, Jr1, Domingos R. Pandelo, Jr1. 1Centro de Alta Performance, Santos, Brazil, 2UNICEMAR, Santos, Brazil. 1UNIFESP, Santos, Brazil.
Email: rodrigo.pandelo@hotmail.com
(No relevant relationships reported)

PURPOSE: The aim of the present study is to verify if Countermovement Jump (CMI) and Countermovement Jump with arm swing (CMJW) 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 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), Power (AP) and Fatigue Index (FI).

RESULTS: The results were as expected as the PP and AP indicators were higher in CMJW 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 CMJW, 4.89% in CMJ, 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-CMJW, 1.17 for WAnT-CMJ, and 0.42 for CMJ-CMJW. 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 CMJW). Therefore the WAnT test should not be replaced by the CMJ and CMJW 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.

268 Board #84 May 27 9:30 AM - 11:00 AM Establishing Prediction Equations For “the big 3”: Bench Press, Squat, And Deadlift
Amanda Aileen Wheeler Gryffin, Brian Church, Lance Bryant, Greg Allen. Arkansas State University, State University, AR.
Email: awheeler@astate.edu
(No relevant relationships reported)

The bench press (BP), squat (SQ), and deadlift (DL), often referred to as “the big 3”, are the three exercises implemented into programs to improve muscular strength, power, and hypertrophy. Many times athletes are limited by injury to perform only one or two of these lifts. Identifying a relationship that would allow prediction of the 1RM for one of these lifts based on the other two would help clinicians, coaches, and other fitness professionals in these situations. 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) = 415.904; 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 = .642) 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 developed 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.
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 3 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 sport-related activities, travel to extra-curricular activities, and travel to and from home. 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 mobility 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 = 1.112, 95% CI: 0.32 to 2.91) 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 related 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.
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 heading 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(total, standard deviation): youth (4.66±0.5, SD 0.28), parents (4.52±0.5, SD 0.86), and coaches (3.83±0.5, 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<0.003 for 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.

PURPOSE: To determine severity and prevalence of EIB in healthy triathletes and to determine whether the mixed relay triathlon has any effect on respiratory function and baseline spirometry measures which influence EIB. METHODS: In this feasibility pilot study, female student-athletes from an urban minor high school (n=10) and suburban high school (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 (depression, anxiety, pain, peer relationships and physical function) and physical performance, and 3) assess injury risk. Self-reported data from the subjects were collected at each session, and FMS and performance data were collected at pre- and post-intervention. Statistical analyses to assess changes after the 10-weeks of athletic training were performed using paired t-test.

RESULTS: The mixed relay triathlon, despite its high intensity and short duration format, will induce heavy ventilation that could lead to EIB. However, no research at present can be attributed to heavy ventilation associated with sustained high intensity exercise greater than 5 min. High aerobic and ventilatory training demands can exacerbate the EIB response and lead to prevalence of EIB in endurance athletes like triathletes. Exercise-induced bronchoconstriction (EIB) is a transient narrowing of the airway that can be attributed to heat and humidity. Studies have found EIB to be a concern among endurance athletes, and the mixed relay triathlon could exacerbate the EIB response.

PURPOSE: To determine if the QuickDash Sport Module can predict injury in adolescent softball athletes. 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 second (FEV1), Forced Vital Capacity (FVC), FEV1/FVC (%) and Forced Expiratory Flow at 50% FVC (FEF50), FEV25-75% and Peak Expiratory Flow (PEF) were performed before warm up and 5 min post-race. Spirometry 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 FEV25-75% were
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 negatively affect respiratory function in young healthy junior triathletes. It maybe 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.
The Influencing Factor Of Chinese Adolescents’ Scientific Fitness Literacy

Lei Yao1, Yan Li1, Xiaolei Liu2, Jindong Chang1. Southwest University, Chongqing, China. 2High School Affiliated to Southwest University; Chongqing, China. 3# Institute of Motor Quotient of Southwest University, Chongqing, China.

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Board #97 May 27 9:30 AM - 11:00 AM
The Influencing Factor Of Chinese Adolescents’ Scientific Fitness Literacy
Lei Yao1, Yan Li1, Xiaolei Liu2, Jindong Chang1. Southwest University, Chongqing, China. 2High School Affiliated to Southwest University; Chongqing, China. 3# Institute of Motor Quotient of Southwest University, Chongqing, China.

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Table 1

<table>
<thead>
<tr>
<th>Item</th>
<th>M</th>
<th>Dif</th>
<th>Infit</th>
<th>Diffit</th>
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<td>0.94</td>
<td>-0.26</td>
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<td>1.00</td>
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<td>0.01</td>
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<td>0.01</td>
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<td>0.01</td>
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<td>0.01</td>
</tr>
<tr>
<td>CM28: Kicking</td>
<td>0.41</td>
<td>-0.26</td>
<td>1.00</td>
<td>0.01</td>
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Scientific fitness literacy (SFL) is based on scientific theories and methods to guide the body’s ability to exercise. It includes five main contents: knowledge, skills, behavior, attitude, and cognition of scientific fitness. 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: 22.56 ± 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: We used the “China Adolescents’ Fitness Literacy Questionnaire (CAFLQ)”. The CAFLQ 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 indicate that there are differences in the scientific and fitness literacy of adolescents in the following aspects. (1) Gender differences (F(1,4660)=63.24, P = 0.000<0.05), females (28.60±3.69) were higher than males (27.58±3.69), (2) Age differences (F(2,4660)=30.32, P = 0.000<0.05), pre-youth (28.32±3.81)>late youth (28.21±3.77)>juvenile (26.94±4.40); (3) Differences of education (F(2,4660)=63.10, P = 0.000<0.05), Postgraduate (28.54±3.50)>University (28.41±3.76)>Middle school students (26.76±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 (27.85±4.13); (5) Differences of exercise patterns (F(2,4660)=203.194, P = 0.000<0.05), regular exercise (30.93±3.96)>less regular exercise (28.70±3.51)>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. (S# is corresponding author)

POURPOSE: 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.

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Board #98 May 27 9:30 AM - 11:00 AM
Exercise Type, Physical Activity Level And BMI: Association With Cardiorespiratory Fitness In Adolescents
Ana Beatriz Pacifico, Thiago Silva Piola, Michael Pereira da Silva, Edina Maria de Camargo, Jonatan Gritten Campos, Eliane Denise Araújo Bacil, Wagner de Campos. Universidade Federal do Paraná, Curitiba, Brazil. (Sponsor: Carlo Baldari, FACSM)

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Board #99 May 27 9:30 AM - 11:00 AM
Lower Limb Force And Power Production And Its Relation To Body Composition In 14- To 15-year-old Adolescents
Fatón Tishukaj1, Ismet Shalaj2, Masar Gjaka3, Harald Tschani¹, Barbara Wessner1. ¹University of Prishtina, Prishtina, Kosovo, Republic of. 2University of Vienna, Vienna, Austria. 3University of Rome “Foro Italic”, Rome, Italy.

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No relevant relationships reported
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 and 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 (i.e., muscular strength, speed-agility, and cardiorespiratory fitness) using the ALPHA and FUPRECOL 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 a significant association between speed-agility (β=0.77; p<0.001) 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.

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.

**METHODOLOGY**
Elementary school children in 1st, 3rd, 5th and 7th grade were recruited 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 using the 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/meter²) was used as body composition measure.

**RESULTS**
In total, 94 (43%) 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<0.05). 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 children 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 during both 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@VT and the VO₂@ the last positive (LP) (r=0.79) and the equivocal (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

**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 tool and validate it using a contracting-group method.

**RESULTS**: A total 219 students (106 boys, 113 girls) in School A and 235 students (125 boys,110 girls) in School B were tested and their aerobic fitness level were evaluated using the 2018 high school entrance exam (HSEE) criterion. After (125 boys,110 girls) in School B were tested and their aerobic fitness level were evaluated using the 2018 high school entrance exam (HSEE) criterion. After
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: 20.21 ± 4.22 kg/m², 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 kg/m²; r = 0.90, p = 0.00), BMI and BF% (BMI: 20.21 ± 4.22 kg/m²; 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: 51.94 ± 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 kg/m²; r = -0.04, p = 0.13), VE and BF%’s (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. 28.8% 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.
The seated medicine ball throw was utilized to measure upper-body power. Physical characteristics and qualities were measured. The stationary broad jump (n=49) came from 3 distinct levels: playing levels and positions in youth elite hockey players.

The purpose of this study was to compare physical test results between 5.5pp and no proportional error was observed between MFBIA and DXA. -6.9 vs. MFBIA, -5.7pp, p=0.008). Random error (the limits of agreement) was -3.0 to -4.4pp. Thus, systemic error (the mean difference) of Δ%fat between the 2 methods was 1.2 percentage points [pp] (DXA, 5.4% and 12.7 ± 3.1 vs. 12.2 ± 2.6%, respectively. Thus, the results suggest that the development of strength measured through handgrip strength is a strong and moderate association in young athletes, especially height and weight.

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.

The purpose of this study was to determine the accuracy of MFBIA for evaluating the decrease in %fat by weight loss among competitive girl 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 girls long distance running competitions. MFBIA was performed at the preparatory season (PRE) and repeated after 5.5 ± 0.5 months at the competitive season (CMP) with dual energy X-ray absorptiometry (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. The 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 the 2 methods was 1.2 percentage points [pp] (DXA, -6.9 vs. MFBIA, -5.7pp, p=0.008). Random error (the limits of agreement) was -3.0 to -5.5pp and no proportional error was observed between MFBIA and DXA.

CONCLUSIONS: The small size of systemic error (mean difference) allow the use of MFBIA to evaluate a group mean of Δ%fat. However, due to the large random error size relative to the low level of %fat of the competitive runners, caution should be taken to use MFBIA for individual monitoring of %fat change during weight loss period.

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 15m according to the frequency of the beep. Adolescents need to reach the 15m mark before the beep. Each unsuccessful attempt is indicated on the treadmill. The best result of each side was taken and summed for analysis. Adolescents had to reach the 15m mark before the beep. Each unsuccessful attempt is indicated on the treadmill. The best result of each side was taken and summed for analysis.
Performed 8 min prior to the event did not impact the 50 m sprint performance in compared to the TS ($p = 0.046$, $\eta^2 = 0.27$). One were significantly higher in TS than in control condition ($p=0.03$, $\eta^2 = 0.62$). One: Pre-performance tethered swimming had no effect on swimming time, of perceived exertion (RPE)) variables and Counter movement jump (CMJ) flight-time by 8 min of rest and a maximal 50 m freestyle swimming sprint. The experimental level male adolescent swimmers (age: 13.0±2.0 y; height: 161.1±12.4 cm; body mass: 40 kg) performed 8 min before a 50-m freestyle swimming sprint could be an effective post- 

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 TS than in control condition ($p < 0.03$, $r^2 = 0.62$). One minute after the 50 m sprint, heart rate was significantly higher in the control condition compared to the TS ($p = 0.046$, $r^2 = 0.27$). 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.

Purpose: Use wearable sensors (WS) to compare player incurred impacts (PII) and absolute vs 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 traxial 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 ($p = 0.05$; 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 ± 7.7; $p<0.05$). 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 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.

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 ROM then randomly assigned to either the VP treatment group or the control group. The control group continued normal team stretching at the end of every practice, four days per week. The treatment group substituted standard stretching for VP stretching twice per week. ROM was measured after a single one-minute VP treatment and after 10 weeks of VP treatment. Prior to each measurement gymnasts completed a standard team warm-up including active ROM exercises. Measurements were taken using Myomotion inertial sensors placed on the lateral aspect of the distal femurs and overlaying the sacrum. RESULTS: After 10 weeks of training, the VP group’s ROM increased by 8.4 ± (5.5) degrees ($p=0.002$), while the control group’s ROM increased by 5.8 ± (8.0) degrees ($p=0.064$). There was no significant difference between groups ($p=0.435$). A single VP treatment increased ROM by 3.6 ± (7.3) degrees ($p=0.045$). CONCLUSIONS: There was a significant, although temporary, improvement in ROM after a single VP treatment. However, VP stretching does not appear to be a viable training option to improve ROM beyond standard stretching over time in child and adolescent female JO gymnasts.

Purpose: Functional Bilateral Asymmetries In Adolescent Competitive Skiers

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 (aged 14-18 years) skiers 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 s isometric mid-thigh pull of a force platform) and power (vertical jump), rotational power (accelerometer measured medical ball throw) and balance ($\gamma$-balance test). Differences between legs were compared 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 during 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 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 significantly higher magnitude head impacts, which could assist football-governing bodies in developing or modifying policy guidelines to help make the game safer. Supported by a grant from The National Operating Committee on Standards for Athletic Equipment (NOCSAE).

**CONCLUSIONS:** These data indicate that certain, modifiable characteristics of play are associated with higher magnitude head impacts in youth football. Additional research is warranted to continue to examine practice and game situations (extrinsic characteristics) that produce higher magnitude head impacts, which could assist football-governing bodies in developing or modifying policy guidelines to help make the game safer.

Supported by a grant from The National Operating Committee on Standards for Athletic Equipment (NOCSAE).
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**

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

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

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(No relevant relationships reported)

Osteocytes are secretary 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 age or accelerate bone fracture healing.

**Methods:** The murine MLO-Y4 (Keratase) cell line was cultured according to Keratase instructions. Human adipose stem cells (ATCC® PCS - 500-011™) were expanded and differentiated into osteocyte-like cells (hOCC) according to ATCC instructions. Cells were cultured in a computer-controlled bioreactor (Flexcell Int) for mechanical loading (3.4%, 3Hz, 5h). Static cultures were used as control. Relative expression of 84 key genes of the WNT signalling pathway (Sabiomics) 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 Oncomics (SCIEX) software.

**Results:** The relative gene expression remained unchanged in mechanically MLO-Y4 and hOCC. 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 hOCC; ~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 hOCC.

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

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

**Identifying Triad Risk Factors In Ultramarathon Runners**

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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% of males reported at least one prior bone stress injury.

**Conclusion:** Triad risk factors were common among ultramarathoners, 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.

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

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

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**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 R² 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=0.01; 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=0.01 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.

**308 Board #124 May 27 10:30 AM - 12:00 PM**

**Effect Of Exercise On Opg And Rankl As Bone Metabolic Markers: A Systematic Review And Meta-analysis**

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(No relevant relationships reported)

Bone metabolism is determined by the balance of bone formation (osteoblasts) and bone resorption (osteoclasts). Osteoprotegerin (OPG) and receptor activator of nuclear factor kβ ligand (RANKL) signaling are important factors that regulate bone metabolism. However, there are conflicting results about effectiveness of exercise on these factors.

**Purpose:** The purpose of this review is to investigate the effect of different types of
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 that: 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 (cohen’s 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=−0.57, 95% CI=−2.20, 0.925, p<0.001). Moderator analysis results showed that exercise type (resistance, endurance, a combination of both) partially explained the heterogeneity of ESs (Qbetween=7.704, df=2, p=0.021). The endurance exercise has the highest ES across the groups (ES=1.343, 95% CI=−670, 2.016). 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.

309 Board #125 May 27 10:30 AM - 12:00 PM BONE MINERAL DENSITY, BODY COMPOSITION AND BLOOD PRESSURE IN YOUND AND MENOPAUSAL RUNNERS AND NON-RUNNERS

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(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) 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

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(No relevant relationships reported)

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 licensed 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: Radius 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 quadriceps 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)

<table>
<thead>
<tr>
<th>BMD Sites</th>
<th>Muscular Performance</th>
<th>R-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Total Hip</td>
<td>Hamstring PT</td>
<td>.610</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Jump PP</td>
<td>.640</td>
<td>0.000</td>
</tr>
<tr>
<td>Right Femoral Neck</td>
<td>Hamstring PT</td>
<td>.690</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Jump PP</td>
<td>.722</td>
<td>0.000</td>
</tr>
</tbody>
</table>

PT: Peak Torque; PP: Peak Power
Bone Mineral Density And Muscle Mass Determine Handgrip Strength Only When Multiple Tests Are Performed

Maijia Zhu1, Sareena Hanim Hamzah2, Boon-Hooi Lim3, Te Chao4, Jinfu Wu5, Chi-Pei Lin6, Chiu-Yung Chang7, Wen-Hsin Feng1, Peng-Wen Chen8, Chao-Chieh Hsieh9, Min-Jung Hsieh10, Kuan-Jyh Chen11, Ting-An Shih12, Li Fan Lai13, Yi Chen Chen14, Che Chun Chiang15, Tania YY Lee16, Yu-Wan Lu17, Yun Huang18, Yu-Wen Shen19, Po-Hao Huang20, 1University of Taipei, Taiwan, Taipei, Taiwan. 2University of Malaya, Malaysia, Kuala Lumpur, Malaysia. (Sponsor: Chia-Hua Kuo, FACSM)

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(No relevant relationships reported)

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 to 60 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 correlated with bone mineral density (r=0.60, p<0.01), respectively. 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 similar in reflecting muscle mass and bone mineral density than single maximal value of handgrip strength.

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 BSI (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 (OsteoProbe), and questionnaires.

RESULTS: There were no differences between groups in age, BMI, age of menarche, or aBMD. Multi 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 other risk factors in those with recurrent BSI remain to be characterized.
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 variance (whole body lean mass as covariate) was used to compare BMD values of men and women runners at 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 a significant increase from v1 to v3 (1.240 ± 0.048 gm/cm^2 vs 1.194 ± 0.048 gm/cm^2, p=0.002) and v1 to v3 (1.240 ± 0.048 gm/cm^2 vs 1.185 ± 0.043 gm/cm^2, p=0.002) in WBBMD and men had a significant increase from v1 to v3 (0.414 ± 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 time 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 women 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 interest with 28.6% of women with low z-scores. It appears that running may not have an osteogenic effect on WBBMD in female collegiate distance runners over two-years, however runners often experience bone injuries and may have site-specific deficiencies compared to norms.

Board #133 May 27 10:30 AM - 12:00 PM
Bilateral Bone Strength Differences In Division II Female Volleyball Players
Claudia Romero Medina, Daniel Den Briones, Jorge Gonzalez, Sena Harlfey, Vanessa R. Yingling Ph.D., FACSM. California State University East Bay, Hayward, CA. (Sponsor: Vanessa R. Yingling, Ph.D., FACSM)

Loading (exercise) increases bone strength and reduces the likelihood of fractures later in life. However, questions remain as to the specific loading parameters that optimize bone strength. Past research investigating the effect of loading on bone strength have reported significant bilateral differences in bone characteristics favoring the dominant arm in male-racket-sport players (Haapalaso et al., 2000) and former professional baseball pitchers (Warden et al. 2014). Results also emphasized positive lifelong effects of loading on bone. Volleyball players primarily utilize a dominant side; therefore they are an excellent model to investigate the effects of bilateral loading on bone. PURPOSE: To determine bilateral differences in bone strength, including bone architecture, size and density in the radius. METHODS: 16 Division II female volleyball players (mean age 19 years + 1.15, height 1.74 + 0.69 m, weight 69.81 + 8.14 kg, body fat 23.86 + 5.73%) underwent peripheral quantitative computed tomography (pQCT) scans to measure bone strength on both the dominant and non-dominant radius. Trabecular bone variables (4% epiphyseal site) included trabecular bone mineral density (BMD;b), total bone mineral content (Total BMC), total area (Total A), and compressive strength index (BSIc). Cortical bone variables (66% diaphyseal site) included cortical density (CoD), cortical area (CoA), strain strength index (pSSI), and moment of inertia (J). One-tailed paired T-tests were performed to compare the variables. RESULTS: No significant side to side differences were found. The side to side percent (%) differences found at the 4% site were BMD: th (-0.45%), Total BMC (0.99%), ToA (-0.03%). The side to side J (7.2±13.4%) differences found at the 66% site were CoD (+0.97%), CoA (1.90%), pSSI (0.31%). J (5.23%). CONCLUSION: Volleyball may not result in loading significant enough to cause bilateral bone strength differences. Limitations include possible prevalent bilateral strength differences in the humerus, consideration of starting age (pre or post menarche) of playing volleyball, comparison of males and females of different sports.

Exercise Therapy For Bone Health: Translation To Clinical Practice
Belinda R. Beck, FACSM1, Lisa J. Weis2, 1GRIFFITH UNIVERSITY, GOLD COAST, Australia. 2The Bone Clinic, Brisbane, Australia.

We previously reported that high-intensity resistance and impact training (HRIT) is safe and improves risk factors for osteoporotic fracture in postmenopausal women and older men with low bone mass under trial conditions (LIFTMOR and LIFTMOR-M trials). We have now established a translational research Clinic implementing HRIT in practice alongside systematic longitudinal monitoring of musculoskeletal and functional outcomes to determine effectiveness and feasibility as osteoporosis prevention and therapy in the ‘real world’. PURPOSE: The aim of the current report is to present 4 year outcomes from the Clinic. METHODS: All Clinic clients undergo testing for height, weight, spine (LS), total hip (TH) and femoral neck (FN) bone mineral density (BMD), lean and fat mass, back extensor strength (BES), and functional indices of fall risk at their baseline visit, and annually thereafter. Twice-weekly supervised HRIT with balance training and a dietary consult is provided. Compliance and injuries are comprehensively monitored. In the absence of a control group, program effectiveness is determined from one-sample t-tests of percent change from baseline. RESULTS: We report outcomes from 275 clients (94.9% female) who have completed a minimum of 12 months HRIT (63.6±7.1 yrs, 162.3±16.8 cm, 60.6±10.0 kg, LS T-score -2.0±1.1, FN T-score -2.0±0.7, compliance 69.1±39.6%). 70 clients were on bone medications at baseline but only 18 at follow-up. Improvement was observed in weight (0.8±3.8%, P<0.0001), LS (2.2±5.1%, P<0.0001), TH (1.0±3.7%, P<0.0001) and FN BMD (1.4±4.8%, P<0.0001), lean mass (2.3±5.5%, P<0.0001), fat percent (-4.5±10.7%, P<0.0001), functional reach (7.2±13.4%, P<0.0001), timed up and go (-9.8±12.0%, P<0.0001), tandem walk (-20.6±3.15%, P<0.0001), sit to stand (-9.9±15.9%, P<0.0001), BES (20.6±3.15%, P<0.0001), and kyphosis (5.1±5.48%, P<0.05). Clients increased daily dietary calcium (23±67%, P<0.0001) and total calcium (19±68%, P<0.0001). 20 injuries were sustained in a total of 31,483 training sessions, the majority being minor muscle strains. CONCLUSION: We show that, when supervised in clinical practice, an evidence-based, targeted, high-intensity resistance and impact training program is safe and highly effective osteoporosis therapy for older men and women with low bone mass.
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.

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

**METHODS:** In a randomized controlled cross-over study over three days, twenty-nine postmenopausal women (age (mean±SD): 60.0±5.6 years) were randomly assigned to 6x10 repetitions of three jumps: counter-movement jump (CMJ), drop jump (DJ), and 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-I amino-terminal propeptide (P1NP), osteocalcin (OC) and C-terminal telopeptide of type-I collagen (CTX) were evaluated by a fully automated immunoassay system (SISYS, 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) SGA-6 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<0.01) than C. OC was increased (p<0.05) by 5.5±1.8% (DJ), 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, P1NP 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 modeling, which based on the relationship between the combined three-axis peak GRF and the acute P1NP response after CMJ seems to be dose-dependent.

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**RESULTS**

Post-hoc analysis. Significance was accepted at one-way ANOVA. BMD measures were compared across groups with an ANCOVA.

Composition (total fat mass, lean mass, and percent body fat) with dual-energy x-ray and BMD at the femoral neck of the dominant leg were measured along with body composition, bone mineral density, and muscle mass, obtained from middle-aged long-term endurance runners, and compares the findings with matched non-runners. METHODS: Total and regional lean and fat mass (kg) and total body percent lean and fat mass (%) were assessed by DXA and analyzed using enCORE software version 17.

Sagittal Magnetic Resonance images using a T2-weighted sequence captured the cross-sectional area and thickness of the multifidus from L1 to L5.

RESULTS: Analyses included 10 male runners with a mean (standard deviation; SD) age of 49 (4) yr, height of 178.9 (4) cm, weight of 67.8 (5) kg, and weight mass index (BMI) of 21.4 (1.4) kg/m² that had been running 82 (67.9) km/wk for 23 (13) yr and nine non-runner sex-, age-, height- and weight-matched controls with a mean (SD) age of 51 (5) yr, height of 176.0 (7) cm, weight of 72.8 (7) kg and BMI of 23 (2) kg/m². Only BMI statistically differed between the groups (P<0.001).

Runners had 4.4 kg greater mean total body lean mass than controls, which equated to 10 percentage points greater mean total body percent lean mass, albeit only the latter was significant (P<0.001). Runners also had 14% greater trunk lean mass. Moreover, runners had lower total body (8.6%) (58%) (52%), trunk (73%), android (91%) and gynoid fat mass (64%). No differences were observed between groups for BMD outcomes. No between-group differences in multifidus size were observed.

CONCLUSIONS: Middle-aged long-term male runners exhibit lower total body fat percentage and healthier fat storage distribution, but no different BMD compared sex-, age-, height- and weight-matched non-running participants. Other than cardiovascular benefits, long-term endurance running seems to also provide structural benefits.

**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/BS, 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 athletes selected for long-duration missions.

This work is supported by the Translational Research Institute for Space Health through Cooperative Agreement NNX16AO69A.

**RESULTS**

Researchers had 4.4 kg greater mean total body lean mass than controls, which equated to 10 percentage points greater mean total body percent lean mass, albeit only the latter was significant (P<0.001).

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**CONCLUSION**

The comparison of bone mineral density (BMD) across sport-specific athletes has not yet been made. Soccer players, who engage in odd-impact loading, have greater BMD in the regions most susceptible to injury compared to sports that do not combine power and odd-impact loading. Power lifting can improve total body bone mineral density (BMD), but improvements in the regions most susceptible to injury (femoral neck and lumbar vertebrae) have not been demonstrated. Soccer players, who engage in odd-impact loading, have greater BMD at the femoral neck than sedentary controls. Olympic lifting involves both high- and odd-impact loading at the femoral neck and lumbar regions, but comparisons in BMD across sport-specific athletes have not yet been made.

**Purpose:** The purpose of this study was to compare the bone mineral density (BMD) across different sports and body composition measures using total body DXA scans.

**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 (1.27 ± 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.

**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/BS, 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).

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CONCLUSIONS: Middle-aged long-term male runners exhibit lower total body fat percentage and healthier fat storage distribution, but no different BMD compared sex-, age-, height- and weight-matched non-running participants. Other than cardiovascular benefits, long-term endurance running seems to also provide structural benefits.
A total of 41 women (38.90 ± 7.92 years) were included in this study. Anthropometric data were collected and BMD 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 Utrasoundometer.

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 causality 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.

Purpose: 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 a group of calcium sufficient, a significant positive correlation (p < .05) was found between lumbar spine BMD and dietary cholesterol intake (r = -.41, p = .020) even after controlling for dietary protein intake (r = -.41, p = .020). A significant positive correlation (p = .03) was found between femoral neck BMD and saturated fat intake (r = .37, p = .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 = 9.03, p = .014). 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. IRB# 1213-0223
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 methods. 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 (bPAQ) of average 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 = -0.387, p = 0.002), TH (r = -0.458, p = 0.001), and lumbar spine (r = -0.299, p = 0.034) in young women, while controlling for bPAQ and BMI. Similarly, FN (r = -0.453, p = 0.001), TH (r = -0.425, p = 0.001), and lumbar spine (r = -0.291, p = 0.034) were found in young men. In addition, higher %BF had a negative impact on isotonic hand grip strength in both women (r = -0.446, p = 0.001) and men (r = -0.410, p = 0.002), 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 US 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 smokers 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 recruits, 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 -9% decrease following TRT only. Circulating IGFBP-1 (P = 0.0001) in both TRT+RT (1764±665 to 2548±583 ng/ml) and TRT (1918±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.
Autism Spectrum Disorder (ASD) is a neurological disorder characterized by impaired social interaction and atypical behaviors. Children with ASD appear to have weaker muscular function and low bone mineral density. Recent studies have indicated that adolescents with ASD develop obesity and bone fracture incidence at a higher rate compared to typically developing peers (TDC). Limited information is available to identify levels of obesity and its relation to muscular function and body composition in children with ASD before they start puberty.

**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 forearm 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 composition.

**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 ±1.8 TDC, 32.9 ±3.84 ASD, %) and percent lean body mass (2.5 TDC, kg). There is a significant inverse relationship with muscular strength and 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.

**CONCLUSION:** These findings suggest that body composition appeared to influence muscular strength in children with ASD. Less regional fat and higher bone mass rather than the total body fat may contribute for higher leg or forearm muscular strength in children with ASD.
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 1200 visit. However, 6/17 subjects did not recover to the same degree after the placebo. This difference in force recovery between high (1200) dose and placebo was significant with p<0.03. Muscle recovery correlations with depression and QOL differed between 1200 vs. Placebo (0.35 vs. -0.44, p=0.03 and -0.09 vs. 0.67, p=0.03, respectively).

CONCLUSIONS: PBMT at 1200 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

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**Board #154**

**May 27 10:30 AM - 12:00 PM**

**Effect Of Longterm Resistance Training On Bone Mineral Density, Muscular Strength, And Balance In Cerebral Palsy**

Victoria B. Kott, Gabrielle R. Trakhter, Alex R. Magana, Tiffany N. Racynski, Ramon C. Ronquillo, Areum K. Jensen. San Jose State University, San Jose, CA.

(No relevant relationships reported)

Cerebral Palsy (CP) is a non-progressive neurological disorder caused by lesions in the brain leading to musculoskeletal dysfunction and immobility. Physical deconditioning in individuals with CP appears to accelerate muscle atrophy and osteoporosis; thus, adults with CP are more prone to fall and fracture. Balance is also related to the higher risk of fall in the general public, and resistance training is known to improve bone mineral density (BMD), muscular strength, followed by balance. However, equivocal results were reported whether resistance training has a positive effect on BMD, muscular function and balance in CP population.

Purpose: To determine the influence of long-term resistance training to BMD, muscular strength, and balance in adults with CP who have muscle atrophy and/or osteoporosis.

Methods: 26 adults with and without CP were tested before and after resistance training twice a week for one year. Dual-energy X-ray absorptiometry was used to measure local BMD at the lumbar spine, proximal femur, and radial/ulnar regions. Muscular strength (torque, work, and power) from the lower extremity was assessed at 90, 150, and 210 °sec using the Humac Norm Isokinetic Dynamometer. The handgrip dynamometer was used for maximal isometric contraction. Balance was measured from the Berg Balance Test, and limits of stability test using the Biodex Balance System.

Results: After one year of resistance training, the CP group showed a significant improvement in BMD compared to before training (BMD at femoral neck: 0.63±0.09 vs. 0.75±0.08 g/cm²; p=0.001); however, they did not show statistical differences in improvement in BMD compared to before training (BMD at femoral neck: 0.63±0.08 vs. 0.63±0.09 g/cm²; p=0.44) or limits of stability test (e.g. overall score (32±5 vs. 31±2)). However, after training, CP participants who exhibited greater BMD appeared to develop greater muscular strength followed by improved balance.

Conclusion: These findings suggest that long-term resistance training significantly improved BMD in CP adults without a dramatic improvement in muscular strength or balance. In addition, BMD appeared to play a role in enhanced muscular strength and improved BMD in CP adults without a dramatic improvement in muscular strength or balance.

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**Board #156**

**May 27 10:30 AM - 12:00 PM**

**A Single-site, Retrospective Review Of Clinical Complications From Ultrasound-guided Tendon Scraping Procedures**

Patrick J. Shaeffer, Stephanie C. Clark, Jacob L. Sellen, Jay Smith, Jonathan T. Finnoff, FACSM. Mayo Clinic, Rochester, MN.

(No relevant relationships reported)

Purpose: To evaluate the safety of ultrasound-guided tendon scraping procedures performed at a single center. Methods: This was a single center, retrospective chart review. Following Institutional Review Board approval, all tendon scraping procedures performed by three investigators (JFT, JLS, JS) from January 1, 2011 to September 1, 2018 were identified using the physicians’ procedure logs and by searching the electronic medical record with the term “tendon scraping.” Patient charts were reviewed to search for procedural complications and comorbidities. Results: Fifty-eight tendon scraping procedures performed on 48 people were included in the study. The average age and body mass index were 44.5 (17 to 69) and 28.15 kg/m² (22.33 to 45.36 kg/m²), respectively. There were 29 (60%) males and 19 (40%) females. No complications were reported in the 51 (88%) procedures with follow-up. Procedure location included 25 (43%) patellar tendons, 16 (28%) mid-patellar Achilles-tendons, 14 (24%) insertional-Achilles-tendons, and 3 (5%) elbow common extensor tendons. Thirty (52%) procedures were performed on the right and 28 (48%) on the left. Seven (12%) procedures were performed using sterile gloves, sterile ultrasound gel, and sterile ultrasound transducer cover, while 51 (88%) were performed using the same plus a gown, cap, and mask. Comorbidities included hypertension (9 [19%]), hyperlipidemia (7 [15%]), unknown (5 [10%]), hypothyroidism (4 [8%]), migraines (4 [8%]), depression (3 [6%]), anxiety (2 [4%]), fibromyalgia (2 [4%]), obstructive sleep apnea (2 [4%]), tobacco use (1 [2%]), diabetes mellitus (1 [2%]), chronic obstructive pulmonary disease (1 [2%]), non-alcoholic steatohepatitis (1 [2%]), coronary artery disease (1 [2%]), peripheral neuropathy (1 [2%]), undifferentiated connective tissue

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**A-45**

**Free Communication/Poster - Imaging and Assessment in Skeletal Muscle, Bone, and Connective Tissue**

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

**Room: CC-Exhibit Hall**

**Board #155**

**May 27 10:30 AM - 12:00 PM**

**Six Months’ Rehabilitation Exercise Affects Lower And Higher Muscle Echo Intensity In Elderly Individuals**

Akito Yoshiko1, Takashi Kaji2, Takayuki Sawazaki1, Hiroshi Akima1. 1Chukyo University, Toyota, Japan. 2Kajinkoki Medical Clinic, Gifu, Japan. Nagoya University, Nagoya, Japan. (Sponsor: Katsumi ASANO, FACSM)

(No relevant relationships reported)

Muscle echo intensity (EI) reflects the content of fat and connective tissue within a skeletal muscle. Muscle EI becomes higher with aging and/or inactivity caused by increase of fat and connective tissues, and eventually it may induce lower muscle strength. We have previously reported that the EI improved after a few months’ resistance and endurance training in elderly individuals. This result would be led by decreasing of fat and connective tissues (i.e. decrease higher EI area) and/or increasing of contractive muscle tissue (i.e. increase lower EI area); however, it is not well understood how the muscle EI change by several months rehabilitation exercise.

Purpose: The purpose of this study was to investigate the effects of 6 months rehabilitation exercise on gradation-based muscle EI area in elderly men and women.

Methods: Five men and women (2 men and 3 women; age, 75 ± 5 years; height, 156.4 ± 4 cm; weight, 53 ± 9 kg) participated in this study. They performed rehabilitation exercises consisting of resistance exercises, stretching, and aerobic exercises once or twice a week for 6 months because they needed long-term care during a part of daily living. B-mode ultrasonographic transverse image was taken from rectus femoris. To obtain EI, region of interest (ROI) was set on rectus femoris as large as possible exclude fascia. Average muscle EI, which was shown by 256 gray scale level, was measured within a ROI. We also calculated cross-sectional area based on 256 grey scale level divided into 6 different components (e.g. 0-49, 50-99, 100-149, 150-199, 200-249 and 250-256 a.u.).

Results: Average EI decreased after six months exercise (72.70 ± 7.55 vs. 53.50 ± 15.51 a.u.; p < 0.05). Lower ranged EI area was significantly increased after the exercise (0-49: 1.13 ± 0.88 vs. 1.93 ± 1.00 cm²; p < 0.05). Middle to higher ranged EI areas were significantly decreased after the exercise (100-149; 0.44 ± 0.20 vs. 0.24 ± 0.15 cm², 150-199; 0.08 ± 0.05 vs. 0.03 ± 0.04 cm², p < 0.05).

Conclusions: Six months rehabilitation exercise improved muscle EI in elderly men and women. This result might be induced by decreasing fat and connective tissues and increasing contractile muscle tissue.
disorder (1%), Sjögren’s syndrome (1%), hyperparathyroidism (1%), and HIV (1%). Conclusion: This study suggests that tendon scraping is a safe procedure. While we were unable to perform a sub-analysis to determine if there was an association between comorbid factors and increased complication rates, there were no complications reported in this study despite the presence of multiple comorbidities.

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 condition. 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 (penetration 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 penetration 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 penetration angle and muscle thickness values. Muscle strength was assessed with using digital hand-held dynamometer.

RESULTS: Penetration angles of RF, BF, TA were lower in MS patients (respectively, p=0.042, 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 novel and efficient loading models in related muscles.

The flexor muscles of the forearm are repeatedly found to be the rate limiting factor related to muscle strength in many pathological condition. However, there is no pathology of core muscles. A new ultrasound technique, panoramic imaging, could be used to visualize the whole length of the muscle in one image. The purpose of this study is 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, and 73% of the thigh were taken on the vastus medialis, vastus lateralis, and 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 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 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.

Quantification of muscle size can enhance assessment of musculoskeletal conditions in both clinical and research settings. Magnetic resonance imaging (MRI) is often considered a gold standard for assessing muscle morphology, while ultrasound imaging (US) is gaining recognition for its utility in musculoskeletal imaging. In the lower leg and foot, there is a need to validate US based assessment of muscle size compared to MRI in musculoskeletal imaging.

Purpose: To validate muscle size measured from US images compared to images captured using MRI.

Methods: Eighteen people (female n = 10, age = 31 ± 15 y, ht = 176 ± 11 cm, wt = 76 ± 18 kg) had their leg muscle size of the tibialis anterior (TA), tibialis posterior (TP), flexor digitorum longus (FDL), and fibularis brevis (FB) assessed at the 50% point along the same line. Cross sectional area (CSA) was manually traced from two separate US and MRI images for each muscle and averages were calculated. Statistical analysis included comparison of MRI and US measures using the Pearson product correlation.

RESULTS: CSAs from MRI were larger than those measured from US by 0.90, p=0.003; TP r = 0.94, p=0.000; FL r = 0.97, p=0.000; FDL r = 0.86, p=0.000; FB r = 0.94, p=0.000. CSAs from MRI were larger than those measured from US by an average of 0.17 cm². Muscle CSA measurements from US appear to provide valid assessment of leg muscle size and may be used in clinical and research settings to quantify muscle morphology.

CONCLUSION: SF analysis successfully detected differences between injured and unjured 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 UL1TR002373 and TL1TR002375.
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. The purpose of this study was to investigate the whole muscle mechanical characteristics (stiffness; ST, elasticity; EL, and mechanical stress relaxation time; MSRT) as assessed by myotonometry (FT) and used for statistical analysis of each variable. Pearson product-moment correlation coefficients were used to determine the relationship between EI, FT, and ST (r = 0.81, p = 0.003). RESULTS: A significant, strong, negative correlation for FT, and ST (r = -0.76; R² = 0.457; p = 0.032) were observed. There were no significant correlations between FT, EI, EL, and MSRT (p<0.05). CONCLUSION: These findings indicate that a greater FT may contribute to improved compliance of the Achilles tendon; subsequently increasing relaxation time following mechanical oscillation. Taken together, isolation of structural and mechanical characteristics may provide a greater understanding of the viscoelastic characteristics of the FT.

Lateral abdominal muscles play a significant role in trunk control and rotation during baseball batting. Repetitive and unidirectional baseball batting could lead to asymmetric hyperlaxity 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 determined 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 non-dominant side than in the 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.

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

METHODS: Nine male subjects (20.0 ± 0.8 yrs, 175.4 ± 2.4 cm, 65.2 ± 6.3 kg) performed isoinertic (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.
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 unilateral 22-cuff occlusion method, this protocol enabled twice as many replicates 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-1-2-deoxuridine (EdU) injection. 7d after ACL-T, quadriceps muscle was harvested from injured and uninjured limbs. Immunoblotting measured myostatin signaling, and immunohistochemical techniques assessed morphological changes. 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 (Tcf4+/mm²: 45%, p=0.08; Tcf4+/mm², p<0.01). Fibroblast proliferation (215%, p=0.02). Extracellular matrix (ECM) content increased 53% (p=0.03), along with a 31% increase in fiber cross sectional area (CSA) (134 ± 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.

**Background:** Many individuals with end-stage osteoarthritis undergo elective total hip or knee arthroplasty (THA/TKA) to improve mobility 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 (MuIS+), an overt pro-inflammatory state localized to skeletal muscle surrounding the diseased joint, found in some but not all TKA/THA patients. PURPOSE: We are interrogating the hypotheses that a) MuIS+ status will result in a differential perioperative myogenesis profile that may partially explain low functional outcomes, and b) resistance training rehabilitation will more effectively overcome MuIS+ 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 MuIS+ status (+) based on surgical (SX) muscle gene expression of F14 which drives pro-inflammatory signaling via NFκB. MuIS+ 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 MuIS+ (n=14, ~4-fold greater F14 mRNA) or MuIS− (n=23). SX thigh muscle mass (TMM), quadriceps 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 MuIS+ respectively (P<0.05). Tumor necrosis factor-α receptor and IL-6 trended higher in MuIS+ (P=0.05). Phosphorylated h-RPS6 was lower in the SX leg and 4E-BP1 was significantly lower in MuIS+ (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. MuIS+ leads to greater inflammation and blunted anabolic signaling, highlighting the profound impact of muscle inflammation and emphasizing the potential value in perioperative MuIS assessment to inform optimal post-surgical care. Grant: R01HD104124

**Table 1. Elevated myostatin signaling mediates ECM accumulation and myofiber atrophy in quadriceps muscle 7 days after ACL transection.**

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<thead>
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<th>myostatin</th>
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**References:**


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 transactions 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 ± 3.6 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 larger load values than the Control group (59.0 ± 2.7% and 53.3 ±12.1% for the Training and 52.4 ±12.1% 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 NSF 0850516.

The prevalence of Knee Osteoarthritis (KOA) is increasing, most of the kinesiotherapy is focus on improving the strength of knee muscles. However, the relationship between periarthritic muscle strength of Knee and Hip in KOA in old people remains unknown.

**PURPOSE:** To explore the relationship between periarthritic muscle strength of Knee and Hip. **METHODS:** Forty patients with Knee Osteoarthritis (24females and 16males, Age:55.3±7.05years) were enrolled in the study. The Isomed-2000 dynamometer was adopted to measure the peak torque/body weight (PT/BW) and peak work/body weight (PW/BW) of knee and hip at 60°·s⁻¹ and 180°·s⁻¹, respectively. **RESULTS:** Correlation Analysis and multiple regression analysis were used to measure the muscle strength between knee flexors-extensors and hip flexor-extensor, adductor-abductor. **RESULTS:** Pearson Correlation Analysis showed that in the case of 60°·s⁻¹ and 180°·s⁻¹, the results of Isokinetic muscle strength of flexion and extension knee were correlated with the results of PT/BW and PW/BW of flexion and extension hip, adduction and abduction hip in most cases (p < 0.05). Multiple regression analysis showed that there was a positive linear relationship between knee flexor, extensor and hip flexor PT/BW at 60°·s⁻¹ and 180°·s⁻¹. pearson correlation (r=0.6, p<0.05) and a positive linear relationship between knee flexors and hip extensors (r=2.77, p<0.05). The knee flexors and hip flexors. Therefore, Practitioners with KOA should not only focus on the function of the knee muscles, but also the use of the muscles around the hip joints.
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 of ≥ 5/9. 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.

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

METHODS: Three hundred and thirty undergraduate students (age 19.24 ± 2.07 yrs) enrolled in AP1 classes completed the Beighton score, including measures of elbow hypermobility. Ultrasound images of the participants' ulnar collateral ligament were obtained in both arms under gravity induced valgus force in supine.

RESULTS: Overall, 48 of 330 participants (14.6%) reported generalized joint hypermobility (GJH) as defined on a Beighton score ≥ 5/9. 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.

CONCLUSION: There was no difference in the 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 < .04; r = .432, 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; t(251) = .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.

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Carpal tunnel syndrome (CTS) is a common peripheral neuropathy of the upper extremity. Open release surgery for CTS may affect post-operative functional capacity of the operated hand. PURPOSE: This pilot study examined the effects of a progressive strength training program of the forearm flexors and extensors on functional and clinical parameters after open carpal tunnel release (OCTR). METHODS: Sixty-three participants having SIS with GIRD were randomly divided into three groups. Isolytic Stretching Group (ISG) and Static Stretching Group (SSG) received usual physical therapy care, followed a 9-week strength training program of the wrist flexors/extensors (3 sets of 10 reps, 4 days/week) started 3 weeks after surgery. Hand grip strength (HGS Test), hand pinch strength (HPS Test) and sensibility (Two-point Discrimination Test-TPDT) were assessed before and 3, 6 and 12 weeks after surgery, while load for strength training was set at 2% of the maximal grip strength and was readjusted accordingly during the experimental period. Patients also completed the Boston Carpal Tunnel Questionnaire (BCTQ) before and 12 weeks after surgery. Two-way ANOVA was used for statistics and data are presented as mean±SE.

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: 28.7±6.4 kg), HPS (IG: 7.1±4.4 kg, CG: 8.8±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 tendon 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 ULI TR002377.

**PURPOSE**: Ankle proprioception plays a crucial role in balance control. Previous research indicates that individuals with chronic nonspecific low back pain (CNLBP) rely more on ankle than lumbar proprioception in maintaining balance compared to controls. This study aimed to explore if individuals with CNLBP demonstrated any difference in ankle proprioception compared to healthy controls.

**METHODS**: Twenty-six participants with no ankle injuries in the last 3 months volunteered in this case-control study. Thirteen CNLBP participants (9 females, age 29.3±9.6yrs old) and 13 were healthy controls (6 Female, age 25.8±8.2yrs old). The Örebro Musculoskeletal Pain Questionnaire (OMPQ) and the Oswestry Disability Index (ODI) were administered for the CNLBP group. Left and right ankle proprioception was assessed by using the Active Movement Extent Discrimination Apparatus (AMEDA) in standing. To assess ankle proprioception, participants were required to actively invert their ankles to a physical stop and to discriminate between 4 possible ankle inversion angles (10°, 12°, 14° and 16°). The receiver operating characteristic curve (ROC) was generated and the mean Area under the ROC Curve (AUC) was calculated to give each participant an ankle proprioceptive acuity score.

**RESULTS**: The mean proprioceptive discrimination AUC scores for CNLBP and healthy controls were 0.756±0.361 and 0.793±0.04. CNLBP participants demonstrated significantly worse proprioception than healthy controls (p=0.02, 95%CI=[61.70%-89.4%]). In healthy controls, there is significant and strong correlation between left and right ankle proprioception (r=0.747, p<0.003), but not significant in the CNLBP group (r=0.139, p=0.650).

**CONCLUSION**: The findings of the present study confirm that the ankle proprioception is impaired in individuals with CNLBP. In addition, a common motor program may be used to bilateral ankle movement control in healthy people that demonstrate impairment in people with CNLBP. These findings provide a possible explanation for impaired balance in individuals with CNLBP and may have implications for physiotherapy intervention.

**366**  Board #182  May 27 10:30 AM - 12:00 PM  Genetic Predisposition Related To Overuse Injuries In Athletes: Genome-wide Association Study In Estonian Elite Athletes.

Agnes Maegi,1 Sulev Küks2, Ele Prans3, Eve Umm1, Maie Talim1. 1Tartu University Hospital, Tartu, Estonia. 2The Perron Institute for Neurological and Translational Science, Perth, Australia. 3University of Tartu, Tartu, Estonia. 4Tartu University Hospital, University of Tartu, Tartu, Estonia.

**Purpose**: To identify potential loci (chromosomal regions) that are associated with the tendinopathy of Achilles and patellar tendons.

**Methods**: Study group consisted of 121 elite athletes (21 females and 100 males), current and former Estonian national team members, in the age range 27.5±5.1 years, involved in 16 different sports. The case group (n=42) consisted of athletes with patellar and Achilles tendinopathies, and the control group (n=79) was formed by athletes without these injuries. The electronic health record system was used to find

Injuries in sports are the most common causes where athletes are forced to change their training plans temporarily, or more, to interrupt trainings and competitions for a certain time. Several genome-wide association studies have concluded that variations in DNA sequence interacting with non-genetic risk factors may play an important role in the etiology of injuries, including overuse injuries.

**Purpose**: To identify potential loci (chromosomal regions) that are associated with the tendinopathy of Achilles and patellar tendons.

**Methods**: Study group consisted of 121 elite athletes (21 females and 100 males), current and former Estonian national team members, in the age range 27.5±5.1 years, involved in 16 different sports. The case group (n=42) consisted of athletes with patellar and Achilles tendinopathies, and the control group (n=79) was formed by athletes without these injuries. The electronic health record system was used to find
Insufficient recovery of quadriceps muscle strength is commonly reported after acute ACL injury. As measured by the IPAQ and NASA physical activity scales. 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). 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. Methods: Twenty college students (8 males and 12 females, age=21.2 ± 2.4yr., 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 ± 2.8yr., mass=79.0±20.2kg, ht=172.5±5.9cm) 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 talar body. All measurements were 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 posterior-injury ATFL thickness and both the IPAQ and
NASC physical activity scales. As ligament thickness increased, “average time spent performing vigorous physical activity” significantly decreased (p=0.04, r2=-.86) and “average time spent performing moderate physical activity” (p=0.02, r2=-.84) also decreased one year after injury. As ligament thickness increased in subjects with a LAS, time spent walking (p=0.01, r2=-.92), days per week where vigorous activity (p=0.02, r2=-.81) or moderate activity (p=0.04 r2=-.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.

Females are three times more susceptible to tear their anterior cruciate ligament (ACL) and have significantly weaker quadriceps after injury. Despite the high frequency of injury, little is known about whether the morphology of the quadriceps alters in a sex specific manner. Muscle imaging of volume, fibrosis, pennation angle, and fiber tract length could provide valuable insights into these differences. Purpose: To investigate sex differences in morphology of the vastus lateralis (VL) after ACL injury.

Methods: 24 ACL deficient patients (11M, 13F, 2:8 ± 5.0, 25.0 ± 3.7 kg/m2, days since injury 24:6 ± 16:2) underwent magnetic resonance imaging including multi echo T1, DTI, and 2D turbo spin echo. Data was post-processed in MATLAB, where a mono exponential decay curve was fitted to analyze the T1 signal. Fiber muscle bundles were tracked by taking the first eigenvector of diffusion tensor starting at the aponeurosis until the fiber exited the side or top of the selected slices. From these tracks pennation angle and fiber length were calculated. Muscle volume was calculated by manually outlining the border of the VL. Independent t-tests compared differences between males and females.

Results: T1 times (M: 0.031 ± 0.003 s; F: 0.028 ± 0.002 s, p = 0.06) and pennation angle (M: 16.6 ± 2.6°; F: 14.9 ± 1.8°) of the involved limb was not significantly different between sexes; however, fiber length was significantly longer in females compared to males (F: 55.1 ± 6.2 mm; M: 48.3 ± 7.0 mm; p = 0.04). Volume of the vastus lateralis was not significantly different between sexes (M: 355.1 ± 117.5 cm3; F: 339.5 ± 97.1 cm3; p = 0.6). Conclusions: We show that ACL injury results in a sex specific difference in muscle fiber length. Fiber length is an important determinant in physiological cross-sectional area (PCSA). The longer fiber lengths seen in the females may lead to decreased PCSA which could have a negative influence on quadriceps muscle strength. Potentially, this longer fiber length prior to surgery may be one factor that drives differences in recovery of muscle strength after surgery. Future work is needed to examine how these morphological aspects change over time following ACL reconstruction.

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 a RA disease activity (DAS), physiologic, and biologic assessments pre- and post-10 weeks of supervised HIIT. Cardiopulmonary exercise testing measured CRF as VO2peak (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 Spearman correlations (p<0.05) assessed association of gene expression with DAS and ACRF (post - pre).

Results: HIIT improved RA DAS (r=23.8%; p<0.001) and CRF (r=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, NDUFS3, GLDC, AGL, BCKDH1, PDK2, LDHB, ACS52, PANK2) and inflammatory pathways (n=4; FCR1L6, TNFSF15, CMTM4, NGK7). In contrast, ΔCRF was strongly correlated with baseline expression of 16 genes; only one (NDUFB4) involved in cellular metabolism and 6 in inflammation. Novel network analysis revealed muscle upregulation of NF-κB 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 metabolism and pathways. Thus, exercise training may improve RA inflammation via coordinated regulation of muscle and immune cell energy metabolism.

CONCLUSIONS: We show that ACL injury is associated with greater estrogen levels. Estrogen increases knee laxity, in part by binding 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 GNRR knee arthrometer (Prothria, Worcester, MA) at menstruation and ovulation during baseline (month 1&2) and intervention phases (month 3). The first estrogen-blinded manner, from month 3 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, n=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.
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-Forrest5, Tishya Wren1. 1Children’s Hospital Los Angeles, Los Angeles, CA. 2University of Southern California, Los Angeles, CA. 3University of Miami, Miami, FL. 4University of California, Irvine, CA. 5University of Miami, Miami, FL. (No relevant relationships reported)

Purpose: Visual impairments affect up to 90% of patients post-concussion and may include deficits in fixation accuracy, smooth pursuit, saccadic latencies, vergence, accommodation, or vestibulo-ocular reflexes. Quantitative assessment of oculomotor function may provide a sensitive measure of concussion recovery since coordinated eye movements require the use of diverse and widely dispersed areas of the brain. This study quantified oculomotor function over time in adolescents following concussion, hypothesizing that initial deficits would resolve by the time of RTP and remain stable after RTP.

Methods: 13 adolescent athletes with mild to moderate concussion (7 male; mean age 15.1, SD 2.1, range 10-17 years) were prospectively evaluated at their initial visit (mean 18, range 4-43 days post-concussion), at the time of RTP clearance (mean 46, range 12-173 days post-concussion), and one month later (mean 26, range 20-41 days after RTP). 11 controls without past concussion or injury (3 male; mean age 12.3, SD 3.1, range 8-17 years) were tested at similar time points. Eye tracking was recorded as subjects followed a target moving on a screen in predefined patterns related to sinusoid and trapezoid smooth pursuit, vergence, saccade, and anti-saccade. Metrics characterizing the speed, accuracy, and variability of tracking were compared between groups and visits using t-tests and linear mixed-effects regression.

Results: At baseline, patients tended to have greater overshoot and greater variability in tracking compared with controls, though the differences were not statistically significant. Overshoot (coef -1.97, SE 0.98, p=0.045), variability of overshoot (-2.10, SE 1.02, p=0.013), and variability of shake (-2.59, SE 1.04, p=0.013) decreased from baseline to RTP. Understress during sinusoid smooth pursuit tended to decrease from RTP to 1-month follow-up (-0.16, SE 0.09, p=0.080). The rate of convergence in the distance vergence task increased (0.27, SE 0.10, p=0.005) while the rate of divergence decreased (-0.32, SE 0.17, p=0.068) between these time points.

Conclusion: Possible deficits in eye tracking resolved by the time of RTP and generally remained stable or continued improving after RTP, suggesting that oculomotor function recovers sufficiently under current conservative treatment protocols.

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

A-47 Free Communication/Poster - Ankle  Wednesday, May 27, 2020, 9:30 AM - 12:00 PM  Room: CC-Exhibit Hall

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 Kim2, Ty Hopkins, FACSM. 1Brigham Young University, Provo, UT. 2Cha University, Seongnam, Korea, Republic of. 3University of Westminster, University West, Chester, PA. (Sponsor: J Ty Hopkins, FACSM) Email: hyunwook.lee31@gmail.com (No relevant relationships reported)

Chronic ankle instability (CAI) patients have demonstrated impairments of the sensorimotor system. The sensorimotor system plays an important role in steadily generating fine forces to control balance and functional movement. Submaximal force steadiness measures sensory, motor, and visual function via feedback mechanisms, which helps researchers and clinicians to comprehend sensorimotor deficits associated with CAI.

PURPOSE: This study aimed to identify effects of stroboscopic glasses on force steadiness and accuracy among CAI patients, ankle sprain copers, and healthy controls.

METHODS: Twenty CAI patients (M=10, F=10; 23±3 yrs, 174±11 cm, 76±17), 20 copers (M=10, F=10; 22±3 yrs, 176±10 cm, 69±10 kg), and 20 controls (M=10, F=10; 22±3 yrs, 174±7 cm, 80±24 kg) participated in this study. Subjects performed a maximal voluntary isometric contraction (MVIC) of six 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% MVIC 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% 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 LASs (CAI) altered reliance on visual input.

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 (No relevant relationships reported)

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=.035) 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=.0001) 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.

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 Albar Almazán2, Mariola Estudillo-Martínez2, David Cruz-Diaz2. 1University of Miami, Miami, FL. 2University of Jaén, Jaén, Spain. 3Midwestern State University, Wichita Falls, TX. Email: kmk154@miami.edu (No relevant relationships reported)

Stroscopic Vision (SV) is characterized by intermittent visual obstruction via the use of goggles with lenses that can switch between opaque and transparent. Incorporating SV into physical training has been shown to induce more significant improvements in sports and medial fields. Given SV that has the potential to improve balance further, it may be effective to restore balance deficits in patients with chronic ankle instability (CAI). PURPOSE: To determine the efficacy of SV incorporated into balance training for CAI.

METHODS: A total of 73 CAI patients were randomly assigned to one of 3 groups: balance training (BT, n=25), BT with SV (BTSV, n=24), and control (no intervention, n=24). BT consisted of progressive balance exercises (e.g., single-leg support to cope with sudden perturbation. In addition, KT improved perception stability and comfort, whereas AT improved perception stability but provided the least comfort.

ACSM May 26 – May 30, 2020
San Francisco, California
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:** Thirty-four individuals: 17 CAI (10 F/7 M; age = 21.06 ± 3.19 yr; height = 172 ± 6 cm; weight = 67.5 ± 14.9 kg), 20 coper (10M, 10F; age = 23 ± 4 yr; height = 174 ± 10.2 cm; weight = 69 ± 8.9 kg), and 20 control (10M, 10F; age = 22.6 ± 2.7 yr; height = 174.4 ± 7.2 cm; weight = 80 ± 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-hold 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 × condition) were used to examine the differences between condition (EO, SV) and group (CAI, coper, control). **RESULTS:** Visual condition main effect was driven by differences between EO and SV during dynamic postural control (p < 0.001). Only CAI patients displayed altered DPSI scores between EO and SV (p < 0.005). However, no differences were observed in copers (p = 0.31) and controls (p = 0.99). Regardless of visual condition, CAI patients displayed dynamic postural control deficits relative to controls (p < 0.001) but no differences between CAI patients and copers (p = 0.45). For the directional stability indices, each group displayed no statistically significant interaction (p > 0.01) for the PL reach direction without VE (CAI: 70.43 ± 4.52 vs Healthy: 71.77 ± 5.10 and PM: CAI: 85.41 ± 7.19 vs Healthy: 86.45 ± 8.71). 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), Postero medial (PM), and Postero lateral (PL) reach distances. FABQ was compared between the CAI and Healthy groups using a t-test; all alpha levels were < 0.05 a priori. **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 stressors have on functional performance in patients with pathologies such as CAI.
proprioception between male and female in follicular cycle. METHODS: Twenty-four healthy college student (male: n=12, age: 23.08±1.8 years; height: 1.73±0.07m; weight: 79.83±12.96kg; 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 times 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=1.00) 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.

### 384 Board #200 May 27 9:30 AM - 11:00 AM
**Attitude Training Mask Alters Ankle Joint Kinetics During Treadmill Walking**
Douglas W. Powell, FACSM^1, Alexis K. Nelson^2, Jay Hinton^2, Hailey B. Fong^2, Aaron Persinger^1, Melissa J. Puppia^2.
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(No relevant relationships reported)

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 performance in elevation training masks, little data is available regarding the effect of elevation training masks on lower extremity joint biomechanics during an exercise task. PURPOSE: to determine the effects of an altitude 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 mechanical adaptation occurred in response to the 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>Moment</th>
<th>Power</th>
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<tr>
<td></td>
<td>M2</td>
<td>M10</td>
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<tr>
<td>CON</td>
<td>-1.24 (0.32)</td>
<td>-1.25 (0.34)</td>
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<tr>
<td>RI</td>
<td>-1.25 (0.35)</td>
<td>-1.31 (0.35)</td>
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### 385 Board #201 May 27 9:30 AM - 11:00 AM
**Influence Of Ankle Flexibility On The Single Leg Balance Test Using A Dynamic Balance System**
Anna Blackley, Maggie McDermott, Moroni de Moors, Abigail McCarty, David Titecomb, Jared Horsey, James Schoffstall, FACSM. *Liberty University, Lynchburg, VA.* (Sponsor: James Schoffstall, FACSM)

Email: ablackley1@liberty.edu

(No relevant relationships reported)

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 ± 7.3 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 task for each leg. The dependent t test was used to compare differences between the 20 Pearson Correlation and Independent T-test were utilized. RESULTS: No significant correlations between overall stability and dorsiflexion (p = 0.899), plantarflexion (p = 0.790), eversion (p = 0.704), and inversion (p = 0.550) on the left and right ankle were present (p = 0.05). However, there was a significant correlation between inversion of the left ankle and medial/lateral SI (p = 0.022), and between dorsiflexion of the left ankle and anterior/posterior SI (p = 0.049). No significant differences for ankle flexibility or SI occurred between unfit and fit individuals (p < 0.05). CONCLUSION: Results suggest ankle ROM may be a contributing factor in dynamic balance on the non-dominant leg.

### 386 Board #202 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^1, Kimberly Migliarese^1, Thomas Wagon^1, Kristen Jagger^1, Adrian Aron^1, Stephen Glass^1, Brent Harper^1, Rajford University, Roanoke, VA. ^2Regis University, Denver, CO. ^3Chapman University, Irvine, CA. (Sponsor: Trent Hargens, FACSM)

(No relevant relationships reported)

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 neuromotor or fear-avoidance mechanisms. The purpose of this study was to explore the contribution of perception of unilateral and bilateral CAI on dynamic balance. METHODS: Subjects were males and females 18-35 years old (n=25, age: 23.8 ± 1.8y). 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 by 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<0.007) and between CAIT scores and postero-medial reach scores (r = 0.554, p<0.004). Significant differences were found between participants with the highest (n=5) and lowest (n=5) bilateral CAIT scores in right postero-medial reach (101.60 ± 9.91 vs 86.80 ± 5.89, p=0.02), right posterolateral reach (94.60 ± 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.

### 387 Board #203 May 27 9:30 AM - 11:00 AM
**Static Platform Model Evaluation For Study Of Sudden Ankle Movement**
Leandro Santos, Júlia Greve, Angélica Alonso, Raul Bolliger, César Augusto. *Universidade de São Paulo, São Paulo - SP, Brazil.*

Email: leandro.dias@usp.br

(No relevant relationships reported)

Ankle sprains are very common in sports and can cause joint instability with clinical and performance consequences. The sudden ankle inversion platform that simulates the sprain movement evaluates the movements performed associated with the electromyography of the fibular and anterior tibial muscles. The aim of this research is to develop a sudden ankle inversion platform limited to 15° medial rotation, 20° plantarflexion, 20° inversion, and to evaluate the mechanical sprain movement associated with the electromyographic response of the fibular and anterior tibial muscles of soccer players. METHODS: A total of 30 soccer players between 16 and 19 years
A-48 Free Communication/Poster - Biomechanics of Clinical Tests

Wednesday, May 27, 2020 - 9:30 AM - 11:00 PM
Room: CC-Exhibit Hall

389 Board #205 May 27 9:30 AM - 11:00 AM Correlations Between Dual-task Costs In Clinic Versus Laboratory Movements

Patrick D. Fischer, Sean M. Callahan, James N. Becker, Keith A. Hutchison, Scott M. Monfort. Montana State University, Bozeman, MT.
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(No relevant relationships reported)

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 ± 3yrs, 1.7 ± 0.1m, 64 ± 10kg) 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 (aDTC) 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 unexpected 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 computed between aDTC and bDTC (Figure 1).

RESULTS: Increases in aDTC 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>.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.
Board #206
May 27 9:30 AM - 11:00 AM
Relationships Between Feedforward And Feedback Movement Control Strategies And The Star Excursion Balance Test
Kristin A. Johnson. University of Iowa, Iowa City, IA.
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(No relevant relationships reported)

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 PM-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 PM-SEBT 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 (GMD), 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=0.011, R = -0.557), and LLR QH Ratio (Flexing: p=0.003, R = 0.548). 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.

Board #207
May 27 9:30 AM - 11:00 AM
Sex Differences In Lower Extremity Kinematics During Overhead And Single Leg Squat Tests
Peter Lismam, Joshua N. Wilder, Joshua Berenbach, James J. Foster, Bethany Essalhi. Towson University, Towson, MD.
Email: plismam@towson.edu
(No relevant relationships reported)

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 with a marker-less motion capture system.

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 OHS 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 determined.

RESULTS: Females produced higher muscle activity than males mostly for the PL (74±34 vs 42±22 %MVIC; P=0.02) directions of the OHS. On the SLS, females produced higher muscle activity than males across all directions (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=0.04) 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 OHS.

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 hop bridge (SLHB) and the single-leg wall-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 wall 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 ± 6.78 cm, and 76.86 ± 10.60 kg and 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 previous injury to the lower extremity, with 12% reporting previous injury to the ankle, 8% to the knee, and 7% to the hip. Of those who reported previous injuries, 74% reported previous injury as a result of a related sport. Of those who reported previous injury as a result of a related sport, 18% reported a history of anterior cruciate ligament (ACL) injury.

CONCLUSION: Previous injury to the lower extremity may not be as accurate when compared to individual technical flaws, and should be used with caution.

Dual-task (DT) tandem gait has been used as a viable, functional task of postural stability and cognitive changes following a sports-related concussion (SRC). Additionally, completing tasks that test cognitive abilities during DT, such as serial 7’s, is thought to capture cognitive changes. However, current methods of collecting DT information may not have sensitive psychometric properties. PURPOSE: The purpose of this study was to examine differences in time and errors in DT tandem gait testing between NCAA Division 1 athletes with and without SRC. METHODS: 13 Division I athletes with sports-related concussion (SRC): 6 males and 7 females, age=20±1) and 13 nearly-matched controls (CON: age=19±1) completed three trials of DT tandem gait testing using the Tekscan Strideway (100Hz, Boston, MA). All SRC participants had a medically-verified SRC and were assessed within 24-48 hours post-injury. All CON assessments were collected during pre-season. In the DT condition, all participants completed serial 7’s subtraction with random numbers between 50-100. Data collected for tandem gait trials included time to complete the walking task and number of errors emitted. RESULTS: Paired t-tests were used to assess the differences across the average time and errors across trials. Results indicate that the SRC group (M time=23.7±3.7 s) took significantly longer to complete DT compared to the CON group (M time=17.2±5.1 s, p=0.03, d=1.3). Total amount of errors emitted during the DT were not significantly different (SRC: M errors=1.3±1.6, CON: M errors =0.7±0.6, p=0.18, d=0.49). CONCLUSIONS: Only time in DT trials appears to be a viable method of discriminating between participants who experienced an SRC compared to those without SRC. This indicates that errors emitted during a serial 7’s task may not provide meaningful information regarding cognitive changes following SRC. Extant literature indicates that serial 7’s may be a favored task among researchers, however, alternative tasks may provide a more sensitive measure of cognitive changes. Future research should examine the use of alternative tasks, such as an auditory Stroop task, which may provide more clinically meaningful data.

Abstracts were prepared by the authors and printed as submitted.
dominant wrist 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-g 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) minutes per day of MVPA, 248 (81) 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 (p > .05 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 3 of the 7 days to be included analyses. Sedentary time was defined as any count <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 the 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 sedentary during the week was distributed across (1) time of day: 62.8% of morning, 62.5% of afternoon, and 63.2% of evening and (2) type of day: 64% weekdays and 62.9% of weekend days. Women took 76.8±17.6 breaks from sedentary behavior per day, each lasting 4.0±0.9 minutes. CONCLUSION: Emerging evidence suggests that sedentary behavior during pregnancy can have a negative impact on maternal and child outcomes. Our findings suggest that women in their third trimester, even while participating in a behavioral physical activity intervention, spent a majority of their waking hours engaged in sedentary behaviors. Interventions that address challenges commonly seen during the latter part of pregnancy (e.g., fatigue, body size, swelling, etc.) are needed to help reduce time spent sedentary. Increasing light intensity activity (vs. moderate intensity) may be an appropriate place to start.

Pregnancy represents a potent stimulus to the cardiovascular system, eliciting significant hemodynamic adaptations. The factors that mediate these adaptations are largely unknown; whilst habitual PA does not influence resting cardiac function during pregnancy, whether it influences the hemodynamic adaptations observed during exercise is unclear. PURPOSE: This study sought to determine whether PA during pregnancy influences the antenatal cardiac response to acute exercise, assessed via heart rate (HR) and stroke volume (SV).

METHODS: Twenty-three pregnant women participating in the ‘PE-CAMP’ randomized controlled trial underwent physiological assessment at 34-36 weeks gestation. HR and SV were continuously recorded using the Task Force Hemodynamic Monitor during rest (5-min), during exercise on a cycle-ergometer at a workload equivalent to 40-60% HR reserve (15-min), and during post-exercise recovery (20-min). Antenatal PA levels were assessed 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: Thirty one pregnant women were assessed for PA-2T and PA-3T. PA levels did not differ across 2T and 3T (p > .05) however, HR was significantly lower during PA-3T at rest (p < .05), and during recovery post-exercise (p < .05). Furthermore, PA-3T was a stronger predictor of HR during recovery (p < .05) compared to PA-2T (p > .05). CONCLUSION: Reduced PA during pregnancy is associated with lower HR and SV during recovery post-exercise. Further studies are needed to establish whether such an adaptation is a cardiac adaptation due to the pregnancy or a decrease in PA levels.

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, 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 = 0.036), the proportion of participants with low education level (25.42% vs 8.78%, p = 0.05), and over-weight or obese before pregnancy (38.90% vs 24.05%, p = 0.01), and during pregnancy (47.19%, p = 0.003) in GDM group was significantly higher. The area under the ROC curve was 0.82 (0.77-0.86) (P < 0.05) and the “optimal physical activity cut-off value” is 834 MET*min per week.

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

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±3.0years, ≤ 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,
T-spine mobility exercise, breathing exercises and inner core activation. Before and after the intervention, a pelvic floor bio-feedback test (PFBBT) was used to assess PFF, a Y-balance test (YBT) and a abdomen muscle endurance test (AMET) were used to assess the CS, and a 3-minute step test (ST) were used to assess the AC. During the YBT, values on three directions (A-anterior, PM-postermomedial, and PL-posterolateral) bilaterally were measured. And, during the AMET, three muscle groups (F: Flexor, E-Extensor and bilateral Flexor-LFL&LFR) were recorded. Paired t-tests were used to compare pre- and post-intervention values of all variables.

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 PFBBT composite score improved by 33.8% (p<0.01), the YBT scores for the directions of AL, PL, PM, PLL and PR 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, LF, LFL and LFR were improved by 56.6%, 39%, 26.5% and 30.1%, respectively (all p<0.01), and the ST score was improved by 19.9% (p<0.05).

CONCLUSIONS: 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
Stephanie A. Paplinskie1, Rachel Filler1, Taniya S. Nagpal2, Karishma Hosein1, Roberta Begginski1, Mollie Manley1, Chiara Marra1, Giorgia Spigolon1, Silvia Pogliaghi1, Michelle F. Mottola, FACSM1. 1Creighton University, Omaha, NE. 2University of Nebraska at Omaha, Omaha, NE.

Purpose: New mothers frequently report a lack of adequate physical activity (PA) due to a variety of constraints. PA is an important factor in developing and maintaining a healthy lifestyle and may assist new mothers in returning to prepregnancy weight. Despite the potential positive impact of PA on new mothers, PA level during the postpartum period is unknown. PURPOSE: To evaluate the impact of a PA intervention in increasing postpartum PA level and weight loss.

Methods: Thirty-two postpartum women (mean age=33±3.3 years, mean BMI=27.8±5.6 kg/m²) were randomized into control (n=16) and intervention (n=16) groups. The intervention group was instructed to engage in 150 minutes of MVPA each week and take 10,000 steps per day. The control group was given no physical activity prescription. Measures of body weight and PA (by wrist-worn ActiGraph Link accelerometers worn continuously over 7 days) were made at 3, 6, 9, and 12 months postpartum. PA data was expressed as the vector magnitude of counts (VMC) across the three axes. Differences in body weight and PA between groups over time were examined using two-way ANOVA with repeated measures and Tukey post hoc analysis. RESULTS: Baseline values for body weight were similar across groups (p>0.05). The control group showed a significant increase in PA from the 3 month to the 12 month visit (2.4x10³±0.4x10³ vs. 2.8x10³±0.4x10³ counts, p<0.05) but the only significant differences in PA by time between groups was at the initial 3 month postpartum visit (2.7x10²±0.3x10² vs. 2.4x10³±0.4x10³ counts, p<0.05) as the intervention did not lead to a further significant increase in PA throughout the remainder of the postpartum period. The control group showed a significant increase in PA from the 3 month to the 12 month visit (2.4x10³±0.4x10³ vs. 2.8x10³±0.4x10³ counts, p<0.05), ultimately reaching similar PA to that of the intervention group. Body weight was similar at the initial 3 month visit and decreased significantly in both groups during the postpartum period, however the intervention group had a significantly lower body mass by the end of the postpartum period compared to the control group (70.2±14.8 vs. 72±16.5 kg, p<0.05). CONCLUSION: Increased PA habits during the postpartum period may help women more successfully return to prepregnancy body weight and reduce the risk for overweight or obesity following childbirth.

405 Board #221 May 27 10:30 AM - 12:00 PM Exercise And Nutrition Patterns Of Pregnant Women Self-Selecting For Participation In A Lifestyle Intervention
Karishma Hosein1, Taniya S. Nagpal2, Roberta Begginski2, Harry Prapavessis1, Barbara de Vrijer1, Christina G. Campbell1, Stephanie A. Paplinskie2, Mollie Manley1, Michelle F. Mottola, FACSM1. 1Western University, London, ON, Canada. 2University of Ottawa, Ottawa, ON, Canada. 3University of Verona, Verona, Italy. (Sponsor: Michelle F. Mottola, FACSM)

Purpose: Exercise and healthy eating are integral parts of a comprehensive healthy lifestyle intervention during pregnancy. Women who volunteer to participate in such an intervention in early to mid-pregnancy may already be practicing healthy lifestyle

Abstracts were prepared by the authors and printed as submitted.
habits such as walking 10,000 steps/day (active), and consuming 1800-2252 kilocalories/day (kcal), whereas most pregnant women walk on average 3000-7000 steps/day (sedentary to low active) and consume 1882-2789 kcal/day. As such, intervention participants may not be representative of the general population of pregnant women, especially relating to exercise. PURPOSE: To assess the baseline exercise and nutrition patterns of pregnant women who enrol in a healthy lifestyle intervention in London, Canada. METHODS: Pregnant women who had self-selected to participate in the nutrition and exercise intervention completed a baseline (12-18 weeks gestation) 3-day step count log and 3-day food intake record (3dFR). Step counts were recorded over 3 consecutive days using a hip-worn pedometer or a wrist-worn activity tracker, and an average was calculated. The 3dFR was completed over the same 3 consecutive days and was analyzed for average energy intake (kcal) using Nutritionist Pro (NP; Axxya Systems). Measured height and self-reported pre-pregnancy weight were used to calculate pre-pregnancy body mass index (BMI). Gestational age at study entry and maternal age were also collected. RESULTS: Ninety-seven pregnant women chose to participate in a healthy lifestyle intervention study and completed both the 3-day step count log and 3dFR at baseline. At study entry, mean daily steps were 7399±2741 (low to above normal range) and energy intake was 2305±634 kcal/day (within to above normal range). Pre-pregnancy BMI was 26.2±5 kg/m² (overweight), gestational age was 15±3 weeks, and maternal age was 32±4 years. CONCLUSION: Many pregnant women who self-select to participate in a lifestyle intervention in early to mid-pregnancy may already have healthy patterns of exercise and to a lesser extent nutrition. To achieve a more representative sample of pregnant women, interventions could be performed in a clinical setting, which may allow for better identification of effective behaviour change strategies to promote and maintain healthy exercise and nutrition patterns during pregnancy.

**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**

Ryan A. Flynn1, Jonathan J. Ruiz-Ramírez1, Neil M. Johannsen2, Timothy S. Church3, Mark A. Sarzynski, FACSM1. University of South Carolina, Columbia, SC. 1Louisiana State University, Baton Rouge, LA. 2Pennington Biomedical Research Center, Baton Rouge, LA. Email: rafflynn@email.sc.edu

(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 (AT/RT). The effects of the 9-month intervention on BCAAs (leucine, valine, and isoleucine) and ketone bodies (β-hydroxybutyrate, BHB; acetoacetate, AcAc; and acetone) were examined across groups using generalized 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 at least 70% adherence to their exercise prescription for 6 months (AT, n=62; RT, n=55; AT/RT, n=64). Results: AcAc (17.6±6.4, p=0.006), acetone (10.6±3.6, p=0.003), and total ketone body (51.4±20.0, 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 AT/RT compared to the control group (-10.2±3.5 μmol/L, p=0.004). Conclusion: Our results suggest that RT and AT/RT programs could improve ketone body metabolism in those with T2DM.

**Does Exercise Intensity Influence Dietary Protein Requirements Of Male Endurance Athletes?**


(No relevant relationships reported)

Adequate protein intake is important for endurance athletes to replenish exercise-induced amino acid (AA) oxidation and support post-exercise muscle and whole body protein synthesis. High-intensity endurance exercise is associated with increased carbohydrate oxidation during exercise and greater protein turnover (synthesis and breakdown) after exercise relative to lower intensity exercise. Muscle glycogen depletion can increase AA oxidation during exercise and increase daily protein requirements.

**Purpose:** To determine the impact of exercise intensity during prolonged endurance exercise on estimates of dietary protein requirements in endurance athletes.

**Methods:** Eight males (26±3y, 76±1kg; 61±2ml O2·kg⁻¹·min⁻¹; mean±SD) completed two trials in a randomized order with exercise (20-km run) performed at a low (LOW; 72.1±1%HReax, 55.5±5% VO2 peak) or high (HIGH; 88.1±1%HReax, 75.7±7% VO2 peak) intensity. After 2 days of exercise and dietary intake (1.4·kg·1·d protein) control, participants consumed 0.6·kg·1·CHO before a 20-km treadmill run with continuous HR monitoring and periodic measurement of gas exchange (indirect calorimetry). During the 8th post-exercise recovery period, participants consumed 8.6·kg·1·CHO and hourly meals providing 0.93·kg·1·d protein as crystalline AA, modeled after egg protein, which was enriched with [13C]phenylalanine as an indicator AA. Breath and urine were collected at isotopic and metabolic steady state to determine phenylalanine excretion (F13CO2), flux (Q; estimate of protein breakdown), and oxidation (OX; reciprocal of protein synthesis).

**Results:** Preliminary analysis (n=6) showed that respiratory exchange ratio during exercise was higher in HIGH vs. LOW (0.92±0.03 vs. 0.88±0.03, p=0.05), which corresponded to a 37% greater CHO oxidation rate in HIGH (3.12±0.76 vs. 1.96±0.52 g·min⁻¹, p<0.01). Exercise duration was shorter in HIGH vs LOW (112±23 vs. 86±18 min, p=0.01). F13CO2 was not different between trials (HIGH: 0.94±0.25 vs. LOW: 0.89±0.14 μmol·kg⁻¹·h⁻¹, p=0.05). Urinary analysis is ongoing to determine Q and OX. Conclusion: Preliminary findings suggest that prolonged, high-intensity endurance exercise increases CHO oxidation during exercise but has little impact on estimates of protein requirements of male endurance athletes.

**High And Standard Free-form EAA Intake Equally Stimulate Muscle Protein Synthesis During Moderate Energy Deficit**

Jess A. Gwin1, David D. Church2, Adrienne Hatch-McChesney1, Emily E. Howard1, Chris T. Carrigan1, Nancy E. Murphy1, Marques A. Wilson2, Lee M. Margolin1, John W. Carbone1, Robert R. Wolfe3, Amber A. Ferrando1, Stefan M. Pasiakos, FACSM1. U.S. Army Research Institute of Environmental Medicine, Natick, MA. Donald W. Reynolds Institute on Aging, University of Arkansas for Medical Sciences, Little Rock, AR. Eastern Michigan University, Ypsilanti, MI. (Sponsor: Stefan M. Pasiakos, FACSM)

**Background:** Muscle protein synthesis (MPS) is regulated by essential amino acid (EAA) intake, postprandial extracellular EAA concentrations, and exercise. During energy balance, consuming approximately 0.10-0.14 g EAA/kg/meal optimally stimulates MPS after exercise. However, EAA requirements are increased during energy deficit, and whether consuming EAA beyond 0.10-0.14 g/meal further stimulates MPS during energy deficit is unknown.

**Purpose:** Determine the effects of standard and high EAA intake on resting and post-resistance exercise MPS during moderate energy deficit.

**Methods:** Nineteen males (mean±SD; age: 22.9±5y; BMI: 25.4±2.7kg/m²) completed a randomized, double-blind crossover study consisting of two, 5d periods of controlled energy deficit (30%Δ), separated by a 14d washout. At the end of each energy deficit period, MPS was determined at rest (postabsorptive and postprandial) and post-resistance exercise (postprandial) using a unilateral resistance exercise model and primed, constant [13C]-phenylalanine infusions. Drinks providing standard (0.10g/kg/meal, 7.87±0.87g) and high (0.30g/kg/meal, 23.52±5.84g) EAA amounts were consumed post-exercise. Circulating EAA concentrations were measured throughout each infusion.

**Results:** Postabsorptive MPS at rest was not different (p=0.71) between standard (0.047±0.3%) and high (0.045±0.2%) EAA. In the postprandial state, and independent of EAA, MPS at rest (standard, 0.055±0.01%/h; high, 0.061±0.02%/h) and post-exercise (standard, 0.055±0.01%/h; high, 0.065±0.02%/h) was greater than postabsorptive MPS at rest (fed state main effect, p=0.019 and p=0.005). Postprandial MPS at rest and post-exercise did not differ (p=1.0). EAA concentrations were greater in high (peak: 2915±569μmol/L; AUC: 22845±54783μmol/L×240min) than standard (peak: 1843±497μmol/L; AUC: 75727±32254μmol/L×240min; both, p=0.001).
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.

In recent years vegetarian diets have increased in popularity. While they have been associated with decreased risk for cardiometabolic diseases, concern remains over the potential of low protein intake, which can lead to reduced muscle mass and strength. Plasma creatinine has been shown to be a reliable marker of muscle mass. PURPOSE: Examine the relationship between plasma creatinine, lean body mass (LBM), and strength in underactive vegetarian and vegan adults. Additionally, to determine any change in creatinine levels following an 8 week protein supplementation intervention. METHODS: Twenty-six inactive (<150 min exercise/wk) vegetarians and vegans (34±8.9 y, n=19 vegan) of at least 1 year participated in this study. This study examined relationships between creatinine, strength, and LBM before and after 8 weeks of supplement with 18 g/day of mung bean protein. Additionally, change in creatinine levels before and after supplementation was determined between control and experimental groups. Handgrip strength was measured at baseline and week eight. LBM was determined via DEXA. Creatinine was determined via standard assay technique. An a priori α of 0.05 was used, and Pearson Product Moment correlation assessed relationships between creatinine, LBM and grip strength. A repeated measures ANOVA was used to determine changes in creatinine between groups over time. RESULTS: There was a positive correlation between baseline creatinine (r=0.513, p<0.008) as well as grip strength (r=0.390, p<0.054). The increase in creatinine (r=0.040±0.060 mg/dL) was not correlated to change in LBM (r=0.08±0.76 kg) (p=0.015, n=26, p=0.943) or change in grip strength (0.18±1.90 kg) (r=0.081, n=26, p=0.699). There was no significant change in creatinine between groups following 8 weeks of protein supplementation. A repeated measures ANOVA was used to determine changes in creatinine following 8 weeks of protein supplementation, this study shows positive associations between creatinine and lean mass as well as grip strength in underactive vegetarians and vegans.

Resistance exercise (RE) elevates skeletal muscle myofibrillar protein synthesis (MyoPS) for up to 4h, which can be measured under ‘free-living’ conditions using deuterated water (D2O). The accumulation of free-released RE-induced (RT) results in skeletal muscle hypertrophy, which in men has been reported to correlate with post-RE ‘free-living’ MyoPS only in the trained state. However, the impact of training status on acute responses to RT and their relationship to hypertrophic adaptations has yet to be investigated in women. PURPOSE: The present study examined the MyoPS response over 4h of recovery from an acute bout of RE in the untrained (UT) and trained (T) state to determine its association with hypertrophic adaptations in women. METHODS: Ten recreationally active young women (23.3±5.7 y, 62.3±12.0 kg, 23.7±4.7 % body fat; mean±SD) were subjected—8 wk of supervised whole-body RT (4 x 10 repetitions, 75% 1 repetition maximum (1RM), 3x/wk). Whole-body fat free mass (FFM; BODPOD), vastus lateralis muscle thickness (MT; B-mode ultrasound) and 1RM for each completed exercise were measured in the UT and T state to quantify training responses. MyoPS was measured during the mid-fOLLacular phase (day 3-9 of the menstrual cycle) at rest pre-training and for 48h following the first and final bout of RE using orally administered D2O. Muscle biopsies were obtained at pre- and post-RE to determine MyoPS in both the UT and T state. RESULTS: Following RT, there was a ~3.4% increase in FFM (49.3±6.4 vs. 51.0±6.9 kg; P<0.001) and ~8.8% increase in MT (2.31±0.39 vs. 2.50±0.38 cm; P<0.05). Representative 1RM strength increased for bench press and leg press exercise (28.5±5.8 kg vs. 38.7±9.8 kg and 151.6±63.5 vs. 259.3±92.7 kg, respectively; P<0.001). Forchumong analysis will determine if: i) training alters the post-exercise MyoPS response, and, ii) whether muscle hypertrophy correlates with acute MyoPS in the UT and/or T state. CONCLUSIONS: Women responded favourably to ~8 wk of RT with significant gains in FFM, MT and 1RM strength. Ongoing analysis will provide insight into the potential relationship between acute muscle protein synthesis and training-induced hypertrophy in the understudied female population. Supported by the Natural Sciences and Engineering Research Council of Canada.

PURPOSE: To determine whether weight training combined with high protein intake enhances total and regional bone mineral density (BMD) in athletes. METHODS: BMD of 27 Division-1 collegiate baseball players aged 18-22 y (N=13, 2 dropouts), received either 14% protein or isocaloric 44% protein supplements, were assessed by dual-energy x-ray absorptiometry (DEXA) before and following a 12-week weight training (challenging upper and lower body). RESULTS: Baseline data show unequivocally greater humerus BMD in the dominant arm than their contralateral non-dominant arm (~20 %) among all baseball players. Humerus BMD of non-dominant arm was enhanced by 2.7 % after weight training for both low and high protein groups (main effect, P = 0.008), concurrent with an unexpected, small decrease in total body BMD (main effect, P = 0.014). Humerus BMD of dominant arm with greater baseline value than non-dominant arm was not increased unless high protein was supplemented (~2.7 %) (P < 0.05). CONCLUSION: Bones with relatively higher BMD show inert adaptation against training, which can be delineated by high protein supplementation. Total BMD of athletes cannot be further elevated by weight training.

PURPOSE: To determine the effects of PP on MPS with and without RE in healthy young women. METHODS: In a single blind, parallel-group design, twenty-four healthy younger women (21 ± 3 years, n = 12 group) were assigned to consume either 25 g of PP twice daily or a non-protein-containing control (CON). Participants consumed a fully controlled diet for 3 weeks (0.8 g/kg/day CON, 1.6 g/kg/day PP), with non-supplemental protein comprising 51 ± 3% of total protein intake in the PP group. One leg of each participant was randomly allocated to perform RE (Exercise) while the other leg served as a rested control (Rest). RE was performed thrice weekly at ~30% of 1RM (20-25 reps) for 3 sets until volitional fatigue on the leg extension and leg press machines. Potato MPS was measured at baseline, following supplementation, and at supplementation+RE via the deuterated water method. RESULTS: PP ingestion increased MPS by 0.14 ± 0.09 %/d at Rest and by 0.32 ± 0.14 %/d in Exercise (p = 0.008) while MPS was elevated only in Exercise with CON 0.20 ± 0.11 %/d but was not different from Baseline 0.01 ± 0.04. CONCLUSIONS: Consumption of PP in addition to a habitual diet increased rates of MPS at rest and during resistance exercise (RE) where RE enhances MPS above feeding alone. The use of vegetable-based proteins has increased in popularity, however many vegetable based protein sources are of lower protein quality. Potato protein (PP) is a complete protein and has the highest protein quality score of any vegetable protein, however, its efficacy in stimulating MPS beyond the acute setting has yet to be determined.
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 (REE) in recreationally-active men. METHODS: Twenty healthy males (24.1 ± 4.3 yrs) consuming a controlled diet (1.25g/kg/day of protein) were randomized to consume 40g of LEAA (containing 1.6g leucine) or isocaloric placebo (PLA) thrice daily for four days following an acute bout of lower-body RE (5x12 repetitions at 75% maximum of leg press and knee extension). MyoPS at rest and over 96h of recovery was measured by D2O (150ml, 70% APE) with body water enrichment as the precursor. RESULTS: MyoPS increased ~72% after RE (P < 0.01) 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 < 0.05) 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. SUM correlated with SOR (r = 0.64, P < 0.05) whereas there were no correlations between MyoPS and any other outcome measures. 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.

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### Board #240 May 27 9:30 AM - 11:00 AM

**IMPACT OF CASEIN PROTEIN CONTAINING L-TRYPTOPHAN AND MELATONIN ON SLEEP QUALITY AND ENERGY EXPENDITURE**

SILVIO VALLADAO,1 Thomas Andre1, Robert Sanders1, Hannah Nelson1, Neil Schwarz2, Melinda Valliant1, Josh Hogg1, 1University of Mississippi, OXFORD, MS. 2University of South Alabama, Mobile, AL.

(No relevant relationships reported)

Increases in morning resting energy expenditure (REE) have been observed following late evening ingesction of protein. However, the impact of late night protein supplementation containing melatonin and L-Tryptophan has yet to be examined.

**PURPOSE:** The purpose of this study is to determine the impact of the ingestion of pre-sleep casein protein supplement that contains L-Tryptophan and melatonin (PRO) on sleep quality, energy expenditure prior, during, and post exercise. **METHODS:** Aerobically active females (n = 13; age = 22.6 ± 1.9 yrs; ht = 1.65 ± 0.06 m; wt = 60.5 ± 9.6 kg; % bf = 22.5 ± 4.3; VO2max = 44.1 ± 5.3 ml/kg/min) participated in the study. In a cross-over design, PRO (Casein; 34.3g; 140 kcal; 289mg L-Tryptophan; 1mg Melatonin) or placebo (PLA) (coca powder; 10g; 20 kcal) were ingested 30 min prior to sleep. Sleep quality and perceived satiety were assessed using 10cm sliding scale the following morning. REE was measured for 30 minutes with at least 5 minutes of steady state before and after exercise. The exercise protocol consisted of 20 min of aerobic exercise on a treadmill at 40-50% of VO2max. Total calories during exercise were used to compare exercise energy expenditure (EE). For the statistical analyses, Paired-samples t-tests and two-way repeated measures ANOVA. Results were considered significant at p<0.05. **RESULTS:** Sleep quality during PRO was not significantly different than the PLA trial (61.6 ± 21.5 mm vs 68.4 ± 20.5 mm; p = 0.39). Perceived satiety during PRO was not significantly different than PLA (29.6 ± 8.2 mm vs 23.9 ± 6.6 mm; p = 0.43). EEE during PRO was not significantly different than PLA (112.1 ± 20.4 kcals vs 112.2 ± 21.8 kcals; p = 0.91). The main effects (supplement: p = 0.93; time: p = 0.15) and the interaction (Supplement: time: p = 0.75) for REE pre and post exercise in PRO and PLA were not significantly different. **CONCLUSIONS:** No changes were observed ingesting PRO prior to sleep on next morning EEE and REE before and after exercise. Future investigations should examine the effects of relative (g/kg bw) pre-sleep protein containing tryptophan and melatonin ingestion on next morning EEE.

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### Board #241 May 27 9:30 AM - 11:00 AM

**Pre-sleep Or Post-exercise Protein Intake Does Not Augment Resistance Training Adaptations In Older Adults**

Alex Klempp, Mingchua Yeh, Chet Sokolowski, Do-Hoon Kim, Michael J. Ormsbee, FACSM, Lynn B. Panton, FACSM, Jeong-Su Kim, FACSM, Florida State University, Tallahassee, FL.

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(No relevant relationships reported)

Resistance training (RT) and protein consumption are recommended to attenuate damage in muscle mass and associated with the secretion of cortisol. Serum protein intake has been regarded as optimal for augmenting RT adaptations. However, nocturnal sleep is the longest post-absorptive period with muscle protein synthesis lower than basal rates. Thus, pre-sleep (Pre-sleep) protein intake may be more advantageous for older adults, who display blunted muscle anabolism, than Post-ex protein intake. **PURPOSE:** To examine the effects of pre-sleep versus post-exercise protein intake during 12 weeks of RT on muscle thickness (MT) and one-repetition maximum (1RM) strength in older adults. **METHODS:** 30 healthy, sedentary older males (age: 65.7±4.0 yrs, body mass: 85.9±13.1 kg) underwent the same 12-week whole-body RT program (2x/wk) and were randomly assigned to 1 of 3 groups, 1) consumed 40 g of protein immediately pre-sleep (Pre-ex), 2) consumed 40 g of protein 30 minutes Pre-sleep (n=11), or 3) did not consume additional protein supplementation (Ex only, n=10). MT was measured via ultrasound as the added values of the right rectus femoris, vastus intermedius, and vastus lateralis muscles. 1RM strength was assessed on the leg press machine. A 3x3 mixed-model ANOVA was used to analyze outcomes at pre-, mid-, and post-testing with significance at p<0.05. **RESULTS:** There were significant main time effects for both MT (Pre: 6.29±0.98; Mid: 6.63±0.86; Post: 6.75±0.94) and 1RM strength (Pre: 155.9±30.0; Mid: 170.1±36.0; Post: 184.2±47.1 kg). There were no group time interactions or main group effects. Interestingly, only Post-ex significantly increased MT from pre to mid (Pre: 6.14±0.91; Mid: 6.67±0.88; Post: 6.76±1.16 cm). **CONCLUSION:** During 12 weeks of RT in older adults, Post-ex protein intake increased MT in the first 6 weeks; however, after 12 weeks, improvements were similar to Pre-sleep protein intake and Ex only groups. Further, neither Post-ex nor Pre-sleep protein intake augmented RT-induced improvements in 1RM strength.

Supported in part by Dymatize/ISSN Research Grant and Florida State University College of Human Sciences.

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### Board #242 May 27 9:30 AM - 11:00 AM

**Effect Of Whey Protein Isolate On Cortisol Awakening Response In Recreationally Active Women**

MICHAEL D. OLDHAM, Vic Ben-Ezra, Anthony A. Duplanty, Kyle D. Biggerstaff, Texas Woman’s University, Denton, TX.

(No relevant relationships reported)

**INTRODUCTION:** The hypothalamus-pituitary-adrenal (HPA) axis plays a major role in stress responses and is associated with the secretion of cortisol. Serum cortisol concentration peaks between 30 and 45min after awakening, and is known as the cortisol awakening response (CAR). Disruptions in CAR have been associated with repetitive strenuous physical exercise. Whey protein branched chain amino acids (BCAA) compete for tryptophan transporters in the brain, subsequently reducing fatigue associated with exercise. **PURPOSE:** To determine the effects of whey protein on CAR after strenuous exercise, in recreationally active women, on post-exercise days. **METHODS:** Eleven recreationally active women (19 ± 2 yrs; VO2max = 31.6 ± 4.5 ml/kg/min) completed a double blinded, randomized, cross-over placebo trial, with a 7 day washout between trials. The supplement regimen (25g of maltodextrin (PL) or 25g of maltodextrin plus 25g of whey protein isolate (WPI)) was given between 8am - 9am and 9am to 10am prior to exercise on 3 consecutive days of each trial. On Day 2 and 3 of each trial participants walked 30 min on a treadmill at 70-75% VO2max (21.7 ± 0.1 ml/kg/min), rested 5 min, and completed a 30s Wingate anaerobic threshold test (WAnT). Saliva (2ml) was collected on days 1-4 of PL and WH, between 6am and 7am, immediately upon waking and every 15 min for the next 1.5h. WPI samples were analyzed for cortisol concentration using an enzyme linked immunosorbent assay (ELISA) and the area under the curve (total AUC) was calculated for cortisol. A repeated measures ANOVA (2 trial x 4 days) was used to determine significant differences (p<0.05) in cortisol AUC. A repeated measures ANOVA (2 trial x 2 day) was used to determine significant differences (p<0.05) in WAnT fatigue index. **RESULTS:** Main effect means for AUC were significantly different (p = 0.033) between PL (33.3 ± 2.0 µg*hr/dL) and WH (30.88 ± 0.8 µg*hr/dL). No significant difference (p = 0.149) in WAnT fatigue index means occurred between PL (20.79 ± 6.1% Day 2 & 21.97 ± 6.4% Day 3) and WH trials (22.52 ± 6.2% Day 2 & 22.78 ± 6.4% Day 3).

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### Board #243 May 27 9:30 AM - 11:00 AM

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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.

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 (LBM). PURPOSE: To assess the acute effects of pre-sleep consumption of isocaloric CP, CP+WP, or CHO at a dose relative to LBM on recovery following an evening lower-body resistance exercise (RE) bout.

METHODOLOGY: 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/LBM WP supplement post RE. A single dose of 0.6g/kg/LBM of CP, 0.4g/kg/LBM CP and 0.2g/kg/LBM WP (CP+WP), or CHO 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 (Biodes™) 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 were no significant differences in overall time trial performance (WP: 16.8 ± 0.34 km; PL: 17 ± 0.4 km; p = 3.46). WP stimulated a significant increase in plasma insulin concentrations at time point 0 (WP = 222.8 ± 45.1 pg/ml; PL = 85.95 ± 45.1 pg/ml; p = 0.047) 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 glucagon concentrations for timepoint -10, 0, 15, 30, 45, and 60 when compared to the PL trial (all p values < 0.05).

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, FACSFM) (No relevant relationships reported)
S84 Vol. 52 No. 5 Supplement

**421 Board #237 May 27 9:30 AM - 11:00 AM Skeletal Muscle Regulatory Markers Responses Following Whole And Egg White Ingestion In Resistance Trained Men**

Amy Allnutt1, Lee E. Brown, FACSM2, Edward Jo3, Babak Hooshmand Moghadam4, Reza Bagheri5, Damoon Asharty-Larky6, Alexei Wong7, 1Marymount University, Arlington, VA. 2California State University, Fullerton, CA. 3California State Polytechnic University Pomona, Pomona, CA. 4Ferdowsi University, Mashhad, Iran, Islamic Republic of. 5University of Isfahan, Isfahan, Iran, Islamic Republic of. 6Ahvaz Jundishapur University Medical Sciences, Ahvaz, Iran, Islamic Republic of.

(Sponsor: Lee E. Brown, FACSM)

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(No relevant relationships reported)

**422 Board #238 May 27 9:30 AM - 11:00 AM**

**Proteins Or Carbohydrates Influence On Strength And Functionality After Exercising In Elderly Type II Diabetics.**

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(No relevant relationships reported)

**423 Board #239 May 27 9:30 AM - 11:00 AM**

**Effects Of Protein Intake On Gastrointestinal Symptoms In Runners - A Pilot Study**

Vanessa R. Lee, Jill Parnell. Mount Royal University, Calgary, AB, Canada.

(No relevant relationships reported)

**424 Board #240 May 27 9:30 AM - 11:00 AM**

**Preschool Children Consumption Of School Lunches Different From Menus That Meet Dietary Guidelines And To What Is Served**

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(No relevant relationships reported)
significant (p<0.05) difference for protein between men (21.7 ± 5.7g), served (27.9 ± 10.6g) and consumed (19.5 ± 11.8g). The majority of food served was white (38.1%), brown (20.4%), or yellow (14.2%) with minimal from orange (10.2%), red (6.1%) or green (10.7%) foods. Children described food as yummy (75.2%), okay (7.6%), and yucky (17.2%). Consumption of vegetables (46.9%) was significantly (p<0.05) lower than dairy (88.9%), fruits (82.0%), grains (81.8%), and meats (72.8%). Children consumed a high percentage (77.9%) of fats/sweets.

CONCLUSION: The amount of food consumed at lunch was significantly less than the menu and served amount, indicating that children were not meeting the dietary recommendations as intended, potentially contributing to long-term health consequences.

425 Board #241 May 27 9:30 AM - 11:00 AM The Effects Of Two Different Patterns Of Protein Ingestion On Muscle Growth In Trained Men.
André dos S. Costa, José Henrique C. Tavares Filho, Álvaro N. Madureira, Vitória F. Souto, Elizabeth Nascimento. Federal University of Pernambuco, Recife, Brazil. Email: andre.santoscosta@ufpe.br

Abstract: 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.

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

METHODS: 19 men (24.9 ± 5.6 years old), with more than 1 year of experience in resistance training, were randomly allocated in one of two groups: P3X (n=10) or P5X (n=9). All volunteers had a diet program prescribed by a registered dietician. 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: Both groups showed an increase in the CSA of RF (P3X: 9.97±1.08 to 10.76±0.56cm², P5X: 8.53±0.61 to 9.64±0.59cm², p=0.014), VL (P3X: 30.19±1.54 to 33.60±1.49cm², P5X: 31.95±1.62 to 34.31±1.57cm², p=0.003), and in the sum of 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.

426 Board #242 May 27 9:30 AM - 11:00 AM Protein-enriched Meals At Breakfast Increase Muscle Accretion In Healthy Young Men Undergoing 12-week Resistance Training
Jun Yasuda, Toshiki Tomita, Takuma Arimitsu, Satoshi Fujita. Ritsumeikan University, Shiga, Japan. (Sponsor: Takeshi Hashimoto, FACSIM)
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Abstract: While daily protein intake has been reported to be essential for muscle regulation, the breakdown of daily protein intake in individuals is typically the lowest at breakfast and skewed 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.

PURPOSE: This study aimed to examine whether a protein-enriched meal at breakfast to achieve adequate protein intake at all 3 meals is more effective for muscle accretion compared to typical protein intake pattern, skewed protein intake towards dinner. 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 intra-muscular adaptation to treadmill-based endurance exercise training.

METHODS: This 12-week, parallel-group randomized clinical trial included 26 men (means ± Sds: age, 20.8 ± 0.4 years; BMI, 21.8 ± 0.4 kg/m²). The participants were divided into 2 groups: HBR (n = 12), consuming a protein-enriched meal at breakfast to achieve adequate protein intake at all 3 meals; LBR (n = 14), consuming a provided meal at breakfast to achieve adequate protein intake at lunch and dinner. The participants performed 12-week supervised resistance training (RT) program 3 times/week (3 sets of 8-12 repetitions at 75-80% of one repetition maximum for 5 exercises). We used dual-energy X-ray absorptiometer to measure total fat-free mass (TotalFFM).

RESULTS: There was no significant difference in TotalFFM between the 2 groups at baseline (HBR vs LBR: 52.4 ± 1.3 vs 53.4 ± 1.2 kg). After completing the 12-week diet plan and RT program, both the groups gained significant TotalFFM (P3X: 2.1 ± 0.2 kg, 4.0 ± 0.4 kg), with the HBR group having greater changes in TotalFFM than the LBR group (HBR vs LBR: 2.5 ± 0.3 vs 1.8 ± 0.3 kg; P = 0.056; Cohen’s d = 0.795 (Large effect size)).

CONCLUSIONS: Protein-enriched meal at breakfast to achieve adequate protein intake at all three meals is more effective than skewed protein intake at dinner for RT-induced muscle hypertrophy.

This work was supported by the Japan Society for the Promotion of Science, Grants-in-Aid for Scientific Research (no. 17H02183 to S. Fujita).
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 nutrient postexercise intake on substrate oxidation and protein retention during recovery. METHODS: In a single-blinded, crossover design, resistance trained (≥1 y) men (n=10, 22±2 y, 83±10 kg) consumed a mixed, eucaloric meal 2 hours before performing resistance exercise (3 sets of 6 repetitions of different lower body exercises: calf raise every 30 min). Mixed-macronutrient meals (~55:30:15% protein:carbohydrate:fat) 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-[2H5]phenylalanine or ring-[13C6]phenylalanine to model the metabolic fate of dietary AA. Muscle biopsies taken at the end of each trial as well as at the begis-dig of trial 2 were used to determine change in AA enrichment (LC/MS/MS) in the myofibrillar protein fraction (AMo). RESULTS: AMo was 0.032±0.004MPF 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±5% BMI: 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 Bogradus (RB) and 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: RMRb=132.82+28.37(W)-250.59(H)-9.464(FM)+2.871(A)-25.932(FM) M: RMRb=1862.68-7.797(W)+1716.697(H)+18.099(FM)-1.964(A)+14.972(FM) M: RMRa=553.971+16.601(W)+1033.839(H)-13.734(FM)+10.930(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±2 vs. 28.3±1; W: 32±4 vs. 27±3, P=0.01) and FM in kg (M: 37±7 vs. 26±8; W: 49±9 vs. 27±8, P<0.01), M only in FFM (65±9 vs.63±9, P=0.02, W only 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 -691±128); but only accurate was W before WL (P=0.35). RMR calculations with the new equations were more accurate and closest to measured RMR before and after WL in M (0.05±0.154 vs. 0.03±0.197) but only after WL in W (-301±116). CONCLUSION: The study illuminates the need to adopt different equations for assessment of individuals’ RMR before and after weight loss.
CONCLUSIONS: 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 = ≤0.05) throughout the first year of fitness club membership.

CONCLUSIONS: A total of 63.0% reported non-regualr 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.

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 prescribed while intensity within TREAT was modulated in response to observed shifts in daily HRV. Participants reported state motivation to exercise and global physical fatigue immediately prior to each exercise session.

RESULTS: Prevalence of temporal shifts in resting HRV were 32.6% and 34.7% for CON and TREAT conditions, respectively. Within CON, shifts in HRV resulted in less motivation (mean diff. = -4.00%, 95%CI = -7.56, -0.44; F = 4.86, p = 0.028) and more physical fatigue (mean diff. = -4.79%, 95%CI = -8.73, -0.85; F = 10.24, p = 0.001). Spectral domain metrics (i.e., LF:HF ratio) were significantly lower (mean diff. = -0.14 au; 95%CI = -0.27, -0.01; F = 4.715, p < 0.030) during HRV shifts. Within TREAT, shifts in HRV resulted in no change in motivation (mean diff. = 2.58%; 95%CI = -6.54, 1.38; F = 1.63, p = 0.202) with reduced physical fatigue (mean diff. = -5.94%; 95%CI = -9.56, -2.32; F = 10.40, p = 0.001). Within TREAT, LF:HF ratio was higher (mean diff. = 0.13 au; 95%CI = 0.03, 0.24; F = 5.59, p = 0.018) 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 #250 May 27 10:30 AM - 12:00 PM

Heart Rate Variability Mediates Fatigue And Motivation Throughout A High-intensity Exercise Program.

Derek A. Crawford1, Justin DeBlauw1, Katie M. Heinrich2, Brande Kurz1, Nicholas B. Drake3, Michael J. Carper4

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(No relevant relationships reported)

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 prescribed while intensity within TREAT was modulated in response to observed shifts in daily HRV. Participants reported state motivation to exercise and global physical fatigue immediately prior to each exercise session.

RESULTS: Prevalence of temporal shifts in resting HRV were 32.6% and 34.7% for CON and TREAT conditions, respectively. Within CON, shifts in HRV resulted in less motivation (mean diff. = -4.00%, 95%CI = -7.56, -0.44; F = 4.86, p = 0.028) and more physical fatigue (mean diff. = -4.79%, 95%CI = -8.73, -0.85; F = 10.24, p = 0.001). Spectral domain metrics (i.e., LF:HF ratio) were significantly lower (mean diff. = -0.14 au; 95%CI = -0.27, -0.01; F = 4.715, p < 0.030) during HRV shifts. Within TREAT, shifts in HRV resulted in no change in motivation (mean diff. = 2.58%; 95%CI = -6.54, 1.38; F = 1.63, p = 0.202) with reduced physical fatigue (mean diff. = -5.94%; 95%CI = -9.56, -2.32; F = 10.40, p = 0.001). Within TREAT, LF:HF ratio was higher (mean diff. = 0.13 au; 95%CI = 0.03, 0.24; F = 5.59, p = 0.018) 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 #250 May 27 10:30 AM - 12:00 PM

Heart Rate Variability Mediates Fatigue And Motivation Throughout A High-intensity Exercise Program.
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 + Exercise group (ME), and M and ME mice were sacrificed with 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) (Fig 1A); In the forced swimming test (Fig 1B) and the open field experiment (Fig 1C) the mice 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 α-Syn was up-regulated in the M group (P<0.01), but in the ME group was decreased after exercise (P<0.05) (Fig 2A). (3) The expression of Tyrosine hydroxylase (TH)(Fig 3), TOM-40(Fig 4) in group M was lower than that in group S (P<0.05), while ME group was higher than the M group (P<0.05). (4) The protein of Parkin and PINK1 were increased after exercise (P<0.05) (Fig 5). **CONCLUSION:** Exercise can enhance the mitochondrial autophagy ability, improve the mitochondrial transport function, promotes behavior features in PD mice.

**Key words:** aerobic exercise; mitochondria; autophagy; Parkinson’s disease Correspondent author: Dr. Jianshe Wei, M.D. & Ph.D., Email: jsweij@henu.edu.cn

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**Activation of Motor Skills and Health-Enhancing Physical Activity Participation in Children With and Without Asthma**

**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, FACS, Toby C. Lewis, Rebecca E. Hasson, FACS, University of Michigan, Ann Arbor; MI. (Sponsor: Rebecca Hasson, FACS)

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=60.3±6.2) participating in the Exercises for a Healthier Lifetime and Enrichment (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=0.95). Children with asthma engaged in fewer minutes of MVPA per day compared to their healthy peers (27.7±5.3 vs. 44.1±22.3, 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±1.70; PMC: β=-14.6±9.3; p>0.05), and there were no differences by asthma status (p's>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.

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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:** Datas were from an ongoing program evaluation study 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 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). Differences 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 improvement in health (0.2 ± 0.4) was significantly correlated with SE for adherence (r = 0.68, p < 0.01), describing fitness goals/weaknesses (r = 0.81, p = 0.01), and recognizing strengths/weaknesses in different situations; a slight increase in motivation (0.3 ± 1.0) was not correlated with any changes in SE factors. Although C3 participants averaged a slight decrease in health (0.2 ± 0.4), improved health was correlated with SE for adherence (r = 0.78, p < 0.008), and a slight motivation increase (0.4 ± 1.5) was correlated with SE for adherence (r = -0.65, p < 0.04)
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.

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. 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, 140) min/wk of moderate intensity PA, 240 (120, 300) 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=0.009). 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.

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 research 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-intervention studies 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 (GW) with CMP.

Methods: Fifty-five GW 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 d 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 performed 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 8 of 8 lifts. Estimates for the fixed effects and their interaction were not significant for either measure (IPAQ: F1,7 = 0.17, F1,7 = 0.02, F1,7 = 0.09, p < 0.05; ACTI: F1,7 = 0.17, p < 0.22, p < 0.05). 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 h101cx0005383

WEDNESDAY, MAY 27, 2020

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

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

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(no relevant relationships reported)

Intermittent 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 bronchoconstriction that occurs during longer bouts of 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-one 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: i) 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±2.4 bpm; step test: 146.0±3.5 bpm; walk test: 122.4±4.1 bpm; resistance circuit: 131.8±8.2 bpm; activity video: 105.7±2.5 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, Tiwaloluwa A. Ajibewa, Indira Sur, Leah E. Robinson, FACSIM, Toby Lewis, Rebecca E. Hasson, FACSIM. University of Michigan, Ann Arbor, MI. (Sponsor: Rebecca E. Hasson, FACSIM)

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(no relevant relationships reported)

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 and duration 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 each condition.

Abstracts were prepared by the authors and printed as submitted.
and long-term adherence to MVPA in previously inactive individuals. We should investigate the association between exercise interests, identity and motivations 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, exportant role in MVPA engagement: Future research should investigate the association between exercise interests, identity and motivations and long-term adherence to MVPA in previously inactive individuals.

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: ktaylor31@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<0.01) and creativity (p<0.05) subscales. Intrinsic motivations (p<0.001) 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 (10.8±2.4, p<0.005 for all). Further, people who prefer sports had higher competition interest (11.1±2.9) than group (8.1±1.0), individual (8.6±2.9), or outdoor activities (8.4±3.4, p<0.006 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, exportant role in MVPA engagement: 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 women and 96 men (age [SD]; 36 [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 104-Year 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-
term (yearly). Participants responded to questions about the likelihood of signing up for the promotion, the perceived effectiveness of the promotion for changing exercise behavior, and the perceived effectiveness of the promotion for getting new members to join the fitness center. **RESULTS:** Independent t-tests indicated no difference in reported likelihood of signing up for the promotion (p = .343), no difference in the perceived effectiveness for changing exercise behavior (p = .144), and no difference in the perceived effectiveness for getting new members to join the fitness center (p = .324). **CONCLUSIONS:** In the context of hypothetical fitness center memberships and commitment contracts, different frames of visit frequency did not impact the likelihood of signing up for the promotion, perceived effectiveness for changing exercise behavior, or perceived effectiveness for recruiting new members. The usually robust framing effect may not translate to this situation. These data were about hypothetical commitment contracts, therefore, real-world data are needed to replicate these findings.

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-48 (MTQ-48) 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 correlations 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; VPA, r(273) = .199, p < .05; and meeting PA guidelines, r(273) = .119, 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), as was VPA (444.15 ± 389.63 vs 191.73 ± 269.78, p < .05). Additionally, PA was higher for males compared to females (329.57 ± 16.44 vs 220.31 ± 323.72, p < .05). No significant differences were found between any form of MT and PA behaviors when regarding age and race. **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.

Physical activity (PA) has been linked to health and quality of life benefits. Differences in race and body mass index (BMI) may contribute to health-related disparities. Sleep quality (SQ) has been associated with both PA and health, influencing each other in a two-way interaction. Variations in PA are linked to differences in mental toughness (MT). MT is linked to higher SQ and increased PA, but the influence of race and BMI on MT is still under investigation. **Purpose:** To characterize the association and the effects of PA, race, BMI, and SQ on MT. **METHODS:** Sixty-two participants (age 25.4 ± 6.0 SD) completed surveys related to PA, race, BMI, SQ, and MT. Main and interaction effects of the responses analyzed using factorial ANOVA. Significance was set at p < .05. **Results:** There were no significant differences in mental toughness (MT) across race or BMI. Race was positively correlated with PA, r = .246, p < .027, and SQ was negatively correlated with MT, r = .470, p < .000. Race was negatively associated with MT (r = .343, p < .033). SQ had a main effect on MT (F(1, 68) = 18.568, p < .000, η²p = .218). PA and BMI interaction had an effect on MT (F(2, 67) = 5.572, p = .009, η²p = .211). The interaction of race and BMI had an effect on MT (F(2, 67) = 2.805, p = .049). **Conclusion:** MT was positively correlated (r = .246, p < .027) and SQ was negatively associated with MT (r = .470, p < .000). Race was negatively associated with MT (r = .343, p < .033). SQ had a main effect on MT (F(1, 68) = 18.568, p < .000, η²p = .218). PA and BMI interaction had an effect on MT (F(2, 67) = 5.572, p = .009, η²p = .217). The interaction of race and BMI had an effect on MT (F(2, 67) = 2.805, p = .049). **Conclusion:** As previously reported, poor quality sleepers are mentally tougher compared to good quality sleepers. When PA and BMI are combined, PA and overweight individuals are mentally tougher, followed by the non-PA and underweight ones. When race and BMI are combined, White-overweight and other-normal BMI individuals are the mentally toughest. Followed by Hispanic-overweight, and Asian underweight and obese I, II, III, with African Americans underweight and overweight having similar values. Health care professionals may find this information valuable when they are trying to address health-related issues that pertain to race, PA, BMI, SQ, and MT.

Alzheimer’s disease currently affects 5.8 million people in the US and the number is projected to triple by 2050. As the baby boomer population ages, it is important to identify measures that correlate with cognitive decline. Measures that show a relationship with cognitive decline can serve as early indicators that a person is in need of a cognitive evaluation. **Purpose:** To determine if functional fitness tasks could accurately discriminate between older adults with and without mild cognitive impairment. **METHODS:** Adults 60+ years participated in the present investigation (n = 107). Each participant completed demographic questionnaires; completed two stationary cognitive tasks: Montreal Cognitive Assessment (MoCA) and visual paired comparison (VPC); and completed four functional cognitive assessments: dual-task maximal speed (DTMS), dual-task habitual speed (DTHS), sit-to-stand power, timed up and go test (TUG). Participants with MoCA scores ≥ 23 were classified as cognitively intact (CIN), whereas participants with MoCA scores < 23 were classified as cognitively impaired (CIM). A one-way ANOVA determined if there were significant differences between groups for each cognitive task. **RESULTS:** Eighty CIN and twenty-three CIM subjects completed all assessments. The CIN group had higher scores on the VPC task (p < .02), while exhibiting faster times to complete DTMS (p < .001), DTHS (p = .002), and TUG (p < .02) compared to the CIM group. No significant differences were found between the cognitive groups in sit-to-stand power variables: peak power (p = .08), average power (p = .07), and average velocity (p = .08). Furthermore, overall PA was higher for athletes compared to non-athletes (688.65 ± 734.82 vs 324.80 ± 511.70, p < .05), as was VPA (444.15 ± 389.63 vs 191.73 ± 269.78, p < .05). Additionally, PA was higher for males compared to females (329.57 ± 16.44 vs 220.31 ± 323.72, p < .05). No significant differences were found between any form of MT and PA behaviors when regarding age and race. **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.
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 (session points 1 and 2).

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/ethnicity interactions with CRAVE.

Results

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

<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 ± 14.5</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 ± 15.1</td>
<td>0.86</td>
<td>28.0 ± 15.9</td>
<td>24.5 ± 15.2</td>
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</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.

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

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(No relevant relationships reported)
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 (FLASHIE) Study was to evaluate health risk behaviors (including PA and ST) in parent-adolescent dyads. **Methods:** Parent-adolescent dyads provided responses to online surveys addressing PA and ST behaviors in the context of environmental and family interactions. We examined the influence of SDT-based constructs (observed variables 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<0.001). Parent’s and adolescent’s motivation did predict each other’s motivation (p<0.001) 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.

**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: 103 female participants with various exercise habits and activity levels and self-perceptions of CrossFit participants and participants of other exercise modes. This may benefit older adults who are recommended to participate in aerobic, strength, and mobility class with workouts modified to fit their needs and abilities. Participants completed an online questionnaire that included demographics, social, and mental health measures. Participants assessed their ability to continue HIFT exercise, rated perceived physical ability, appearance evaluation, fitness evaluation and orientation, health orientation, body area satisfaction, and self-esteem (p<0.05). They also demonstrate greater preference and tolerance of higher intensity exercise and are more oriented toward living a healthy and fit lifestyle than their alternate exercise counterparts.

**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). 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<0.001) while desire to rest significantly increased (17.8 ± 12.3 vs. 29.1 ± 18.1, p<0.001) from pre- to post-treadmill test. Desire to move pre- was significantly associated with desire to move post- (r=0.63, p<0.002). Baseline desire to rest was significantly associated with desire to rest post- (r=-0.48, p<0.027) and with the post-test change in desire to move (r=0.53, p<0.001). Change in desire to move was inversely associated with change in desire to rest (r=-0.73, p<0.002). Baseline desire to move was significantly associated with the post PE (r=0.45, p=0.041). Change in desire to move had a negative association with change in PF (r=-0.52, p=0.019), 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=0.003) and a positive correlation with change in PF (r=0.53, p<0.016). 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 physical energy/fatigue but not mental energy/fatigue.

**Purpose:** To investigate how one’s SE for participation in HIFT is related to 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:** Data were from an ongoing program evaluation study including a cohort of 13 older adults. **Results:** High intensity functional training (HIFT) 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 compare physical activity levels and self-perceptions of CrossFit participants and participants of other exercise modes. 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 compare physical activity levels and self-perceptions of CrossFit participants and participants of other exercise modes. 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. **Results:** High values in self-efficacy for participation in HIFT was expected to positively correlate with perceptions of energy and fatigue. **Conclusion:** Desires to move and rest change with an exercise stimulus, with desire to move decreasing and rest increasing. Furthermore, these findings suggest that physical energy/fatigue but not mental energy/fatigue.

**References:**

Standford Philip R, FACSM1, Miguel Blaucut2, Matthew Stults-Kolehmainen3, Susannah Williamson4, John B. Bartholomew, FACSM1, Todd A. Gilson5, Rajita Sinha6. The University of Texas at Austin, Austin, TX. Teachers College, Columbia University, New York, NY. Yale-New Haven Hospital, New Haven, CT. Texas A&M University, College Station, TX. Northern Illinois University, De Kalb, IL. *Yale University Medical School, New Haven, CT.

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exercise (r = 0.65, p = 0.01), and ‘I can do physical exercises that require resistance’ (r = 0.59, p < 0.05). 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 stresses (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; M = 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 < 0.01. The multiple regression model with gender and BMI controlled was statistically significant, F(6,242) = 3.37, p < 0.01, R² = 0.177. Cultural stress significantly predicted MVPA (β = 0.21, p < 0.01), 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 discourage 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 oculumotor assessment revealed a reliable unidirectional switch-cost (22 ms, SD=18) (p < 0.01) 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 > 0.01). 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.

Physical activity (PA) is the well-known lifestyle behavior determining individual health. However, public health concerns exist regarding the low level of PA, particularly among middle-aged and older women, with limited understanding of its modifiable determinants at individual and environmental levels. Purpose: The purpose of this study was to examine the sociocultural factors explaining PA among middle-aged and older women, with specific focuses on subjective social status (SSS) and perceived neighborhood characteristics. Methods: The survey data were collected from a total of 588 women (mean age: 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.
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:2.67-7.68, p < 0.001). No activity-related variables (daily physical activity, sports participation, muscular strength/exercising) 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.

**Purpose:** Previous research has found that both music and mental toughness (MT) may affect exercise performance; however, no study has examined the relationship between MT and music on exercise performance. Therefore, the purpose of this study was to examine the effect of exercise desks on levels of physical activity and classroom performance in 4th and 7th grade students with neurodevelopmental disorders.

**METHODS:** Thirty-five children (N=13 4th grade; N = 21 7th grade) were monitored with an Actigraph accelerometer (wGT3X-BT) worn on the non-dominant wrist during school hours. Derived variables were time (minutes) in sedentary, light, and moderate intensity using published cut points. Using a repeated measures cross-over design, students attended school in two different environments for 8 weeks each: traditional school with chairs and desks and a classroom designed with exercise desks comprised of pedaling, a stand and spin, and accorion chairs. Students reading skills were assessed using two curriculum-based measurements: Maze Reading Comprehension and Oral Reading Fluency.

**RESULTS:** Weight significantly correlated with time spent in sedentary (r = 0.43, p < 0.001), light (r = 0.47, p < 0.001) and moderate (r = 0.46, p = 0.001) activity. There was a significant main effect of the activity desks on decreasing sedentary activities with a proportional increase in moderate activity once controlling for weight. A main effect for grade showed that 4th graders participated in significantly less sedentary activity and greater moderate activity compared with 7th graders. Compared to the traditional classroom, the kinesthetic classroom significantly increased reading skills in both grades although there was a trend for a slightly greater increase in 7th graders.

**CONCLUSIONS:** Exercise desks improved reading skills and decreased time spent in sedentary activities in youth with neurodevelopmental disorders. The greater decline in sedentary activity and concomitant increase in physical activity among fourth graders may suggest that older youth are less inclined to use the exercise desks.

**Purpose:** The aim of this study was to examine compulsive exercise and associations with physical activity and psychosocial health among early adolescents.

**METHODS:** Four municipalities with 15 secondary schools in Telemark County, Norway, were recruited into participate in this cross-sectional study. A total of 644 pupils (age 13.9±0.3 yrs) participated in the study (response rate: 79%). Information about weight regulation and body dissatisfaction was obtained. Instruments included Actigraph GT3X, Behavioural Regulation of Exercise - Questionnaire (BREQ), KIDSSCREEN-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, KIDSSCREEN-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 behaviour per se.
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, tiredness, tension and calmness, 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 Scales across the day. 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=0.034). Desire to Rest: lower post-lecture compared to pre (28.3±2.8 vs. 33.1±2.8, p=0.016) and lower than mid (31.1±2.8, p=0.019). Cronbach alpha coefficients for pre-, mid- and post-lecture (desire to move=.85; rest=.90. p=0.019). Cronbach alpha coefficients for pre-, mid- and post-lecture (desire to move=.85; rest=.90. p=0.019).

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Desire to move at baseline was significantly associated with energy (r=0.38, p=0.018) and calmness (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.

Conclusion
The desire to move significantly increased while the desire to rest significantly decreased across a lecture period. Desires to move/rest were correlated with energy (positively and negatively), but move was most strongly associated with calmness and rest with tiredness. Finally, the CRAVE Scale showed high internal consistency.

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CONCLUSIONS
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 as a means of enhancing 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.
obviously and body mass index (BMI) was calculated (age- and sex-specific percentiles for children). Mothers completed the International Physical Activity Questionnaire - Short Form to evaluate maternal PA; MET hours PA/week were calculated. Child PA was measured using accelerometry-determined counts per minute. Mothers completed the Family Nutrition and Physical Activity Questionnaire to evaluate family PA participation score, which was the sum of two survey items; higher scores indicate higher frequency of PA practices including family encouragement and involvement. The association between maternal PA and BMI with child PA and family PA participation was assessed using linear regression, and adjusted for maternal age, child hours away from home, household income, and child BMI percentile.

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 44.8±48.4 MET hours PA/week. Children averaged 115.9±262.8 CPM and mothers reported average family PA participation score of 8.2±7.4 (max. score 8). Maternal 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.

A-52 Free Communication/Poster - Behavioral Aspects of Sport

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

470 Board #286 May 27 10:30 AM - 12:00 PM

Motivational Language Used By Strength And Conditioning Coaches: Are They Developing Their Athletes’ Psychological Capital?

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(No relevant relationships reported)

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 affecting states, building efficacy or confidence, and developing positive pathways design, implementing obstacle planning, experiencing success or affecting states, building efficacy or confidence, and developing positive expectations) of the Psychological Capital Model (PCM). These are the conduits through which hope, efficacy, resiliency, and optimism are developed. METHODS: Ten “Mic’d up” videos were acquired vis-a-vis YouTube. The videos purposively included both men’s and women’s sports (i.e., basketball, football, hockey, softball, and volleyball), with half featuring men coaching men and half featuring men coaching women. Every coach’s statements was transcribed verbatim by two coders. Statements were then reviewed by the five-person research team and classified into one of the developmental dimensions. RESULTS: The videos were published between 2012 and 2018 (M = 2015.70, SD = 1.94) and ranged in length from 1.00 min. to 6.20 min. (M = 2.04, SD = 1.35). A total of 178 statements were recorded. No differences were observed in the use of the developmental dimensions between sports or context (i.e., all p>0.05). Three of the PCM developmental dimensions accounted for 136 (76.4%) of the total observations (i.e., experiencing success/modeling others [n = 54, 31.2%], building efficacy/confidence [n = 48, 27.8%], and implementing obstacle planning [n = 34, 19.7%]). Relative to the theoretical model, these were overrepresented (i.e., standard residuals ranging from +2.76 to +7.10). The other five dimensions were underrepresented (standard residuals ranging from -2.23 to -4.18). CONCLUSIONS: On the basis of this set of observations, strength and conditioning coaches appear to be employing a limited range of psychological strategies with their athletes. Efforts to develop resiliency among athletes were notably underused. Resiliency relates to the ability to cope with hardship, setbacks, and stress. An outcome of this study has been the development of a catalog of appropriate statements across the eight developmental dimensions of the PCM.
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.

**METHODS:** To verify the relation between sleep parameters, perceived recovery and aerobic performance of runners. **RESULTS:** 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 (tLIM). **RESULTS:** Runners had a sleep efficiency of 87.4 ± 9.6%. The intervention group having a significantly lower 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 run, the tLIM 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, tLIM 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 improved aerobic threshold exhaustion and perceived recovery are associated with sleep parameters of the night before the race.

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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 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 performed the next skill. The blocked schedule group showed also an improvement in the post-test and follow-up measure compared to the pre-test (p<.05, p<.05). Additionally, the random group was significant 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.

The interest in research on the exercise ways to improve executive ability has grown rapidly in the last decade due to the aging global population. The exercise programs were mainly involved in walking, swimming and Tai Chi. However, there is little report about the bodybuilding calisthenics training efficiency in improving executive ability of old women adults.

PURPOSE: To examine the effect of bodybuilding calisthenics training on executive ability in old women adults.

METHODS: One hundred and twenty-seven old women adults (Age: 70.2±7.6 yr., Height: 158.2±4.9 cm, Mass: 59.4±8.5 kg) were recruited from local newspaper advertisement, whose Mini-Mental Status Examination scores were above 25. All subjects were randomly divided into experimental group (EG, n = 52), control group (CG, n = 52). The EG conducted bodybuilding calisthenics training 2 times a week, 45 minutes each, for 25 weeks, and the CG continued to follow normal daily activities. The Trail Making Test A and B (TMT-A, TMT-B) and Tapping Test (F(1,125) = 9.35, p<.005). The main effect for group was significant for TMT-A (F(1,125) = 29.48, p<.001), TMT-B (F(1,125) = 6.84, p<.005) and Tapping Test (F(1,125) = 3.90, p<.05). RESULTS: 1. There were statistically significant group by time interactions for TMT-A (F(5, 609) = 6.90, p<.001), TMT-B (F(5, 609) = 6.84, p<.005) and Tapping Test (F(3, 609) = 3.90, p<.05). 2. The main effect for time was significant for TMT-A (F(1,125) = 22.09, p<.001) and Tapping Test (F(1,125) = 9.35, p<.005). The main effect for group was significant for TMT-A (F(1,125) = 4.77, p<.01), TMT-B (F(1,125) = 4.74, p<.05) and Tapping Test (F(1,125) = 3.14, p<.05). CONCLUSIONS: Bodybuilding calisthenics training helped improving executive ability for old women adults.

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). 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 putter 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 a demographic survey and the 12-item grit survey via Google Forms. The grit scale is comprised of two major components (a) consistency of interest (passion), and perseverance of effort. The ultramarathon runners were recruited through emails from race directors, facebook groups, and email invitations from the primary investigator. Statistical analyses were performed using Pearson product-moment correlations and a one-way ANOVA. Significance was set to p<0.05. RESULTS: There was a positive correlation between number of years running and grit-passion (r = 0.167, p<0.039). On average, participants had spent 14.4 (9.8) years running and had competed in ultramarathons for 4.3 (3.5) years. A positive correlation was found between the number of miles run per week and grit-passion (r=0.217, p=0.007). Participants, on average, ran 36.0 (13.3) miles per week. There was no significant difference across categories of ultramarathon distances completed and grit-passion or grit-perseverance. Failure to complete their last ultramarathon was not significantly associated with grit-passion or grit-perseverance. CONCLUSION: Grit was not found to be associated with ultramarathon distance or successful completion of an ultramarathon. Grit-passion was correlated with number of years running and weekly miles run. One limitation of this study was that 85% of the study participants were female.
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 Five 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's > .05). Thus, data were collapsed across gender and sport. Regression analyses revealed that Extraversion was the only significant predictor of INT [R = .32, p < .01], ITG [R = .36, p < .005], and IDN [R = .40, p < .001]. No traits significantly predicted AMT (p > .05). Extraversion and SH predicted RAI in the final model [R = .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.
Board #301 May 27 9:30 AM - 11:00 AM
Light Physical Activity Is Associated With Reduced Signs Of Immune Aging In Healthy Older Adults
Eunha Cho1, Bailey Theall1, James Stampeley3, Brett Davies3, Heather Quiarte1, Frank Greenway4, Neil Johannsen1, Guillaume Spielmann1, Brian A. Irving, FACSM1, 2.

Louisiana State University, Baton Rouge, LA. 2Pennington Biomedical Research Center, Baton Rouge, LA. (Sponsor: Brian Irving, FACSM)

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(No relevant relationships reported)

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 (VO2peak) in adults over 65 years old is associated with improved T-cell phenotypic 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 association 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 (70-84y) on an on-going exercise intervention (REALPA). At baseline participants performed a VO2peak exercise test on a treadmill. Participants also wore a physical activity monitor (Actigraph, GT9X) 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 G1 (KLRG1) monoclonal antibodies. T-cell phenotypes were analyzed by four-color flow cytometry (BD Accuri C6). Pearson’s correlation coefficients were used to determine linear correlations between T-cell phenotype and PA. Results: Participants VO2peak ranged from 12.2 to 29.9 mL/kg/min (20.5 ± 5.1 mL/kg/min) and spent 17.4 ± 5.6 minutes of LPA/day (5.9±0.1 h; 5.9±0.0 h, respectively) and 14.3 ± 4.6 minutes 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 VO2peak (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 (r = 0.23, p = 0.35). 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. Conclusion: Our data support the benefits of high VO2peak on immune aging in a cohort of sedentary elderly adults. More importantly, LPA and increased daily steps are associated with reduced markers of immune aging, even in elderly individuals with moderate-low aerobic fitness. This study was supported by the NIA SR21AG058181-02.

Board #302 May 27 9:30 AM - 11:00 AM
Work-week Sleep Restriction Modifies Physical Activity But Not Glucose Or Insulin Responses In Overweight Adults.
Jay W. Porter, Ryan Pettit-Mee, Travis Emerson, Jill Barnas, Jill Kanaley, FACSM, University of Missouri, COLUMBIA, MO. (Sponsor: Jill A Kanaley, FACSM)

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(No relevant relationships reported)

Insufficient sleep and inadequate amounts of physical activity (PA) are common lifestyle behaviors, but there is a paucity of research examining the interaction between insufficient sleep and PA. Purpose: To establish how sleep restriction affects PA, and the role this plays in sleep restriction-induced insulin resistance (IR) in overweight adults. METHODS: Thirteen overweight adults, who regularly sleep 7-9 h/night, underwent two study conditions; 5 days of modest sleep restriction (6-h time-in-bed, SR), and 5 days of SR-exercise (SREX), followed by a weekend recovery period (WR). Sleep (Actigraphy) and PA (Actigraph) were monitored for 7 days prior to each condition, throughout each condition, and during WR. Blood samples were collected during a mixed meal tolerance test (MT) after baseline (B), SR-SREX, and WR. Daily exercise, SREX, was 45 minutes on a treadmill walking (65% VO2peak). RESULTS: Subjects slept 8.0 ± 0.2 h during B weekdays compared to SR and SREX (5.9±0.1 h; 5.9±0.0 h, respectively) and 7.4 ± 0.2 hours on weekend (7.4±0.3; 7.6 ± 0.4, respectively). Steps were maintained during SR compared to B (B-SR, 8276±622; SR, 7656±676 steps/day) but were increased during SREX (B-SREX, 8550±776; SREX 13182±276 steps/day; p = 0.001). Steps during the B weekend period were reduced compared to B (p = 0.001) and during WR following SREX (SR, p = 0.01) or SREX (p < 0.001). Subjects performed less light (LT) PA during SR:SREX (p = 0.001). Sedentary (SED) PA tended to be higher during SR compared to B (p = 0.07) but tended to be reduced during SREX (p = 0.09). Moderate-vigorous PA was reduced during SREX (p = 0.001) and reduced during SR (p = 0.05) compared to B. During MT, glucose and insulin response did not differ by condition or across time. Matsuda calculations tended to also show improvements in IR (time, p = 0.06), where WR improved compared to B (p = 0.05), no differences between B and SR:SREX. CONCLUSION: Overweight adults maintained steps during SR, but reduced time spent performing MVPA. When subjects performed EX during SREX, SREX was replaced with MVPA with no changes in LTPA observed. Subjects increased SED and decreased LTPA and MVPA during WR compared to B, likely due to the reduced step counts. Modest SR did not reduce IR in overweight adults, but despite reduced PA during WR, IR was improved compared to B.

Board #303 May 27 9:30 AM - 11:00 AM
Acute Resistance Exercise Fails To Improve Influenza Vaccine Response In Older Adults
Emily C. LaVoy, Mahmoud T. Elzayat, Melissa M. Markofski, University of Houston, Houston, TX. Email: eclavoy@uh.edu

(No relevant relationships reported)

Older adults are at elevated risk for morbidity and mortality caused by influenza. Vaccination is the primary means of prophylaxis, but the magnitude and duration of the protective response is often compromised in older adults. As acute eccentric resistance exercise can mobilize immune cells into targeted muscle, it may enhance immune responses to vaccination. PURPOSE: To compare immune responses to influenza vaccination in older adults who performed eccentric resistance exercise prior to vaccination to those who did not exercise. METHODS: 29 resistance training naïve older adults (20 women, 75.6 ± 5.5 years) were randomized to 1 of 3 groups: 1) exercise in the vaccinated arm (EX-S), 2) exercise in the opposite arm (EX-OP) and 3) control (NO-EX). Exercise consisted of 10 sets of 5 repetitions at 85% of each subject’s pre-determined concentric one repetition maxima. Lateral raises were alternated with bicep curls, with 15 sec rest between exercises and 30 sec rest between sets. Focus was on the eccentric component of the exercise. NO-EX sat quietly for 20 min. Following treatment (EX or NO-EX), all subjects received the 2018 quadrivalent influenza vaccine (Sequois Afluria) in the deltoid of the non-dominant arm. Antibody titers against the 4 influenza strains in the vaccine were determined by hemagglutinin inhibition assays at 6- and 24-weeks post-vaccination. Group differences in antibody titers by time were assessed by maximum likelihood linear mixed models; sex was included as a covariate. Fold-changes in antibody titers at 6 and 24 weeks from baseline were compared between groups by Kruskal-Wallis H tests. RESULTS: Subjective reports of soreness did not differ between groups. One subject (EX-S) reported flu-like symptoms 18 weeks post-vaccination. No significant group x time effects were found for any strain. Women had greater titers to strain A Singapore compared to men (F(1, 24) = 5.85, p = 0.022). There was a trend for group differences in fold-increase in antibodies against B Colorado at 6 weeks (H2(2) = 4.512, p = 0.105) with a mean rank antibody titer of 16.88 for EX-S, 12.29 for EX-OP, and 10.40 for NO-EX. CONCLUSION: Acute eccentric resistance exercise of the deltoid and bicep brachii did not significantly influence antibody titers to the influenza vaccine delivered post-exercise in older adults.
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.

**Board #305**
**May 27 9:30 AM - 11:00 AM**
**Abstract Withdrawn**

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 a subsequent trial, 45 min of intermittent cycling at 60% of CPET peak wattage was performed. Blood was taken at rest, immediately (0h) and 1h after exercise. Monocyte function in breast cancer survivors (BCS) following acute exercise and

**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. Mooret1, Jordan T. Lee1, Williams S. Evans1, Eli Danson1, Chad W. Wagoner1, Elizabeth P. Harrell1, Stephanie A. Sullivan1, Lauren C. Bates1, Brian C. Jensen1, Hyman B. Muss1, Claudia L. Battaglini, FACS1. 1University of North Carolina at Chapel Hill, Chapel Hill, NC. 2Duke University, Durham, NC. (Sponsor: Claudia Battaglini, FACS) Email: edhanson@email.unc.edu (No relevant relationships reported)

**RESULTS:** Phagocytosis increased 1h after acute exercise (pre: 3396±941 fl; 0h: 3257±772, 1h: 3692±824, p = 0.035) but not after training. There was a trend for greater phagocytosis with training (pre: 3533±815 fl; post: 3624±328, p = 0.067) whereas CD16+ TLR4 expression tended to decrease with acute exercise (p = 0.067) whereas CD16+ TLR4 expression tended to decrease with acute exercise (p = 0.067) whereas CD16- TLR2 expression was determined on CD14+CD16- and CD14+CD16+ monocytes. All assays were performed before (pre) and after (post) 16 wk of combined aerobic and resistance training. Data are presented as mean fluorescence intensity ± SD. **PHYSICAL ACTIVITY:** Phagocytosis increased 1h after acute exercise (p = 0.008). Oxidative burst was unchanged with acute exercise but improved following training (pre: 4264±1061 fl; post: 5446±1287, p = 0.026). CD16- TLR2 expression decreased acutely at 1h compared to rest and 0h both before and after training (rest: 350±70, 0h: 328±73, 1h: 287±41, both p = 0.05) while CD16- decreased acutely before training only (pre: 355±115 fl; 0h: 339±98 fl; 1h: 291±87, CD16- TLR4 expression tended to decrease with acute exercise (p = 0.067) whereas CD16+ TLR4 expression decreased across all time points (rest: 140±15, 0h: 135±15, 1h: 123±18, all p = 0.05) with neither population affected by training. **CONCLUSIONS:** In BCS, monocyte phagocytic capacity of bacteria increased following acute exercise, while training increased both phagocytosis and oxidative burst. Training appeared to mitigate the acute response, possibly due to higher resting function. Expression of TLR2 and TLR4 were progressively reduced with acute exercise that was mostly independent of training. The reduction of monocyte TLR2 and TLR4 may represent an anti-inflammatory response to acute exercise that promotes enhanced elimination of bacteria. Supported by Breast Cancer Research Foundation (New York, NY).

**Board #307**
**May 27 9:30 AM - 11:00 AM**
**Association Between Circulating FGF21 Levels And Physical Activity In Abdominal Obese Adults**

Masahiro Matsui1, Keisii Kosaki2, Koichiro Tanahashi3, Nobuhiko Akazawa1, Yusuke Osuka1, Kiyoji Tanaka, FACS1, Makoto Kuro-o4, Seiji Maeda5. 1University 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, FACS) Email: masahironmatsui70@gmail.com (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 assessing using an 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.

**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. Arsentios-Lantz2, Christopher S. Fry1, Douglas Paddon-Jones, FACS1. 1University of Kentucky, Lexington, KY. 2The University of Texas Medical Branch, Galveston, TX. (Sponsor: Douglas Paddon-Jones, FACS) Email: jfr282@uky.edu (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, 62.2 ± 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), RASGRP1 (rs7403531), PROX1 (rs2075423), HHEX (rs35763322), IGF2BP2 (rs4402960), CDKAL1 (rs7754840), SLC30A8 (rs13266634), ZFAND6 (rs11633437), 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). SPSS 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 significantly 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. Post-bed rest Mat-ISI ranged from 18.1 ± 11.3 to 6.8 ± 26.0 in the highest risk group. Post-bed rest DI was 16.8 ± 12.9 for
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 Claudia D. Pepper Older Americans Independence Center (P30 AG02832).

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 Hou¹. ¹Institute of Sports Sciences, Taipei city, Taiwan. ²Holistic Education Center, Hualien city, Taiwan. (Sponsor: Chia-Hua Kuo, FACSMM) Email: qute3332@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 6 weeks, before and participated in a self-monitored HIIT training (treadmill running 7 x 2 minutes at 85-90 % VO2max) and passive rest). To capture HR, a heart rate monitor (Polar, v800, Finland) was approved by the ethics committee under number 1,643,562. The participants 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, and metabolic syndrome blood biomarkers. RESULTS: Time to exhaustion significantly increased in TWK10 (+11.4%, p = .008) and PLA (+8.3%, p = .004). Hip circumference reduced significantly only in TWK10 group (-2.1%, p = .018) and waist circumference increased significantly only in PLA group (+1.7%, p = .008). No significant group effects were found in waist and hip circumference respectively. FBG increased significantly in PLA group (+2.1%, p = .018) and waist circumference increased significantly only in PLA group (+1.7%, p = .008). No significant group effects were found in waist and hip circumference respectively. FBG increased significantly in PLA group (+4.5%, p = .004) but no significance was found in TWK10 group and between both groups. No significant time and group effects were found in VO2max, body weight, body fat %, TG, and HDL. CONCLUSION: Probiotics supplement in combination with HIIT may only control body circumstances and stabilize FBG over time, but does not have additive benefits in overall cardiopulmonary fitness and metabolic biomarkers.

A-54 Free Communication/Poster - Diabetes/ Glycemic Control

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

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, FACSMM, Timothy McKay, Kupper Wintergerst. University of Louisville, Louisville, KY. (Sponsor: Jason JaggerS, FACSMM) 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), continuous 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 on 3.48 ± 1.95 days per week only 7.9% (n = 12) met 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 minute a child participated in sport, the primary 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, FACSMM, Timothy S. Church³, Mark A. Sarzynski, FACSMM. 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, FACSMM) (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 complex 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), or 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 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 μmol/L, p=0.03, H1 (7.4nm): 0.44 μmol/L, p=0.03), and RT increased medium LDL-P (43.89 μmol/L, p=0.002), while AT/RT failed to produce changes in any lipoprotein subclass. Adjusted GLMs revealed the change in 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 Gentilli², Lucas Raphael Bento Silva¹, Camila Simões Seguro², Paulo Otião Silva Santos³, Jessiel Fernandes³, Gabriela de Oliveira Teles³, Vitor Alves Marques³. 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. ⁴Federal University of Goias, Faculty of Physical Education and Dance, Goiania, Brazil. ⁵Federal 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 (HRR) kinetics and Heart Rate variability (HRV) 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 = 30.5 ± 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 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)

Abstracts were prepared by the authors and printed as submitted.
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 trails being run on normomweight (STRONG-D) and overweight (IMPACT) diabetics, patients performed individualised ramp CPET. Results of CPET were compared between the groups using statistics.
found for iHRR presence or continuous HRR measure. Stepwise linear regression showed peak CO (B=0.517, 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 benefit from exercise participation encouragement to improve tolerance of physical activity.

501 Board #317
Thursday, May 27, 2020 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

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(Rate: 1 = not important; 5 = extremely important)

(P=0.42, 0.17, 0.33, 0.51, and p<0.05, respectively). A significant improvement in SEE was observed in diabetic (34.3 ± 9.0 vs. 5.9 ± 9.0, p=0.029), but not pre-diabetic (38.8 ±12.8 vs. 60.0 ± 12.8, p=0.024) 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
Thursday, May 27, 2020 10:30 AM - 12:00 PM
Accuracy Of Continuous Glucose Monitoring During Exercise In Type I Diabetes Patients

Matteo Vandoni1, Vittoria Carnevale Pellino1, Luca Correale1, Giulia Liberali2, Valentina Natalucci2, Silvia Bonfadini3, Angela Girelli2, Cosme Franklin Buzzachera2. 1University of Pavia, Pavia, Italy; 2University of Urbino Carlo Bo, Urbino, Italy; 3ASST Spedali Civili di Brescia, Brescia, Italy. (Sponsor: Carlo Baldari, FACC)

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(Rate: 1 = not important; 5 = extremely important)

CONCLUSIONS: Continuous glucose monitoring was not sufficiently accurate to describe glycemic levels at low-to-moderate exercise intensities in Type I Diabetes patients and require confirmatory capillary glucose measurements.

504 Board #320
Thursday, May 27, 2020 10:30 AM - 12:00 PM
Influence Of Monetary Incentives On Exercise Compliance & Health Among Hyperglycemic Adults: Preliminary Analysis.

Sean O’Neill1, Noah J. Curtis2, Rachel N. West3, Jacklyn P. Hensel1, Gabe N. Neil1, Joshua P. Muench1, Rachael K. Nelson3, 1St. Jude’s Children’s Hospital, Memphis, TN; 2Beaumont Health, Southfield, MI; 3Central Michigan University, Mt Pleasant, MI. (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±12 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 if a session was missed per wk: $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 cardiopulmonary 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- and incremental-loss group (90±14% vs. 92±7%, p=0.63). No significant differences were observed between groups or in

Abstracts were prepared by the authors and printed as submitted.
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- (1311.18 vs. 1141.17 mg/dL, p<0.03) and incremental-loss (1522.23 vs. 1322.19 mg/dL, p<0.01) group. No significant differences were detected in acute response to exercise for HR, SBP or DBP.

CONCLUSION: Regardless of loss regime, 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.

505 Board #321
May 27 10:30 AM - 12:00 PM
Effects Of Progressive Combined Exercise Program On Irisin, C-peptide And Homa Index In Obese Elderly Women With Type 2 Diabetes
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PURPOSE: The purpose of this study was to investigate the effects of progressive combined exercise program on irisin, C-peptide, HOMA-β, HOMA-IR, body composition and physical fitness in obese elderly women with type 2 diabetes.

METHODS: Thirty-six obese elderly women with T2DM patients (76.64 ± 6.56 years, %BF 36.09 ± 4.18, HbA1c 7.05 ± 0.85%) were randomly assigned to the combined exercise group (n = 20) and to the control group (n = 16). The 60 minute combined exercise program (outdoor walking + elastic-band resistance exercise) was performed 3 times per week for 12 weeks, and the intensity was progressively increased every four weeks (Outdoor walking RPE 11-14; Band exercise 1-4 weeks: OMNI-RES 3 to 4, 5-8 weeks: OMNI-RES 5 to 6, 9-12 weeks: OMNI-RES 7 to 8).

RESULTS: There were significant time × group interactions for irisin (p<0.001), C-peptide (p<0.001), HOMA-β (p<0.001), HOMA-IR (p=0.045), fasting blood glucose (p<0.001), and HbA1c (p<0.001). Result of combined exercise group were as follows; percentage of body fat had significantly decreased, and insulin level had significantly increased. In addition, HbA1c and Glycemic were significantly decreased to improve glycemic control, and C-peptide, CPI and HOMA-β levels were significantly changed level had a positive correlation with insulin change level.

CONCLUSIONS: Combined exercise improves irisin levels and regulates percentage of body fat and blood glucose, which improves beta-cell function than non-exercise. Therefore, progressive combined exercise improves body composition, blood glucose and β-cell function by increasing insulin levels in obese elderly women with type 2 diabetes.

506 Board #322
May 27 10:30 AM - 12:00 PM
Ethnic Differences In Post-prandial Glycemic Control After Acute Moderate-intensity Continuous Or High-intensity Interval Exercise
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PURPOSE: To examine the acute effect of moderate-intensity aerobic exercise (CME) and low-volume high-intensity interval training (LV-HIIT) on glycemic control in white Europeans (WEs) and south Asians (SAs) with impaired glycemic control.

METHODS: Sixty-six obese elderly women with T2DM patients (76.64 ± 6.56 years, %BF 36.09 ± 4.18, HbA1c 7.05 ± 0.85%) were randomly assigned to the combined exercise group (n = 20) and to the control group (n = 16). The 60 minute combined exercise program (outdoor walking + elastic-band resistance exercise) was performed 3 times per week for 12 weeks, and the intensity was progressively increased every four weeks (Outdoor walking RPE 11-14; Band exercise 1-4 weeks: OMNI-RES 3 to 4, 5-8 weeks: OMNI-RES 5 to 6, 9-12 weeks: OMNI-RES 7 to 8).

RESULTS: There were significant time × group interactions for irisin (p<0.001), C-peptide (p<0.001), HOMA-β (p<0.001), HOMA-IR (p=0.045), fasting blood glucose (p<0.001), and HbA1c (p<0.001). Result of combined exercise group were as follows; percentage of body fat had significantly decreased, and insulin level had significantly increased. In addition, HbA1c and Glycemic were significantly decreased to improve glycemic control, and C-peptide, CPI and HOMA-β levels were significantly changed level had a positive correlation with insulin change level.

CONCLUSIONS: Combined exercise improves irisin levels and regulates percentage of body fat and blood glucose, which improves beta-cell function than non-exercise. Therefore, progressive combined exercise improves body composition, blood glucose and β-cell function by increasing insulin levels in obese elderly women with type 2 diabetes.

507 Board #323
May 27 10:30 AM - 12:00 PM
Motor-assisted And Functional Electrical Stimulation Cycling Impacts Postprandial Glucose In Diabetic Patients With Adl Disability
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Background: Effective glucose management using exercise modalities in older patients with type 2 diabetes and activities of daily living (ADL) disabilities are unknown.

Purpose: The study investigated the acute effects of motor-assisted cycling and functional electrical stimulation (FES) cycling on the 2-h postprandial glucose responses compared with sitting control in older adults with type 2 diabetes and ADL disability.

Methods: The study used a 3×3 crossover study design. Nine participants were randomly assigned to one of the three intervention sequences: ABC, BCA, and CAB. (A, motor-assisted cycling; B, FES cycling; C, sitting control). Linear mixed models (LMM) with Bonferroni post-hoc tests were used to test the mean differences for the 2-h postprandial glucose, estimated by the area under the curve (AUC) and incremental AUC (iAUC) across intervention and control treatments after adjustment for covariates (e.g., age, sex, and race).

Results: There were significant mean difference for iAUC (p = 0.005) and AUC (p = 0.038) across motor-assisted cycling, control, and FES cycling treatments. The FES cycling had a lower mean of 2-hour postprandial iAUC as compared with sitting control (AUC 3.98 mmol·h/L vs 6.92 mmol·h/L, p = 0.006; effect size [ES] = 1.72) and the motor-assisted cycling (AUC 3.96 mmol·h/L vs 6.19 mmol·h/L, p = 0.0368, ES = 1.29, respectively). The FES cycling also had a lower mean of the 2-hour postprandial AUC as compared with sitting control (AUC 18.29 mmol·h/L vs 20.95 mmol·h/L, p = 0.043, ES = 0.89), but had an AUC similar to the motor-assisted cycling (18.29 mmol·h/L vs 20.23 mmol·h/L, p = 0.183, ES = 0.19). There were no statistical differences in iAUC (6.19 mmol·h/L vs 6.92 mmol·h/L) and AUC (20.23 mmol·h/L vs 20.95 mmol·h/L) between the motor-assisted cycling and sitting control (all p>0.05).

Conclusion: Performing 30 minutes of FES cycling on a motor-assisted bike (40 Hz, 38 rpm, 25-29 mA) significantly decreased the 2-h postprandial glucose levels by 42% in older adults with type 2 diabetes and ADL disabilities. Our findings suggested that FES cycling can be a promising exercise modality for glucose management in diabetic patients with ADL disabilities.
PURPOSE: The evidence from randomised controlled trials (RCTs) and meta-analyses supports the use of exercise to manage type 2 diabetes (T2D), and most guidelines propose exercise as a cornerstone of clinical management. However, there is a paucity of evidence for how this translates to real-world practices, specifically the effectiveness of exercise in patients with T2D when delivered as part of complex health service models, rather than relying only on RCTs.

METHODS: A collaboration of universities and health clinics in Australia is addressing this evidence gap by investigating the effectiveness of services provided by Accredited Exercise Physiologists on a range of outcome measures in people with T2D. The novelty of this approach is the authenticity of 1) the sample population, which excludes no one who is referred to the service; and 2) the type of intervention, which is whatever the individual clinic, clinician and/or patient deem suitable for each situation, subject to any cost constraints. This study is a preliminary analysis of the challenges encountered with this real-world research approach and of the population presenting for exercise physiology services in this context.

RESULTS: Key challenges encountered were:
1) delays in regional ethics committees,
2) participant recruitment particular to each site,
3) attrition,
4) access to medical records.
Sixty-two participants (59% female, 65 ± 10 y.o, HbA1c 7 ± 1%, BP 137/77 including 23% stage 1 and 33% Stage 2 hypertension based on ACC levels) have been enrolled to date. All were on 1 or more hypoglycaemic medication, 88% were on 1 or more cardiovascular medication and 83% were on 1 or more other medication. Of those on additional medications the mean number of medications prescribed was 7.5 per person.

CONCLUSIONS: The challenges encountered are consistent with similar approaches of translational research. The sample recruited so far is older with more comorbidity and complex polypharmacy, but has relatively good glycaemic control compared to the typical patient population studied in published RCTs. The difficulty in accrual considered alongside the patient characteristics supports the need for more focus on this type of implementation research to inform the real-world evidence for the benefits of exercise, rather than relying only on RCTs.
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 was 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 three 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.

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 is unknown. PURPOSE: The purpose of this investigation was to test the relationship between glucose variability and intensity of PA and determine if duration of activity is predictive of changes in glucose variability in a sample of teenagers with T1D.

METHODS: Data for this investigation were used from an ongoing study at a local pediatric Diabetes Center. Participants who wore a continuous glucose monitor (CGM): Data for this investigation were used from an ongoing study at a local pediatric Diabetes Center. Participants who wore a continuous glucose monitor (CGM) and Fitabase. Pearson’s correlation and a simple linear regression were used for final analysis with a p-value of 0.05 to determine significance.

RESULTS: Minutes of daily moderate intensity activity had a significant inverse relationship (r = -0.59, p = 0.04) with glucose variability, whereas moderate and vigorous PA (MVPA) combined showed a stronger inverse relationship (r = -0.86, p = 0.03). When placed in a simple linear regression only MVPA significantly predicted changes in glucose variability (β = -0.12, p = 0.03). CONCLUSION: These data show that not only is duration of PA an important factor when it comes to managing diabetes, but that more attention should be paid to the time spent at various intensity levels. Even though more research still needs to be completed in this area it would be of great benefit for children with T1D to incorporate an activity monitor into their daily routine to share with their diabetes care team and better understand how PA levels impact their blood glucose. Funded by Children’s Hospital Foundation, Christensen Family, Norton Children’s Hospital, and University of Louisville.

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

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 (≥5.1 minutes at 95-100% of participants’ maximal heart rate (HRmax)) or moderate continuous aerobic exercise (MC) (24 minutes continuous cycling at 65% of HRmax) on a bicycle ergometer. Before (0) and after (1) 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 (0 vs. 1) 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<.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 sensitively 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.

513 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 Joisten2, Annette Rademacher3, Sebastian Proschinger3, Max Obersle1, Alexander Schenk1, Jan Kool1, Wilhelm Bloch1, Jens Bansi2, Philipp Zimmer1. 1German Sport University Cologne, Cologne, Germany; 2Klinikum- Valens, Valens, Switzerland.
(No relevant relationships reported)
The inflammation marker neutrophil/lymphocyte ratio (NLR) receives 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 cardiorepiratory 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 (HR_max) with active breaks for 2 min in between. The MCT group exercised 24 min continuously at 65% HR_max. Both groups exercised 3x/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 and after the intervention period (T1) during resting conditions. At 3 weeks (h) (T2) after the first exercise session. NLR was calculated from blood panels. Baseline-adjusted ANCVOAs with Bonferroni post-hoc test were performed.

**Results:** RelativVO2_peak increased in HIIT (mean difference (MD)=2.47 ml kg⁻¹ min⁻¹, p<0.001) and MCT (MD=1.51 ml kg⁻¹ min⁻¹, p<0.004), but no group differences were found. The increase in relative 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 (T2) compared to MCT (MD=1.60, p<0.05).

**Conclusion:** Despite the short intervention period, cardiorepiratory 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” and “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 interval training. RESULTS: HIIT protocols were observed for both groups (all p<0.001–0.05). Again, with no between-group differences detected. CONCLUSION: HIIT increased VO2_peak and HRQoL, contributing to the patients’ reduced cardiovascular disease risk, improved health, performance, and enhanced quality of life. Similar improvements were observed if IRS patients were guided by healthcare professionals or an APP, suggesting that utilization of the APP may be excellent in reducing the costs of HIIT as a treatment strategy in this patient population.
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-test 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 < 0.02) and Waist/Height Ratio (WHR) (0.02 ± 0.03, p = 0.018) and an increase in Fat-and-bone free-mass (0.8 ± 1.1 %, p = 0.041) and VO_{max} (148.2 ±120.2 mL/min, p = 0.002) 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 = 0.77, p = 0.019) and a higher increase in VO_{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.

519 Board #335 May 27 9:30 AM - 11:00 AM Influence Of High-intensity Training On Quality Of Life And Daily Activity Performance In Multiple Sclerosis
Sebastian Proschinger1, Jens Bansi2, Annette Rademacher2, Niklas Joisten2, Alexander Schenk1, Max Oberste1, Jan Kool2, Wilhelm Bloch1, Philipp Zimmer2. 1German Sport University Cologne, Cologne, Germany. 2Klinikum Vales, Valens, Switzerland.

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(No relevant relationships reported)

Persons with multiple sclerosis (pMS) 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 pMS. 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 pMS with light-to-moderate disability status. METHODS: The intervention group (INT; n=36) cycled for 24 minutes at 65% of HRmax. Performance of ADL was moderate training seem to have profound clinical impact by improving overall HRQoL and processing (INT: 1.111±0.110 [SE=.053], p=.042; CON: 1.111±0.145 [SE=.057], p=.014) 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 = 0.77, p = 0.019) and a higher increase in VO_{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.

520 Board #336 May 27 9:30 AM - 11:00 AM High-intensity Interval Versus Moderate-intensity Continuous Heated Water-based Exercise On Cardiovascular Variables In Hypertensive Older Individuals
Isabela R. Marcal1, Bianca Fernandes1, Vanessa T. Amaral1, Fernanda Z. Arthuso1, Felipe B. Santinelli1, Raphael M. Abreu2, Isabela R. Marcal1, Bianca Fernandes1

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(No relevant relationships reported)

PURPOSE: To evaluate acute hemodynamic and autonomic responses to high-intensity interval training (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, MlCE 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 cycling at moderate-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 Ratin 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. HR showed an increase in the µ (high 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 HFA_m (PRE: 413 ± 874 ms² vs POST: 272 ± 716 ms²; p < 0.001), during REC only the HII group was able to increase the HFA_m index (POST: 272 ± 716 ms² vs REC: 530 ± 1336 ms²; p = 0.001). The changes in HFA_m during was followed by a decreased of LF_m (low frequency band) index after HIIT (POST: 49 ± 24 n.u. vs REC: 33 ± 18 n.u.; p = 0.013). No difference was found in pre SBP/DBP (p<0.05). Although in post moment SBP was different between CON (153±4) vs MICE (141±6, p<0.02) and CON vs HIIT (136±5; p<0.001), with no difference in DBP. For REC, only CON (131±3) vs HIIT (123±4; p<0.02), with no difference in CON vs MICE and MICE vs HIIT (p<0.05) were founded. Only HIIT 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<0.01) 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 HIIT 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 COMB vs usual care that reported ≥2 modifiable CMH risk factors. Standardized mean (SMD) and mean differences (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±0.6% male with an age mean 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) (SMD -0.36 [-0.50, -0.22], p<0.001), body fat (%FAT) (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], p=0.05) and fasting blood glucose (FBG) (SMD -0.30 [-0.54, -0.05], p=0.02). PRT alone significantly improved BMI (MD -0.37 [-0.53, -0.21], p=0.00001), BF% (SMD -0.91 [-1.70, -0.13], p=0.02) and lean mass body (SMD 0.96 [0.13, 1.87], 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 progressive resistance and impact training (HiRIT) in postmenopausal women with low to very low bone mass. While efficacious in a research setting, exercise improvements may not be generalizable to the ambulatory population due to economic and accessibility barriers. Thus, the purpose of this study was to determine if supervised HiRIT is effective and appealing for postmenopausal women at risk of fracture. **Methods**: Participants (n=103) were randomized to either 8 months of 30-minute, twice-weekly supervised HiRIT (n=49) or unsupervised, low-intensity, home-based exercise (n=52). At baseline and follow-up, all participants completed physical activity enjoyment, quality of life (QOL), and participant perception of the HiRIT program. **Results**: Supervised HiRIT 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 improvements in managing 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 stage 1-3 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 each session, 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. 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 ANOVAs using SPSS 24.0 were conducted to determine 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: 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 = -0.61), and Berg Balance Scale also had a moderate correlation with the single leg balance test (r = 0.54) and UPDRS (r = -0.40). Correlation strength was defined as strong (abs r > 0.7), moderate (0.7 ≥ abs r > 0.5), and weak (abs r < 0.5).

CONCLUSIONS: The results of this pilot study suggest that mental health measures show no significant improvements or decrements 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 among people with PD who exercised regularly. 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 ANOVAs using SPSS 24.0 were conducted to determine 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: Posture control ability remained significantly improved during the 24-week 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>
<tr>
<th>posture control range changes before and after 24-week intervention</th>
<th>Forward</th>
<th>MKE</th>
<th>EDE</th>
<th>DCL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time factor</td>
<td>Wuqinxi (N=23)</td>
<td>Baseline</td>
<td>71.08±19.91</td>
<td>53.21±19.36</td>
</tr>
<tr>
<td>12 weeks</td>
<td>71.08±19.91</td>
<td>62.83±18.97</td>
<td>84.46±9.06</td>
<td></td>
</tr>
<tr>
<td>24 weeks</td>
<td>79.66±18.17</td>
<td>60.80±20.27</td>
<td>82.96±8.71</td>
<td></td>
</tr>
<tr>
<td>Stretch group</td>
<td>Baseline</td>
<td>75.00±17.72</td>
<td>60.38±17.54</td>
<td>83.88±6.68</td>
</tr>
<tr>
<td>12 weeks</td>
<td>80.00±11.92</td>
<td>65.33±15.08</td>
<td>86.06±7.50</td>
<td></td>
</tr>
<tr>
<td>24 weeks</td>
<td>79.63±17.90</td>
<td>62.19±19.08</td>
<td>85.33±6.68</td>
<td></td>
</tr>
</tbody>
</table>

CONCLUSIONS: 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 ANOVAs using SPSS 24.0 were conducted to determine 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. CORRELATIONS: 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>
<tr>
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<th>MKE</th>
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</thead>
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<td>Baseline</td>
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<td>75.00±17.72</td>
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</tbody>
</table>

Table 1. Correlations between various measures of physical function. All correlations were significant (p < 0.002). 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.

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 Li1, Kuncheng Jie1, Zhen Wang1, Yan Jiang1, Yong Gao2, Xiangrong Shi3.
1Shanghai University of Sport, Shanghai, China. 2Boise State University, Boise, ID. 3UNT Health Science Center at Fort Worth, Fort Worth, TX.

Email: zhuangjieshi@163.com

(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).

<table>
<thead>
<tr>
<th>Effect</th>
<th>Baseline</th>
<th>After 12 weeks</th>
<th>After 24 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grip strength</td>
<td>0.110</td>
<td>0.252</td>
<td>0.249</td>
</tr>
<tr>
<td>Pinch strength</td>
<td>0.310</td>
<td>0.236</td>
<td>0.254</td>
</tr>
<tr>
<td>Pincer strength</td>
<td>0.446</td>
<td>0.285</td>
<td>0.274</td>
</tr>
<tr>
<td>Pinch index</td>
<td>0.754</td>
<td>0.252</td>
<td>0.249</td>
</tr>
<tr>
<td>Pincer index</td>
<td>0.310</td>
<td>0.236</td>
<td>0.254</td>
</tr>
</tbody>
</table>
| Correlations between various measures of physical function. All correlations were significant (p < 0.002). 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.
PURPOSE: To assess the effects of a multicomponent exercise training intervention on dynamic and isometric maximal muscle strength of lower and upper extremities and muscle power output in acutely hospitalized older adults.

METHODS: A secondary analysis was conducted on seven randomized clinical trials in acute care elderly (ACE) unit in a tertiary public hospital in Navarre (Spain). 370 hospitalized patients (aged ≥75 years) 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 performed to assess hand dexterity (timed speed and flexibility), and hand-eye coordination, respectively, before and after the 12-week exercise intervention. Mixed-model (group by time) repeated measures ANOVA was used in the studies.

RESULTS: After the 12-week’s exercise intervention, the post-intervention PPT score increased (P<0.01) for both groups through the intervention, with no group difference being observed (P=0.734). (Table 1)

CONCLUSIONS: The Wuqinxi exercise routine could improve hand dexterity following the 12-week’s training in patients with mild-to-moderate PD.

**Table 1.** Scores of PPT and SPT before vs after 12-week intervention

<table>
<thead>
<tr>
<th>Group</th>
<th>Baseline</th>
<th>12 week</th>
<th>Δ (change)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPT-D</td>
<td>22.26 ±3.15</td>
<td>25.78 ±3.05</td>
<td>3.52 ±3.15</td>
</tr>
<tr>
<td>PPT-ND</td>
<td>20.60 ±3.09</td>
<td>23.29 ±3.15</td>
<td>2.69 ±3.26</td>
</tr>
<tr>
<td>PPT-B</td>
<td>17.52 ±3.25</td>
<td>20.94 ±3.22</td>
<td>3.42 ±3.25</td>
</tr>
<tr>
<td>PPT-A</td>
<td>30.79 ±4.37</td>
<td>33.70 ±4.28</td>
<td>3.91 ±3.58</td>
</tr>
<tr>
<td>SPT</td>
<td>8.75 ±2.93</td>
<td>10.62 ±3.31</td>
<td>1.87 ±3.31</td>
</tr>
</tbody>
</table>

D: dominant hand; ND: non-dominant hand; B: both hands; A: Assemble task. Δ (change) = post-intervention – pre-intervention. * or ** denotes significance level (P <0.05 or P <0.01)

Statistical analysis conducted using an ANOVA with Bonferroni post-hoc test for Δ. From the ANOVA, the following factors were found to be statistically significant:

- **Pre- and post-intervention:** P = 0.003
- **Group:** P = 0.005
- **Time:** P = 0.005
- **Pre-post time points:** P < 0.001

Improve muscle strength improved in all PT groups (P < 0.05) with a 23.7%, 23.3%, 34.8%, and 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 and power, may be a cost-effective intervention for improving muscle power output of lower limbs at submaximal loads and maximal muscle strength in very old patients during acute hospitalization.
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 = .19), 90° sit to stand test (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 or older 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 seven days of accelerometer data of 315 subjects aged 65-75 years (body mass index: mean ± SD) 27.91 ± 4.54 kg m⁻²; male: 155; female: 160) were obtained from the Interactive Diet and Activity Tracking in AARP (iDATA) database from the National Cancer Institute. Subjects were also categorized into three body composition (BMI) subgroups: normal (18.5-24.9 kg m⁻²); overweight (25-29.9 kg m⁻²) and obese (>30 kg m⁻²). Average time spent (sec) in standing, sitting and lying 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) among 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. RESULTS: Analysis revealed statistically significant differences for time spent standing and sitting between the normal weight (standing: 26,941 ± 8,163 secs; sitting: 29,954 ± 9,179 secs) group and the overweight (standing: 22,840 ± 7,892 secs; sitting: 33,632 ± 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 (r² = .31, r = -.09; p < .001) among steps, standing, sitting, and lying with the greatest contributors to the model being standing time (p = .008) and sitting (.402). 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 greater 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, which pharmacological treatment have not proven to be as efficient as increasing HDL 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 compared to younger adults. The aim of this study was to examine the effect of five-year of 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 4-10 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.Olavs 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<0.03 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 (PAVIS) 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 PAVS and measures of fall risk. METHODS: 65 seniors (age=81,±8.0) participated. The PAVS 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 BTrackSTM 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 BTrackS normative data) suggested a fall risk. Dependent measures were dichotomized as fall risk or no fall. Separate point biserial correlations were conducted to determine associations between the PAVS and fall risk category for the ABC, TUG, and postural sway.

RESULTS: No significant associations existed between PAVS and ABC (r = -.23, p = .20), TUG (r = .20, p = .12), or postural sway (r = -.01, p = .94). CONCLUSIONS: Increasing physical activity levels based on the PAVS 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 PAVS 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.
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), or the Cr loading diet (4% Cr for 1 week followed by 2% Cr 3 weeks ) and doxorubicin group (Cr2+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 
vivo  metabolic 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 in Cr2+Dox. A between group difference in grip force was also observed at the 5 day time point (p<0.001) with Dox, Cr1+Dox, and Cr2+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 days 3, 5, Con generated less force than Dox at the 10 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 Cr2+Dox. At day 5, Cr1+Dox EDLs generated significantly less force than Con at every time point during the 100 s fatigue protocol (p<0.05), and Cr2+Dox EDLs generated significantly less force than Con 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 Dox injection suggesting that Cr’s benefit may be limited to protecting against the early phases of acute Dox myotoxicity.

538 Board #354 May 27 10:30 AM - 12:00 PM Phase Angle Adaptation To Exercise Training In Cancer Patients Undergoing Treatment Nicholas Harman, Nathaniel Croate, Reid Hayward. University of Northern Colorado, University of Northern Colorado Cancer Rehabilitation Institute, Greeley, CO.

Phase angle is a measure of cellular resistance and reactance to bioelectrical impedance analysis. This measurement is useful as a marker of cell membrane integrity and is used as a prognostic marker in several clinical populations. Cancer and its related treatments impact cell membrane integrity and lead to poor cell function. Exercise is shown to increase phase angle, which is associated with lowered risk of hospitalization and cardiovascular events. However, the effect of chronic exercise training on phase angle in the cancer population is unclear. PURPOSE: To assess the effect of chronic exercise on phase angle in cancer patients who are actively undergoing chemotherapy and/or radiation. METHODS: A total of 56 cancer patients who were actively undergoing chemotherapy and/or radiotherapy were recruited to participate in a 12 week exercise-based rehabilitation program at the University of Northern Colorado Cancer Rehabilitation Institute (UNCCRI). Each participant underwent an initial assessment of physiological parameters, including body composition and phase angle analysis via the InBody 770 (InBody USA, Cerritos, CA). Results of this assessment were used to develop an individualized exercise prescription. Each participant received prescribed, supervised, one-on-one training from a Clinical Cancer Exercise Specialist, three times per week for one hour each session. Each session of exercise consisted of 20 minutes of aerobic training, 30 minutes of balance and resistance training, and 10 minutes of flexibility training at a low to moderate intensity. After 12 weeks, each participant underwent a follow-up assessment of physiological parameters. RESULTS: After 12 weeks of exercise training, significant increases in whole body (Initial: 4.55 ± 0.72; Follow-up: 4.68 ± 0.68; p = 0.02), right arm (Initial: 4.45 ± 0.76; Follow-up: 4.57 ± 0.72; p = 0.03), and left arm (Initial: 4.28 ± 0.79; Follow-up: 4.39 ± 0.75; p < 0.03) phase angle was observed. Conclusion: This study demonstrates that prescribed exercise training can increase phase angle in cancer survivors even while undergoing chemotherapy and/or radiation treatments. These changes may provide insight into the protective and/or rehabilitative benefits (e.g., cellular health, membrane integrity, disease risk) that exercise may have in this population.
METHODS: This is a secondary and preliminary analysis of a 4-month, randomized controlled trial in which 53 women with early-stage BCa scheduled for AC (51 ± 8 years) were randomized to usual care lifestyle advice (UC, n=27) or structured, supervised exercise training (ET, n=26) consisting of moderate intensity aerobic and progressive resistance training (2/week), and high intensity interval training (1/week) during AC. Total body lean mass (LM) and fat mass (FM) (dual-energy x-ray absorptiometry), mid-thigh quadriceps muscle volume and fat fraction (2-point Dixon MR), muscle strength (grip strength, 1-repetition max leg press and seated row) and physical function (30 second sit to stand [30STS], 4-metre gait speed test) was assessed prior to commencing AC, and 4-weeks following the final cycle of AC (4-months). Data are presented as mean ± standard deviation (SD). RESULTS: Mean adherence to the exercise training was 78%. Following the intervention, ET resulted in a significant increase in mid-thigh quadriceps muscle volume [ET: ± 5.9%, (95% CI: 2.8, 9.0) vs UC: ± 0.9% (± 2.2, 4.0), P = 0.013] relative to UC, with no effect on fat fraction [ET: ± 7.9% (± 22.2, 6.4) vs ± 14% (± 1.9, 14.8), P = 0.29]. There was no effect of ET on LM (P = 0.77) or FM (P = 0.28), however there was a main effect for time, with pooled results for ET and UC showing a significant increase in FM [P = 4.6% (0.8, 7.5), P = 0.032]. Relative to UC, exercise also improved usual and fast gait speed (ET: ± 9.3% vs UC: ± 1.8%, P = 0.034; ET: ± 9.8% vs UC: ± 0.6%, P = 0.018) respectively, 30STS (ET: ± 19.4% vs UC: ± 0.6%, P = 0.001) and upper (ET: ± 11.7% vs UC: ± 4.6%) and lower-body (ET: ± 14.7% vs UC: ± 5.2%) dynamic muscle strength (P = 0.002 for both). CONCLUSIONS: Completing structured, multi-modal exercise training is an effective therapy for improving muscle strength, physical function and thigh muscle volume among breast cancer patients undergoing AC.

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Antioxidant Supplementation Improves Neuromuscular Adaptations Induced By Strength Training In Breast Cancer Survivors
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Strength training (ST) and antioxidant supplementation have been used to reverse oxidative stress and muscle loss. However, in healthy subjects, the combination of ST and antioxidant supplementations hamper neuromuscular adaptations. Studies investigating the use of dietary supplementation aimed to improve adaptations to exercise training in cancer survivors are scarce. Thus, there is a need to investigate the chronic effects of ST combined with antioxidant vitamin in breast cancer survivors.

PURPOSE: To assess the effect of antioxidant supplementation on neuromuscular adaptations induced by ST in breast cancer survivors.

METHODS: Twenty-five breast cancer survivors were enrolled in this double-blinded placebo-controlled study. Survivors were randomly assigned to one of two groups: Antioxidant (AG; n = 12; 51 ± 9.03 years; 68.08 ± 10.57kg; 1.61 ± 0.07m) or Placebo (PG; n = 13; 48.23 ± 8.34 years; 70.45 ± 9.92kg; 1.58 ± 0.05m). Both groups participated in a 10-week ST protocol with six different exercises, twice a week. AG supplemented vitamin C (500mg/day) and E (400U/day), and PG with polydextrose (1g/day). At the beginning and at the end of the treatment period, muscle thickness of knee extensors (MT) was measured using B-mode ultrasound. Knee extension isokinetic peak torque (PT) was measured by two sets of four maximal isokinetic knee extension at 60°/s. Work capacity (WC) was measured by the amount of work performed in one set of 30 maximal isokinetic knee extensions at 120°/s. A two-way mixed model ANOVA was used to analyze data.

RESULTS: PT increased similarly in both AG (120.54 ± 17.85 to 133.53 ± 18.91 N.m; p < 0.001) and PG (120.56 ± 23.41 to 131.95 ± 26.57 N.m; p < 0.001). WC also increased in both AG (1083.25 ± 335.25 to 2210.34 ± 334.24 J; p < 0.001) and PG (1945.65 ± 294.87 to 2187.65 ± 396.90 J; p < 0.001). However, greater increase in WC was observed in AG than in PG (F = 5.030; p = 0.035, Δ = 22.44% vs. 12.45%). MT increased in AG (31.05 ± 6.05 to 35.86 ± 5.96mm; p < 0.001) but not in PG (31.83 ± 4.86 to 33.45 ± 6.04 mm; p = 0.105).

CONCLUSIONS: Antioxidant supplementation appears to affect strength gains induced by ST similarly between AG and PG groups. However, antioxidant supplementation appears to improve muscle work capacity and the promotion of muscle hypertrophy are compared to placebo in breast cancer survivors.

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EXERCISE-RELATED SELF-MONITORING AND CHANGE IN MUSCULAR STRENGTH IN PROSTATE CANCER PATIENTS UNDERGOING ANDROGEN DEPRIVATION THERAPY
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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 exercise-related outcomes among PCa patients remains unclear.

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 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 IRM 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 IRM chest strength (b = 0.52, SE = 0.551; r² = .083; p = 0.364) or IRM leg extension strength (b = 0.234, SE = 0.716; r² = .083; p = 0.751). CONCLUSION: 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.

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Effect Of Different Rating Of Perceived Exertions On The Muscle Strength In Breast Cancer Survivors
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PURPOSE: To evaluate the effect of resistance training (RT) with a higher rating of perceived exertion (RPE) 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 12 repetitions, with a 2-min rest interval between sets, until volitional muscle failure, on the bench press (BP). RPE scale (0-10) 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 the 10-repetitions maximum (10-RM) test on the BP, and then normalized by body mass (kg/IRM). 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 = 0.93). 10-RM normalized was 0.27 ± 0.06 and 0.24 ± 0.05, for RPE < 7 and RPE ≥ 7, respectively. BCS who reported lower RPE had a higher RPE. A repeated 10-RM by A 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 for muscle strength in this population. Further studies analyzing the differences between upper and lower RPE in upper muscle strength are needed.
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.