

A-18 Thematic Poster - Athletic Skills Post ACL Reconstruction

Wednesday, May 27, 2020, 9:30 AM - 11:30 AM
Room: CC-2009

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

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

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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 during the descending phase of both tasks. The descending phase was defined between squat initiation and the minimum position of the pelvis during each squat and between initial contact and the minimum position of the pelvis for each stop jump. A limb symmetry index (LSI) was computed for peak KEM and GRFI as the difference between the surgical and non-surgical leg divided by their average during each squat and each stop jump, and then the LSI was averaged across trials. Peak KEM LSI and GRFI LSI were then compared between the stop jump and squat trials using Pearson's correlations. **RESULTS:** There was a significant relationship between both stop jump kinetic asymmetry outcomes and both squat kinetic asymmetry outcomes (Table 1). **CONCLUSION:** Kinetic asymmetry during squatting and bilateral landing are associated in ACL-R patients, which indicates that biofeedback retraining during bilateral squatting could result in improvements in bilateral landing symmetry.

Stop Jump		
Squat	Peak KEM LSI $45.8\% \pm 24.6\%$	GRFI LSI $42.8\% \pm 26.0\%$
Peak KEM LSI $34.8\% \pm 25.4\%$	$r = 0.693$ $p < 0.001$	$r = 0.555$ $p = 0.001$
GRFI LSI $14.5\% \pm 10.5\%$	$r = 0.428$ $p = 0.012$	$r = 0.479$ $p = 0.004$

Table 1: Mean \pm 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

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(No relevant relationships reported)

Most athletes with unilateral ACL reconstruction present with reduced knee and hip flexion and asymmetrical vertical ground reaction force (VGRF) and internal knee extension moment during two-legged jump landings. This landing movement pattern is associated with low scores on self-reported outcome surveys and may contribute to the increased risk of re-injury in athletes with ACL reconstruction. The capacity for correction of inter-limb asymmetries during landing remains understudied.

PURPOSE: To determine whether jump training can correct asymmetrical limb loading and whether corrections are retained over time.

METHODS: An 8-camera motion analysis system with dual force plates collected kinematic and kinetic data in a 30cm drop vertical jump to screen 48 potential participants with unilateral ACL reconstruction. Twenty-three athletes (14 women, 23 ± 5 years old, 20 ± 15 months post-surgical, Tegner score: 7 ± 2) presented with below-average knee loading symmetry in landing and poor clinical outcomes, and participated in 8 weeks of twice-weekly high-repetition progressive jump landing training. Subjects re-tested at 4 and 8 weeks. Retention testing was performed after 8 weeks post-training. Changes in hip and knee kinematics and kinetics including limb symmetry indices (percent of the 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 , $p < 0.0001$; knee: 86 ± 11 to 96 ± 16 , $p = 0.0001$). Symmetry in peak VGRF between limbs during landing increased after the full 8-week training period ($83\% \pm 18\%$ to $91\% \pm 16\%$, $p = 0.005$). Changes in joint flexion and VGRF were retained for at least 8 weeks after the final training session. Symmetry in knee moment between limbs did not reach a statistical improvement until final retention tests (Pre: $80\% \pm 17\%$, Post: $86\% \pm 12\%$, $p = 0.47$; Retention: $94\% \pm 21\%$, $p = 0.004$).

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.

72 Board #3 May 27 9:30 AM - 11:30 AM
Quadriceps Strength And Rate Of Torque Development Are Associated With Countermovement Jump Knee Kinetics Post-aclr

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(No relevant relationships reported)

Quadriceps neuromuscular dysfunction is ubiquitous after anterior cruciate ligament reconstruction (ACLR) 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-ACLR.

METHODS: 31 Division I athletes (age 20.3 ± 1.3 , BMI 26.1 ± 3.9 kg/m², 17 female) performed counter movement jumps (CMJ) on force plates while whole body kinematics 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: $p = .001$, RTD: $p = .044$) and LAND (PT: $p = .009$, RTD: $p = .008$). No significant pairwise interactions between PT, RTD, and time from surgery were detected. Among 24 instances of PT LSI $\geq 90\%$, mean CON and LAND LSI were 87.3% and 94.2%, respectively. In comparison, among 15 occurrences of RTD LSI $\geq 90\%$, 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 $\geq 90\%$, mean PT was 94.5-94.7% and mean RTD was 85.1-85.3%.

CONCLUSIONS: Both peak and rapid knee extensor torque development are strongly associated with symmetrical sagittal plane CMJ knee mechanics. CMJ knee

kinetic asymmetries did not resolve over time, independent from quadriceps function. Restoring maximal and rapid quadriceps torque capacity appears to be an important step in recovering symmetrical CMJ mechanics post-ACLR.

73	Board #4	May 27 9:30 AM - 11:30 AM
Biomechanical Determinants Of Return To Sport Following Anterior Cruciate Ligament Reconstruction		
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(No relevant relationships reported)		

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

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

Methods: 21 subjects, (13 F, 20.1 ± 5.9 years, 22.3 ± 2.1 BMI, Pre-injury Tegner 8.1 ± 2.1) six months (19.0 ± 15.3 days) following ACLR, ran on an instrumented treadmill during three-dimensional assessment. Visual 3D was used to analyze peak GRF, impact peak, and frontal plane knee angle. Subjects were contacted at 4.5 ± 2.1 years post-surgery to answer a questionnaire regarding RTS. Logistic regression model selection was performed using the Feasible Solutions Algorithm with AIC as a criterion. p-values presented here are based on the main effect significance tests from the selected model.

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

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

74	Board #5	May 27 9:30 AM - 11:30 AM
Relationship Between Dynamic Limb Symmetry And Subjective Limb Confidence Post ACL Reconstruction In Youth Athletes		
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(No relevant relationships reported)		

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 (DL) and single leg hop (SLHOP) task with subjective limb confidence in athletes who have had an ACLR. **METHODS:** 23 subjects (13 female, 10 male; 16±1.4 years) underwent a biomechanical assessment, including a DL and SLHOP task, at around 7±1 months post op ACLR. Subjects were outfitted with a custom marker set and recorded with a 3D camera system while performing tasks on 2 force platforms. To examine dynamic limb symmetry, kinematic variables of peak hip flexion, knee flexion, and ankle dorsiflexion, with kinetic variables of peak hip extension moment, knee extension moment, ankle plantar flexion moment, and vertical ground reaction force (GRFz) were collected and analyzed as an index between the involved and non-involved limb. Subjects completed questionnaires for limb confidence; International Knee Documentation Committee (IKDC)/Pedi-IKDC and Tampa Scale of Kinesiophobia (TSK). The relationship between LSI during DL and SLHOP with the IKDC and TSK scores were tested using a multilinear regression analysis. **RESULTS:** A significant strong relationship was found between LSI of DL mechanics and IKDC (86±12, r= 0.84, p<0.05). Among predictor variables, peak GRFz (LSI 79±21, p<0.05) was significant in its explanation of IKDC scores. Independent regressions showed significant moderate correlations between IKDC and LSI for peak hip extension moments (LSI 107±24, r= 0.56, p<0.01), knee extension moments (LSI 80±23, r=0.51, p<0.05), and GRFz (r= 0.62, p<0.01). No significant relationships were found for SLHOP and IKDC scores, or with TSK for either dynamic test. **CONCLUSIONS:**

Subjective limb confidence demonstrated a strong relationship with limb symmetry of sagittal plane mechanics with a 1% difference in LSI of GRFz corresponding to a 0.4% difference in IKDC scores during a DL and not SLHOP task. Symmetry in mechanics during a bilateral task may be more reflective of patient confidence in utilizing the affected limb prior to return to sport after ACLR.

75	Board #6	May 27 9:30 AM - 11:30 AM
Quantifying The Relationship Between Quadriceps Strength And Aerobic Fitness Following AcI Reconstruction		
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(No relevant relationships reported)		

PURPOSE: Investigate the relationship between performance 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±8.7 cm) completed isokinetic quadriceps strength testing using a Biomed dynamometer at 180 degrees/sec on both legs then completed vertical jump (VJ) testing with and without countermovement (NCMJ) on a jump mat. All participants completed an incremental treadmill test to determine maximal oxygen consumption testing (VO_{2max}). Initial running velocity was self-selected and increased 0.5mph every 2 minutes until volitional fatigue. Knee extensor torques and VO_{2max} 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 ($r = 0.43$, $P = .012$), NCMJ ($r = 0.44$, $P = .011$), and VO_{2max} ($r = 0.52$, $P = .002$). The only variable retained in the regression model was VO_{2max}, which explained 26.7% of the variance in strength. In healthy individuals, peak torque was correlated with VJ ($r = 0.72$, $P < .001$), NCMJ ($r = 0.62$, $P < .001$), and VO_{2max} ($r = 0.55$, $P = .002$). Two variables were retained in the regression model, including VJ ($R^2 = 52.2\%$) and VO_{2max} ($R^2 = 6.8\%$) 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 VO_{2max} was a significant predictor of strength after ACLR, it explained a small amount of variance which suggests other factors contribute to strength after ACLR.

76	Board #7	May 27 9:30 AM - 11:30 AM
Effects Of A 4-week Vibration-induced Hamstrings Fatigue Intervention On Quadriceps Weakness After AcL Reconstruction		
Timothy W. Lowe ¹ , Lisa Griffin ¹ , Robert W. Dennis ² , Arturo Arce-Esquivel ³ , Xuanliang Neil Dong ³ . ¹ The University of Texas at Austin, Austin, TX. ² Azalea Orthopedics & Sports Medicine Clinic, Tyler, TX. ³ The University of Texas at Tyler, Tyler, TX. (Sponsor: Yong Tai Wang, FACSM) Email: t.lowe@utexas.edu		
(No relevant relationships reported)		

Arthrogenic muscle inhibition (AMI) results from an inability to voluntarily activate all motor units in the quadriceps due to ongoing neuronal inhibition. This may be due to changes in small diameter afferent activity that increase the excitability of the flexor withdrawal pathway, causing over-excitation of the hamstrings and reciprocal inhibition of the quadriceps. Reciprocal inhibition of the quadriceps from Ia afferents of the hamstrings may be reduced with prolonged muscle vibration of the hamstrings via fatigue of the intrafusal muscle fibers.

PURPOSE: To determine the effects of vibration-induced hamstring fatigue on AMI after ACL reconstruction (ACLR).

METHODS: Seven adults (28.7 ± 8.2 yrs) with unilateral ACLr (time since surgery: 19.4 ± 9.7 months) were recruited. Participants received a 4-week long (3x/week) training program. Vibration-induced fatigue of the hamstrings consisted of 20 minutes of prolonged vibration applied directly to the hamstrings. Then, a cuff was placed on the proximal thigh and inflated to 150 mmHg to trap the metabolites in the muscle, and maintain hamstrings fatigue; 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 1-RM normalized to body weight, and the central activation ratio (CAR) measured by a superimposed burst. The co-activation of the hamstrings was assessed using hamstring EMG during KE. Paired t-tests were used to examine the effect of prolonged vibration on KE strength, quadriceps CAR, and hamstrings co-activation before and after the intervention.

RESULTS: KE strength increased significantly by 38.5% (from 0.45 ± 0.1 to 0.62 ± 0.2 %BW, $P=0.004$); quadriceps CAR also increased significantly by 5.8% (from $93 \pm 0.1\%$ to $98 \pm 0.8\%$, $P=0.02$). Finally, co-activation decreased by 34% (from $12 \pm 1.3\%$ to $8 \pm 0.9\%$, $P=0.03$).

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 restoring 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.

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(No relevant relationships reported)

PURPOSE: The aim of this study was to investigate the influence of CYP1A2 genotype (which influences the rate of caffeine metabolism) on the effects of caffeine on physiological responses to submaximal exercise and cycling time-trial performance. **METHODS:** Eighty six cyclists were screened for their CYP1A2 genotype before being separated into two groups (AA [wildtype] versus AC or CC variant). Seventeen participants from each group (age: 45 ± 9 yrs; height: 1.81 ± 0.07 m; body mass: 76.4 ± 9.9 kg; $\text{VO}_{2\text{max}}$: $4.02 \pm 0.46 \text{ L} \cdot \text{min}^{-1}$) 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 $\dot{V}\text{O}_2$ -power output relationship and $\dot{V}\text{O}_{2\text{max}}$. 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 $\dot{V}\text{O}_{2\text{max}}$, followed by a time trial (~ 30 mins). 95% confidence limits (CL $_{95\%}$) were calculated for all estimates. **RESULTS:** Relative to placebo, caffeine led to a significant 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: $2.4 \text{ b} \cdot \text{min}^{-1}$; CL $_{95\%}$: $1.1 - 3.8 \text{ b} \cdot \text{min}^{-1}$), with effects dissipating as exercise intensity increased. Caffeine also led to submaximal exercise reductions in ratings of perceived exertion (mean difference: 0.5 ; CL $_{95\%}$: $0.2 - 0.8$) and significant increases in respiratory exchange ratio (mean difference: 0.013 ; CL $_{95\%}$: $0.002 - 0.025$), minute ventilation (mean difference: $3.4 \text{ L} \cdot \text{min}^{-1}$; CL $_{95\%}$: $0.4 - 6.4 \text{ L} \cdot \text{min}^{-1}$), and blood lactate concentration (mean difference: $0.24 \text{ mmol} \cdot \text{L}^{-1}$; CL $_{95\%}$: $0.11 - 0.37 \text{ mmol} \cdot \text{L}^{-1}$). However, the responses were not affected by genotype. **CONCLUSION:** Caffeine influences physiological responses to submaximal exercise and improves time-trial performance. However, those effects are not influenced by CYP1A2 genotype.

79 Board #2 May 27 9:30 AM - 11:30 AM
Caffeine Ingestion Increases The Specific Upper-body Performance Of Combat Sports Athletes

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(No relevant relationships reported)

PURPOSE: To investigate the acute effect of caffeine ingestion on upper-body intermittent endurance and maximal isometric strength performance of combat sports athletes. **METHODS:** Ten experienced judo and jiu-jitsu athletes completed two experimental sessions separated by at least 48 hours. Athletes consumed capsules containing either caffeine (5 mg·kg $^{-1}$) or placebo 60 min before performing four bouts of an intermittent judogi's dynamic strength endurance test, interspersed by 3-min recovery, in a double-blind and placebo-controlled crossover design. The performance was determined by the total number of repetitions completed during each of 4 exercise bouts. Furthermore, the sum of all repetition throughout the test was also calculated in

order to analyze the overall performance. Heart rate (HR), rating of perceived exertion (RPE) and maximal isometric handgrip strength (MIHS) were evaluated prior to test and immediately after each exercise bout, while the blood lactate concentration [La] was measured just before and three minutes after the test. **RESULTS:** When compared to placebo condition (41 ± 8 reps and 45.6 ± 2.7 kg), caffeine ingestion increased the total number of repetitions (45 ± 10 reps, + 7%, $P < 0.05$) and the MIHS (47.5 ± 2.8 kg, + 5%, $P < 0.05$). However, there were no significant differences in RPE (CAF: 11.7 ± 1.1 a.u., PLA: 11.8 ± 0.9 a.u.), HR (CAF: 137 ± 3 bpm, PLA: 133 ± 3 bpm) and [La] (CAF: $6.6 \pm 0.4 \text{ mmol} \cdot \text{L}^{-1}$, PLA: $5.7 \pm 0.4 \text{ mmol} \cdot \text{L}^{-1}$) 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.

80 Board #3 May 27 9:30 AM - 11:30 AM
Perceptions Of Caffeine Use Among Kansas High Intensity Functional Training Participants

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(No relevant relationships reported)

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

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

Methods: Seventeen HIFT-experienced men were recruited (age = 26.9 ± 6.5 years, weight = 84.7 ± 10.1 kg). Participants were randomized in a double-blind, crossover design to consume 5 mg/kg body mass of caffeine pills or placebo 60-minutes prior to a HIFT workout. Perceptions of caffeine's effect, successful blinding, and actual positive- and negative-symptoms were determined with surveys. Three chi-square tests were conducted to determine differences between caffeine-users (low- vs. high-users) for perceptions of caffeine's effects (positive vs. negative), blinding to the treatment (successful vs. unsuccessful), and symptoms after caffeine supplementation (positive and negative).

Results: Nine participants were low-users (< 200 mg caffeine/day), and 8 high-users (> 200 mg caffeine/day). Chi-square tests were non-significant ($p > 0.05$). Descriptively, 2 low-users and 0 high-users perceived negative-effects, while 6 low-users and 7 high-users perceived positive-effects of caffeine use at baseline. One low-user perceived both positive- and negative-effects. Four participants from each group correctly identified the caffeine condition. After study caffeine consumption, 1 participant from each group reported negative-symptoms, while 2 low-users and 4 high-users reported positive-symptoms.

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

Funding: Kansas State University College of Human Ecology

81 Board #4 May 27 9:30 AM - 11:30 AM
COFFEE VOLUME DOES NOT SUPPRESS APPETITE OR CHANGE PERCEIVED HUNGER IN HABITUAL CAFFEINE CONSUMERS

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(No relevant relationships reported)

Caffeine is a heavily consumed substance that has several benefits, including appetite suppression and increased energy metabolism. **PURPOSE:** To determine the effect of caffeine amount and coffee volume on appetite profile, affective response, cognitive function, blood glucose levels and subsequent energy intake in female habitual caffeine consumers. **METHODS:** 19 healthy female (age: 24 ± 8 , BF%: 24.9 ± 5.1) habitual caffeine consumers (255 ± 122 mg/day) ingested coffee of different volumes and caffeine amounts on four different occasions (C1: 237 ml/4 mg/kg; C2: 237 ml/6mg/kg; C3: 473 ml/4mg/kg; C4: 473 ml/6mg/kg) in a single blind, randomized, crossover design. Participants completed a visual analog scale (VAS) of appetite profile at pre, 0, 30 and 60 minutes. Affective response and cognitive function were assessed using the Activation-Deactivation Adjective Checklist (AD-ACL), Trail Making (TM) and Stroop tasks (ST) before and after the test drink. Blood glucose levels were measured at pre, 30 and 60 minutes. In addition, ad libitum breakfast was consumed at 60 minutes and 24-hour self-reported energy intake was recorded. A repeated measures

ANOVA 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 ($p=0.16$), fullness ($p=0.11$), desire to eat ($p=0.31$) 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.

82 Board #5 May 27 9:30 AM - 11:30 AM

Caffeine Increases Plantar Flexion Peak Torque In Young But Not In Older Men

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(No relevant relationships reported)

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 contractile impulse (CI; torque integrated to time) of the plantar flexors using a Biomedex 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 60-min after 3 mg/kg of caffeine or placebo (double-blinded). PT, CI $0-50$ (CI_{0-50}), and $100-200$ ms ($CI_{100-200}$) were analyzed. A three-way mixed ANOVA was used to investigate potential differences between conditions (pre vs post-supplement) and groups (older vs young). Cohen's effect size (ES) was used to show the magnitude of differences and the standardized mean differences for caffeine versus placebo in both groups.

RESULTS: Caffeine increased PT in young (3.2% ; $p = 0.007$, ES = 0.21) but not in older individuals (2.7% ; $p = 0.104$, ES = 0.13). No differences were seen in CI_{0-50} and $CI_{100-200}$ in young and older ($p > 0.05$). The standardized mean differences showed a small effect in favor of caffeine on PT in young (ES = 0.47), CI_{0-50} in young (ES = 0.41) and older (ES = 0.40), and $CI_{100-200}$ in older (ES = 0.24).

CONCLUSIONS: Caffeine increased isometric peak torque in young but not in older individuals. Caffeine did not increase rapid torque output (i.e. CI_{0-50} and $CI_{100-200}$) in either young or older individuals. However, a small effect was observed in favor of caffeine against placebo in both groups.

83 Board #6 May 27 9:30 AM - 11:30 AM

Effect Of Caffeine Ingestion On Performance During A Repeated-bout Agility Test In Handball Players

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(No relevant relationships reported)

PURPOSE: To verify whether caffeine would alter the psychophysiological responses and agility performance during repeated bouts of an agility test in handball players.

METHODS: 10 recreationally handball players (20.6 ± 3.3 years, 81.5 ± 10.0 kg, 1.80 ± 0.1 m) performed 6 exercise bouts, interspersed by 1-min recovery intervals, of an agility test (Illinois Agility Run Test) 60 min after ingesting, in a double-blind manner, either caffeine ($5 \text{ mg} \cdot \text{kg}^{-1}$ of body mass) or placebo (cellulose). The total exercise-bout time (sum of all time during each of the 6 exercise bouts) was compared between conditions using a paired *t* test, while the rating of perceived effort (RPE), heart rate (HR) and blood lactate concentration ([La]) were compared between conditions using a two-way repeated-measures ANOVA (condition and bout factors). **RESULTS:** There was no significant difference between caffeine (114.3 ± 5.9 s) and placebo (114.4 ± 4.7 s) conditions for total exercise-bout time ($P > 0.05$). The RPE increased progressively throughout the test in all conditions ($P < 0.05$), but without significant differences

between caffeine (bout 1: 8.1 ± 1.6 ; bout 6: 15.6 ± 4.1) and placebo (bout 1: 7.9 ± 1.1 ; bout 6: 15.5 ± 4.0) conditions ($P > 0.05$). Similar responses were found for HR, revealing an exponential increase during 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; $P > 0.05$). Furthermore, the [La] increased linearly over the test in both conditions ($P < 0.05$), but it was significantly higher in caffeine ($16.2 \pm 2.7 \text{ mmol} \cdot \text{L}^{-1}$) compared with placebo ($13.8 \pm 2.9 \text{ mmol} \cdot \text{L}^{-1}$) 3 min after the repeated-bout agility test ($P < 0.05$).

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

84 Board #7 May 27 9:30 AM - 11:30 AM

Caffeine May Increase Sugar Intake, Alter Taste Perception And Appetite Profile

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(No relevant relationships reported)

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 yrs; BMI $24.3 \pm 4.0 \text{ kg} \cdot \text{m}^{-2}$; BF%: 24.6 ± 8.8) who were habitual caffeine consumers were recruited for 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 using questionnaires 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 0.89 ± 0.07 ; D: 0.82 ± 0.05 and 0.84 ± 0.04 , $p=0.006$) and significant condition effect was observed for VO2 (C: $3.9 \pm 0.5 \text{ ml/kg/min}$; D: $3.7 \pm 0.5 \text{ ml/kg/min}$, $p=0.01$). A significant interaction effect was observed for perceived caffeine amount (C: 3.2 ± 0.5 and 3.7 ± 0.5 ; D: 3.3 ± 0.8 and 3.2 ± 0.8 , $p=0.007$) and bitterness ($p=0.02$), but not aftertaste ($p=0.23$), 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 caffeinated drink ($6.3 \pm 3.6 \text{ g}$) compared to decaffeinated ($3.0 \pm 1.9 \text{ g}$). **CONCLUSIONS:** Although, palatability and pleasantness of taste was not significantly different, caffeinated coffee was perceived bitter leading to more sugar added to the drink.

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

Caffeine Intake Influences The Blood Pressure Response To Strenuous Physical Exertion Among Firefighters

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(No relevant relationships reported)

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 an ambulatory BP (ABP) monitor for 19hr. CAF was assessed with the National Health and Nutrition Examination Survey food-frequency questionnaire. Repeated measures ANCOVA in SAS tested if the ABP response after GEST vs CONTROL differed by CAF group divided by the median as high ($806.8 \pm 190.7 \text{ mg}$) and low ($239.3 \pm 202.9 \text{ mg}$) with baseline ABP as a covariate. **RESULTS:** FF were overweight ($29.0 \pm 3.9 \text{ kg/m}^2$), middle-aged (40.2 ± 9.5 yr) men with elevated resting BP ($124.1 \pm 10.3 / 79.6 \pm 11.5 \text{ mmHg}$). 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 (ASBP) ($18.0 \pm 4.8 \text{ mmHg}$, $p<.01$) and diastolic ABP (ADBP) ($9.1 \pm 1.5 \text{ mmHg}$, $p<.01$) changes from baseline were greater after GEST vs CONTROL over 19hr, independent

of CAF ($P \geq 0.05$), 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 ($p \leq 0.01$ 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, $p = .08$) than high CAF (4.4 ± 2.4 mmHg, $p = .05$). **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

- 86** Chair: Heather E. Webb. *Texas A&M Corpus Christi, Corpus Christi, TX.*
(No relevant relationships reported)

- 87** Board #1 May 27 9:30 AM - 11:30 AM
Impact Of Neuromuscular Electrical Stimulation On Quality Of Life In Older Adults
Nigel C. Jiwan, Kyndall P. Ramirez, Monica A. Mendoza, Mitchell S. Kane, Lindsay E. Kipp, Joni A. Mettler. *Texas State University, San Marcos, TX.* (Sponsor: Tinker Murray, FACSM)
(No relevant relationships reported)

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 change 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 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 (3.84 ± 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 ± 0.45 s, $p = 0.02$, $d = 0.62$). **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 confidence and willingness to perform physical activities, potentially decreasing risk of sarcopenia.

- 88** Board #2 May 27 9:30 AM - 11:30 AM
Predictors Of Functional Performance Among Older Adults
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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 predicable of functional performance among old 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 = $34.7 \pm 7.8\%$) 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 ($R^2=0.55$, $P<0.001$). Faster chair-rise time (x5) was associated with younger age, less body fat, and lower fatigability ($R^2=0.44$, $P<0.001$). Both a faster stair-climb ($R^2=0.3$, $P<0.001$) and a higher Berg balance score ($R^2=0.43$, $P<0.001$) 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.

- 89** 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
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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: $F(1,25)=14.3$, $p=.001$, $R^2=.35$), as well as step length in high CF ($F(1,25)=10.8$, $p=.003$, $R^2=.27$) and average CF ($F(1,50)=4.4$, $p=.04$, $R^2=.08$), and gait variability in average CF ($F(1,48)=9.8$, $p=.003$, $R^2=.17$). For dual-task gait, cognition was positively associated with gait velocity in both high CF ($F(1,25)=9.15$, $p=.006$, $R^2=.26$) and average CF ($F(1,49)=5.8$, $p=.02$, $R^2=.10$), as well as step length in both high CF group ($F(1,25)=7.2$, $p=.01$, $R^2=.21$) and average CF group ($F(1,49)=7.2$, $p=.01$, $R^2=.13$). **CONCLUSIONS:** Cognition was positively associated with mobility outcomes in individuals with average and high

CF, while no associations were seen in those with low CF. These findings suggest that the protective effects of cognition on mobility (e.g., reduced falls risk and prolonged independence) may be hindered by low CF in older adults with hypertension.

90 Board #4 May 27 9:30 AM - 11:30 AM
12-week Of Tai Chi Training Improves Cognitive Function In Older Adults With Mild Cognitive Impairment

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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 (≥ 60) 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-blinded 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. Data were analyzed by generalized linear model with baseline as covariate.

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

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

91 Board #5 May 27 9:30 AM - 11:30 AM
Effect Of Low Intensity Resistance Exercise Training On Cognitive Function In Middle-aged And Older Individuals

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(No relevant relationships reported)

PURPOSE: Many studies have reported that aerobic exercise training improves cognitive function (CF), even with low-intensity (e.g. walking) (Kramer et al. 1999; Hillman et al. 2008). Alternatively, moderate (MRT) to high intensity RT (60–80% 1RM) improves CF (Chang et al. 2012). However, older individuals and patients with chronic disease often have difficulty with higher exercise loads due to declining cardiovascular and musculoskeletal systems. The purpose of this study was to examine the effect of low intensity resistance exercise training (LRT) on CF in middle-aged and older individuals. Given that an acute bout of even low intensity resistance exercise improves CF albeit less effective than higher intensity (Tsukamoto et al. 2017), we hypothesized that LRT would improve CF although its effect might be lower than higher intensity training. **METHODS:** 50 healthy middle-aged and older individuals (age: 50 to 77 years) were randomly classified into three groups (control (CON), LRT (40%1RM), and MRT (60%1RM)). Resistance exercise programs were leg extension, seated leg curl, leg press, and chest press. For each exercise, all participants performed 14 repetitions for three sets with 2 minutes interval. LRT and MRT participants completed all these exercise for three times per week and CON participants maintained their conventional lifestyle. CF (working memory (WM), short memory (SM), and

inhibitory control (IC)) were determined with reading span test, face-name matching task, and color-word Stroop task, respectively. Each task was performed at before the intervention (PRE), 12 weeks (12W), and 24 weeks (24W) of the intervention period. **RESULTS:** There was significant interaction for the IC score ($p = 0.021$). As compared with the PRE, the IC at the 12W did not change in the MRT ($p = 0.184$), while tended to improve for the LRT ($p = 0.065$), and significantly declined in the CON ($p = 0.020$). At the 24W, the IC score did not change significantly for all conditions as compared with the PRE. The score of WM and SM did not change significantly for all conditions throughout the intervention.

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

92 Board #6 May 27 9:30 AM - 11:30 AM
Systolic Blood Pressure And Heart Rate Recovery Are Related To Cognition In Healthy Older Adults

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SYNOPSIS: Attenuated heart rate recovery (HRR) and systolic blood pressure recovery (SBPR) after a maximal exercise test ($VO_2\text{peak}$) 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 HRR or SBPR and cognition has yet to be studied in older adults, here we found that reduced HRR and SBPR were directly related to worse cognition. **PURPOSE:** To determine if a relationship exists between cognition and HRR or SBPR measured during a $VO_2\text{peak}$ test in older adults

METHODS: Prior to enrollment in an intervention, a total of 68 participants (70 ± 6 yrs; 45 women) completed neuropsychological tests and a $VO_2\text{peak}$ 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: $VO_2\text{peak}$ 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.

93 Board #7 May 27 9:30 AM - 11:30 AM
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. Marcin, Andrea C. Kozaiz, Katherine A. Collins, Nalingna Yuan, John M. Jakicic, FACSM. *University of Pittsburgh, Pittsburgh, PA.* (Sponsor: John M. Jakicic, FACSM)
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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 underactive older adults.

METHODS: Baseline data were examined from sedentary older adults ($N=31$; age= 70.3 ± 3.7 years; $BMI=28.8 \pm 4.6$ kg/m 2) 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-

Mental State (3MS) examination and the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). Physical function performance was assessed using the time to complete the 400-Meter Walk Test (minutes).

RESULTS: Average time to complete the 400-meter walk was 6.3 ± 1.0 minutes, which was modestly associated with BMI ($r=0.312$, $p=0.088$). The 3MS Total Score (94.7 ± 3.7) was not significantly correlated with BMI ($r=-.158$; $p=.397$) or 400-Meter Walk Test performance ($r=-.152$; $p=.415$). Similarly, the RBANS Sum of Index Score (209.0 ± 21.1) was not significantly correlated with BMI ($r=-.297$; $p=.105$) or 400-Meter Walk Test performance ($r=-.164$; $p=.378$). When examining this relationship by cognitive domain, a higher BMI was associated with a poorer RBANS Immediate Memory Index Score ($r=-.412$; $p=.021$). We also observed that worse performance on the 400-Meter Walk Test was associated with poorer RBANS Immediate Memory Index Score ($r=-.314$; $p=.08$). Neither BMI nor 400-Meter Walk performance were significantly associated with RBANS Visuospatial/Constructional Index, Language Index, Attention Index, or Delayed Memory Index scores.

CONCLUSION: Findings reveal that RBANS Immediate Memory Index score was inversely associated with both BMI and physical function in sedentary older adults. This may suggest that both obesity and poor physical function negatively impact 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

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(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 performing yoga ($n=19$; 62.25 ± 1.6 yrs old) or circuit training ($n=9$; 59.53 ± 1.96 yrs old). All participants completed 30 minutes of moderate-intensity exercise with moderate efforts, significant accelerated breathing and heart rate. The cognition function tests were performed before, immediately, 30 and 60 minutes after an intervention consisting of 40 min of either Yoga or circuit training exercise and a seated rest control. The cognitive parameters were compared by a mixed-model analysis for repeated measures. **Results:** The results indicated there were no difference in age between the two groups. Acute exercise improved cognitive function immediately after acute exercise, including got a significant higher total response score ($F(3,75)=7.793$, $p<0.001$), and complete Schulte table (as an indicator of attention, $F(3,75)=4.239$, $p=0.008$) and Stroop's neutral test ($F(3,75)=12.64$, $p<0.001$) faster. There were no significant differences in other items such as responsive rate, memory span, and word, congruent, square, incongruent Stroop test after acute exercise. The benefits of exercise on total response score and Stroop's neutral test can even be maintained up to 60 minutes after exercise. For the benefit of two different exercise, only the performance of Schutte table was significantly better in the circuit training group than the yoga group ($F(1, 25)=4.554$, $p=0.043$, Eta value=0.154). The scores of other cognitive tests did not differ between the two exercises. **Conclusion:** The two different exercises significantly improved cognitive function and can maintain up to 60 minutes after exercise. The circuit training exercise represented a better influence on attention than Yoga.

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

A-21 Thematic Poster - Experimental Studies: Biological Outcomes

Wednesday, May 27, 2020, 9:30 AM - 11:30 AM
Room: CC-2011

95 Chair: Kevin E. Finn, FACSM. *Colby-Sawyer College, New London, NH.*
(No relevant relationships reported)

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

Effect Of Frequency Of Breaks During Prolonged Sitting On Postprandial Metabolism In Type 2 Diabetes

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(No relevant relationships reported)

Interrupting prolonged sitting with short activity bouts may be beneficial for glycemic control in adults with type 2 diabetes (T2D). However, the impact of frequency of interruptions has not yet been assessed in T2D. **PURPOSE:** To investigate acute effects of interrupting prolonged sitting with simple resistance activity (SRA) breaks at different frequencies on postprandial glucose and insulin in adults with medication-controlled T2D. **METHODS:** Inactive adults with medication-controlled T2D ($n=23$, 12 ± 8 , 62 ± 8 yrs, 32.6 ± 3.5 kg 2) completed a three-armed randomised crossover trial (6-14 day washout). The experimental conditions were: sitting uninterrupted for 7 h (SIT); sitting with 3-min SRA breaks every 30 minutes (SRA3); and, sitting with 6-min SRA breaks every 60 minutes (SRA6). Fasting and postprandial glucose and insulin concentrations were measured at -1 h and 0 h, and every 30 min thereafter for 7 h. Breakfast was provided at 0 h and lunch at 3.5 h. Total (7-h) and meal-specific (3.5-h) areas under the curve (tAUC; trapezoid method) were calculated. Mixed model regression analyses examined effects of condition on tAUC, adjusting for baseline concentrations and period effects. **RESULTS:** When compared to SIT, 7-h tAUC were attenuated significantly during SRA6 for glucose (SIT; 84.9 mmol L $^{-1}$, 95%CI 80.3, 89.8; SRA6 80.8 mmol L $^{-1}$, 95%CI 76.3, 85.3, $p=0.016$), and insulin (SIT; 1982 pmol L $^{-1}$, 95%CI 1679, 2340; SRA6; 1783 pmol L $^{-1}$, 95%CI 1510, 2105 $p<0.01$) but not SRA3 (see Figure). Post-lunch insulin tAUC was significantly lower during both SRA3 (907 pmol L $^{-1}$, 95%CI 776, 1059, $p<0.01$) and SRA6 (875 pmol L $^{-1}$, 95%CI 750, 1022, $p<0.001$) when compared to SIT (996 pmol L $^{-1}$, 95%CI 853, 1163). **CONCLUSION:** In adults with medication-treated T2D, interrupting sitting with bouts of SRA's every 60 minutes over 7 hours significantly attenuated postprandial glucose and insulin concentrations when compared with uninterrupted sitting.

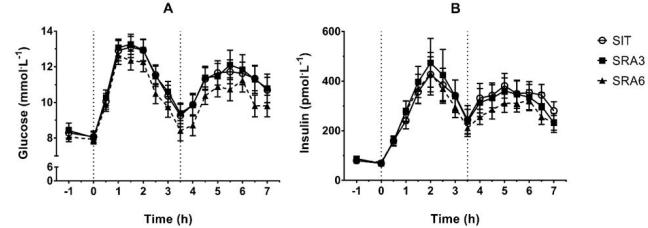


Figure: Effect of the three 7 h trial conditions on postprandial (A) glucose and (B) insulin concentrations in adults with medication controlled T2D ($n=23$). Data are mean \pm SEM. SIT: uninterrupted sitting; SRA3: sitting with 3-minute SRA breaks every 30 minutes; SRA6: sitting with 6-minute SRA breaks every 60 minutes.

97	Board #2 Effects Of Interrupting Sitting With Walking Only Or Combined With Resistance Activities On Glycemic Responses Xia Sheng Ma, Zheng Zhu, Xiao-Mei Liu, Yan-yu Lin, Zhen-Bo Cao. <i>Shanghai University of Sport, Shanghai, China.</i> Email: msx-27@163.com (No relevant relationships reported)	May 27 9:30 AM - 11:30 AM	99	Board #4 Effects Of 8-week Aerobic Exercise On Markers Of Inflammation And Oxidative Stress In Obese Females Kyung-Shin Park ¹ , Jihyung Yoon ² , Brett S. Nickerson ¹ . ¹ Texas A&M International University, Laredo, TX. ² New York University, New York, NY. Email: kpark@tamiu.edu (No relevant relationships reported)	May 27 9:30 AM - 11:30 AM
98	Board #3 Simple Resistance Exercise Breaks To Interrupt Sedentary Behavior In College Students Robert J. Kowalsky, Tyler M. Farney, Christopher M. Hearon, FACSM. <i>Texas A&M University Kingsville, Kingsville, TX.</i> Email: robert.kowalskyjr@tamuk.edu (No relevant relationships reported)	May 27 9:30 AM - 11:30 AM	100	Board #5 Ex-Met Study; Exercise In Prevention Of Metabolic Syndrome Arnt E. Tjonna ¹ , Joyce S. Ramos ² , Axel Pressler ³ , Martin Halle ⁴ , Klaus Jungbluth ⁵ , Erika Ermacora ⁶ , Øyvind Salvesen ¹ , Jhennyfer Rodrigues ⁷ , Carlos R. Bueno Jr ⁷ , Peter S. Munk ⁸ , Jeff Coombes ⁹ , Ulrik Wisloff ¹ . ¹ Norwegian University of Science and Technology, Trondheim, Norway. ² Flinders University, Adelaide, Australia. ³ Private Center of Sports and Preventive Cardiology, Munich, Germany. ⁴ Technische Universität München, Munich, Germany. ⁵ University of the Sunshine Coast, Sunshine coast, Australia. ⁶ KJ fisiosport, Guayaquil, Ecuador. ⁷ University of São Paulo, Ribeiro Preto, Brazil. ⁸ Sorlandet hospital HF, Kristiansand, Norway. ⁹ University of Queensland, Queensland, Australia. Email: arnt.e.tjonna@ntnu.no (No relevant relationships reported)	May 27 9:30 AM - 11:30 AM
99	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/m 2 ; VO $_{2\max}$ 39.1 ± 5.3 ml·kg $^{-1}$ ·min $^{-1}$) who completed three 26-h laboratory conditions, including 22.5 h in a whole-room calorimeter, separated by 5-14 day washout period. The same procedures were performed in each of the three conditions except for the following 9-h activity period: uninterrupted sitting time (SIT); sitting with 8 min intermittent, brisk (60% VO $_{2\max}$) walking bouts (WALK; 7 bouts for a total of 56 min); or alternating 8-min brisk walks and simple resistance activities (RESIST; 3 bouts of walking and 4 bouts of resistance for a total of 56 min). Continuous glucose monitoring (CGM) was performed for 26 h. Standardized meals were consumed during each condition. The incremental areas under the curve (iAUC) for glucose during the entire observation period and the three segmentation periods (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-h iAUC for CGM by $3.04 \text{ mmol} \cdot \text{L}^{-1} \cdot \text{h}$ [95%CI 0.94-6.33] ($p = 0.046$). Compared with SIT, WALK and RESIST reduced the CGM iAUC by $3.80 \text{ mmol} \cdot \text{L}^{-1} \cdot \text{h}$ [0.19-7.40] ($p = 0.036$) and $7.37 \text{ mmol} \cdot \text{L}^{-1} \cdot \text{h}$ [4.08-10.66] ($p < 0.001$) during the 9 h activity period, respectively. The iAUC was lowered by $3.57 \text{ mmol} \cdot \text{L}^{-1} \cdot \text{h}$ [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 $1.91 \text{ mmol} \cdot \text{L}^{-1} \cdot \text{h}$ [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.		PURPOSE: The current study investigated effects of an 8-week moderate intensity aerobic exercise program on changes of body composition and markers of inflammation and oxidative stress in middle-aged obese females. METHODS: 35 obese females were randomly assigned to either exercise (EX, N=16) or control (CON, N=19) group. The exercise group performed moderate intensity aerobic exercise on the treadmill for 60 minutes at 55% of VO $_{2\max}$ for 8 weeks (3 days/week). Body composition measurement with dual-energy X-ray absorptiometry and blood collection were conducted before and after the 8-week intervention (PRE and POST). Blood samples were used to measure levels of tumor necrosis factor-alpha, C-reactive protein, adiponectin, total antioxidant status, and 8-hydroxydeoxyguanosine. Two-way repeated measures ANOVA and Tukey post hoc tests were used for data analysis. RESULTS: 8 weeks of aerobic exercise intervention significantly reduced body weight ($89.2 \pm 14.1 \text{ kg mean} \pm \text{SD} \rightarrow 88.1 \pm 14.4$, $P = .023$), BMI ($34.2 \pm 4.6 \rightarrow 33.7 \pm 4.4$, $P = .035$), %body fat ($42.1 \pm 5.2 \% \rightarrow 41.4 \pm 5.2$, $P = .014$) and tumor necrosis factor-alpha ($4.57 \pm 2.8 \text{ pg/mL mean} \pm \text{SE} \rightarrow 4.24 \pm 0.28$, $P=0.027$) and increased total antioxidant status ($1.76 \pm 1.1 \text{ mM} \rightarrow 1.98 \pm 1$, $P = .017$); however, visceral adipose tissue mass, C-reactive protein, Adiponectin, and 8-hydroxydeoxyguanosine were unaltered. CON showed no significant changes in any variables at POST. CONCLUSIONS: It is suggested that levels of inflammation and oxidative stress are associated with changes in %body fat, indicating that fat loss is effective in preventing and managing obesity-associated disorders. This study confirmed results of previous studies suggesting that longer period of exercise training with fat loss may be required to induce significant changes in CRP, adiponectin, and 8-hydroxydeoxyguanosine in the middle-aged obese females.		
100	Board #3 Simple Resistance Exercise Breaks To Interrupt Sedentary Behavior In College Students Robert J. Kowalsky, Tyler M. Farney, Christopher M. Hearon, FACSM. <i>Texas A&M University Kingsville, Kingsville, TX.</i> Email: robert.kowalskyjr@tamuk.edu (No relevant relationships reported)	May 27 9:30 AM - 11:30 AM	100	Board #5 Ex-Met Study; Exercise In Prevention Of Metabolic Syndrome Arnt E. Tjonna ¹ , Joyce S. Ramos ² , Axel Pressler ³ , Martin Halle ⁴ , Klaus Jungbluth ⁵ , Erika Ermacora ⁶ , Øyvind Salvesen ¹ , Jhennyfer Rodrigues ⁷ , Carlos R. Bueno Jr ⁷ , Peter S. Munk ⁸ , Jeff Coombes ⁹ , Ulrik Wisloff ¹ . ¹ Norwegian University of Science and Technology, Trondheim, Norway. ² Flinders University, Adelaide, Australia. ³ Private Center of Sports and Preventive Cardiology, Munich, Germany. ⁴ Technische Universität München, Munich, Germany. ⁵ University of the Sunshine Coast, Sunshine coast, Australia. ⁶ KJ fisiosport, Guayaquil, Ecuador. ⁷ University of São Paulo, Ribeiro Preto, Brazil. ⁸ Sorlandet hospital HF, Kristiansand, Norway. ⁹ University of Queensland, Queensland, Australia. Email: arnt.e.tjonna@ntnu.no (No relevant relationships reported)	May 27 9:30 AM - 11:30 AM

Emerging research suggests improvement in fatigue, sleepiness, and muscular discomfort from using simple resistance exercises to interrupt prolonged sitting, yet it is unclear if these improvements are observed in college students.
PURPOSE: To examine if interrupting prolonged sitting with simple resistance exercise helps to reduce daily fatigue, sleepiness, muscular discomfort in college students and if it impacts daily physical activity.
METHODS: Twenty four college students (age 23.1 ± 3.4 years, BMI 27.4 ± 5.0 kg/m 2) completed two 7-day assessments of subjective measures for discomfort, fatigue, and sleepiness while wearing an ActivPAL Micro (PAL technologies) to track physical activity for steps, sedentary time, standing time, and sedentary time in 10, 30, and 60-minute bouts. The first week was used as control (CON) and consisted of normal daily activities while completing assessments of all outcomes in the morning (M), mid-day (MD), and evening (E). The experimental week (REX) followed a similar protocol, but added hourly resistance exercise breaks consisting of one bodyweight or resistance band exercise for 2 sets of 15 repetitions per exercise. Paired t-tests evaluated difference in physical activity variables. Repeated measures ANOVA (0 between, 3 within) evaluated differences in discomfort, fatigue, and sleepiness variables across treatment (CON, REX), day (Mon-Fri), and time (M, MD, and E).

RESULTS: Comparison of physical activity resulted in no statistical significance between CON vs REX for all outcomes ($p \geq 0.05$). A main effect for treatment was observed for overall discomfort (CON: 2.97, REX: 1.72; $p = 0.042$) and for sleepiness (CON: 4.38, REX: 3.89; $p = 0.011$). Additionally, a main effect for time was observed for mental fatigue (M: 15.16; MD: 16.19; E: 22.15; $p < 0.001$), physical fatigue (M: 15.41; MD: 15.91; E: 19.53; $p = 0.027$), and sleepiness (M: 4.78, MD: 3.36; E: 4.27; $p < 0.001$). Post hoc testing observed a difference for mental fatigue from, M to E ($p = 0.003$) and MD to E ($p < 0.001$). Sleepiness observed a difference from M to MD ($p < 0.001$), M to E ($p = 0.016$), and from MD to E ($p < 0.001$).

CONCLUSIONS: Hourly simple resistance breaks resulted in no compensation in steps or sedentary time when engaging in the REX condition. Furthermore, the REX condition reduced daytime muscular discomfort and sleepiness.

Conclusion

HIIT exercise with low volume seems to be a time-effective strategy for lowering risk factors constituting metabolic syndrome. Although results from this study show that both HIIT and MICT reduces metabolic syndrome risk factors to a similar degree.

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

		1 HIIT			4 HIIT			MICT				
		Median Change	CI lower	CI high	P-value	Median Change	CI lower	CI high	P-value	Median Change	CI lower	CI high	P-value
WC	-0.5	-2.5	1.5	0.167	<1	-3	0	0.025	<1	-2	0.5	0.109
BP sys	-7	-12	-2	>0.001	-6	-10	-3	>0.001	-3	-9	0	0.004
BP diast	-2	-5	2	0.019	-5	-7	-2	>0.001	-3	-5	-1	0.081
HDL	-0.025	-0.1	0.04	0.922	-0.02	-0.08	0.07	0.922	0.05	-0.01	0.12	0.025
TG	-0.145	-0.34	0.05	0.023	-0.16	-0.42	-0.05	0.006	-0.14	-0.3	-0.04	0.006
Glucose	-0.2	-0.5	0	0.006	-0.3	-0.4	0.1	0.121	0	-0.22	0.3	0.658

101 Board #6 May 27 9:30 AM - 11:30 AM
High Intensity Interval Training And Muscular Strength On Academic And Behavioral Outcomes In Children

Jessica Peacock. Merrimack College, North Andover, MA.

(Sponsor: Kevin Finn, FACSM)

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(No relevant relationships reported)

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) (n = 22). The HITT condition consisted of 4 days of HITT sessions (9 min/session; 30 sec on:30 sec off) followed by X min of standard PE activities; the MS condition consisted of 4 days of strength sessions (3 sets/10-12 reps for 3 exercises/session) followed by ~30 min of standard PE activities; the control condition consisted of ~50 min of standard PE only. PA intensity and duration was measured using actigraph accelerometers (Actigraph, Pensacola, FL). Math Assessment scores and Connor Abbreviated Ratings were conducted at baseline and post-intervention to identify academic and behavioral changes respectively. Intervention effects for outcomes were examined using regression analysis. **RESULTS:** Participation in HITT predicted higher vigorous ($\beta=2.21$, $p=0.005$) and very vigorous minutes ($\beta=0.80$, $p < 0.001$), but not moderate minutes compared to control. Participation in strength was not statistically different. HITT participation was also associated with greater improvement on math test scores ($\beta=1.52$, $p=0.04$). No condition was associated with significant changes to behavioral ratings. **CONCLUSION:** Preliminary evidence from this study highlights the potential for embedding an acute HITT program within PE for improving physical activity levels and academic outcomes in elementary school children. This is consistent with prior studies which show how short bouts of intense exercise can improve cognitive and mental health outcomes in adolescent populations.

102 Board #7 May 27 9:30 AM - 11:30 AM
High-intensity Interval Training Low-volume Vs Moderate-intensity Continuous Aerobic Training On Insulin Resistance In Metabolic Syndrome

Juan C. Calderón¹, Daniel Aguirre-Acevedo¹, Esperanza Montoya¹, Manuela Yépez-Calderón¹, Camila Trillos¹, Miguel Peña¹, Yeliana L. Sánchez¹, Andrés F. Milán¹, Sergio Granados¹, Luis Valbuena², Iván Montoya³, Juan C. Aristizábal¹, Raul Narvaez-Sánchez¹, Jaime Gallo-Villegas¹. ¹University of Antioquia, Medellín, Colombia. ²Indeportes Antioquia, Medellín, Colombia. ³Pontifical Bolivarian University, Medellín, Colombia.

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(No relevant relationships reported)

Moderate-intensity continuous aerobic training (MICAT) and high-intensity interval training (HIIT) interventions improve insulin resistance (IR) and glycemic control in patients with metabolic syndrome (MS). Moreover, skeletal muscle mass negatively correlates with IR. However, there are contradictory results about the superiority of any of these interventions on the control of the glucose metabolism in MS. **PURPOSE:** to

compare the efficacy of a HIIT-low volume protocol vs MICAT on the Homeostatic assessment model, glycated hemoglobin (HbA1c) and skeletal muscle mass, in adults with MS. **METHODS:** controlled, randomized, clinical trial using the minimization method, with two parallel groups for the purpose of showing superiority. Sixty patients with MS, of both genders, 40-60 years old, were included. A clinical evaluation, biochemical tests, an ergospirometry and a dual-energy X ray absorptiometry to determine total and regional skeletal muscle mass were carried out before and after a treadmill exercise program of 12 weeks, 3 sessions/week. Participants were assigned to an intervention with HIIT-low volume (n=29) in 22 min sessions that included six intervals at a load of 90% of maximum oxygen consumption ($VO_2\text{max}$) for 1 min followed by 2 min at 50% of $VO_2\text{max}$. The control group received MICAT (n=31) at an intensity of 60% of $VO_2\text{max}$ in sessions of 36 min. **RESULTS:** patients had a mean age of 50.8 ± 6.0 years, body mass index of $30.6 \pm 4.0 \text{ kg.m}^{-2}$, body fat percentage of $38.7 \pm 7.0\%$ and $VO_2\text{max}$ of $29.0 \pm 6.3 \text{ mL O}_2 \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$; 70% were women. Compared to MICAT, HIIT-low volume was not superior in reducing Ln of IR (marginal mean difference: 0.083 [95% CI -0.092–0.257]; 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 HIIT-low volume group, compared to the MICAT, had a higher HbA1c (5.81% vs 5.69%; 0.119 [0.005–0.233]; Cohen's d: 0.554; p=0.040). When comparing before and after the intervention, both training groups decreased IR. **CONCLUSION:** HIIT-low volume, compared to MICAT, is not superior in reducing IR or increasing skeletal muscle mass in adults with MS. Colciencias 111562638757; Interinstitucional 2016-13041; Doctoral scholarships 727-2015

103 Board #8 May 27 9:30 AM - 11:30 AM
Resistance Exercise And Cardiometabolic Risk In Prediabetes: A Systematic Review And Meta-analysis

Raza Qadir¹, Nicholas Sculthorpe², Taylor Todd³, Elise Brown³.

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(No relevant relationships reported)

Prediabetes is a highly prevalent precursor to type 2 diabetes, and is also associated with an increased risk of morbidity and mortality. Resistance exercise (RE) is an effective method of reducing cardiometabolic risk factors in persons with a diagnosis of type 2 diabetes, but its efficacy in individuals with prediabetes is unclear. Determining the cardiometabolic impact of RE in prediabetes is necessary for evidence-based exercise prescription for diabetes prevention. **PURPOSE:** To undertake a systematic review and meta-analysis of randomized and non-randomized control trials examining the effect of RE on cardiometabolic risk factors in individuals with prediabetes. **METHODS:** PubMed, Cochrane, Web of Science, and Embase databases were searched for published studies of adults at risk for diabetes and who participated in a RE intervention. All studies included randomized or non-randomized control trials. The database search and data extraction were performed by two separate reviewers. A systematic review and meta-analysis were conducted to determine changes in adiposity, glycemic control, insulin resistance, blood lipids/lipoproteins, and blood pressure (BP) following the interventions using a random effects model to assess standardized mean differences (SMD) between RE and control. **RESULTS:** 10 studies comprising 404 participants were included in the analysis. For RE compared to controls, there were significant improvements in glycosylated hemoglobin (SMD = -0.688; 95% confidence interval [CI] -1.178 to -0.198; p=0.006), fasting plasma glucose (SMD = -0.747; 95% CI -1.003 to -0.460; p<0.001), and total cholesterol (SMD = -0.723; 95% CI -1.177 to -0.27; p=0.002). No changes in waist circumference (SMD = -0.232, 95% CI -.526 to 0.062; p=0.122), insulin resistance (SMD = -0.597, 95% CI -1.65 to 0.457; p=0.267), high-density lipoprotein (SMD = -0.287, 95% CI -0.748 to 0.174; p=0.223) or low-density lipoprotein (SMD = -0.398, 95% CI -1.027 to 0.231; p=0.215) cholesterol, triglycerides (SMD = -0.400, 95% CI -0.850 to 0.050; p=0.081), systolic BP (SMD = -0.16, 95% CI -0.491 to 0.158; p=0.315), or diastolic BP (-0.476, 95% CI -1.05 to 0.105; p=0.108) were found. **CONCLUSION:** RE appears to be an effective method of improving glucose control, but is less effective in improving blood lipids or blood pressure.

A-22 Thematic Poster - Vascular Function

Wednesday, May 27, 2020, 9:30 AM - 11:30 AM
Room: CC-2010

- 104** Chair: Maureen J. MacDonald. *McMaster University, Hamilton, ON, Canada.*
(No relevant relationships reported)

- 105** Board #1 May 27 9:30 AM - 11:30 AM
Baseline Cardiac Autonomic Predictors Of Blood Pressure Response To Standardized Endurance Training In Hypertensive Women

Marina Lívia Venturini Ferreira, Alex Castro, Silas Gabriel Oliveira Nunes, Rafael Rezende Ferreira, Cláudia Regina Cavaglieri, Mara Patrícia Traina Chacon-Mikahil. *UNICAMP, Campinas, Brazil.*
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(No relevant relationships reported)

Although international recommendations corroborate the antihypertensive effects of regular endurance training (ET), interindividual responses are widely 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:** Associate baseline ANS variables with interindividual BP responses in hypertensive women undergoing ET.

METHODS: Forty-four women performed 12 weeks of ET on cycle ergometer (50 min.day⁻¹, 3 days.week⁻¹ at 60–70% heart rate reserve). Pre and post ET 20 min beat-to-beat BP waveforms were recorded by finger photoplethysmography and ANS was assessed by heart rate (HR) variability (HRV) recorded from HR monitor and analyzed in the time and frequency domain. Participants were identified as RE by a magnitude of reduction in systolic BP (SBP) greater than the typical error (TE) of measurement (1xTE=7.4 mmHg) and participants with changes less or increase greater than 1xTE as NR. Associations between baseline HRV variables and changes (Δ) in BP after ET were analyzed using Pearson's correlation coefficient and multiple linear regression. Student's t-test to comparisons RE vs. NR. Receiver operator characteristic (ROC) curve to identify predictors cut-off values for RE and NR discrimination.

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 =0.02). SDNN was able to predict 15.6% of variance in SBP changes (B =0.39, p =0.008). Compared to RE, NR demonstrated greater SDNN (29.6±21.4 vs. 16.1±4.9, p =0.09), RMSSD (32.7±27.3 vs. 17.4±8.6, p =0.013) and LF (591±1380 vs. 110±71, p =0.001) and HF (668±1340 vs. 154±164, p =0.012). For SDNN, a cut-off value of 18.7 discriminated RE and NR with good accuracy (AUC=0.81, sensitivity=80%, specificity=76%, p =0.03).

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

- 106** Board #2 May 27 9:30 AM - 11:30 AM
Vascular Function Following An Acute Mental Stressor Among Fit Versus Non-fit Young Adults

Gabriel Zieff, Mohammod Alzer, Anthony Kostov, Simon Wahba, Jesse Rackley, Jade Blackwell, Jake Diana, Erik Hanson, Lee Stoner, FACSM. *The University of North Carolina at Chapel Hill, Chapel Hill, NC.* (Sponsor: Lee Stoner, FACSM)
(No relevant relationships reported)

Purpose: Acute mental stress impairs vascular function. The purpose of this study was to investigate if stress-induced vascular impairment is moderated by physical fitness. **Methods:** Nineteen young, healthy adults (21.6±2.7 y, 23.9 ± 3.1 kg/m², 10 F) were classified as fit (n=11) or non-fit according to ACSM physical activity guidelines (75 min vigorous, or 150 min moderate-intensity aerobic exercise). Across two randomized visits, subjects underwent an experimental (stress) and control (non-stress) testing session. A five-min mental arithmetic task was given to induce stress in the experimental session following baseline measurements. Measurements were taken throughout the 60 mins after the stress/control period. Measures included central blood pressure (cSBP), augmentation index (AIx), and brachial-radial pulse wave velocity (PWV). Mixed linear models were used to perform statistical analyses, covarying for baseline measures. **Results:** There was a significant fitness x condition interaction for AIx (p =0.038), such that the greatest AIx of fit individuals following stress exposure

was 3.3 percentage points less than non-fit individuals (95% CI -1.29, -0.09, d = -1.34). There was no interaction of fitness and condition on PWV (p =0.785; 95% CI -0.18, 0.16), but there was an inconclusive effect of fitness (p =0.143), such that fit individuals had a PWV 0.37 m/s less than non-fit individuals (CI: -0.27, 0.04; d =-0.43). For cSBP, there was no fitness x condition interaction (p =0.653; 95% CI: -1.14, 1.83), but there was a main effect of condition (p =0.045) where, regardless of fitness, stress elicited a 3.05 mmHg greater increase in cSBP after the stressor compared to the non-stress condition (95% CI 0.01, 3.06; d =0.69). **Conclusion:** Fitness was associated with a healthier wave reflection profile following a stressor, as well as better overall vascular function. These adaptive effects of fitness on hemodynamic and vascular measures ensued despite stress-induced increases in cSBP occurring regardless of fitness status.

- 107** Board #3 May 27 9:30 AM - 11:30 AM
Cardiorespiratory Fitness And Aortic Hemodynamics Are Associated With Brain Volume In Healthy Older Adults

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(No relevant relationships reported)

Cardiorespiratory fitness (CFR) is positively associated with greater brain volume in older adults; however, the mechanism is unknown. Improved structure and function of the large vessels supplying the brain due to habitual exercise may explain why CFR influences brain volume. **PURPOSE:** The purpose of this study was to determine if aortic hemodynamics modify the association between CFR and brain volume in both young and older adults. **METHODS:** Young (YA; n =27, age =25±5 y, women =15) and older (OA; n =23, age =64±5 y, women =11) healthy adults ranging from sedentary to exercise trained were studied. CFR was assessed using an incremental maximal exercise test on a cycle ergometer (VO_2 max). Total brain volume (gray matter + white matter) was determined using a T1 weighted scan on a 3T MRI scanner. Aortic hemodynamics were obtained from applanation tonometry (SphygmoCor) where the aortic pressure waveform was used to calculate aortic augmentation index (AIx). **RESULTS:** Young adults had a larger total brain volume (YA; 1.16±0.02 l vs. OA; 1.10±0.02 l, p <0.05), higher VO_2 max (YA; 40±1 ml/kg/min vs. OA; 32±2 ml/kg/min, p <0.05), and lower AIx (YA; 2.9±2.5 % vs. OA; 19.2±2.4 %, p <0.05) compared with older adults. VO_2 max was not associated with AIx in young adults (p >0.05); however, VO_2 max was negatively associated with AIx in older adults (r =-0.61, p <0.05) such that older adults with higher CFR demonstrated lower aortic hemodynamics. There were no associations between VO_2 max, AIx, and total brain volume in young adults (p >0.05 for all). Conversely, both VO_2 max (r =0.51, p <0.05) and AIx (r =-0.64, p <0.05) were associated with total brain volume in older adults. When VO_2 max and AIx were entered into the model using multiple linear regression, VO_2 max was no longer a significant predictor of total brain volume in older adults (VO_2 max; p =0.41, AIx; p =0.03). **CONCLUSIONS:** High CFR and low aortic hemodynamics are associated with larger total brain volumes in older adults. Using multiple linear regression, aortic hemodynamics are a better predictor of total brain volume than CFR in older adults. Improved aortic hemodynamics may be a mechanism by which habitual exercise protects the brain from age-related volume decline. Supported by NIH grant HL118154.

- 108** Board #4 May 27 9:30 AM - 11:30 AM
Acute Adolescent Concussion: Cerebrovascular Reactivity, Symptom Burden, And Exercise Response

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(No relevant relationships reported)

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 (vasoreactivity), and CBF responses during sub-maximal aerobic exercise in adolescents post-concussion. **METHODS:** 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

via transcranial Doppler ultrasonography at the M1 segment of the middle cerebral artery unilaterally during the air rebreathing task and during the aerobic exercise test. Only physical and vestibular-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, as well as current physical activity levels. Age, sex, 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 VO_{2peak} , with resting heart rate, prior concussion(s), and time since injury also contributing.

CONCLUSIONS: Our findings suggest 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.

109 Board #5 May 27 9:30 AM - 11:30 AM

Potential Racial Disparity In Peripheral Vascular Function Regardless Of Menstrual Cycle Phase

Michele N. D'Agata¹, Alexandra E. Hirt¹, Elissa K. Katulka¹, Felicia R. Berube¹, Megan M. Wenner¹, Sushant M. Ranadive², Melissa AH Witman¹. ¹University of Delaware, Newark, DE. ²University of Maryland, College Park, MD.

(No relevant relationships reported)

African American women (AAW) have the highest rates of cardiovascular disease (CVD) across the lifespan compared to women of other races. Vascular dysfunction is a non-traditional risk factor for CVD and is understudied in AAW. Previous studies have reported fluctuations in vascular function across the menstrual cycle (MC) with the changing levels of estrogen, but this relation has never been explored in the context of race. **PURPOSE:** To compare nitric oxide-mediated peripheral vascular function across 3 phases of the MC between AAW and CW using passive leg movement (PLM). **METHODS:** PLM was performed on premenopausal, healthy, female participants not using hormonal contraceptives; 7 AAW (24 ± 2 years, BMI: 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: 195 ± 49, CW: 356 ± 64), OV (AAW: 156 ± 47, CW: 451 ± 102) and ML (AAW: 224 ± 65, CW: 369 ± 41) ($p = 0.02$). The hyperemic response to PLM, calculated as area under the curve (mL), was significantly reduced in AAW compared to CW across the MC phases. EF (AAW: 45 ± 21, CW: 131 ± 40), OV (AAW: 49 ± 28, CW: 144 ± 40) and ML (AAW: 67 ± 22, CW: 130 ± 26) ($p = 0.03$). **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.

110 Board #6 May 27 9:30 AM - 11:30 AM

Acute Effects Of Interrupting Prolonged Sitting On Vascular Function In Type 2 Diabetes

Frances Clare Taylor¹, David W. Dunstan², Ashleigh R. Homer¹, Bronwyn A. Kingwell³, Paddy C. Dempsey⁴, Rachel E. Clime², Neville Owen², Robyn N. Larsen⁵, Michael J. Wheeler², Melanie K. Townsend², Nirav Maniar⁶, Daniel J. Green⁷. ¹Mary MacKillop Institute for Health Research, Australian Catholic University, Melbourne, Australia. ²Baker Heart and Diabetes Institute, Melbourne, Australia. ³CSL Ltd, Bio21, Melbourne, Australia. ⁴Institute of Metabolic Science, University of Cambridge, Cambridge, United Kingdom. ⁵School of Agriculture and Food, The University of Melbourne, Melbourne, Australia. ⁶School of Behavioural and Health Sciences, Australian Catholic University, Melbourne, Australia. ⁷School of Sports Science, Exercise and Health, University of Western Australia, Perth, Australia.

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(No relevant relationships reported)

In overweight/obese adults, frequent interruptions to sitting time by brief activity bouts can mitigate the impairment of vascular function. However, it is unknown whether the

benefits extend to those with type 2 diabetes (T2D), and whether there is an optimal frequency of activity break. **PURPOSE:** To examine the acute effects on vascular function in those with T2D, of interrupting sitting time with simple resistance activities (SRAs): 3min every 30min; or, 6min every 60min.

METHODS: In a randomised crossover trial, 20 sedentary adults with T2D and overweight/obesity (35-70 yr; 11 males; 9 females) completed three 7-hour conditions (6-14 day washout between conditions): 1) uninterrupted sitting (SIT); 2) sitting with 3-min bouts of SRA every 30 min (SRA3); and, 3) sitting with 6-min bouts of SRA every 60 min (SRA6). Shear rate, blood flow and femoral artery flow-mediated dilation (FMD) were measured at 0h, 1h, 3.5h, 4.5h, 6.5h. Mixed models examined effects of condition and condition-by-time interactions, with adjustment for age, sex, BMI, baseline measurements and treatment order. Post-hoc analyses compared vascular measurements at individual timepoints and were re-run with adjustment for multiple comparisons (Šidák correction).

RESULTS: Mean (±SD) resting shear rate across timepoints was significantly lower in the SIT condition ($32.2 \pm 23.3 \text{ s}^{-1}$) relative to SRA3 ($42.2 \pm 27.9 \text{ s}^{-1}$, $P_{\text{Condition}} < 0.0001$) and SRA6 ($44.6 \pm 29.1 \text{ s}^{-1}$, $P_{\text{Condition}} < 0.0001$). Mean (±SD) resting blood flow, was significantly lower in the SIT condition ($64.7 \pm 45.2 \text{ mL/min}$), relative to SRA3 ($86.1 \pm 77.5 \text{ mL/min}$, $P_{\text{Condition}} < 0.0001$) and SRA6 ($85.0 \pm 61.7 \text{ mL/min}$, $P_{\text{Condition}} < 0.0001$). There were no condition differences in the temporal change in femoral artery FMD measurements across the 7h day ($P_{\text{time} \times \text{condition}} > 0.05$ for all). However, FMD was significantly lower at the 6.5h timepoint in SIT compared with SRA3 ($2.8 \pm 3.5\%$ vs $5.3 \pm 2.7\%$, $P = 0.0007$).

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.

111 Board #7 May 27 9:30 AM - 11:30 AM

The Ascending Aortic Function In Elite Endurance Athletes: An MRI Study

Takashi Tarumi¹, Takayuki Yamabe¹, Marina Fukui¹, Ryota Kimura², Keigo OHYAMA-BYUN², Seiji Maeda², Jun Sugawara¹. ¹National Institute of Advanced Industrial Science and Technology, Tsukuba, Japan. ²University of Tsukuba, Tsukuba, Japan.

(No relevant relationships reported)

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 = $69.6 \pm 3.1 \text{ mL/kg/min}$) 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. $48 \pm 5 \text{ bpm}$, $P = 0.001$) and stroke volume was greater in athletes (82.1 ± 10.8 vs. $95.8 \pm 18.5 \text{ mL/beat}$, $P = 0.012$) while cardiac output was similar between the groups. The systolic aortic cross-sectional areas were increased in athletes compared with sedentary subjects (ascending: 6.32 ± 0.99 vs. $6.95 \pm 1.00 \text{ cm}^2$, descending: 4.08 ± 0.64 vs. $4.85 \pm 0.83 \text{ cm}^2$, $P = 0.012$). The diastolic aortic areas ($P = 0.062$) 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 (all $P < 0.05$). **CONCLUSIONS:** Our findings suggest that endurance athletes have dilated thoracic aorta and better recoiling 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 (19K19970, TT) and the ARIHHP Cooperative Grant (University of Tsukuba, TT)

112	Board #8 Vascular Dysfunction In The Lower Limbs Of Young Black Males: Evidence From Passive Leg Movement Stephen J. Ives ¹ , Meaghan Lynch ¹ , Brian Lora ¹ , Tawn Tomasi ¹ , Gaia Giuriato ² , Emma Basso ¹ , Emma Finegan ¹ , Jack Schickler ¹ , Massimo Venturelli ² , Robert Restaino ¹ . ¹ Skidmore College, Saratoga Springs, NY. ² University of Verona, Verona, Italy. Email: sives@skidmore.edu (No relevant relationships reported)	May 27 9:30 AM - 11:30 AM
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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 (StO_2), 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±3 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±5 vs. 86±3 mmHg) were not different between BA and WA, respectively (all, p>0.05). The peak PLM-induced changes in HR (6±2 vs. 11±3 Abeats/min, p = 0.06), SV (7.3±1.6 vs. 11.4±1.9 ΔmL/beat, p = 0.04), and CO (0.7±0.2 vs. 1.0±0.2 Δl/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 StO_2 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.

A-23 Free Communication/Slide - Exercise Immunology

Wednesday, May 27, 2020, 9:30 AM - 11:30 AM
Room: CC-3014

113	Chair: Vanessa D. Sherk. <i>University of Colorado Anschutz Medical Campus, Aurora, CO.</i> (No relevant relationships reported)
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114	May 27 9:30 AM - 9:45 AM Abstract Withdrawn
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115	May 27 9:45 AM - 10:00 AM The Effects Of 16-weeks Of Exercise Training On Neutrophil Functions In Breast Cancer Survivors Grace A. MacDonald ¹ , David B. Bartlett ¹ , Erik D. Hanson ² , William S. Evans ² , Jordan T. Lee ² , Chad W. Wagoner ² , Eli Danson ² , Paige Harrell ² , Stephanie Sullivan ² , Kirsten A. Nyrop ² , Hyman B. Muss ² , Brian C. Jensen ² , Claudio L. Battaglini, FACSM ² . ¹ Duke University, Durham, NC. ² University of North Carolina, Chapel Hill, NC. (Sponsor: Claudio Battaglini, FACSM) (No relevant relationships reported)
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PURPOSE: Following therapy, breast cancer survivors have impaired immune functions which are associated with increased risk of recurrence and infectious diseases. Neutrophils are critical to host protection against infectious diseases. The aim of this study was to use acute exercise as an immunological stressor before and after 16-weeks of exercise training to determine changes in neutrophil functions consistent with a reduced infection risk.

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, CXCR2 and TLR4 were assessed by flow cytometry (MFI ± SD).

RESULTS: Compared to Controls, at BASE PRE, BC survivors had lower phagocytosis of bacteria (4250±718 v 3991±1232; p=0.03), and elevated oxidative burst (4495±651 v 6254±1434; p=0.005). At BASE, BC survivors' phagocytic response to acute exercise was impaired. BC survivors PRE to POST phagocytosis was unchanged (p=0.224) while Controls increased 15±20% (p=0.003). BC survivors PRE to 1Hr POST phagocytosis increased by 10±17% (p=0.046) while Controls increased 14±14% (p=0.003). Following training, BC survivor PRE phagocytosis increased from BASE to FINAL by 10% (p=0.08), to similar levels as Controls (p=0.765). BC survivors FINAL PRE to POST phagocytosis increased by 10% (p=0.001) and PRE to 1Hr POST by 11% (p=0.008). Oxidative killing of bacteria was unchanged by acute exercise or exercise training. At BASE, BC survivor expression of CD16 reduced during acute exercise, PRE to 1Hr POST by 9% (p=0.04) which annulled following training.

CONCLUSIONS: Following cancer therapy, BC survivors have impaired neutrophil functions at rest and to a stressor, which are improved by 16-weeks of exercise training. The improved phagocytosis of bacteria in BC survivors may represent an intrinsic improvement in neutrophil functions consistent with reduced risk of infectious disease. *Supported by Breast Cancer Research Foundation (New York, NY).*

116	May 27 10:00 AM - 10:15 AM
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Stress-related Genetic Variants Modulate Electrodermal Response To Maximal Exercise

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(No relevant relationships reported)

Previous research from our lab established electrodermal activity (EDA) as a valid, surrogate marker of sympathetic nervous system activity during treadmill exercise. We have subsequently reported dose dependent effects of aerobic fitness, combat exposure and blast exposure on the electrodermal response to acute exercise stress.

PURPOSE: As an extension of our prior work, this study evaluated the effect of stress related genetic variants on EDA during maximal exercise in specialized military men.

METHODS: Sixty-four male (age = 34.2±7.0 yrs) Explosive Ordnance Disposal operators completed a graded exercise test to assess maximal oxygen consumption (VO_{2max}). EDA was recorded at baseline, during exercise and recovery. Percent change from baseline was calculated for stages of 25, 50, 75 and 100% VO_{2max} , and active and seated recovery. Genetic variants of catechol-o-methyltransferase (COMT), brain-derived neurotrophic factor (Val66Met) and serotonin transporter (5HTTLPR) were determined from saliva. Combination groups of 2 (COMT + Val66Met) or 3 (COMT + Val66Met + 5HTTLPR) variants (2 or 3GCOM) were created and divided into "low" and "high" EDA groups. A 2 or 3 (GCOM) x 6 (STAGE) repeated measures ANOVA evaluated EDA changes across stages for 2 or 3GCOM groups, separately. **RESULTS:** All GCOM groups showed linear increases in EDA percent change throughout exercise. Low 2GCOM response peaked at 75% VO_{2max} and plateaued in recovery. High 2GCOM had a larger change, peaked at 100% VO_{2max} , then declined in recovery. There was a borderline main effect of 2GCOM ($p=.06$, $\eta_p^2=.108$) and a main effect of STAGE ($p<.001$, $\eta_p^2=.183$). Low 3GCOM had a similar pattern as low 2GCOM, but on a smaller scale. High 3GCOM demonstrated the largest change in magnitude, peaked at 100% VO_{2max} and sharply declined in recovery. There was a 3GCOM x STAGE interaction effect ($p<.001$, $\eta_p^2=.352$). **CONCLUSION:** When combined, genetic variants implicated in the human stress response modulate EDA during and after maximal exercise. Influence of COMT was expected, as EDA is a proxy of plasma catecholamine levels during exercise. Val66Met and 5HTTLPR have been shown to modulate exercise responses and cardiovascular reactivity, respectively. Future work will comprehensively evaluate biobehavioral characteristics and genetic variants in this sample.

117 May 27 10:15 AM - 10:30 AM

INVOLVEMENT OF PURINERGIC SIGNALING AND LYMPHOID ORGANS IN THE BENEFICIAL EFFECTS OF AEROBIC TRAINING IN ASTHMA

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(No relevant relationships reported)

PURPOSE: Asthma is a chronic airway inflammatory disease affecting more than 300 million people around the world. Purinergic signaling via purinergic receptors (mainly P2X7, P2Y2 and P2Y6) are thought play a key role in asthma pathogenesis and severity. High intensity aerobic exercise is known to trigger asthma attacks, while low to moderate intensity training reduces inflammation and improves asthma control. Therefore, this study investigated whether low intensity aerobic exercise reduces asthma phenotype by modulation of purinergic signaling. **METHODS:** Aerobic exercise (AE) was performed in a treadmill at low intensity, 5x/week, 1h/session, for 4 weeks, beginning 2 weeks after HDM administration. HDM (*dermatophagoides pteronyssinus*; 100mg/mouse) was administered 3x/week, for 6 weeks. **RESULTS:** The results demonstrated that AE reduced adenosine triphosphate (ATP) accumulation ($p<0.001$), IL-1beta, IL-4, IL-5, CXCL1/KC, IL-13, IL-17, IL-23, IL-33 and TNF-alpha ($p<0.001$), while increased IL-1ra, IL-2, IL-10 and IL-12p40 in bronchoalveolar lavage (BAL). Total number of leukocytes, eosinophils, lymphocytes and neutrophils in BAL and the number of eosinophils, neutrophils and lymphocytes in the airway wall ($p<0.01$) were reduced by AE. Airway remodeling (collagen, elastin, smooth muscle and mucus) were reduced by AE ($p=0.01$). TGF-beta, IGF-1 and VEGF levels was reduced by AE ($p<0.001$). Lung mechanics (Resistance, Elastance, GTIS, HTIS, RAW) and airway hyperresponsiveness (AHR) to methacholine was ameliorated by AE ($p<0.01$). IL-4, IL-5 and IL-13 production by re-stimulated mediastinal lymph nodes, splenocytes and bone marrow cells was also reduced by AE. The expression of P2X7, P2Y2 and P2Y6 by peribronchial leukocytes ($p<0.01$) and also by airway epithelial cells ($p<0.01$) were reduced by AE. **CONCLUSIONS:** Low intensity aerobic training reduces asthma phenotype by inhibiting purinergic signaling and lymphoid organs hyperactivation.

118 May 27 10:30 AM - 10:45 AM

The Immune Response To Cardiorespiratory Exercise Testing In Heart Failure Patients With Reduced Ejection Fraction

Martin Bahls¹, Aycen Koc², Sabine Kaczmarek¹, Kristin Lehnert¹, Ines Urbaneck¹, Ulf Landmesser², Stephan B. Felix¹, Marcus Dörr¹, Nicolle Kränkel². ¹*University Medicine Greifswald, Greifswald, Germany.* ²*Charité Campus Benjamin Franklin, Berlin, Germany.*
(No relevant relationships reported)

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

METHODS: Patients with HFREF (n=13; left ventricular ejection fraction [LVEF] < 40%) and controls (n=14, LVEF > 50%) participated in a CPET. Blood samples were taken before, immediately after and 2 hours after CPET. Flow cytometry was used to assess quantitative and morphological alterations in leukocyte subpopulations as well as the formation of leukocyte-platelet aggregates. Only significant findings are reported ($p < 0.05$) and are given as median and inter-quartile range (IQR).

RESULTS: HFREF (mean LVEF: 36%) and controls (mean LVEF: 57%) were 59 (range: 41 to 80) and 57 (range: 50 to 65) years old, respectively. CPET increased the leukocyte (control: 1.37-fold [IQR: 1.16 to 1.49]; HFREF: 1.24-fold [IQR: 1.20 to 1.32]), natural killer (NK) cell (controls: 2.11-fold [IQR: 1.30 to 3.13]; HFREF: 1.67-fold [IQR: 1.56 to 1.71]) and NK-T cell (control: 1.69-fold [IQR: 1.52 to 3.60]; HFREF: 1.62-fold [IQR: 1.60 to 2.53]) concentration in the HFREF and control group. CD4+ cells (control: 1.15-fold [IQR: 0.84 to 1.54]; HFREF: 1.45-fold [IQR: 1.10 to 1.98]) and CD8+ T-cells (control: 1.33-fold [IQR: 1.01 to 1.68]; HFREF: 1.70-fold [IQR: 1.25 to 2.15]) only increased in HFREF patients. Aggregation of thrombocytes with monocytes (control: 0.86-fold [IQR: 0.78 to 1.49]; HFREF: 1.59-fold [IQR: 1.05 to 7.30-fold]), T-lymphocytes (control: 1.27-fold [IQR: 1.05 to 1.68]; HFREF: 1.49-fold [IQR: 1.03 to 2.64]) and neutrophils (control: 1.08-fold [IQR: 0.87 to 1.25]; HFREF: 2.13-fold [IQR: 1.62 to 2.19]) increased 2 hour post CPET in patients with HFREF, but not in controls.

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.

119 May 27 10:45 AM - 11:00 AM

Mitochondrial Characteristics Of Adaptive Immune Cells Associated With Aerobic Fitness

Jessica Alley, Connor McGinnis, Josh Borwick, Rudy Valentine, Marian Kohut. *Iowa State University, Ames, IA.*
(No relevant relationships reported)

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 (VO_{2max}) test. Mitochondrial mass and membrane potential (MMP) of CD4+ and CD8+ naïve (CD45RA+ CCR7+) and effector memory (CD45RO+ CCR7-) cells were assessed by geometric mean fluorescence intensity (gMFI) of MitoTracker Green FM and TMRE, respectively. **RESULTS:** Preliminary statistical analyses ($n = 11$ each group) revealed that ACTIVE had higher cardiorespiratory fitness than INACTIVE (60.0 ± 9.9 vs. 43.6 ± 8.2 mL/kg/min relative VO_{2max} ; $p = 0.0004$, independent t-test). There were no differences in cell counts between ACTIVE and INACTIVE T cell subsets. Although gMFI indicating mitochondrial mass of CD8+ naïve T cells approached significance between groups (594.7 ± 127.7 ACTIVE vs. 495.4 ± 70.9 INACTIVE; $p = 0.0355$, 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 VO_{2max} ($r = 0.5375$ and 0.5343 , $p = 0.0099$ and 0.0104 , respectively, Pearson correlation). **CONCLUSION:** These preliminary data suggest that mitochondrial adaptations in certain adaptive immune cells 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.

120 May 27 11:00 AM - 11:15 AM

Systemic β_1 -Adrenergic Receptor Blockade Augments NK-Cell Mobilization In Response To Acute Exercise In Humans

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(No relevant relationships reported)

PURPOSE: Recent research has demonstrated that the release of catecholamines, myokines, and the mobilization and redistribution of effector lymphocytes (e.g. NK-cells) with each bout of exercise plays a mechanistic role in the anti-tumor effects provided by regular exercise. We tested the hypothesis that blocking the β_1 -AR in vivo would increase catecholamine signaling toward the β_2 -AR to augment NK-cell mobilization in response to a single exercise bout. **METHODS:** Thirty healthy subjects (ages 22 - 43) completed a single 30-minute bout of steady state exercise on a cycle ergometer at +10 to +15% of their predetermined lactate threshold to determine the number of NK-cells mobilized to blood with exercise. Eighteen of these subjects then participated in a randomized double-blind controlled trial with a cross-over design, whereby a placebo, a non-preferential $\beta_1+\beta_2$ -antagonist (80 mg nadolol), or a preferential β_1 -antagonist (10 mg bisoprolol) was ingested orally 3 hours before a 30-minute exercise bout performed on separate days. Blood samples were collected before and immediately after exercise for the enumeration of effector lymphocytes (NK-cells, $\gamma\delta$ T-cells and CD8+ T-cells) by flow cytometry. **RESULTS:** The median number of NK-cells mobilized to blood with exercise was $\Delta 524$ cells/ μL , with those subjects below the median demonstrating a smaller epinephrine response to exercise than those above the median ($\Delta 0.05 \pm 0.03$ vs $\Delta 0.13 \pm 0.08$ ng/mL; $p < 0.05$). Larger numbers of NK-cells were mobilized with exercise in the bisoprolol trial ($\Delta 703.8 \pm 352.2$ cells/ μL) compared to the placebo trial ($\Delta 537.9 \pm 198.1$ cells/ μL ; $p < 0.05$), both of which were larger than the nadolol trial ($\Delta 285.1 \pm 165.6$ cells/ μL ; $p < 0.05$). Bisoprolol did not augment the mobilization of $\gamma\delta$ T-cells or CD8+ T-cells relative to

placebo. 44% of subjects who mobilized less than Δ524 NK-cells/μL with exercise in the placebo trial were able to mobilize >Δ524 NK-cells/μL after ingesting bisoprolol (n = 4). **CONCLUSION:** Systemic β₁-AR blockade augments NK-cell mobilization in response to acute exercise. These findings may have implications for cancer patients on cardioprotective β-blockers and also provide insights on how certain β-AR antagonists may enhance or inhibit immune responses to exercise.

121 May 27 11:15 AM - 11:30 AM

Intestinal Epithelial Cell-specific Deletion Of Hif1a Affects The Intestinal Barrier Function In High-fat Diet-fed Mice

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(No relevant relationships reported)

High-fat diet (HFD) feeding disrupts the intestinal barrier integrity, inducing the translocation of bacteria into the portal circulation, leading to the whole-body inflammation. Intestinal epithelial cells (IEC), producing antimicrobial proteins to prevent the attachment and entry of pathogens, are affected by the tissue hypoxia. The hypoxia-inducible factor (HIF)-1α is pivotal in the transcriptional response to oxygen flux. **PURPOSE:** To determine the role of HIF-1α signaling pathway in the regulation of intestinal barrier function on HFD fed mice. **METHODS:** The Villin-Cre mediated, IEC-specific deletion of *Hif1a* (*Hif1a*^{VKO}) and the control *Hif1a*^{fl/fl} mice (male, 8-week) were used in this study. The *Hif1a*^{VKO} and *Hif1a*^{fl/fl} were fed HFD (HFD-Hif1a^{VKO} and HFD-Hif1a^{fl/fl}, n=6/group) or normal chow for 12 weeks. Immediately after euthanasia, the serum, abdominal fat, intestine and feces were sampled. The intestinal mucus structure was observed by the AB-PAS staining. The intestinal permeability was quantified with FITC-dextran. Fasting plasma glucose, albumin, alanine aminotransferase, aspartate aminotransferase, total bilirubin, triglycerides (TG), total cholesterol (TC), LDL cholesterol (LDL-C), and HDL cholesterol levels were measured. The fecal microbial DNA was extracted and sequenced on an Illumina MiSeq platform. Student's t-tests and one-way ANOVA were used. Differences with P<0.05 were considered significant. All animal experiments were performed in compliance with and approved by the Shanghai University of Sport ethical review board. **RESULTS:** We found that HFD feeding markedly increase the intestinal permeability without significant morphological changes. Compare with HFD-Hif1a^{fl/fl}, the HFD-Hif1a^{VKO} mice were higher in the body weight (40.55±3.94 vs. 35.06±5.31 g, p<0.05), TG (1.75±0.56 vs. 1.08±0.31 mmol/l, p<0.05), TC (4.28±0.92 vs. 3.74±0.56, p<0.05) and LDL-C (0.83±0.08 vs. 0.68±0.14, p<0.05). Principal coordinates analysis based on unweighted Unifrac distances highlighted a clear clustering of the microbial populations of *Hif1a*^{VKO} away from that of *Hif1a*^{fl/fl}. **CONCLUSIONS:** IEC HIF-1α signaling is involved in the intestinal barrier function maintenance in HFD fed mice. Supported by the National Natural Science Foundation of China (31701040, 31801003 and 31471135).

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

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

Room: CC-3020

122 Chair: Nicholas P. Greene, FACSM. University of Arkansas, Fayetteville, AR.

(No relevant relationships reported)

123 May 27 9:30 AM - 9:45 AM

Increasing Mitochondrial Content Does Not Protect Against Disuse-induced Muscle Atrophy

Megan E. Rosa-Caldwell, Seongkyun Lim, Wesley S. Haynie, Lisa T. Jansen, Kirsten R. Dunlap, Tyrone A. Washington, Nicholas P. Greene, FACSM. *University of Arkansas, Fayetteville, AR.* (Sponsor: Dr. Nicholas Greene, FACSM)

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(No relevant relationships reported)

Skeletal muscle mass is maintained by a balance in protein synthetic and degradative pathways. Deteriorations to skeletal muscle health can have significant implications for whole body health and quality of life. This is particularly true for disuse-associated muscle wasting, a common pathology associated with ICU stays, casting and space flight. Mitochondrial aberrations have been hypothesized to underlie these muscle 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 mice were bred at the University of Arkansas. At 10 wks of age, male and female mice (~8-10/group, ~70 mice total) underwent hindlimb unloading (HU) or normal cage activity (CON) for 7 days. Tissues were then collected, weighed and prepared for mRNA analysis of mediators of proteasomal degradation. Data for males and females were analyzed by 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 proteasomal degradation system during disuse atrophy, these blunted responses do not appear sufficient to mitigate disuse-induced muscle loss. This study was funded by the National Institutes of Health, Award number: R15 AR069913/AR/NIAMS

124

May 27 9:45 AM - 10:00 AM

Aging Blunts The Repeated Bout Effect In Skeletal Muscle

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(No relevant relationships reported)

PURPOSE: The ability of skeletal muscle to adapt to eccentric contraction-induced injury is known as the repeated bout effect (RBE), a well-established phenomenon observed in young human and rodent muscle. It has been suggested aged muscle may lack this adaptive potential, which would limit strength gains that could be achieved through training. Therefore, the purpose of this study was to determine if the RBE is blunted in aged muscle when compared to young muscle. **METHODS:** The anterior crural muscles of young (4 mo) and aged (21 mo) female mice were subjected to repeated bouts of eccentric contractions using an *in vivo* model. Specifically, mice performed 50 maximal eccentric contractions with isometric torque being measured immediately pre- and post-injury, and 2 and 7 days into recovery. These procedures were then repeated four times (making five total bouts) with 7 days between each bout. **RESULTS:** Following the initial injury bout, isometric torque of young and aged muscle were reduced to a similar extent (p=0.12) and did not differ throughout recovery (2 days, p=0.15 and 7 days, p=0.82). Over the course of the next four injuries, both young and aged muscle adapted to the prior injuries, experiencing less strength deficits immediately post-injury and an enhanced rate of recovery. However, the adaptive response measured by the fifth injury was less in aged muscle, with strength improvements being only 10-15% in aged muscle while 20-32% in young muscle (p<0.05). **CONCLUSIONS:** The extent of injury and ensuing rate of recovery governs how frequently and how intensely subsequent bouts can be completed. Here, we demonstrate the RBE is blunted in aged muscle compared to young muscle over the course of five injurious bouts of eccentric contractions. These data suggest there is an age-related impairment in the mechanisms underlying the RBE, which could be due to a slowed adaptation rate or a compromised ability to adapt to eccentric contractions.

125

May 27 10:00 AM - 10:15 AM

Intake Of Essential Amino Acids Stimulates Mtorc1 Signaling And Inhibits Autophagy Following Glycogen-depleted Resistance Exercise

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(No relevant relationships reported)

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

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

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

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

126 May 27 10:15 AM - 10:30 AM

Testosterone Supplementation Upregulates Myogenesis And Attenuates Proteolytic Gene Expression During Severe Energy Deficit

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(No relevant relationships reported)

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 \pm 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 WM and ED at baseline, and at 1 and 6 h after exercise (1 h cycle ergometry matched between phases for power and total work), with a mixed-meal (40 g protein) consumed following the first post-exercise biopsy.

RESULTS: Change (ED - WM) in leg lean mass (1.2 ± 0.7 vs. -0.7 ± 0.4 kg) and total testosterone concentrations (712 ± 159 vs. -193 ± 78 ng/dL) differed between TEST and PLA ($P < 0.05$). Relative to WM, baseline AR total protein was 118 % higher for TEST than PLA ($P < 0.05$) and was associated with changes in leg lean mass and fibroblast growth factor-inducible 14 (Fn14) gene expression ($r = .540$ and $.563$, $P < 0.05$). Baseline Fn14 gene expression relative to WM was 52 % lower for TEST than PLA ($P < 0.05$) and tended to associate with changes in leg lean mass ($r = -.455$, $P = 0.058$). After exercise (6 h), muscle atrophy F-box and muscle ring finger-1 gene expression was lower (61 and 44 %) and MyoD expression was 122 % higher for TEST than PLA ($P < 0.05$), relative to WM. Mechanistic target of rapamycin-mediated anabolic signaling was not different between groups.

CONCLUSIONS: The hypertrophic effect of testosterone on lean mass during severe energy deficit may be due, in part, to reduced ubiquitin-mediated proteolysis and increased myogenesis after exercise and feeding, subsequent to modulation of upstream AR and Fn14 signaling. Supported by USAMRDC; authors' views not official U.S. Army or DoD policy.

127

May 27 10:30 AM - 10:45 AM

Skeletal Muscle Raptor And Tsc1/2 Differential Responses To Activity And Fasting In The Tumor Environment

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(No relevant relationships reported)

Cancer is a debilitating disease that is often accompanied by decreased physical activity and chronic energetic stress that disrupts muscle proteostasis. Skeletal muscle protein turnover is highly sensitive to changes in feeding and activity. Raptor serine 792 and TSC1/2 serine 1387 phosphorylation sites, 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-hour 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 C57BL/6 (B6, N=24) and *ApcMin/+* (MIN, N=31) mice were either sacrificed under *ad libitum* conditions (B6-fed, M-fed), fasted for 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-fast 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 to B6-fed ($p = 0.039$). Puromycin was trending 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-fast, 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 determine this specific mechanism.

128

May 27 10:45 AM - 11:00 AM

Effects Of Lactate Infusion On Resistance Exercise Induced MTORC1-signaling And Protein Synthesis In Human Muscle

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(No relevant relationships reported)

Lactate has recently been highlighted as a potential signaling molecule. In myotubes, lactate incubation increase 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 lactate and 7.34 with saline. This effect was not noted in muscle were pH was reduced by 0.06 units after exercise in both trials. Exercise increased the phosphorylation of mTOR^{S2448} (~40%), S6K1^{T389} (~3-fold) and S6^{S240/T244} (~9-fold) during recovery, without any differences between trials. Effects of exercise without any influence of lactate infusion was also noted for eEF2^{T56}, AMPK^{T172}, PRAS40^{T246} and p44^{T202/T204}. 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.

129 May 27 11:00 AM - 11:15 AM

OXIDATIVE METABOLISM DURING THE TIME-COURSE OF DISUSE ATROPHY IN MALE AND FEMALE MICE

Madeline G. Amos¹, Megan E. Rosa-Caldwell¹, Wesley S. Haynie¹, Kirsten R. Dunlap¹, Seongkyun Lim¹, Lisa T. Jansen¹, Jacob L. Brown¹, David E. Lee¹, Tyrone A. Washington¹, Michael P. Wiggs², Nicholas P. Greene, FACSM¹. ¹University of Arkansas, Fayetteville, AR. ²University of Texas at Tyler, Tyler, TX. (Sponsor: Dr. Nicholas Greene, FACSM)

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(No relevant relationships reported)

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 *Ppara* 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, *Ppara* 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, *Ppara* was ~60% lower at days 1, 2, and 3 compared to CON, but then recovered back to CON levels. Whereas in males, *Ppara* 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 *Ppara* content in EDL across all groups. In males, there was ~50-75% lower *Ppara* 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

130 May 27 11:15 AM - 11:30 AM

High-Volume And High-Intensity Resistance Training Effects On Upper-Leg Lean Tissue Mass And Muscle Cross-Sectional Area

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(No relevant relationships reported)

PURPOSE: Evaluate the effects of 6 weeks of unilateral high-intensity resistance training and high-volume resistance training on upper-leg lean tissue mass and mid-thigh lean muscle cross-sectional area. **METHODS:** Well-trained, college-aged males (n = 15) underwent 6 weeks of unilateral resistance training, with one limb training with high-volume (HV), and the other with high-intensity (HI). Dual-energy X-ray absorptiometry (DEXA) scans and peripheral quantitative computed tomography (pQCT) scans were collected both before training (PRE) and after the 6 weeks of resistance training (POST). Upper-leg lean tissue mass (LTM) was quantified by selecting a region of interest to isolate the upper-leg compartment from the whole-body DEXA scan, while lean muscle cross-sectional area (mCSA) of the mid-thigh was measured using pQCT and analyzed through an open source plug-in through ImageJ (NIH). Changes in LTM and mCSA between conditions and over time were evaluated statistically using a 2x2 [CON (HI vs. HV) x TIME (PRE vs. POST)] repeated measures ANOVAs. LSD pairwise comparisons were used as follow-up analyses when a significant interaction was detected. Statistical significance was set at *p* 0.05.

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 = 185.7 ± 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.

A-25 Clinical Case Slide - Hip I

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

Room: CC-2005

131 Chair: Lauren Elson. Spaulding/Harvard University.

(No relevant relationships reported)

132 Discussant: Andrea Stracciolini, FACSM. Children's Hospital Boston, Boston, MA.

(No relevant relationships reported)

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

(No relevant relationships reported)

134 May 27 9:30 AM - 9:50 AM

RARE CASE OF ACETABULAR FRACTURE FROM BEACH VOLLEYBALL

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(No relevant relationships reported)

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

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

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

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

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

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

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

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

Case reports unusual etiology of a posterior wall fracture after seemingly 'minor' injury on soft sand, and providers should have a low threshold to proceed with further workup such as CT. Unknown if bystander pulling on leg worsened injury. May even had transient hip dislocation, a rare injury due inherently stable hip bony anatomy.

Case raises awareness to counsel patient on recurrent dislocation, osteonecrosis, and arthritis risks with these injuries, and consider bone density testing if a low-energy injury.

135 May 27 9:50 AM - 10:10 AM

A Busy Adult With Hip Pain

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(No relevant relationships reported)

HISTORY:

51 yr old F with PMH 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/ gluteal area

DIFFERENTIAL DIAGNOSIS:

1. Labral tear
2. Snapping hip syndrome (tendon/muscle)
3. Femoroacetabular impingement (FAI) syndrome

4. Hip OA

5. Lumbar referred pain

6. Iliopsoas bursitis

7. Gluteal tendinopathy

TESTS AND RESULTS:

Hip Xray (8/26/2016): WNL

MR arthrogram (2/28/2017): Degenerative tear, anterosuperior labrum.

MSK Ultrasound (6/23/2017):

Proximal IT band: thickened/hyperechoic. Cortical irregularities at the greater trochanter. Negative snapping hip maneuvers. Positive sonopalpation over posterior hip joint.

MSK Ultrasound (9/29/2017):

No snapping hip sx with leg 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. Discussed Platelet Rich Plasma (PRP), prolotherapy, continued steroid injections, and surgery. Did not want surgery due to work schedule/lifestyle. Was agreeable to try prolotherapy.
3. Anterior Superior Labral tear was visualized on Ultrasound in clinic and an ultrasound guided dextrose/lidocaine intra-lesional labral injection was performed (1/23/19) - doing well at 5 mo. follow-up - no pain with ROM, pain level 0.
4. MSK Ultrasound (6/10/2019): R labral tear noted in anterior labrum with improved mild hyperechoic signal.
5. HEP with avoiding of high resistance exercise due to aggravated gluteal tendinopathy

136 May 27 10:10 AM - 10:30 AM

Pelvic Pain- Ballet

Alexandria Joann Haselhorst, Monica Rho. *Shirely Ryan Ability Lab, Chicago, IL.* (Sponsor: Dr. Joe Ihm, FACSM)
(No relevant relationships reported)

HISTORY: Patient is a 13 yo female pre-professional ballerina who developed pelvic pain during her training. She was doing an arabesque with her leg in single stance with the opposite leg extended. She then moved to a penché position with her torso leaned forward over a leg in single stance with her legs at 180 degrees. She felt an immediate pop in her left groin. She continued to dance through pain during 6 weeks of intensive ballet training prior to presentation to clinic. Pain described as 3/10, aching in left groin and buttock pain at rest. Pain better with rest and worse with walking, leg extensions and entrechanc which is a vertical jump with repeated adduction of feet. She denied any numbness, tingling or weakness. Patient had no prior history of stress fractures, is not menstruating and eats a balanced diet.

PHYSICAL EXAMINATION: Tenderness to palpation over left pubic bone. Full pain free ROM in both hips. Special tests positive on the left side included FABER, FADIR, single leg hop and resisted adduction more than abduction. She had 4/5 hip abduction strength in side lying bilaterally.

DIFFERENTIAL DIAGNOSIS:

1. Ischiopubic stress fracture
2. Pubic apophysitis at adductor insertion
3. Femoral acetabular impingement

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.
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. Patient will follow up in 6 weeks

137 May 27 10:30 AM - 10:50 AM

Non-remitting Gluteal Pain In An Adolescent Soccer Player

Kristopher Paultre¹, Thomas Best, FACSM². *JMH/UM, Miami, FL. ²University of Miami, Miami, FL.* (Sponsor: Dr. Thomas Best, FACSM)

Email: kristopher.paultre@jhsmiami.org

(No relevant relationships reported)

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. There was mild pain with active deep flexion during squat

Straight leg raise: Significant for pain on proximal right hamstring

Tenderness: Over ischial tuberosity and toward proximal hamstring

Strength: 4/5 on hip extension remainder of strength testing unremarkable

Log Roll: neg

FABER/FADIR neg/neg

Ober Test: neg

Thomas Test: neg

Sensation: intact to light touch

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. Femoro-acetabular joints preserved.

MRI: Ill-defined area within the ischium approximately 1.7 x 0.6 x 3.6 cm corresponding to the suspicious area seen on prior x-ray. Findings are likely due to a healing avulsion fracture of the right ischial tuberosity.

Final Working Diagnosis:

Healing avulsion fracture over right ischial tuberosity, clinically improving with PT

138 May 27 10:50 AM - 11:10 AM

Rare Case Of Avascular Necrosis In A Dodgeball PlayerSteven C. Liu¹, Alpha Anders², Kenneth Vitale, FACSM².¹*Eastern Virginia Medical School, Norfolk, VA.* ²*UCSD School of Medicine, San Diego, CA.* (Sponsor: Kenneth Vitale, FACSM)

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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.

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

Bilateral Hip Pain - Soccer PlayerSamantha Lucrezia, Danielle Hirsch, Patrick Mularoni. *Johns Hopkins All Children's Hospital, St. Petersburg, FL.* (Sponsor: Dilipkumar R. Patel, MBBS, MBA, MPH, FACSM)

Email: slucrez1@jhmi.edu

(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 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-26 Clinical Case Slide - Knee I

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

Room: CC-2016

140

Chair: Peter Gerbino, FACSM. *Monterey Sports Medicine, Monterey, CA.*

(No relevant relationships reported)

141

Discussant: Ashley Zapf. *Schwab Rehabilitation Hospital, Chicago, IL.*

(No relevant relationships reported)

142

Discussant: Siobhan Statuta. *University of Virginia, Charlottesville, VA.*

(No relevant relationships reported)

143

May 27 9:30 AM - 9:50 AM

Knee Injury- A Tragic Tackle In A Weekend WarriorLaura A. Shaffer, John R. Deitch. *WellSpan Health, York, PA.* (Sponsor: Mark E. Lavallee, M.D., C.S.C.S., F.A.C.S.M., FACSM)

Email: lah5089@gmail.com

(No relevant relationships reported)

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

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

Differential Diagnosis:

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

Tests and Results: CT angiogram- No arterial injury

MRI - Edema and nonorganized hematoma involving gastrocnemius, soleus, popliteus, and tibialis anterior. Detached medial and lateral patellar retinaculum, medial and lateral meniscus tears. Partial tear of PCL, MCL strain, ruptured ACL and LCL. Thin but intact peroneal nerve noted. Avulsion fracture of biceps femoris and tear of popliteus tendon. Medial femoral condyle osteochondral impaction fracture.

Final Working Diagnosis:

Multi-ligament left knee injury. Avulsion fracture of biceps femoris. Meniscal tears. Peroneal nerve injury without arterial injury.

Treatment and Outcomes:

1. Surgical repair 2 weeks after injury.
2. Extensive rehabilitation (0-6 weeks post-op: ROM exercises 0-90; 6-12 weeks post-op: strengthening exercises and advancing weight bearing 25% weekly).
3. Functional brace.
4. Continued monitoring for peroneal nerve improvement in motor and sensation.
5. Had discussion with patient regarding limited outcome and primary goal of function.
5. Unlikely to return to sport.

144 May 27 9:50 AM - 10:10 AM**114 Kilograms Overhead Too Much For This Knee**

Erin S. Barnes, MD¹, Joseph Medellin, MD, MPH, MBA², Ryan Rompolo, DAT, AT, ATC². ¹Temple University/MossRehab, Philadelphia, PA. ²Henry Ford Allegiance Health Sports Medicine, Jackson, MI. (Sponsor: Mark Lavallee MD, FACSM)
Email: esbarnes89@gmail.com
(No relevant relationships reported)

HISTORY: History: 61 year old male competing in the 102 kg category in the International WeightLifting Federation World Masters Championships, on his third attempt at clean and jerk (114 kg), was able to power clean the bar into the front rack position and subsequently performed a power jerk. As the bar was stabilized overhead, the patient's right knee collapsed medially and he fell to the ground. Medical staff assessed the patient immediately on the platform. **PHYSICAL EXAM:** Right knee exam: no obvious deformity with the leg in extension. Local edema quickly developing superior to patella, passive flexion and extension elicited pain, flexion with notable gapping between the superior pole of the patella and quadriceps muscle bulk. Patella was midline in femoral condyles, no tenderness along the medial or lateral joint lines. There was a palpable defect between the superior pole of the patella and quadriceps muscle bulk. Pulses: palpable DP pulses, good capillary refill. Sensation: grossly intact to light touch in the right lower extremity. **DIFFERENTIAL DIAGNOSIS:** Tibial-femoral dislocation/Patellar dislocation/Quadriceps tendon rupture/ Medial collateral ligament tear ACL tear

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

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

145 May 27 10:10 AM - 10:30 AM**LEG BUMP- SOCCER**

George Ross Malik, Samuel Chu. Shirley Ryan Ability Lab, Chicago, IL. (Sponsor: Dr. Joseph Ihm, FACSM)
Email: gmalik@sralab.org
(No relevant relationships reported)

HISTORY:

A 12-year-old male with a past medical history of Celiac's disease and growth deficiency on hormone supplementation presented to sports medicine clinic with a large, painless bump on the medial aspect of his left knee. He noticed it three months prior, but reported enlargement over the last few weeks. He described it as firm and 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 tibia. No knee effusion was noted bilaterally. The left knee was non-tender to palpation along the medial and lateral joint lines as well as the patellar facets. There 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

146 May 27 10:30 AM - 10:50 AM**Knee Injury Football**

Michelle L. Walls. Michigan State University, East Lansing, MI.
(Sponsor: Susan M. Ott, FACSM)
(No relevant relationships reported)

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

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

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

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

FINAL WORKING DIAGNOSIS: tibial spine fracture

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

147 May 27 10:50 AM - 11:10 AM**Knee Injury-Football**

Alexander A. Spiewak. Western Michigan University School of Medicine, Kalamazoo, MI. (Sponsor: Robert J Baker, FACSM)
Email: Alexander.spiewak@gmail.com
(No relevant relationships reported)

HISTORY: A 17-year-old senior high school football quarterback sustained a right knee injury during the third quarter of a game. During the third quarter while the player was attempting to cut and change directions he planted hard on his right leg and attempted to push off. He subsequently fell to the ground screaming in pain.

There was no contact with another player. Athletic trainers and the team physician ran onto the field to aid him. **PHYSICAL EXAMINATION:** Examination demonstrated a deformed right knee. The tibia was displaced laterally in relation to the femur. The patella was midline. His sensation was intact, no dorsalis pedis pulse was palpable. His range of motion was severely limited. Reduction of his true knee dislocation was performed on the field due to the lack of palpable DP pulse. His knee was easily reduced on the field and his dorsalis pedis pulse was then easily palpated. He was carried to the sideline. On sideline he had a grade II Lachmans with his exam being limited by pain. He was placed in a straight leg immobilizer and taken to the emergency department. **DIFFERENTIAL DIAGNOSIS:** 1. Knee dislocation 2. Patellar dislocation 3. Ligamentous injury **TEST AND RESULTS:** CT Angiography lower extremity right-Normal vascular structures with normal pop. Artery-Moderate right knee effusion -No visualized fractures seen Knee complete 4 view right-Skeletally mature with physiologic valgus alignment-Large knee effusion MR right knee without contrast-Complete tear of ACL-Lateral femoral condyle cortical impaction fracture with deepened femoral notch-Large joint effusion-Suspected longitudinal tear of the posterior horn of the lateral meniscus **FINAL/WORKING DIAGNOSIS:** True knee dislocation with complete ACL tear and lateral meniscus tear as well as lateral femoral condyle impaction fracture **TREATMENT AND OUTCOMES:** 1. The patient was kept in hinged knee brace for 4 weeks to allow for capsular healing 2. Patient underwent right knee arthroscopic ACL reconstruction with bone-tendon-bone autograft and lateral meniscus repair. No posterolateral corner injury was noted on

arthroscopy.3.Patient began physical therapy. He demonstrated significant quadriceps atrophy which improved throughout his course4.Patient returned to sport with a functional brace, but did not return to football

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

Bone Injury In A Gymnast

Philip Zhang¹, Jacob Joseph², Jorge Rojas¹, Edward G. McFarland¹, Brian J. Krabak³. ¹*The Johns Hopkins University, Lutherville, MD.* ²*The Johns Hopkins University, BALTIMORE, MD.* ³*University of Washington, Seattle, WA.* (Sponsor: Brian J Krabak MD MBA FACSM, FACSM)
Email: phzhang@augusta.edu
(No relevant relationships reported)

Bone Injury - Gymnastics

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

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

DIFFERENTIAL DIAGNOSIS:

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

TESTS AND RESULTS:

Plain radiographs of the knee (sunrise, true AP and lateral): Normal

MRI of the Knee: Normal ACL and PCL. Moderate knee effusion. Contusion of the lateral femoral condyle and the anterolateral tibial plateau.

CT scan of the Knee: Cortical break in the lateral tibial plateau anteriorly

FINAL WORKING DIAGNOSIS:

TREATMENT AND OUTCOMES:

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

A-27 Clinical Case Slide - Neurological

Wednesday, May 27, 2020, 9:30 AM - 11:30 AM
Room: CC-2022

149 **Chair:** Kathryn E. Ackerman, FACSM. *Boston Children's Hospital, Boston, MA.*
(No relevant relationships reported)

150 **Discussant:** James Dunlap, FACSM. *Maine-Dartmouth Sports Medicine, Augusta, ME.*
(No relevant relationships reported)

151 **Discussant:** Terry Nicola, FACSM. *UIC Sports Medicine Center, Chicago, IL.*
(No relevant relationships reported)

152 May 27 9:30 AM - 9:50 AM
Isolated Infraspinatus Weakness Due To Suprascapular Neuropathy In A National Level Volleyball Player
Jason Lou¹, Daniel Krasna¹, Terry Nicola, FACSM². ¹*Schwab Rehabilitation Hospital/University of Chicago, Chicago, IL.*
²*University of Illinois, Chicago, Chicago, IL.*
(No relevant relationships reported)

HISTORY: 15-year-old female national-level volleyball player with no PMH who presented for nagging right shoulder pain and subjective right arm weakness for 1.5 years. The patient did not endorse a specific inciting injury. The pain was located at the anterolateral aspect of the deltoid with radiation down the arm without numbness or tingling, made worse with volleyball activity and made better with rest. Due to her continued pain and right shoulder weakness, she was held from participating in volleyball matches. MRI arthrogram was negative for pathology, so she was referred for EMG.

PHYSICAL EXAMINATION: General Appearance: Young Caucasian female in no acute distress

Musculoskeletal: 4 out of 5 strength at right shoulder external rotation. 5 strength in bilateral upper extremities otherwise. No atrophy of the bilateral shoulder muscles. Normal bilateral scapulothoracic movement. Full range of motion at the bilateral upper extremities. Bilateral shoulders non-tender to palpation over the anterior, lateral, or posterior aspects. Neck non-tender to palpation. No pain noted with cervical neck flexion, extension, or rotation.

DIFFERENTIAL DIAGNOSIS: 1) Labral Tear 2) Rotator Cuff Tendinopathy 3) Suprascapular nerve palsy at the spinoglenoid notch

TEST AND RESULTS: Bilateral upper extremity EMG: On nerve conduction studies, no response obtained from the right infraspinatus, response normal at the supraspinatus when stimulating at Erb's point. On needle EMG, 4+ fibrillations and no recruitment seen at the right infraspinatus; normal supraspinatus. Electrodiagnostic evidence suggestive of a right suprascapular nerve neuropathy selectively affecting the infraspinatus. Findings compatible with suprascapular nerve palsy proximal to or at the spinoglenoid notch.

FINAL WORKING DIAGNOSIS: Suprascapular neuropathy selectively affecting the infraspinatus due to repetitive overhead activity.

TREATMENT AND OUTCOMES: The patient was prescribed a 4-week course of physical therapy for range of motion exercises and shoulder rotator cuff muscle strengthening. She was advised to initiate a return-to-play graduated exercise program after completion of PT based on strength and tolerance to pain. The patient's pain significantly improved with PT and rest. She was able to return to competitive play within 8 weeks.

153 May 27 9:50 AM - 10:10 AM
Unilateral Pectoralis Atrophy

Stefanie Lewis. *Maine Dartmouth, Augusta, ME.* (Sponsor: James Dunlap, MD, FACSM)
(No relevant relationships reported)

History:

A 49 year old male, right hand dominant, referred for evaluation of right sided pectoralis weakness and atrophy first noted incidentally 2 months prior at routine physical. He subsequently noted weakness as he was no longer able to do bench press or even a single push-up which were standard exercises in his workout routine. He

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

Physical Examination:

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

Differential Diagnosis:

- 1) Pectoral nerve entrapment
- 2) Brachial plexopathy
- 3) Cervical radiculopathy

Test and Results:

EMG/NCS

-Electrodiagnostic evidence of multiple right cervical radiculopathy, mostly involving C5 and C6 roots. Incidental finding of mild right ulnar neuropathy.

MRI C spine

-Right-sided hypertrophic changes are seen about the Luschka joints at C3-C4, C5-C6 and C6-C7. Most prominent at 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.

154 May 27 10:10 AM - 10:30 AM
Arm Weakness In A Recreational Weightlifter

Ashkan Alkhamisi. University of Florida, Gainesville, FL.
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(No relevant relationships reported)

HISTORY:

A 47-year-old RHD male presented to sports medicine clinic with 3-4 month history of left shoulder weakness. He first noticed the weakness while working out, specifically during overhead shoulder press. He denied any specific injury or trauma of his left shoulder. He reported intermittent pain extending from the posterior shoulder to his neck. Pain was described as dull. Pain was 2/10 at rest and 4/10 with overhead activity. The patient noticed progressive muscle atrophy in his posterior shoulder region since the onset of symptoms. He denied any numbness or tingling of the left arm. Denied any recent illnesses. He denied prior treatment for this issue, including PT, injections, or surgeries.

Physical Exam:

General: No acute distress. Left shoulder: No swelling or erythema. Notable atrophy of body of infraspinatus. Sensation intact to light touch. Normal range of motion in all directions. Strength 5/5 with shoulder abduction, forward flexion, and internal rotation. Strength 3/5 with external rotation with elbow at side. Negative Empty Can, Drop Arm, Hawkin's, Neer, O'Brien, and Speed's tests.

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

Final Diagnosis:

Suprascapular Nerve Entrapment

Treatments and Outcomes:

Patient was referred to orthopaedic surgery and recommended shoulder arthroscopy for suprascapular nerve release. During the case the surgeon noted a small cyst at the spinoglenoid notch (not apparent on MRI imaging). 2 weeks post-op, the patient reported doing light daily activities with no pain or weakness. 4 weeks post-op patient was asymptomatic performing home exercises up to 5x/week. He returned to activities as tolerated with no restrictions.

155

May 27 10:30 AM - 10:50 AM

Foot Drop In A Runner: A Novel Treatment For An Uncommon Problem

Ross Quinn Osborn. The Center for Health and Sports Medicine, Fruit Cove, FL. (Sponsor: James Churilla, PhD, MPH, MS, FACSM, FACSM)

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(No relevant relationships reported)

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 eversion and dorsiflexion of the foot. His resisted dorsiflexion was 3/5 and eversion was 4/5.

Follow up exam 5 weeks later demonstrated 1/5 strength with resisted dorsiflexion and 3/5 with eversion, but normal sensation and patellar and Achilles reflexes. Examination of the lumbar spine was negative. There was no atrophy.

Differential Diagnosis:

1. Peroneal nerve entrapment
2. Anterior tibial tendonitis
3. Peroneal tendon strain
4. Osteoarthritis

Tests and Results:

X-ray, right ankle/foot - minimal osteoarthritic changes diffusely in the tarsal bones. Calcifications within the Achilles tendon.

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

NCS - peroneal nerve entrapment

MRI - periarticular ganglion extending into proximal calf

Final Working Diagnosis: peroneal nerve palsy secondary to periarticular ganglion

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.

156

May 27 10:50 AM - 11:10 AM

Arm Pain And Weakness In A Soccer Player

Melissa Lau, Jeffrey Strakowski. Ohio State University, Columbus, OH.

(No relevant relationships reported)

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 extensors; 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 EE; 4+/5 WE; 3+/5 FE; 5/5 FF LUL, RLL, LLL: 5/5 in all muscles -Palpation: 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

spiral 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: Neuralgic amyotrophy AKA Parsonage-Turner Syndrome

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

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

Hockey Player With Weakness In His Extremities

Ima Vera Jonkheer, 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 duration 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 from which he recovered with no apparent sequelae.

PHYSICAL EXAMINATION: Vitals: HR 120s, BP 160-275/100-175. Gen: NAD. Neck: No bruits, full ROM w/o pain/meningeal signs. HEENT: B/L pupils reactive to light L>R pupil. CV: Tachycardic. Chest: Clear, non-labored. Abd: Soft, BSx4. Back: No tenderness. Skin: No rash. Neuro: A&Ox3, no facial droop, uvula midline, speech clear, neg pronator drift, tone normal. Strength test: deltoid 5 R&L, bicep 4+ R&L, tricep 4+ R&L, hand intrinsic 5- R&L, psoas 4+R ,5-L, quad 5- R&L, hamstring 4+ R&L, tibialis 5 R&L, gastroc 5 R&L. Light touch/vibratory/pinprick sensations intact. Reflexes 2-. Difficulty lifting R-L leg to walk.

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

TEST AND RESULTS: LABS: Hgb 18.9 gm/dL, Hct 51.5%, Total protein 9.2 gm/dL, CK: 625 units/L, DDimer: 0.70 mg/L, IMAGING: CXR Neg, CT Head Neg, CT Chest/Abd/Pelvis Neg

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

TREATMENT AND OUTCOMES: 1. Neurology assessed in the ED, w/ hx of antecedent URI, progressive weakness, preserved sensation w/areflexia, novel hypertension/tachycardia representing dysautonomia, recommended LP. 2. LP 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 after hospitalization. 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 program focused on strength training, cardiovascular conditioning, & diet modification w/ inc protein. 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 healthy 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 monitor at 5 mins before, and 0-5, 10-15 and 25-30 mins after interventions.

Results: During the first 5 mins after interventions, mean HR (95.4 ± 11.1 bpm) and the normalized units of high frequency power (23.6 ± 10.3 nm) of the CWT group showed significantly higher value than the CON group (81.5 ± 11.6 bpm, 18.5 ± 9.0 nm; P<0.05), the mean R-R intervals (636.8 ± 78.8 ms), the standard deviation of normal R-R intervals (26.1 ± 6.6 ms) and the square root of the mean squared differences between adjacent R-R intervals (17.2 ± 7.7 ms) for CWT showed significantly lower than that of CON (749.3 ± 105.4 ms, 46.1 ± 17.7 ms, 33.0 ± 12.8 ms; P < .05). However, 10-15 and 25-30 mins after interventions, all HRV parameters between the two groups showed no significant difference (P > .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

186

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 Colantuno, Robert Lavellee, Anders LaFortune, Disa L. Hatfield, Jonathan McLinden, Jacob E. Earp. University of Rhode Island, Kingston, RI.

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

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

PURPOSE: The purpose of this study was to determine if the contrast with compression (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 ±8.5cm; 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 received no 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.

187

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.

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(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 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 time main effects ($p < .05$) were indicated 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 FR significantly increased muscular endurance 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 O_2 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 O_2 delivery, increased waste product removal from the muscle, and augmented restoration of the muscles' length-tension relationship.

- 188** 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: tabithabraham5@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. Rep 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 ($p < 0.01$). There were significant condition*time interaction and condition and time main effects for the total number of reps ($p < 0.03$). 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 ($p < 0.03$), 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 ($p < 0.05$) and day 3 values ($p < 0.05$). **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 O_2 delivery to the muscle, and/or reduced pain perception due to inhibition of nociceptor activity.

- 189** 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. Maresh, FACSM, William J. Kraemer, FACSM. *The Ohio State University, Columbus, OH.*
(Sponsor: William J. Kraemer, FACSM)
Email: caldwell.713@osu.edu
(No relevant relationships reported)

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 known to induce significant 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 ($p \leq .05$). 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, 1R: 0.68, +24: 0.47, +48: 0.28). Immediate improvements in positive affect (ES, 1R: 0.74), negative affect (ES, 1R: 1.03) and fatigue (ES, 1R: 1.13) were accompanied by differences in neuroendocrine signaling. Norepinephrine was significantly reduced (ES, 1R: 0.99) and testosterone significantly increased (ES, 1R: 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.

- 190** Board #6 May 27 9:30 AM - 11:00 AM
Effects Of Foam Rolling For Delayed-onset Muscle Soreness On Military Performance And Perceived Recovery
Veronika Pribislavská, Brianna Sayer, Brian Church, Lance Bryant, Eric Scudamore. *Arkansas State University, Jonesboro, AR.*
(No relevant relationships reported)

Table 1. Results of military performance tasks for baseline, foam roll, and passive recovery sessions (mean \pm SD)

Recovery method

Task	Time (s)	Baseline	Foam roll	Passive	p	η^2_{partial}
SC	Peak	13.7 ± 3.4	13.3 ± 3.4	13.5 ± 3.7	.293	.062
	Mean	$14.7 \pm 4.1^\dagger$	13.8 ± 3.8	14.2 ± 4.4	.038	.625
CC	Peak	10.8 ± 1.8	10.8 ± 1.6	11.1 ± 1.9	.118	.109
	Mean	11.2 ± 2.1	11.1 ± 1.6	$11.6 \pm 2.1^\dagger$	.047	.582
AC	Peak	12.7 ± 3.7	12.8 ± 3.0	$13.4 \pm 3.6^*$	.011	.224
	Mean	13.1 ± 3.7	13.3 ± 3.2	$13.9 \pm 3.6^*$	.003	.270
SR	Peak	49.0 ± 7.5	50.3 ± 7.7	$50.9 \pm 8.4^*$	.036	.162
	Mean	50.1 ± 8.2	51.4 ± 7.5	$52.3 \pm 8.9^*$	.034	.164

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, $\alpha = < .05$

PURPOSE: Evaluate the effects of post-exercise foam rolling (FR) and passive recovery (PR) on short-term symptoms of delayed-onset muscle soreness (DOMS) and military performance tasks (MPT). **METHODS:** Twenty participants (23.6 ± 4.1 years) completed a baseline session that included four MPTs: 1) stair climb, 2) cover-to-cover sprint, 3) ammunition can carry, and 4) 200-yd shuttle run. All tasks were completed while participants wore a 12-kg weighted vest and timed using photocell laser timing gates. Participants then completed two experimental sessions that included a DOMS-inducing exercise protocol followed by either a 20-min FR or 20-min PR, and a follow-up MPT test 24 hours later. Ratings of perceived exertion (RPE) were measured after each MPT. Ratings of muscle pain (RMP) were assessed prior to MPT and after FR and PR. A one-way repeated measures ANOVA was used to compare peak and mean MPT times across baseline, FR and PR sessions. If necessary, a post-hoc pairwise comparison with least significant difference was performed. Friedman test compared perceptual variables between the three sessions. Wilcoxon matched-pairs signed-ranks test evaluated post-recovery RMP between FR and PR. **RESULTS:** MPT times after PR were slower than baseline or post-FR measurements (Table 1). MPT mean and peak times differed for all but two tasks. In addition, a medium-large effect size was found for all variables. Post-recovery RMP approached significance ($p = .06$) showing a slightly lower median of 3.0 (IQR 2.3 - 4.0) for FR compared to a median of 4.0 (IQR = 3.0 - 6.0) for PR. There was no difference ($p = .21$) in RPE across the sessions. Similarly, no difference ($p = .09$) was found for RMP assessed before each MPT session. **CONCLUSION:** FR appears to be an effective and practical recovery

method for mitigating the negative performance effects associated with DOMS. Given the importance of military readiness, practitioners should consider including FR after strenuous exercise.

- 191** Board #7 May 27 9:30 AM - 11:00 AM
The Effects Of Foam Rolling On Exercise Induced Muscle Damage
 Lauren M. Visconti, Brandon Beimborn, Kurt Escobar, Joshua A. Cotter, FACSM, Evan E. Schick. *California State University, Long Beach, Long Beach, CA.*
(No relevant relationships reported)

Exercise-induced muscle damage (EIMD) occurs following strenuous and unaccustomed exercise. EIMD is associated with elevated creatine kinase (CK) blood concentrations, limitations in range of motion (ROM), and cellular swelling. EIMD may negatively affect training quality and performance thus methods to mitigate EIMD may be useful to resistance training populations. Self-myofascial release, in particular foam rolling (FR), has been utilized by competitive and recreational athletes to ameliorate the effects of EIMD. However, the effect of FR on EIMD has yet to be established. **PURPOSE:** The purpose of this study is to investigate the effect of FR on markers of EIMD after an acute bout of high volume resistance exercise. **METHODS:** Eight participants (five males and three females), between the ages of 18 and 35, completed two acute resistance exercise bouts (10 sets of 10 repetitions barbell back squat at 60% 1RM) separated by a minimum of seven days. Following one exercise bout, subjects performed FR targeting the thigh (i.e hamstrings and quadriceps), the shank (i.e. calf and tibialis anterior), and the gluteus maximus immediately post, 24, and 48 hours post exercise, while no FR was performed following the alternate bout (CON). In both conditions, participants were asked to refrain from additional recovery methods following exercise. Outcome measures included serum CK, hip ROM, knee ROM, and thigh circumference. All measurements were pre-exercise, immediately post, 24, and 48 hours post. **RESULTS:** There was a significant increase in serum CK from pre to 24 hours post ($p = 0.04$), as well as 24 and 48 hours post ($p = 0.04$). Hip ROM ($p = 0.02$) and knee ROM ($p = 0.03$) decreased and thigh circumference ($p = 0.03$) increased 48 hours post exercise. No significant differences between FR and CON were found for any measures. **CONCLUSION:** FR does not attenuate markers of muscle damage (i.e. serum CK, hip ROM, knee ROM, and thigh circumference) after an acute bout of high volume resistance training. This study suggests that despite its common practice, FR may not be an effective strategy for mitigating EIMD.

- 192** Board #8 May 27 9:30 AM - 11:00 AM
Artificial CO₂-water Immersion Facilitates Recovery From Muscle Fatigue Caused By High Intensity Anaerobic Exercise
 Noriyuki Yamamoto¹, Tadashi Wada², Fumiko Takenoya³, Masaaki Hashimoto⁴. ¹*Japanese Red Cross College Of Nursing, Kitami, Japan.* ²*Kokushikan Univ., Tokyo, Japan.* ³*Hoshi Univ., Tokyo, Japan.* ⁴*Teikyo. Univ. Sci., Tokyo, Japan.*
(No relevant relationships reported)

In response to the CO₂-water (CO₂≥1000 ppm) immersion, the reduction of sympathetic nerve activity may imply the facilitation of muscle fatigue recovery. **PURPOSE:** In the present study, we investigated whether the whole body bath with CO₂-water influences recovery of the muscle fatigue after high intensity exercise. **METHODS:** The healthy male college students (n=6, 18-21yrs, 171.3±6.7cm, 73.6±13.0kg) participated in this study. The cycle ergometer work tests lasting 30 seconds were used to estimate anaerobic power with leg pedaling exercises. Exercise loads of the tests were 0.075kp per body weight. Anaerobic power was determined by measuring the highest power output during 30 seconds. Core temperature (CoreT) and ECG were recorded continuously throughout the experiment. The subjects performed 30-s maximal pedaling exercise, and took bath in tap- or CO₂-water at 35 °C for 10 minute after exercise. Subjective thermal sensation (TS) in the body bath was also recorded. Vastus lateralis (VL) dominant muscle hardness using the elastography, muscle pain by visual analog scale (VAS), and blood lactate (BLa) and were evaluated at pre- and immediately after-exercise, and at 10 min after exercise. **RESULTS:** The strain ratio (SR) between the VL and a reference material was calculated. TS in the CO₂-water was significantly higher than in the tap-water (tap-water vs. CO₂-water, -0.17±0.76 vs. 1.17±0.41, $p<0.01$). At 10 min in recovery, in the CO₂-water compared with the tap-water, SR significantly decreased quicker (0.49±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 kinds. **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.

- 193** 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.*
Reported Relationships: J.K. Davis: Salary; Gatorade Sports Science Institute, PepsiCo Inc. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc..

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 competition. Therefore, 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 10-point Likert scale questions examining stress, 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 ± 0.09 ug/dl, post-game 0.34 ± 0.25 ug/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, significantly increased (baseline -1.5 ± 7.0 , 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.

- 194** Board #10 May 27 9:30 AM - 11:00 AM
Effects Of Respiratory Impedance On Performance And Recovery
 Ro-Anne Khrystel Galleta, Julia C. Robbert, Peggy A. Plato. *San Jose State University, San Jose, CA.* (Sponsor: Craig J. Cisar, FACSM)
(No relevant relationships reported)

Respiratory impedance has been studied as a possible countermeasure against fatigue during repeated bouts of high-intensity exercise. By creating resistance during inspiration, an impedance threshold device (ITD) decreases intrathoracic pressure and pulls more blood back to the heart, resulting in increased stroke volume and cardiac output. This increased blood flow may enhance exercise recovery by clearing metabolites and increasing tissue perfusion. **PURPOSE:** To examine the effects of breathing with an ITD during recovery between repeated bouts of high-intensity exercise. **METHODS:** Eleven participants (8 men, 3 women, 19-29 years-of-age) performed a total of 9, 20 s bouts of high-intensity exercise interspersed with 3 min of active recovery on an electronic bicycle ergometer. Participants were instructed to perform each exercise bout at an intensity that would elicit a rating of approximately 7 (very strong) on the Borg Category-Ratio scale of perceived exertion. The same exercise protocol was performed on different days, with and without the ITD during recovery. **RESULTS:** As expected, the exercise protocol significantly increased blood lactate (1.7 ± 0.2 mM pre-exercise vs. 11.5 ± 0.6 mM after bout 9, $p < .001$). Ratings of perceived exertion also increased across exercise bouts (4.9 ± 0.4 after bout 1, 7.5 ± 0.2 after bout 5, and 9.0 ± 0.2 after bout 9, $p < .001$). Participants rated their perceived recovery lower as the number of exercise bouts increased ($p < .001$). There were significant differences in peak and mean power output, as well as total work between exercise bouts, with the highest values recorded during the 9th bout (total work: 7434 ± 380 joules during bout 1, 8015 ± 266 J during bout 5, and 8391 ± 303 J during bout 9, $p < .01$). Thus, participants paced themselves during early bouts and gave a near maximal effort during the last bout. However, results were not significantly different between the control and ITD conditions. **CONCLUSION:** Use of an ITD during recovery periods between repeated, high intensity exercise bouts that required pacing did not positively impact subsequent performance. Results may be different if individuals perform repeated, high-intensity exercise that requires a maximal or near maximal effort during each exercise bout rather than a pacing strategy.

195	Board #11 The Effects Of Foam Rolling On Fatigue-induced Performance Decrements In Trained Females: A Sham-control Study Jennifer Rivera ¹ , Lee E. Brown, FACSM ² , Christian V. Ison ¹ , Gabriela Juache ¹ , Matthew R. Rodriguez ¹ , Edward Jo ¹ . ¹ <i>California State Polytechnic University, Pomona, Pomona, CA.</i> ² <i>California State Polytechnic University, Fullerton, Fullerton, CA.</i> (Sponsor: Lee Brown, FACSM) Email: jrivera3@cpp.edu (No relevant relationships reported)	May 27 9:30 AM - 11:00 AM
196	Board #12 Soreness And Fatigue As The Key Perceptual Indicators For Previous Day Workload In Athletes Hanna Gardner, William Adams, Travis Anderson, Eleni Karras, Stacey Walton, Laurie Wideman, FACSM. <i>University of North Carolina at Greensboro, Greensboro, NC.</i> (Sponsor: Laurie Wideman, FACSM) Email: hmgardne@uncg.edu (No relevant relationships reported)	May 27 9:30 AM - 11:00 AM
197	Board #13 Self-reported Sleep Habits During A Professional American Football Season Steven A. Basham ¹ , Anthony S. Wolfe ¹ , Eric C. Freese ¹ , Bridget C. Sopeña ² , Timothy J. Roberts ³ , Jon K. Davis ¹ , Melissa L. Anderson ³ . ¹ <i>Gatorade Sports Science Institute, Frisco, TX.</i> ² <i>Gatorade Sports Science Institute, Barrington, IL.</i> ³ <i>Gatorade Sports Science Institute, Bradenton, FL.</i> Email: steven.basham@pepsico.com Reported Relationships: S.A. Basham: Salary; Gatorade Sports Science Institute, PepsiCo Inc. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc...	May 27 9:30 AM - 11:00 AM
198	Board #14 Effects Of Percussion Massage On Delayed Onset Muscle Soreness Michael E. Rogers, FACSM, Nicole L. Rogers. <i>Wichita State University, Wichita, KS.</i> Email: michael.rogers@wichita.edu (No relevant relationships reported)	May 27 9:30 AM - 11:00 AM

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 ± 1.1y) participated in this crossover design study. Subjects were tested for reactive strength index (RSI), peak isometric mid-thigh pull (IMTP) 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 T-Test was used to make comparisons between treatments on the pre- to post-fatigue protocol Δ score for each outcome measure. **RESULTS:** There was a significant treatment x time interaction for fatigue perception ($p=0.03$) and RSI ($p=0.03$) but not peak IMTP force. Both treatments resulted in a significant ($p<0.05$) increase in fatigue perception (FR: +3.2 ± 1.8 cm; CTL: +4.1 ± 2.1 cm) and decrease in RSI (FR: -8.9 ± 6.9 %; CTL: -11.9 ± 7.5%) from pre- to post-fatigue protocol. Further analyses revealed that the increase in fatigue perception following FR was significantly less than CTL ($p=0.03$). Additionally, the decrease in RSI following FR was significantly less than CTL ($p=0.02$). The fatigue-induced decrease in peak IMTP force did not differ between treatments. There was no significant correlation between the pre- to post-fatigue change in RSI and fatigue perception ($p=0.10$; $r= -0.3$). **CONCLUSIONS:** In conclusion, this study corroborates a prior non-sham-controlled investigation in that foam rolling during neuromuscular fatigue situations may aid in the preservation of performance while reducing perception of fatigue.

PURPOSE: As monitoring of athletes has become prominent throughout competitive sport, objective and subjective methods have proven valuable in informing of an athlete's physical condition and preparedness. However, it remains unclear how objective load metrics are reflected in self-reported subjective indices. Thus, the purpose of this study was to examine the relationship between objective markers of workload and subjective assessments of soreness, fatigue, and stress the following day. **METHODS:** Twenty-six collegiate male soccer players (mean±SD; 20±1y; 75.83±5.90kg; 178.5±6.8cm) wore GPS-enabled heart rate monitors during every training session and match within the 2017 season. Objective load variables (total distance covered (TD), number of sprints (SP), number of accelerations (AC), number of decelerations (DC), and training load (TL)) were collected each day. Subjective load (soreness, fatigue, and stress) were reported on a 1-10 Likert scale the following morning. Mixed models tested the relation between subjective metrics and the objective metrics of the previous day's training or match. **RESULTS:** Training load and deceleration numbers from the day before showed significant relevance to reported scores of soreness and fatigue. Heavier training loads resulted in higher soreness and fatigue scores (TL $P<0.001$), just as lighter training loads resulted in lower soreness and fatigue scores. A similar positive correlation was found with the number of decelerations reported soreness and fatigue (DC $P=0.023$). **CONCLUSIONS:** Lasting physiological impacts of the previous day's training load and decelerations were reflected in player-reported soreness and fatigue the following morning. This information may be utilized by coaching staff to; 1) adjust training based on subjective metric scores and 2) inform tapering strategies to maximize performance in matches.

American football is physically and psychologically demanding, thus highlighting the potential need for adequate sleep for recovery. **Purpose:** To investigate self-reported sleep habits over the course of a seven-week football season and determine how game load may impact sleep. **Methods:** Professional football players ($n = 24$; 25.9 ± 2.7 y) were recruited from the Alliance of American Football league. A customized sleep survey was used to ask about sleep duration (SLD), "How many hours of sleep did you get last night?" and sleep quality (SQ). "What was your quality of sleep?", while a total sleep score (TSS) was calculated using SLD and SQ, with higher scores meaning better sleep. Players completed the sleep survey sent via automated text message at 0800h the day before each game (GD-1), game day (GD) and each day following game day (GD+1, GD+2, GD+3, GD+4, and GD+5) during the seven-week season. Game load was recorded and defined as total snaps played for each game. A mixed-effects model was used to measure changes in all variables, while a Pearson's correlation coefficient was used to assess relationships between game load and sleep variables. Two, three, and four-day averages for all sleep variables were calculated and correlated with the respective game load. **Results:** A significant interaction for GD x time ($p < 0.05$) for SLD was observed, where players slept less on GD (6.1 ± 1.3 h) and GD+2 (6.7 ± 0.7 h) compared to GD-1 (8.5 ± 0.9 h) for week three, and GD+5 (6.3 ± 0.8 h) compared to GD-1 (8.4 ± 0.6 h) for week seven. Overall, SLD was higher on GD-1 (8.1 ± 0.9 h) than all other time points ($p < 0.05$). No significant main effect or interaction was found for SQ ($p > 0.05$). Overall, the TSS was significantly higher on GD-1 (7.0 ± 1.8 AU; $p < 0.01$) compared to GD, GD+2, GD+3, and GD+4 (5.4 ± 2.2 ; 5.6 ± 1.6 ; 5.8 ± 1.4 ; 6.1 ± 0.9 AU; respectively). Significant positive correlations for game load were found with SQ for two ($r = .34$, $R^2 = 0.119$, $p < 0.05$), three ($r = .39$, $R^2 = 0.155$, $p < 0.01$) and four ($r = .50$, $R^2 = 0.247$, $p < 0.01$) day averages and the TSS for two ($r = .29$, $R^2 = 0.083$, $p < 0.05$), three ($r = .29$, $R^2 = 0.084$, $p < 0.05$), and four ($r = .37$, $R^2 = 0.139$, $p < 0.01$) day averages, but not for SLD. **Conclusions:** Professional football players reported impaired SLD and TSS up to 5 days following a football game. Higher game load was associated with better SQ in the days following the game.

PURPOSE: To determine the effects of percussion massage on pain and performance in those with DOMS. **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 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 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 8.0% lower ($p < 0.05$) vertical jump height (56.42 cm) compared to baseline. After percussion massage, pain declined ($p < 0.01$) to 5.38 (moderate 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 reduces pain and improves performance in those with DOMS. However, additional studies are needed to determine the effects of percussion massage on other types and levels of pain as well as on other types of performance measures.

199	Board #15	May 27 9:30 AM - 11:00 AM
Effects Of Percussion Massage On Hamstring And Low Back Flexibility		
Nicole L. Rogers, Michael E. Rogers, FACSM. <i>Wichita State University, Wichita, KS.</i> (Sponsor: Michael E. Rogers, FACSM) Email: nicole.rogers@wichita.edu (No relevant relationships reported)		

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= 14.0 ± 4.7 cm). Percussion massage did not affect ($p=0.13$) ROM (pre= 13.4 ± 4.4 cm; post= 13.7 ± 4.7 cm). **CONCLUSIONS:** Results indicate that percussion massage does not affect hamstring and low back flexibility. However, additional studies are needed to determine if longer applications of percussion vibration may improve ROM.

200	Board #16	May 27 9:30 AM - 11:00 AM
The Efficacy Of Prolonged Cooling Using Phase Change Material For Enhancing Recovery Following A Marathon		
Susan Y. Kwiecien ¹ , Malachy P. McHugh, FACSM ¹ , Kirsty M. Hicks ² , Karen Keane ² , Glyn Howatson, FACSM ² . ¹ <i>Lenox Hill Hospital, New York, NY.</i> ² <i>Northumbria University, Newcastle upon Tyne, United Kingdom.</i> (Sponsor: Malachy P McHugh, FACSM) Email: susan@nismat.org (No relevant relationships reported)		

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

METHODS: Twenty-four participants (8 male, 16 female) completed a marathon and were randomized to receive the post-race intervention (3 h of 15°C PCM covering the quadriceps) or recover without an intervention (control). Soreness, knee extension strength, vertical jump height, creatine kinase (CK), and high sensitivity c-reactive protein (hsCRP) were recorded at baseline, 1, 2, and 3 days following the marathon. **RESULTS:** Soreness increased following the marathon ($P < 0.0001$) in both groups, but was lower in the PCM group (treatment effect $P = 0.028$) and resolved faster (treatment by time $P < 0.044$; D3 soreness: 1.1 ± 0.9 PCM vs 2.7 ± 1.6 control). Strength decreased following the marathon in both groups ($P < 0.0001$) with no difference between groups. Although not significant, by Day 3 strength recovered more in the PCM ($98.6 \pm 15.6\%$) vs. control group ($90.4 \pm 7.6\%$). PCM had a beneficial effect on jump height (treatment effect $P = 0.037$, treatment by time $P = 0.031$); over the 3 days post-race, jump height averaged $101 \pm 10\%$ of baseline in PCM treatment versus $89 \pm 10\%$ in the control condition ($P = 0.037$). CK and hsCRP increased over time (both $P = 0.0001$) peaking on D1, with no difference between groups.

CONCLUSIONS: Prolonged post-marathon PCM cooling accelerated resolution of soreness and recovery of vertical jump performance, but had no effect on other indices of damage or inflammation. PCM cooling is a practical, wearable cryotherapy modality that can facilitate recovery following excessive exercise stress.

201	Board #17	May 27 9:30 AM - 11:00 AM
The Effect Of Percussive Massage Versus Foam Rolling On Recovery Between Two 91 Meter Swims		
Ryan Mullin, Casey Spor, Jessica Diaz, Peter Byrne, Jacob Virginia, Robert Otto, FACSM, Michele Aquino, John Petrizzo, John Wygand, FACSM. <i>Adelphi University, Garden City, NY.</i> (Sponsor: Robert Otto, FACSM) Email: ryanmullin@mail.adelphi.edu <i>Reported Relationships:</i> R. Mullin: Industry contracted research; Theragun®.		

Swim competition often requires repeat bouts of the same event, as well as several different events for each swimmer. Multiple events during the competition may influence subsequent outcomes, thus various strategies are employed to enhance recovery and reduce fatigue. The search for the optimal recovery is never ending. Two of the more popular recovery techniques include foam rolling massage and percussive massage. There is a paucity of research to support the efficacy of either. **Purpose:** The purpose of this study was to assess the effect of no massage (NM), foam roller massage (FM) and percussive massage (PM) on repeated swim performance separated by 30 minutes of recovery. **Methods:** 8 male and 12 female college-aged swimmers (age: 20.9 ± 2.8 yr., height: 171.7 ± 8.6 cm., weight 70.3 ± 10.9 kg.) volunteered to participate in three 91 meter repeat swim trials. Blood lactate (BL) was measured two minutes pre-swim and three minutes post-swim. A randomized, single blind cross-over application of FM, PM, or NM was conducted between each of the two 91 meter maximal velocity swims. For both FM and PM the treatment was applied bilaterally for a total of 16 minutes with 2 minutes per muscle group (calves, hamstring, quadriceps, and upper arms). **Results:** For the first vs second bout of each trial, male times were 52.3 ± 2.5 vs 52.7 ± 2.7 sec, 52.2 ± 2.7 vs 52.3 ± 2.8 sec, and 52.5 ± 2.3 vs 52.4 ± 2.6 sec and female times were 63.7 ± 3.6 vs 63.9 ± 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 ($P < .05$) revealed NSD ($p > .05$) pre vs 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 8.5 ± 3 mmol, 8.8 ± 2.56 mmol, 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 for FM, PM, and NM respectively. Statistical analysis of BL by ANOVA revealed no significant difference across all trials ($p > .05$). **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®.

202	Board #18	May 27 9:30 AM - 11:00 AM
The Effect Of Percussive Massage Versus Foam Rolling On Recovery Between Two 1000 Meter Runs		
Casey Spor, Jessica Diaz, Peter Byrne, Ryan Mullin, Jacob Virginia, John Petrizzo, Robert Otto, FACSM, Michele Aquino, John Wygand, FACSM. <i>Adelphi University, Garden City, NY.</i> (Sponsor: Robert Otto, FACSM) Email: caseyspor@mail.adelphi.edu <i>Reported Relationships:</i> C. Spor: Industry contracted research; Theragun®.		

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 rolling (FR) and percussive massage (PM) when implemented during the rest period between two running trials. **Methods:** 20 recreationally active college-age students (age: 22.5 ± 2.8 yrs., height: 176.2 ± 8.0 cm, body mass: 70.8 ± 11.1 kg, 11 ♂) volunteered to participate in a randomized, single-blind, crossover design study. Three trials consisting of two repeat 1000m runs separated by 30 minutes of rest were conducted with a minimum of 48 hrs. between trials. The 30 minute recovery was 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 12 minutes with two minutes per muscle group (calves, hamstrings, and quadriceps). FR trials followed the same protocol. Run time(sec) and lactate values(mmol) were recorded for all trials. **Results:** Statistical analysis by ANOVA ($P < .05$) revealed no significant difference in run performance time among all conditions. Mean pre-intervention times were: 245 ± 24 , 244 ± 23 , and 246 ± 24 and post-intervention times were: 246 ± 22 , 245 ± 23 sec, and 247 ± 23 for NM, FR, and PM respectively. Blood lactate significantly decreased from post first run: 11.2 ± 2.3 , 11.7 ± 2.3 , and 10.7 ± 2.0 to the pre-second run with values of 5.1 ± 2.1 mmol, 5.5 ± 2.2 mmol, and 5.1 ± 1.7 mmol for NM, FR, and PM respectively, with no significant difference among conditions. **Conclusion:** Although subjects reported enhanced recovery with the interventions, the results of this study suggest that

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 analyzing shoulder function, specifically for athletic and active populations. It has not been proven to be suitable for the older adults and obese populations. Research shows that 67% of bodyweight is carried during the up position of push-up. During the TUQYBT this weight is shifted to one shoulder, which place a lot of stress on it. A decrease of 15% of the body load was found during a modified push-up (knees down) position. Moreover, load will further be reduced when performing a push-up in standing position on the wall.

PURPOSE: To determine test-retest reliability of two modified UQYBTs (modified push-up and standing positions) and to identify performance differences with respect to TUQYBT. **METHODS:** Twenty-five students (nine men, 16 women; mean age 24.4 ± 3.3 and 23.6 ± 3.3 years), performed three variations of the UQYBT. Cronbach's Alpha test-retest reliabilities were performed to analyze data consistency. Two separate one-way repeated measures ANOVAs were performed to determine the effect of the three starting UQYBT positions on the composite reach scores for each side, followed by post-hoc analyses. **RESULTS:** Findings revealed consistency for the two UQYBT modifications in all three reach directions, Cronbach's Alpha values 0.87 – 0.99 . Significant main effects were found on the right ($F(2,72) = 6.19$, $p = 0.003$) and left ($F(2,72) = 4.12$, $p = 0.004$) sides. Post-hoc analyses revealed that the standing UQYBT composite scores were significantly higher for both sides (right 73.1 ± 7.5 cm, left 73.1 ± 7.2 cm) than the modified push-up (right 68.5 ± 7.5 cm, left 69.5 ± 7.9 cm) and TUQYBT (right 65.2 ± 9.0 cm, left 66.5 ± 9.0 cm) scores ($p < 0.05$). The modified UQYBT composite scores, for both sides, were significantly higher than TUQYBT scores ($p < 0.05$). **CONCLUSION:** It appears that the modified 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. Alshakha ¹ , John R. Macaulay ¹ , Paul Gerges ¹ , Stella Crall ¹ , Marshall D. McCue ² , Derek C. Monroe ¹ . ¹ University of California Irvine, Irvine, CA. ² Sable Systems International, Las Vegas, NV. (No relevant relationships reported)		

Widely used measures of energy expenditure (EE) are based on Weir's (1949) equation that relies on oxygen utilization and carbon dioxide production to derive a respiratory quotient (RQ). However, Weir's RQ-free equation, presented in the same article, was 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) 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 respirometry system (Sable Systems Intl.; Las Vegas, NV). EE was down-sampled and averaged at rest (EE_{rest}), during the first stage (EE_1), during the last completed stage (EE_{Submax}), and during the final stage (EE_{Max}). The intensity (VO_2 ; 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. VO_{2max} 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 VO_{2max} (EE_{Max} 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: EE_{rest} was predicted by PT and resting HR [$p < .001$, $R^2 = .658$]. EE_1 was predicted by PT and HR and RPE in Stage 1 [$p < .001$, $R^2 = .871$]. EE_{Submax} was predicted by PT, the intensity of, and HR and RPE response to, the last completed stage [$p < .001$, $R^2 = .844$]. EE_{Max} was predicted by PT, VO_{2max} , and the intensity of, and HR and RPE response to, the final stage [$p < .001$, $R^2 = .746$]. 83% of the increase in EE, from rest to the final stage, was explained by increasing HR.

CONCLUSIONS: The reliability (R^2) 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, Shyretha D. Brown, Lindsay B. Baker, FACSM. <i>Gatorade Sports Science Institute, Barrington, IL.</i> Email: corey.ungaro1@pepsico.com (No relevant relationships reported)		

Research has been equivocal on whether or not sweat lactate ([Lac]) and glucose ([Gluc]) are related to serum [Lac] and [Gluc]. **Purpose:** To determine the relationship between sweat [Lac] and [Gluc] versus serum [Lac] and [Gluc] during cycling exercise in the heat for 90 min. **Methods:** Twelve moderately-trained recreational athletes (38 ± 6 y, 75.6 ± 14.5 kg, $VO_{2max} 45.6 \pm 7.7$ ml/kg/min) completed 90 min of cycling at $78 \pm 5\%$ HR_{max} in the heat (31°C , 50% RH). Prior to exercise, the forehead was cleaned with alcohol and deionized water, then three absorbent patches (10 cm^2 absorbent pad, 3M Tegaderm™ + Pad) were applied sequentially (at 0, 30, and 60 min) and each patch was removed after 30-min increments of exercise 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 was 10 for each marker. Data are shown as mean \pm 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 mg/dL 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], $r(8) = 0.485$, $p = 0.155$ and a minimal, but non-significant, positive correlation between sweat and serum [Gluc], $r(8) = 0.186$, $p = 0.606$. **Conclusion:** Sweat [Lac] and [Gluc] explain only 24% and 3% of the variation in serum [Lac] and [Gluc], respectively; suggesting other factors (aside from serum) impact sweat [Lac] and [Gluc]. Further research is warranted to understand the presence of lactate and glucose in the sweat and their applicability and relevance for use as biomarkers.

206	Board #22	May 27 9:30 AM - 11:00 AM
Elite Athletes Have Mildly Elevated Serum Bilirubin Concentrations		
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Bilirubin is a potent endogenous antioxidant and immune system-modulating substance, which is implicated also in the cell signalization and in various metabolic pathways. Mild elevation of its systemic concentrations seems to provide substantial protection against numerous pathological conditions such as atherosclerotic and inflammatory diseases. Scarce reports in the literature suggest that serum bilirubin might have relevance also to the physical performance. **PURPOSE:** The aim of the current study was to assess serum bilirubin concentrations in the Czech elite athletes and to compare them with the Czech general population. **METHODS:** The study was performed in 145 consecutive healthy Czech elite athletes (M:F ratio=1.78) and in 2597 individuals (M:F ratio=0.91) of the Czech post-MONICA study randomly selected from the Czech general population. Serum bilirubin concentrations as well as prevalence of benign hyperbilirubinemia > 17 $\mu\text{mol/L}$ (1 mg/dL, a phenotypic sign of Gilbert's syndrome) were evaluated. **RESULTS:** The medians of serum

bilirubin concentrations in the elite athletes were substantially higher compared to the general population (11.75 vs. 9.6 $\mu\text{mol/L}$, $p<0.001$), and this substantial difference was observed in both men (13.02 vs. 11.3 $\mu\text{mol/L}$, $p=0.006$) and women (10.29 vs. 8.3 $\mu\text{mol/L}$, $p<0.001$). Compared to the general population, the prevalence of a phenotypic Gilbert's syndrome (known also as benign hyperbilirubinemia) was significantly higher in both male (18.4% vs. 31.1%, $p=0.004$) and female athletes (7.4% vs. 17.3%, $p<0.001$). **CONCLUSIONS:** Elite athletes have significantly higher serum concentrations of bilirubin, the most potent endogenous antioxidant substance. Simultaneously, also the prevalence of Gilbert's syndrome is higher in elite athletes, suggesting that the presence of Gilbert's syndrome may predispose to better physical performance. This study was supported by grant No. SVV 260156/2019 provided by Charles University.

207	Board #23	May 27 9:30 AM - 11:00 AM
Salivary Hormone Critical Difference And Biological Variation In A Professional American Football Season		
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Reported Relationships: A.S. Wolfe: Salary; Gatorade Sports Science Institute, PepsiCo Inc. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc..		

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 (sUA), and immunoglobulin A concentration (sIgA). Player data were included for analysis if they provided samples at $\geq 70\%$ of all collection time points ($n=17$). Data were analyzed using parametric statistics after confirmation of normality by Shapiro-Wilk and Reed's 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, sUA, and sIgA were 27.5%, 61.3%, 48.0%, and 59.2%; while BV was 10.8%, 26.1%, 20.5%, and 25% respectively. II was calculated as 0.93, 0.52, 0.59, and 0.65 (arbitrary units) for T, C, sUA, 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 team-wide fluctuations are 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.

208	Board #24	May 27 9:30 AM - 11:00 AM
Validation Of The Human Hex Lactate Threshold Estimate		
Tyson Trainor ¹ , Bryson Carrier ² , Brayden Jolley ³ , Andrew Creer ¹ . ¹ Utah Valley University, Orem, UT. ² University of Nevada, Las Vegas, Las Vegas, NV. ³ Tulane University, New Orleans, LA. (No relevant relationships reported)		

Fitness trackers track a wide range of fitness and physiological metrics, including muscle oxygen saturation and lactate threshold (LT). The Human Hex (HH) is a low-cost wearable device that uses continuous-wave near-infrared spectroscopy (NIRS) to determine muscle oxygen saturation. The HH is unique in its ability to estimate 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 ± 6.4 yrs, 67.9 ± 16.3 kg, 173.3 ± 9.5 cm, 31.6 ± 21.5 km/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 Humanon website.

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 1 mmol/L jump from the previous stage that also placed the total lactate concentration above 4 mmol/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 ± 2.0 km and 12.7 ± 1.3 km/hr, respectively). There was a MAPE of 9.00% and an ICC of 0.652 with a 95% confidence interval of -0.222 to 0.869 ($F(15,15) = 4.546$, $p = 0.004$) when comparing the variables. **Conclusion:** Although there was no difference between HH estimated LT velocity compared to laboratory testing, the MAPE was above 5% and ICC slightly below 0.7 with a significant relationship. This data suggests that the HH does not produce a completely valid estimate of LT compared to lab-based tests; however, it still may be useful in situations where laboratory testing may not be available or practical.

209	Board #25	May 27 9:30 AM - 11:00 AM
Exercise As A Tool For Evaluation Of A Novel Subcutaneous Lactate Monitor		
Nitsan Dror, John Weidling, Shlomit Radom-Aizik, Sean White, Francesca Ortenzio, Elliot Botvinick. <i>University of California Irvine (UCI), Irvine, CA.</i> (Sponsor: Bareket Falk, FACSM) Email: nitsand@uci.edu (No relevant relationships reported)		

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

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

METHODS: Five healthy individuals 18-45 y/o (3 males, 2 females) participated in the study. Two CLM devices were inserted subcutaneously in the lower back flank an hour before the exercise challenge. Each exercise challenge consisted of a 12-minute warm up and up to 7, 4-min incremental workload bouts separated by rest intervals. Continuous lactate measures obtained from CLM were compared with commercial 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 linear interpolation between blood lactate measurement, was 1.4 mM/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

210	Board #26	May 27 9:30 AM - 11:00 AM
Effect Of Exercise Setting On Energy Expenditure And Enjoyment During Active Virtual Reality Gaming		
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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 (VO_2) 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 = 22.6 ± 2.6 years), all of whom completed two 45-minute AVRG sessions in the lab and gym. A subset of 4 participants completed an additional AVRG session at home. **RESULTS:** Significant differences

in VO_2 were observed among the three AVRGs ($F(1, 28) = 9.128, p = .005$; range = 13.53 - 23.04 ml/kg/min). However, there were no differences between settings in VO_2 or enjoyment ($p > .05$). **CONCLUSIONS:** Different AVRGs elicit varying exercise intensities, yet the setting in which they are played does not affect VO_2 or perceived enjoyment. These results suggest AVRGs 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 AVRGs during at-home play.

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

A Superjump® Into ACSM Guidelines

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(No relevant relationships reported)

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 recorded. Percentages of age-predicted maximal HR (%HRmax) were utilized to quantify intensity. %HRmax data were categorically separated according to the American College of Sports Medicine (ACSM) classes of intensity (very light: <57%HRmax; light: 57-63%HRmax; moderate: 64-76%HRmax; vigorous: 77-95%HRmax; near maximal to maximal: ≥96%HRmax). Repeated measures ANOVA was used to evaluate differences ($p<0.05$) in relation to gender and exercise intensity. Post hoc analysis was applied using Bonferroni correction. **RESULTS:** No difference emerged for gender for HR and sRPE data. Frequency of occurrence of %HRmax was significantly higher ($p<0.005$) for the moderate intensity (48.9±34.9%) with respect to very light (5.5±9.5%), light (16.5±24.4%) and vigorous (29.1±37.7%) intensities, while none of the subjects experienced near maximal to maximal values. According to sRPE values (3.1±1.2) subjects rated the SJ session as moderate. **CONCLUSION:** Findings indicate that SJ can be classified as moderate physical activity according to ACSM guidelines. Therefore, SJ may contribute to meet daily physical activity recommendations by representing an alternative form of low-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

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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, directions, modes, and at varying intensities. Both legs were assessed in a random order and each athlete was given both technique and symptom scores. Intra-rater and inter-rater reliability was evaluated. Participants were followed up for 12 months, and their exposure to sport and injuries were recorded. Independent samples t-tests were performed to determine if a significant difference existed in LoLiFST scores between those injured and non-injured athletes. Receiver operating characteristic (ROC) analysis was employed to assess the instrument's capacity to predict injury.

RESULTS: 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 ($df=48, t=4.149, P<0.05; df=16.402, t=2.979,$

$P<0.05$). 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 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

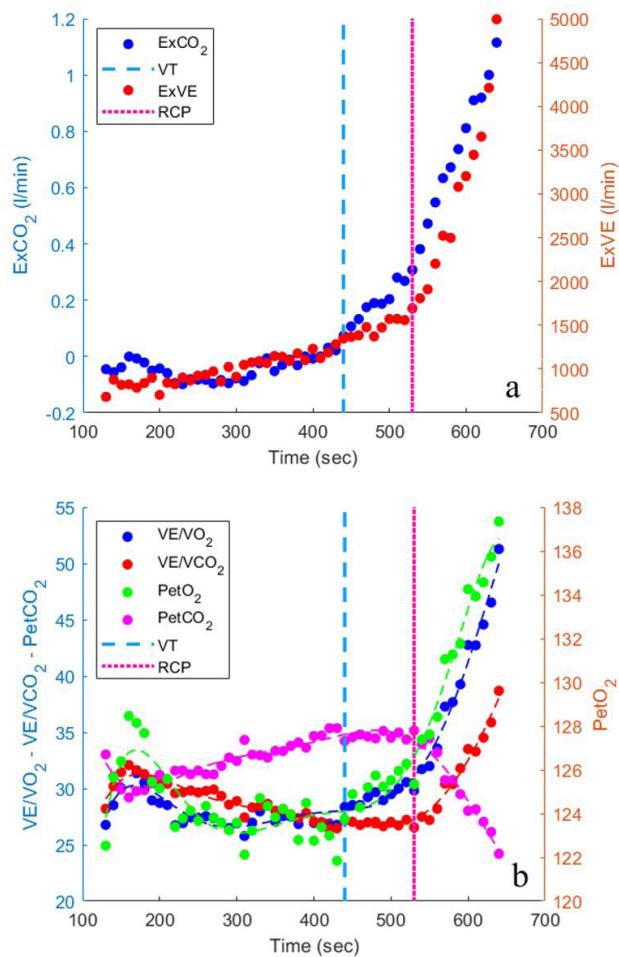
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(No relevant relationships reported)

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 VCO_2 (ExCO_2) concept used to detect VT (Gaskell et al. 2001) and calculated ExVE as $(\text{VE}^2/\text{VCO}_2)-\text{VE}$ to determine RCP. The V-slope method may not be capable of providing automatic solutions (Pantaleimon et al. 2008). Thus we applied a parametric global method (Lavielle, 2005) to automatically find the first sustained rise in the ExCO_2 and ExVE curves. **RESULTS:** The detected RCP in the ExVE curve (Figure a) was located at the point of an increase in both the VE/ VO_2 and VE/ VCO_2 and a decrease in end-tidal CO_2 (PetCO_2) (Figure b) (Jesús et al. 2016). There were extremely strong positive correlations in both RCP Time and RCP VO_2 between the ExVE and V-slope methods (0.934, 0.920). There was no significant difference between the ExVE and V-slope methods in both RCP variables (0.610 and 0.162) (Table). **CONCLUSION:** The ExVE method can determine the RCP. Our novel and automated protocol may increase the methodological consistency in both research and clinical practice.



Result of Pearson correlation and independent two sample t-test								
Variables	Pearson Corr.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% CI (lower)	95% CI (upper)
RCP Time (sec)	0.934	-0.511	348	0.610	6.959	1.181	-33.137	19.471
RCP VO ₂ (l/min)	0.920	-1.402	348	0.162	0.097	0.014	-0.228	0.038

- 214 Board #30 May 27 9:30 AM - 11:00 AM
Effect Of Scapular Dyskinesis On Scapular Functionality And Back Endurance In Elite Women Handball Players
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Purpose: In professional handball players, accurate scapulohumeral rhythm is crucial for the prevention of overhead shoulder injuries. Additionally low back strength and endurance transfer power to scapular and upper part of body via posterior fascia chain. The aim of this study was to investigate the difference between handball players with scapular dyskinesis and without scapular dyskinesis regarding to functionality and back endurance. **Methods:** Forty-one elite female handball players were included in the study. Sixteen women (mean age: 22.5±6.4yrs BMI: 22.5±2.7kg/m²) who has scapular dyskinesis according to lateral scapular slide test (LSST) as Group 1, 25 women (mean age: 22.5±6.4yrs, BMI: 21.8±2.0kg/m²) who has no scapular dyskinesis according to LSST as Group 2 divided into groups. Davies Test and Closed Kinetic

Chain Upper Extremity Stability Test (CKQUEST) 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 mean values between the groups. **Results:** There were no statistically significant differences in CKQUEST 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 dyskinesis needs to future studies for handball players.

- 215 Board #31 May 27 9:30 AM - 11:00 AM
Fitness Readiness For Yoga Poses Scale (fryps): Development And Validation
 Liwen 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 pose 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 yr) 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.

- 216 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 6th 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: Peak hamstrings muscle bulk displacement detected by sMMG (mean= 4.02 ± 1.04 mm) positively correlated with HHD maximum force generation (mean= 28.84 ± 12.13 lb), $r^2= 0.850$. 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.

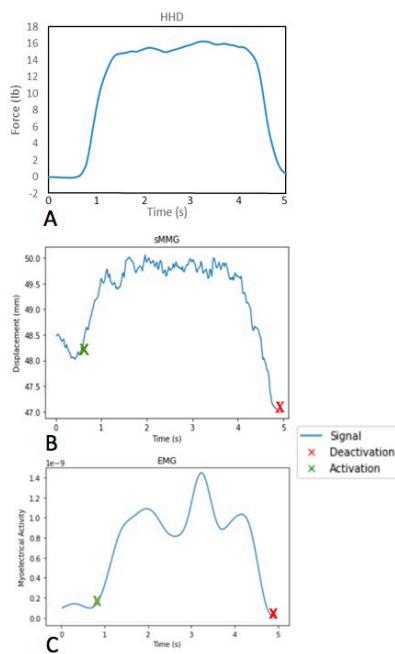


Figure 1. Example comparison of surface mechanomyography (sMMG) sensor output to hand-held dynamometry (HHD) and electromyography (EMG) during a resisted isometric hamstrings curl.

Raw sMMG hamstrings muscle displacement (B) aligns with HHD force output (A) and processed EMG data (C) for muscle contraction duration. The timing activation threshold was set at 3 times above the standard deviation of a resting trial for each modality (Solonik et al., 2010).

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

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

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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 = $22.7 \pm 2.9 \text{ kg/m}^2$; 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: $3.01 \pm 0.69 \text{ L/min}$, verification phase test 3: $3.04 \pm 0.69 \text{ L/min}$; P=0.55). Likewise, VO_{2max} achieved on the verification phase was similar to the ramp VO_{2max} test (verification phase test 2: $3.01 \pm 0.69 \text{ L/min}$, verification phase test 3: $3.04 \pm 0.69 \text{ L/min}$; GXT 2 = $3.03 \pm 0.71 \text{ L/min}$, GXT 3 = $3.04 \pm 0.69 \text{ L/min}$; P > 0.05). ICCs and CVs for the group showed excellent consistency for VP VO_{2max} (ICC = 0.991; CV = $2.68 \pm 2.52\%$). ICC and CV for female participants VP VO_{2max} demonstrated excellent consistency (ICC = 0.987; CV = 2.5%). Male participants VP VO_{2max} displayed excellent consistency (ICC = 0.941; CV = 2.2%). Bland-Altman Plots showed no bias between VO_{2max} .

Conclusions: The verification phase proved to be reliable with low variability and showed no bias based on VO_{2max} value. A 90% submaximal verification phase is a reliable test to confirm a 'true' VO_{2max} .

218

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

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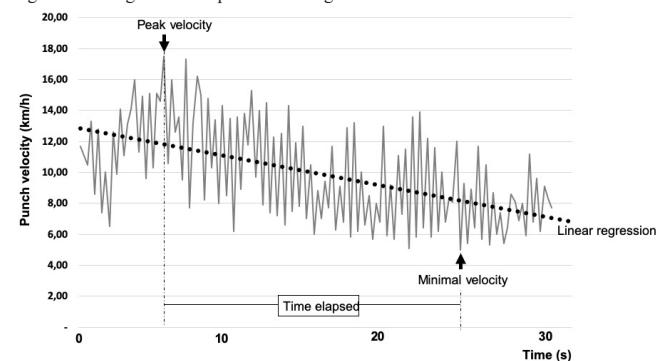
PURPOSE: The principle of specificity states that training and testing should be relevant and appropriate to the sport in order to achieve better performance.

The Wingate test measures anaerobic power and fatigue in a 30-seconds bout of all-out cycling. Despite the importance of anaerobic power analysis for performance in combat sports, there is no specific test for its evaluation in fighters. We propose the Winfight test, for analysis of fatigue and anaerobic capacity in professional combat sports athletes.

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

RESULTS: Peak V ($27.5 \pm 7.9 \text{ km/h}$) was achieved at 4±3 s. MinV ($5.5 \pm 1.3 \text{ km/h}$) was achieved at 23±4 s. VDO was $22.08 \pm 7.5 \text{ km/h}$, a drop of $78.7 \pm 7.7\%$. When time was considered, FI = $1.2 \pm 0.4 \text{ km/h/s}$; %FI = $4.4 \pm 1.2\%$ /s. Punch velocity x time slope = -0.08 ± 0.04 .

CONCLUSIONS: Due to the predominance of anaerobic metabolism, professional combat sports athletes cannot keep very high punching velocity for more than a few seconds. The Winfight test enabled the analysis of punching fatigue. This data can be used for training and tactics during fight camps. Studies are currently being done to evaluate Winfight test's results reproducibility and correlation to performance. Figure 1. Winfight test of a professional fighter



219

Board #35

May 27 9:30 AM - 11:00 AM

Comparison Of The Wingate Anaerobic Test And The New Power Bike Test On Anaerobic Power

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Anaerobic power (AP) is the one of the most important factors influencing athletic performance in many sports. Although the Wingate anaerobic test (WAT) has been the most representative measurement for assessing AP, exhaustive testing procedure limits its use in the lab. Recently, the New Power Bike test (NPT) was developed and can measure anaerobic power with maximal pedaling for only four seconds without load.

PURPOSE: The purpose of this study was to 1) compare the power output between the WAT and the NPT and 2) examine relationships among WAT, NPT, and vertical jump test (VJT). **METHODS:** Thirty-seven participants (age, 26.65 ± 4.16 years; height, $169.2 \pm 9.56 \text{ cm}$; weight, $84.49 \pm 20.10 \text{ kg}$) went through AP measurements using the WAT, NPT, and VJT. The participant conducted VJT and either WAT or NPT randomly on the first visit. Participants then performed either WAT or NPT via a counterbalanced design on second visit with one-week interval. The Pearson correlation coefficient were computed among the WAT, NPT, and VJT scores and the effect size was evaluated with Cohen's d. Variance between the variables was calculated with the coefficient of determination (r^2). The statistical significance was set at 0.05. **RESULTS:** There were

significant positive correlations between the WAT and NPT in the mean of peak power (MPP) ($r = 0.727$, $p < 0.001$) and mean of relative peak power (MRPP) ($r = 0.388$, $p = 0.018$), respectively. The MPP (976.18 ± 344.17 W) and MRPP (11.47 ± 2.60 W/kg) of the NPT were significantly higher than the MPP (705.67 ± 249.30 W) and MRPP (8.34 ± 2.55 W/kg) of WAT. There were positive correlations in MPP between NPT and VJT ($r = 0.620$, $p < 0.001$) between the WAT and VJT ($r = 0.399$, $p = 0.015$). Also, there were significant correlation ($r(35) = .25$, $p = .014$, $d = 5.1$) in MRPP between WAT and VJT, with shared variance between the variables at 0.6%. **CONCLUSION:** There were significant positive correlations between the WAT and NPT in MPP and MRPP. The NPT also showed greater correlation with field test (VJT). So, the NPT can be a good alternative measurement with lesser efforts for assessing anaerobic power and predict athletic performance in the field.

220	Board #36	May 27 9:30 AM - 11:00 AM
Can Cognitive Training During Exercise Improve Performance On A Time To Exhaustion (TTE) Test?		
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(No relevant relationships reported)		

Mental fatigue can negatively affect our drive to continue exercise. A recent study showed that a training intervention combining exercise and a cognitive task was able to improve performance on a time to exhaustion (TTE) test, which is a challenging task where individuals are required to exercise at a set workload for as long as possible. The duration of the training needed to improve TTE is unknown. **PURPOSE:** To determine if an 8-week cognitive training intervention can improve TTE performance by delaying mental fatigue. **METHODS:** Subjects were 28 recreationally active individuals, with a mean \pm SD age of 22.1 ± 2.6 years. They were randomly assigned to one of three intervention groups: a control group (CON) that was asked to exercise normally at home, and two groups that exercised in the laboratory either once (1X) or twice (2X) per week. Groups were designed to have nearly equal men and women. All subjects were asked to complete a graded exercise test (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% $\dot{V}O_{2\text{max}}$. Training sessions included 1hr of cycling at 65% $\dot{V}O_{2\text{max}}$ 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 $\dot{V}O_{2\text{max}}$ values. **RESULTS:** CON had no change in $\dot{V}O_{2\text{max}}$ (-0.8 ± 4.5 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 $\dot{V}O_{2\text{max}}$ 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.

221	Board #37	May 27 9:30 AM - 11:00 AM
Reliability Of Cycling Time Trials Performed At Maximal And Submaximal Intensities		
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(No relevant relationships reported)		

Maximal time trial efforts provide reliable assessments of exercise performance, yet are 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 (TT_{SUB} ; $n=14$) or three maximal (TT_{MAX} ; $n=8$) 250kJ time trials on a cycle ergometer over a period of four weeks. TT_{SUB} was completed at a self-selected work rate to maintain Rating of Perceived Exertion (RPE) between 13 and 17 (Somewhat Hard to Very Hard) throughout the trial. TT_{MAX} 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. Independent t-tests were used to assess mean differences between TT_{SUB} and TT_{MAX} . Fisher r-to-z transformation was used to compare ICCs ($\alpha = 0.05$). **Results:** Time to complete 250kJ 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 ± 607 s; $P = 0.035$). However, there were no differences in TT_{SUB} and TT_{MAX} reliability as assessed by ICC

(0.92 vs. 0.97, $P = 0.352$) or CV of time to completion (7.3 ± 5.3 vs. 6.7 ± 4.0 , $P = 0.807$). **Conclusion:** This study supports the concept that a tempo-style workout may be used as a reliable index of exercise performance. Future studies will be completed to evaluate the sensitivity of the non-exhaustive time trial to changes in aerobic capacity.

222	Board #38	May 27 9:30 AM - 11:00 AM
Differences Between Pointe Shoe And Barefoot Jumping In A Professional Ballet Dancer: A Case Study		
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(No relevant relationships reported)		

Ballet is an art form that requires highly trained athletes to perform specialized movements specific to their field. Some of the most unique aspects of ballet training that sets it apart from other athletics are the use of pointe shoes, the emphasis on bilateral training, and the full body aesthetic requirements of every movement.

PURPOSE: To determine how wearing pointe shoes alters full body kinematics during ballet temps levé jumps on both the preferred stance leg and the non-preferred stance leg, to compare the left and right side to determine the effectiveness of bilateral ballet training, and to observe the contribution of upper extremity movement to jump execution.

METHODS: One professional female ballet dancer (23 yrs) with 17 years of ballet training performed various jumps in two footwear conditions. She was instrumented with 39 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* ($79.1^\circ \pm 1.31^\circ$) than barefoot ($56.4^\circ \pm 0.68^\circ$) 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* ($45.8^\circ \pm 2.43^\circ$) than barefoot ($56.1^\circ \pm 6.33^\circ$) for single leg jumps, regardless of preferred takeoff leg. A bilateral jump revealed no distinct differences between left and right sides. Upper extremity angles did not show clear trends between left and right sides or between footwear conditions, however, the ipsilateral shoulder ($114.7^\circ \pm 6.69^\circ$) had slightly greater ROM than the contralateral shoulder ($103.4^\circ \pm 8.49^\circ$) during single leg jumps.

CONCLUSIONS: Wearing pointe shoes causes alterations to lower limb angles during single leg jumps, altering the demand on the dancer's body during these movements. The increase in ipsilateral shoulder ROM implies ballet dancers utilize the upper extremity to accurately execute single leg jumps. The lack of obvious differences between left and right side joint angles indicates that bilateral ballet training is effective at the professional level.

223	Board #39	May 27 9:30 AM - 11:00 AM
DECREASE IN PHYSICAL FITNESS IN SOUTH CHINA COLLEGE STUDENTS FROM 2015 TO 2018		
Chunbo Qin ¹ , Xi Jin ² , Daixi Xie ¹ , Yang Wen ¹ , Mark Loftin, FACSM ² . ¹ <i>Shenzhen University, Shenzhen, China.</i> ² <i>The University of Mississippi, University, MS.</i> (Sponsor: Mark Loftin, FACSM)		
Email: 67696054@qq.com (No relevant relationships reported)		

Physical fitness (PF) is important for human health and movement throughout the lifespan. **PURPOSE:** The aim of this study was to explore changes in physical fitness in college students from the first year of college to the third year of college.

METHODS: 3606 Chinese college students aged from 16 to 23 years old (1810 males) were recruited from Shenzhen University in China. The subjects participated in PF tests in 2015 and 2018. Physical characteristics and PF tests included body weight (BW), body height (BH), body mass index (BMI), vital capacity, 50-meter running, long distance jumping, sitting body flexion, 800-meter running (only for females), 1000-meter running (only for males), sit-up (only for females) and pull-up (only for males). All students were tested by facilities TSN200 (produced by Physical Fitness Science and Technology Company). Dependent T-tests were used to compare variables responses and a two-way ANCOVA was used to examine gender by time at post-test with pre-test scores serving as a covariate ($p < 0.05$). **RESULTS:** In females, significant differences were noted for BH, VC, 50-meter running, long distance jumping, sitting body flexion, 800-meter running, and sit-ups. In males, significant differences were found for BW, BMI, VC, 50-meter running, long distance jumping, sitting body flexion, and 1000-meter running. **CONCLUSION:** The results indicated that many PF performance tests decreased over the time frame noted. Moreover, it appears that limited performance 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.

224	Board #40 A Comparison Of Step Tests To Predict Maximal Oxygen Consumption	May 27 9:30 AM - 11:00 AM
	Taylor Rowley ¹ , Chris Cho ² , Ann Swartz, FACSM ² , Scott Strath, FACSM ² . ¹ Saginaw Valley State University, Saginaw, MI. ² University of Wisconsin-Milwaukee, Milwaukee, WI. (Sponsor: Scott Strath, FACSM)	
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Introduction: Of the many methods to estimate maximal oxygen consumption ($\dot{V}O_{2\max}$), step tests provide a quick estimation of $\dot{V}O_{2\max}$ without expensive equipment. Few studies have investigated varied step height and cadence speed across a broad sample population. The purpose of this study was to generate and validate models to predict $\dot{V}O_{2\max}$ using three different step tests. **Methods:** A sample of 162 adults, aged 18-79 years, completed a graded exercise test to assess $\dot{V}O_{2\max}$. All three step tests were completed on a later day. The step tests differed in duration, number of stages, and step height. Test 1 (T1) was a two-stage, six-minute test, and had a six-inch step height, Test 2 (T2) was a three-stage, nine-minute test, and had a six-inch step height, and Test 3 (T3) was a three-stage, nine-minute test, and had an eight-inch step height. Stepping cadence increased with each stage and was prescribed based on age group (<40 years, 40-60 years, and >60 years). Recovery heart rate (HR_{rec}) was measured every 30-seconds for two-minutes after each test. Model equations were obtained using hierachal multiple regression analysis. Covariates for each model included age, sex, body mass, stepping cadence, and HR_{rec} at all measured time intervals. The baseline model for each test consisted of age, sex, and body mass. Stepping cadence was entered in step two but was only significant for T3. Thirty-second HR_{rec} was entered in the final step and was significant for all three tests. Validity was assessed using a Jackknife cross-validation method, allowing for root mean square error (RMSE) and percent bias to be calculated. **Results:** The baseline model accounted for ~72% of the variance for predicting $\dot{V}O_{2\max}$. Each model accounted for ~83% of $\dot{V}O_{2\max}$ variance and had an error ~4.15 mL·kg⁻¹·min⁻¹. The results of the jackknife analysis found that bias for all three tests was minimal (<0.001%) and the resulting bias-adjusted R² was 0.825, 0.826, and 0.834 for T1, T2, and T3, respectively. Adjusted RMSE was 4.259, 4.223, and 4.102 mL·kg⁻¹·min⁻¹ for T1, T2, and T3, respectively. **Discussion:** All three step tests account for ~83% of the variance of $\dot{V}O_{2\max}$ with an error around 4.2 mL·kg⁻¹·min⁻¹. As there is a minimal difference between tests, there is flexibility in the utilization of these step tests based on the need of the administrator and ability of the client.

225	Board #41 Biomechanical Analysis Of The Closed Kinetic Chain Upper Extremity Stability Test	May 27 9:30 AM - 11:00 AM
	Ethan S. Welch, Matthew D. Watson, George J. Davies, Bryan L. Riemann. Georgia Southern University - Armstrong Campus, Savannah, GA. Email: ew09516@georgiasouthern.edu (No relevant relationships reported)	

PURPOSE: The closed kinetic chain upper extremity stability test (CKCUEST) involves counting alternate touches of each hand to the contralateral hand while maintaining a push-up position. The purpose of this study was to compare kinematic and ground reaction force (GRF) patterns between the dominant (DOM) and nondominant (NDOM) limbs. **METHODS:** Healthy college-aged males (n=16) and females (n=16) completed three 15s trials of the CKCUEST with 45s rest between trials. DOM and NDOM GRF and hand kinematics were captured using an electromagnetic tracking system and two forceplates. Contact and flight times were computed separately for each limb. For both the medial-lateral (ML) and 3-dimensional (3D) composite vectors, the average hand travel distance, hand velocity, and peak and average GRF per touch were computed and statistically compared between limbs. **RESULTS:** There were no significant limb differences for contact (DOM= .97±.28s, NDOM=.98±.28s, P=.679) and flight (DOM=.69±.19s, NDOM=.69±.19s, P=.305) times. ML distance was statistically equal (P=.866) between the NDOM (1.38±.13m) limb compared to DOM (1.38±.14m), as well as the 3D distance (DOM=1.36±.14m, NDOM=1.34±.13m, P=.189). There were no significant differences for ML (DOM=2.08±.44m/s, NDOM=2.08±.45m/s, P=.728) and 3D (DOM=2.30±.50m/s, NDOM=2.30±.49m/s, P=.734) velocities. Peak ML GRF was significantly (P=<.001) greater for the NDOM (186.7±77.2N) limb compared to DOM (166.6±65.7N). Average ML GRF was significantly (P<.001) greater for NDOM (130.3±51.1N) limb compared to DOM (112.6±44.5N). There were no significant limb differences for either peak 3D GRF (DOM=475.6±163.6N, NDOM=474.7±163.8N, P=.840) or average 3D GRF (DOM=362.1±121.1N, NDOM=362.0±121.7N, P=.974). **CONCLUSIONS:** Although there were significant findings with ML GRF, the differences may not be clinically meaningful. Future research will consider patients with shoulder pathologies being assessed during rehabilitation progression and at discharge.

226	Board #42 Validity And Reliability Of Small Respiratory Chamber To Assess Exercise Energy Expenditure	May 27 9:30 AM - 11:00 AM
	Elvis Alvarez Carnero, Christopher Bock, Steven R. Smith, Bret H. Goodpaster. AdventHealth Translational Research Institute, Orlando, FL. Email: Elvis.Alvarezcarnero@AdventHealth.com (No relevant relationships reported)	

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 the same day with a 30-minute resting period between bouts, each bout had a light and a moderate load; they repeated the same protocol after two days. Oxygen uptake ($\dot{V}O_2$) and CO₂ production ($\dot{V}CO_2$) were derived with the same equation. EE, Net EE, gross efficiency (GE) and net efficiency (NetEF) were calculated for each load (L1 & L2). FLEX within and between-day reliability was calculated 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 NetEE were not significantly different between cart and FLEX technologies (EE_{L1}, FLEX= 4.29 vs. Cart= 4.13 kcal/min, EE_{L2}, FLEX= 6.2 vs. Cart= 6.0 kcal/min, P>0.05 for both; NetEE_{L1}, FLEX= 2.7 vs. Cart= 2.7 kcal/min, EE_{L2}, FLEX= 4.63 vs. Cart= 4.57 kcal/min, P>0.05 for both). GE and NetEF were similar between both systems for all loads (GE_{L1}, FLEX= 11.8% vs. Cart= 12.3%, GE_{L2}, FLEX= 16.3% vs. Cart= 18.9%, P>0.05 for both; NetEF_{L1}, FLEX= 18.8% vs. Cart= 18.9%, NetEF_{L2}, FLEX= 22.0% vs. Cart= 22.4%, P>0.05 for both). FLEX assessments of EE were highly reliable within-day (L1= 0.11 kcal/min (2.5%) and L2= 0.07 kcal/min (1.1%)) and between-days (L1= 0.10 kcal/min (2.4%) and L2= 0.14 kcal/min (2.2%)). **CONCLUSION:** FLEX is a valid and reliable technique to assess energy metabolism during exercise without the cumbersome mouthpiece or mask required by metabolic carts.

227	Board #43 A Comparison Of Predictive Equations Versus Measured Resting Metabolic Rate In Healthy Individuals	May 27 9:30 AM - 11:00 AM
	Ben Pike ¹ , Grace O'Connor ¹ , Jeremy Ducharme ² , Brian Miller ³ , Jakob D. Lauver ¹ , Justin P. Guilkey ¹ , Christine M. Mermier ² , Kelly E. Johnson ¹ . ¹ Coastal Carolina University, Conway, SC. ² University of New Mexico, Albuquerque, NM. ³ Mary Baldwin University, Staunton, VA. (Sponsor: William G. Lyerly, FACSM) Email: bnpike@coastal.edu (No relevant relationships reported)	

Established prediction equations, such as the Mifflin-St. Jeor (MSJ), Harris- Benedict (HB), World Health Organization (WHO), and Nelson provide an estimate of resting metabolic rate (RMR). However, these prediction equations should be reinvestigated to determine if an update is needed. **PURPOSE:** To examine several well-known RMR prediction equations (RMR_{pred}) against measured (RMR_{meas}) values in healthy adults. **METHODS:** Twenty-four participants (35.2 ± 15.4 yrs, 171.8±3.9 cm, and 71.5±33.2kg) participated in this study. Each participant followed standard pre-test guidelines and underwent a single RMR assessment (RMR_{meas}) 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 two-factor mixed methods ANOVA was used to compare the measured RMR against other prediction equations (HB, WHO, and MSJ, and Nelson) by sex. Additionally, sex-adjusted Bland Altman Limits of Agreement (LA) were reported as frequency of subjects outside of agreement compared to RMR_{meas} . For significant differences, Cohen's d effect sizes were reported. All results are expressed as $M \pm SD$ with significance set at $p \leq 0.05$. **RESULTS:** On average males had 498±137kcal/d higher RMR than females ($p \leq 0.001$). The HB (1609.7 ± 300.5 kcal/d) and WHO (1620 ± 302.8 kcal/d) prediction equations did not differ from the RMR_{meas} (1703.5 ± 349.5 kcal/d) ($p > 0.05$). However, significant differences were observed for MSJ (1529.4 ± 284.5 kcal/d; $d = 0.92$) and Nelson (1515.7 ± 352.9 kcal/d; $d = 1.05$) prediction equations when compared to RMR_{meas} (1703.5 ± 349.5 kcal/d). The Mifflin-St. Jeor and Nelson significantly underestimated RMR when compared to RMR_{meas} by 9.3 ± 10.5% and 10.9 ± 9.8%, respectively. MSJ and Nelson had the largest frequencies outside of the LA at 20% and 36% under-predicted for females, respectively. **CONCLUSIONS:** Preliminary data shows that MSJ and Nelson RMR equations

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.

228 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. Raters were instructed to score the performance of each video participants 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. ($\alpha = .987$). **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.

229 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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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 curve areas were < 0.61 indicating the scoring rubric failed to accurately diagnose LSI > 10% or >15%.

CONCLUSIONS: Although active, adult subjects 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.

230 Board #46 May 27 9:30 AM - 11:00 AM

Body Mass Scaling Of Metabolic Rate During Submaximal Steady-state Motorized Treadmill Climbing

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Avid rock climbers and the research literature commonly agree that body mass (M_B , kg) is the primary determinant of the energy cost of climbing. Given that gravitational resistance is the primary external force being worked against when climbing, it is presumed that the energy cost, as measured by steady-state oxygen uptake (VO_2 , l/min), should be proportional to both *body mass* (M_B , kg) and the *total mass* of a climber and their gear (M_T , kg) - i.e., $VO_2 \propto M_B^b \propto M_T^b$, where b 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_T scaling exponents for energy cost during motorized treadmill climbing. It was hypothesized that both mass exponents would scale to the +1.0 power. **METHODS:** Data for 16 men and 4 women (Mean±SD: 25±4 yrs age; 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 (0°), overhang or negative incline (-5 to -10°), positive inclines (+5 to +10°). Steady-state VO_2 data collected with a portable indirect calorimetry system were analyzed using standard log-linear multiple regression analyses using treadmill speed and grade, a dummy-coded gender term, and either M_B or M_T as independent variables ($\alpha=0.05$). Derived mass exponents were then compared to the theoretical value of +1.0 using 95% CIs. **RESULTS:** Without the gender term in the regression model, mass exponents for both M_B (b ; 95%CI: 1.28; 1.11-1.45) and M_T (+1.32; 1.14-1.49) were significantly higher than +1.0 (model $P<0.001$; $R^2 = 0.79$). With the gender term, however, mass exponents for neither M_B (1.05; 0.85-1.25) nor M_T (1.09; 0.89-1.29) differed from +1.0 (model $P<0.001$; $R^2 = 0.82$). **CONCLUSIONS:** The mass exponents for both M_B and M_T 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.

231 Board #47 May 27 9:30 AM - 11:00 AM

Evaluation Of Longitudinal Combine Performance Assessments In Ncaa Division Two Football Athletes

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INTRODUCTION: Combine style assessments provide information regarding athlete's strengths, weaknesses and ability. Values allow strength and conditioning professionals to assess training objectives and method of operation. **PURPOSE:** To evaluate longitudinal combine performance assessments in NCAA Division II football athletes. **METHODS:** One hundred fifty-four football athletes participated in combine style assessments over three years using six time points (16WI, 16SU, 17WI, 18WI, 18SU, 19SU). Tests included vertical jump via Vertec, broad jump via meter tape, electronically timed 40-yard dash, stopwatch or electronically timed pro-agility run, and maximal power clean, back squats, and bench press. For data analysis, positions were condensed into categories of Bigs (offensive and defensive lineman) Skill (wide receivers, running backs, defensive backs) and Big Skill (quarterbacks, tight ends, linebackers). Descriptive statistics and comparative analysis, mixed methods regressions, were performed using SPSS (version 24.0) with significance set at $p \leq 0.05$. **RESULTS:** Athletes displayed significant increases in back squat ($F=4.965$, $p<0.0005$), power clean ($F=3.164$, $p=0.008$), and bench press ($F=4.329$, $p=0.001$) as they participated in subsequent assessments. Athletes displayed significant decreases related to subsequent assessment in broad jump ($F=3.889$, $p=0.002$), vertical jump ($F=3.146$, $p=0.009$), pro-agility right ($F=2.555$, $p=0.028$) and left ($F=2.797$, $p=0.017$), Squat ($F=4.931$, $p<0.0005$), power clean ($F=2.806$, $p=0.017$), 40-yard dash ($F=4.369$, $p=0.001$), pro-agility left ($F=4.509$, $p=0.001$), and right ($F=4.329$, $p=0.001$) performance improved with subsequent assessments and was significantly related to position category (Skill < Big Skill < Bigs). Bench press ($F=4.827$, $p<0.0005$) performance was significantly related to subsequent assessments and position category (Skill < Big Skill < Bigs). Broad jump ($F=4.415$, $p=.001$) and vertical jump ($F=3.707$, $p=0.003$) performance were significantly related to subsequent assessments and position category (Skill > Big Skill > Bigs). **CONCLUSION:** Subsequent assessment had an impact on combine performance results. Further, position categories have differing attributes that will impact combine performance values.

232	Board #48	May 27 9:30 AM - 11:00 AM
Stressful Exercise Reveals Hidden Correlations Between Anthropometric Measurements And Cardiovascular Parameters		
Sawsan M. Muthana, Anila K. Maskeen, Emily A. Freund, Jennae M. Fenton, Nick J. Rein, J. Mark VanNess, Courtney D. Jensen. <i>University of the Pacific, Stockton, CA.</i> Email: s_muthana@u.pacific.edu (No relevant relationships reported)		

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 retested on the Fit3D and had post-exercise values of heart rate and blood pressure collected. Descriptive statistics characterized the study sample; simple linear regressions tested the relationships between anthropometric assessments and cardiovascular parameters. **RESULTS:** Subjects were 20.5 ± 1.7 years old, weighed 73.8 ± 15.4 kg, had a body fat of $24.2 \pm 6.6\%$, resting heart rate (HR) of 78.1 ± 14.9 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 ($\beta=-0.691$, $p=0.033$). Resting forearm circumference was unrelated to SBP ($p=0.978$) and DBP ($p=0.539$), but post-exercise forearm circumference predicted both SBP ($\beta=1.336$, $p=0.031$) and DBP ($\beta=1.823$, $p=0.038$). Calf circumference was unrelated to SBP, but demonstrated trends with DBP at rest ($\beta=0.942$, $p=0.033$) and post-exercise ($\beta=1.403$, $p=0.080$). Upper arm and upper leg circumferences were unrelated. **CONCLUSION:** In a condensed age group, stressful exercise seemed to reveal otherwise-hidden correlations between peripheral anthropometric measurements and cardiovascular assessments.

233	Board #49	May 27 9:30 AM - 11:00 AM
A Simulated Climbing Test Is Correlated With Total Work From The Wingate Anaerobic Test		
Dustin D. Dunnick, Kayla Wright, James W. Navalta, FACSM, Brian K. Schilling. <i>University of Nevada, Las Vegas, Las Vegas, NV.</i> (No relevant relationships reported)		

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 the upper and lower body. Simulated 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 (Versaclimber SM Sport). On days 2-5, participants performed the anaerobic test protocol on each machine twice using a random order. The WAnT protocol used a 7.5% body mass resistance with a 3-5-minute warm-up followed by 30-sec of maximal effort cycling. The climbing protocol included a 3-5-minute warm-up with no resistance followed by a 30-sec maximal effort climb with the lowest resistance possible on the machine. Each protocol was performed twice on two separate days. Intraclass correlation coefficient (ICC3,1) were calculated between two trials of the WAnT total work (J), between the two trials of the climber for distance climbed. Bivariate correlations were calculated for total work on the WAnT and distance on the climber.

RESULTS: Fifteen males (24.8 ± 6.5 yrs; 176.2 ± 5.4 cm; 77.0 ± 13.5 kg) and fifteen females (23.1 ± 4 yrs; 159.4 ± 6.4 cm; 69.2 ± 13.8 kg) completed the study. A high degree of test-retest reliability was found for WAnT total work ($ICC = .99$ [.98-.99], $p < .001$) and climbing distance ($ICC = .94$ [.93-.99], $p < .001$). WAnT total work and climbing distance were significantly correlated, $r = .81$, $p < .001$.

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

234	Board #50	May 27 9:30 AM - 11:00 AM
Methods For Estimating Anaerobic Glycolytic Capacity (vLa_{Max}) In Trained Cyclists		
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PURPOSE: The maximum rate of lactate production (vLa_{Max}) can be used to estimate the maximum anaerobic energy contribution, which can be used to optimize endurance training. The aim of this study was to examine the reliability of a 20-sec vLa_{Max} estimate using either a variable or standardized alactic time interval (t_{alac}).

METHODS: 16 trained male cyclists and triathletes (35.3 ± 8.9 yo, 1.80 ± 0.05 m, and 73.3 ± 11.2 kg, average 30-sec Wingate power of 9.0 ± 1.6 Wkg⁻¹) were recruited. Subjects completed two familiarization trials on their own before completing two 20-sec maximal sprints on their own bikes which were attached to a Wahoo Kickr trainer. Each session began with a 10-min warm-up at 100 W before each sprint and were then followed by 12-min passive rest. A lactate (HLA) sample was taken from the finger at the end of the sprint and then every 2-min after that until HLA dropped ≥ 1 mM. vLa_{Max} was then calculated using ($HLA_{post - pre}/(20\text{-sec} - alactic\ time)$), where t_{alac} was either time 0-sec to time where power drops 3.5%, or was set at 5-sec. **RESULTS:** Individual sprint sessions data were analyzed and no significant differences ($p > 0.05$) nor were noted between session 1 and 2 data; all data were pooled and then vLa_{Max} calculated using methods described above. Mean 20-sec sprint power was 9.8 ± 1.0 Wkg⁻¹ (~109% of Wingate) and a total work of 14.5 ± 2.7 . The t_{alac} was calculated to be 4.0 ± 2.3 -sec. There was no significant difference ($p > 0.05$) between the calculated vLa_{Max} 0.51 ± 0.18 mM L⁻¹ sec⁻¹ and vLa_{Max} using a standard 5-sec value, 0.54 ± 0.15 mM L⁻¹ sec⁻¹. Neither vLa_{Max} value appears to be associated ($r^2 < 0.10$, $p > 0.05$) with absolute sprint performance.

CONCLUSIONS: These results indicate that using a standard t_{alac} of 5-sec produced similar results as calculating it using a 3.5% drop in power. While vLa_{Max} may ultimately influence HLA testing curves (i.e., lactate threshold) and endurance performance, it does not appear to be associated with actual sprint power output.

235	Board #51	May 27 9:30 AM - 11:00 AM
Comparisons Of Functional Movement Screen Values In Different Weight Populations		
Dao Wang, Dong Zhou, Jingjing Wang. <i>Shanghai Research Institute of Sports Science, Shanghai, China.</i> Email: bluebird_2003@126.com (No relevant relationships reported)		

PURPOSE: In this study, we explored the mechanism of overweight and obesity on functional exercise ability through correlating functional movement screen (FMS) with BMI, and comparing FMS values among different weight groups. **METHODS:** FMS was performed in 481 adults (male 209, female 272) aged 20 to 69. The FMS consists of 7 modes of action: deep squat, hurdle step, in-line lunge, shoulder mobility, active straight leg raise, trunk stability push up and rotary stability. The total score of FMS is 21 points. The BMI grading criteria of Chinese people was used. **RESULTS:** (1) BMI was negatively correlated with the total score of FMS, and the correlation coefficient was -0.309 ($P < 0.01$). The correlation coefficients of BMI with shoulder mobility and rotary stability were -0.404 and -0.311 ($P < 0.01$), respectively. (2) If BMI exceeded 26 kg/m², the total score showed a downward trend. The decline was most obvious when exceeded 31 kg/m². (3) The total FMS score of obese group was significantly lower than that of normal weight and overweight group ($P < 0.01$), and that of overweight group was significantly lower than that of normal weight group ($P < 0.01$). (4) The scores of shoulder mobility and rotary stability of obese people were significantly lower than those of normal weight and overweight people ($P < 0.01$). The scores of active straight leg raise in obese group were significantly lower than normal weight group ($P < 0.01$). (5) There was significant difference in the score distribution of in-line lunge ($\chi^2 = 13.097$, $P = 0.011$), the proportion of 1 point is the highest in obese people, and the proportion of 3 points from high to low is normal weight, overweight and obese people. The scores of shoulder mobility and active straight leg raise were significantly different among the three groups ($\chi^2 = 61.661$, $P = 0.000$; $\chi^2 = 14.852$, $P = 0.005$), the proportion of 3 points from high to low was normal weight, overweight and obese people. There was also a significant difference in the distribution of rotary stability scores ($\chi^2 = 34.388$, $P = 0.000$). **CONCLUSION:** BMI was negatively correlated with FMS performance, and the order of FMS performance from good to bad was normal weight, overweight and obese people. Among the three groups, the most obvious differences were shoulder mobility, rotary stability and active straight leg raise.

236	Board #52	May 27 9:30 AM - 11:00 AM
Examining A Method For The Comprehensive Assessment Of Instantaneous Force Using Directional Continuous Jump Motion Test		
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(No relevant relationships reported)		

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 jump measurements. The individual results indicated that six subjects had an overall standard score (T-score) that was higher than the average (50) under the conventional measurement method, and eight subjects had higher than average scores under the directional continuous jump measurement method. It show 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.

237	Board #53	May 27 9:30 AM - 11:00 AM
The Accuracy Of Prediction Equations For Estimating 1rm In The Press And The Deadlift		
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(No relevant relationships reported)		

Many of the equations used to predict the one-repetition maximum (1RM) from the number of repetitions performed to fatigue with a submaximal load have been derived from the squat and bench press exercises in which the eccentric portion precedes the concentric portion of the repetition. In the press and deadlift, the concentric phase precedes the eccentric phase which may affect performance in the number of repetitions performed to fatigue and, thus, the accuracy of existing 1RM prediction equations for these exercises.

PURPOSE: To compare the actual 1RM to the predicted 1RM from seven existing prediction equations for the press and deadlift.

METHODS: 30 resistance trained individuals (23 ± 3 yrs) completed a 1RM protocol for the press and deadlift. Participants then returned to the lab on two separate occasions and completed one set of each exercise to fatigue at either 70% or 90% of their 1RM in a randomized order. The actual 1RM was compared to the predicted 1RM from seven 1RM prediction equations for each exercise at each load. A one-way repeated measures (1x8) ANOVA was used followed by Bonferroni post-hoc tests to determine pairwise differences between the actual and predicted 1RM values.

RESULTS: For the press, the predicted 1RM from 70% 1RM lifted to fatigue was significantly ($p \leq 0.002$) lower than the actual 1RM from three of the seven equations (mean differences of 3.1 ± 0.7 , 5.7 ± 0.7 , and 6.2 ± 0.7 kgs) and the predicted 1RM from 90% 1RM lifted to fatigue was significantly ($p \leq 0.012$) greater than the actual 1RM from four of the seven equations (mean differences of 3.0 ± 0.7 , 3.2 ± 0.7 , 3.5 ± 0.6 , and 4.7 ± 0.7 kgs). For the deadlift, the predicted 1RM from 70% 1RM lifted to fatigue was significantly ($p \leq 0.001$) lower than the actual 1RM from three of the seven equations (mean differences of 13.7 ± 2.7 , 20.1 ± 2.3 , and 20.3 ± 3.2 kgs) whereas the predicted 1RM from 90% 1RM lifted to fatigue was significantly ($p \leq 0.012$) greater than the actual 1RM from one of the seven equations (mean differences of 7.1 ± 1.0 kg).

CONCLUSIONS: Lower loads (70% 1RM) used to predict the 1RM may underestimate the actual 1RM whereas higher loads (90% 1RM) may overestimate the

1RM for the press and deadlift. The use of higher loads for 1RM prediction increases the accuracy of the 1RM prediction for the deadlift in most equations but still may lead to an overestimation of the 1RM.

238	Board #54	May 27 9:30 AM - 11:00 AM
Use Of HR_{index} To Predict Oxygen Uptake: A Validation Study		
Jie Kang, FACSM, Christopher Roser, Devyn Montemarano, Hannah Mercado, Morgan Choma, Christian Mendez, Matthew Pollock, Nicholas A. Ratamess, Avery D. Faigenbaum, FACSM, Jill A. Bush, FACSM. <i>The College of New Jersey, Ewing, NJ.</i> Email: kang@tcnj.edu (No relevant relationships reported)		

Heart rate index (HR_{index}), expressed as an activity HR divided by resting HR (HR_{rest}), has been proposed to estimate oxygen uptake (VO_2) of physical activity and aerobic capacity ($VO_2\text{max}$). Recently, a prediction equation (e.g., $\text{METs} = 6 \times HR_{index} - 5$) that used HR_{index} to predict VO_2 in MET was developed retrospectively from aggregate data of 60 published studies. However, it is unclear whether this predictive model is accurate when applied among individuals. **Purpose:** To examine the predictive validity of the HR_{index} equation by comparing submaximal and maximal VO_2 predicted by the HR_{index} equation ($VO_2\text{-Pred}$) with that measured by indirect calorimetry ($VO_2\text{-Meas}$). **Methods:** 60 healthy adults (21 ± 2 yrs.; 28 males and 32 females) participated in this study. Each subject underwent a $VO_2\text{max}$ test and an experimental session on two separate days. The experimental session consisted of a 15-min resting period and three successive 10-min treadmill exercise bouts performed at 40%, 60% and 80% of $VO_2\text{max}$. VO_2 and HR were recorded continuously during both the $VO_2\text{max}$ test and the experimental session and these data were used to obtain $VO_2\text{-Pred}$ and $VO_2\text{-Meas}$ for each level of intensity and for $VO_2\text{max}$. Validation was carried out by Pearson product-moment correlation analysis, paired t-test, Bland-Altman plots, and by assessment of mean absolute errors. **Results:** A significant ($p < 0.05$) correlation coefficient was found between $VO_2\text{-Pred}$ and $VO_2\text{-Meas}$ at 40% ($r = 0.56$), 60% ($r = 0.60$), and 80% of $VO_2\text{max}$ ($r = 0.55$) and at $VO_2\text{max}$ ($r = 0.51$). $VO_2\text{-Pred}$ differed significantly ($p < 0.05$) from $VO_2\text{-Meas}$ at 40% (5.7 ± 1.4 vs. 4.9 ± 1.0 METs), 60% (8.5 ± 2.0 vs. 7.5 ± 1.4 METs), and 80% of $VO_2\text{max}$ (10.5 ± 2.4 vs. 9.6 ± 1.8 METs) and at $VO_2\text{max}$ (11.8 ± 2.7 vs. 12.6 ± 2.3 METs). Prediction biases were $+0.74$, $+1.06$, $+0.82$, and -0.83 METs, while mean absolute errors of prediction were 22.1%, 21.6%, 19.1% and 16.1% at 40%, 60%, and 80% of $VO_2\text{max}$ and at $VO_2\text{max}$, respectively. **Conclusion:** It appears that the prediction equation involving HR_{index} overestimates VO_2 at submaximal intensities and underestimates $VO_2\text{max}$ in healthy adults. These results suggest that further investigation aimed to establish the accuracy of using HR_{index} to predict VO_2 is warranted.

239	Board #55	May 27 9:30 AM - 11:00 AM
A Novel Device To Assess Eccentric Grip Strength		
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PURPOSE: To determine normative values for eccentric grip strength derived from an original device in general Japanese 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 (18.7–20.0%). The ICC of 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 20.7–27.5% higher than the isometric grip strength in the general population.

240 Board #56 May 27 9:30 AM - 11:00 AM
Abstract Withdrawn

241 Board #57 May 27 9:30 AM - 11:00 AM
Does Heart Rate Response Confirm The Attainment Of Maximal Oxygen Uptake In Adults 45 Years And Older?
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(*No relevant relationships reported*)

Heart rate plateau (HR_{plat}) is an effective indicator for confirming $\dot{V}O_{2\text{max}}$ attainment. However, it is unknown if this criterion holds for older populations. **PURPOSE:** Test the efficacy of HR_{plat} for confirming $\dot{V}O_{2\text{max}}$ in older individuals. **METHODS:** Twelve males and twelve females (60±8 years, N=24) completed individualized ramp and staged protocols to volitional fatigue on the cycle ergometer (CE) and treadmill (TM), respectively. Participants then performed verification protocols at 105% of their peak workload from each $\dot{V}O_{2\text{max}}$ test. $\dot{V}O_{2\text{max}}$ was confirmed using a plateau in $\dot{V}O_2$ ($\dot{V}O_{2\text{plat}} = \text{largest } \dot{V}O_2 \text{ value} - \text{closest neighboring point} \leq 150 \text{ mL/min}$), a $\dot{V}O_2$ max verification criterion of a $\dot{V}O_2$ not greater than 2% higher than the incremental phase, and two different criteria for HR_{plat} ($\leq 2 \text{ bpm}$ or $\leq 4 \text{ bpm}$). Secondary criteria for establishing maximal effort were RER_{max} ≥ 1.10 , HR_{max} $\pm 10 \text{ bpm}$ of APHR_{max}, RPE ≥ 17 , and [BLA^a] $\geq 8 \text{ mM}$. **RESULTS:** Data are presented (Table 1) as sex-specific percentages. All attained $\dot{V}O_{2\text{plat}}$ on both modalities. The verification criterion was met by $\geq 67\%$ of females and $\geq 92\%$ of males in our sample regardless of modality. HR_{plat} ($\leq 2 \text{ bpm}$) was met by $\leq 67\%$ of females and $\leq 44\%$ of males in our sample regardless of modality. Males more frequently attained HR_{plat} ($\leq 4 \text{ bpm}$) than did females; females attained HR_{plat} ($\leq 4 \text{ bpm}$) more frequently on TM as compared to CE. **CONCLUSION:** A verification bout is reliable for confirming $\dot{V}O_{2\text{max}}$ in older males on both modalities and for females on the TM. HR_{plat} ($\leq 4 \text{ bpm}$) may serve as a standalone criterion for TM $\dot{V}O_{2\text{max}}$ attainment for males and females. $\dot{V}O_{2\text{plat}}$ was the most robust method for confirming $\dot{V}O_{2\text{max}}$ attainment in older adults. Due to wide variability in the literature regarding $\dot{V}O_{2\text{plat}}$ criteria and indirect calorimetry processing methods, agreement on a standardized definition for $\dot{V}O_{2\text{plat}}$ and clear data processing procedures are needed.

Table 1. $\dot{V}O_{2\text{max}}$ attainment criteria for all tests across sex and modality (N=24)

Criterion	Treadmill (%)		Cycle Ergometer (%)	
	Males	Females	Males	Females
$\dot{V}O_{2\text{plat}} (\leq 150 \text{ mL/min})$	100	100	100	100
HR _{plat} ($\leq 2 \text{ bpm}$)	44	67	25	18
HR _{plat} ($\leq 4 \text{ bpm}$)	100	83	75	64
[BLA ^a] ($\geq 8 \text{ mM}$)	25	8	50	25
HR _{max} ($\pm 10 \text{ bpm}$ APHR _{max})	90	92	92	75
RER _{max} (≥ 1.10)	83	75	92	100
RPE (≥ 17)	92	100	100	100
$\dot{V}O_{2\text{verif}}$ ($\leq 2\%$ higher than $\dot{V}O_{2\text{max}}$)	92	83	92	67

$\dot{V}O_{2\text{plat}}$ = plateau in oxygen consumption. HR_{plat} = plateau in heart rate. [BLA^a] = maximal blood lactate concentration. APHR_{max} = age-predicted heart rate max (220-age). RER_{max} = maximal respiratory exchange ratio, RPE = maximal rating of perceived exertion. $\dot{V}O_{2\text{verif}}$ = $\dot{V}O_{2\text{max}}$ of the verification trial.

242 Board #58 May 27 9:30 AM - 11:00 AM
SEX DIFFERENCES IN MAXIMAL OXYGEN UPTAKE: WHAT ARE THE BIGGEST CONTRIBUTORS?

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(*No relevant relationships reported*)

Previous investigations in maximal aerobic capacity ($\dot{V}O_{2\text{max}}$) have attributed sex differences to anatomical and physiological parameters. **PURPOSE:** To determine the main factor affecting $\dot{V}O_{2\text{max}}$ in a sample of physically active young adults. **METHODS:** Sixteen college-aged students (18-25 years, 8 males and 8 females) participated in one laboratory visit including body composition, hematocrit (HCT), and $\dot{V}O_{2\text{max}}$ assessment. Lean body mass (LBM) and fat mass (FM) were obtained from a whole-body DEXA scan. Hematocrit (HCT) was determined using a finger prick blood sample and validated by measures of urine specific gravity (USG) to control for hydration status. A graded exercise test was performed on the cycle ergometer using 25 watt (W) per minute and 20 W per minute incremental protocols for men and women respectively. $\dot{V}O_{2\text{max}}$, cardiac output max (Qmax) and stroke volume max (SVmax) were recorded using the COSMED Quark CPET metabolic cart. Cardiac output was

determined using the Fick principle. Test measure means were grouped by sex and analyzed for significance using a one-way ANOVA. A Pearson's R correlation was performed to determine the association between variables of HCT, LBM, SVmax, Qmax, absolute $\dot{V}O_{2\text{max}}$.

RESULTS: Males showed significantly greater measures of height (177.94 cm ± 5.74 cm vs. 166.6 cm ± 3.1 cm; $p < 0.01$), LBM (63.70 kg ± 7.51 kg vs. 43.85 kg ± 1.90 kg; $p < 0.01$), HCT (46.9% $\pm 3.5\%$ vs. 42.2% $\pm 3.0\%$; $p < 0.05$), absolute $\dot{V}O_{2\text{max}}$ (3.377 L/min ± 0.464 L/min vs. 2.439 L/min ± 0.300 L/min; $p < 0.05$), Qmax (20.4 L/min ± 2.3 L/min vs. 14.84 L/min ± 1.80 L/min; $p < 0.01$) and SVmax (110.1 mL ± 13.5 mL vs. 78.24 mL ± 7.47 mL; $p < 0.01$) compared to females. Pearson's R correlation analysis showed that absolute $\dot{V}O_{2\text{max}}$ (L/min) was positively correlated with Qmax ($R = 0.989$), SVmax ($R = 0.958$) and LBM ($R = 0.777$).

CONCLUSIONS: Sex differences in maximal aerobic capacity should be understood predominantly as a consequence of maximal cardiac output and sex-related differences in body size and lean mass.

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

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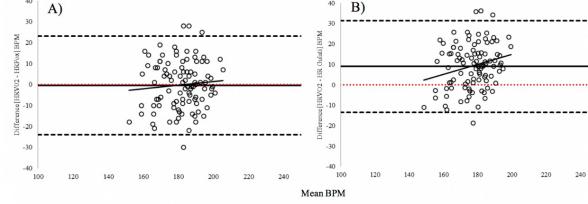
Age-predicted maximal heart rate (APMHR) is an essential measure for health care professionals in determining cardiovascular response to exercise testing, exertion during exercise, and exercise prescription. Although multiple prediction equations have been validated for specific populations, the criterion validity of each for use in a general population requires testing. **PURPOSE:** To evaluate the agreement between measured max heart rate (HR_{max}) with APMHR equations in the general population.

METHODS: HR_{max} from 99 graded treadmill exercise tests (GXT) at a sports performance clinic were attained (age: 38.2±12.4, BMI: 25.6±3.9, $\dot{V}O_{2\text{max}}$: 46.5±10.3). GXTs was terminated once volitional fatigue was achieved and were only included for analysis if RER exceeded 1.10. Five previously established equations were used to predict HR_{max} : Fox (220-age), Tanaka (208 - 0.7*age), Gellish (207-0.7*age), Gulati (206-0.88*age), and Arena (209.3-0.72*age). Bland-Altman plots were used to establish the level of agreement. Univariate ANOVA with pairwise comparisons was performed to assess if differences existed between measured and predicted HR_{max} .

RESULTS: Figure 1 depicts agreement between measured and predicted HR_{max} . A significant main effect was found for HR_{max} between measures ($F_{5,588} = 12.094$, $p < 0.001$). The Gulati equation was significantly different from GXT HR_{max} ($p < .001$). Analysis of Bland-Altman plots revealed minimal bias with similar levels of agreement in all prediction equations with the exception of Gulati (mean difference: 9.3). Slope of the plots show that prediction equations underestimate HR_{max} in individuals with lower measured HR_{max} and vice versa, with the exception of the Fox equation.

CONCLUSION: All prediction equations aside from Gulati may be suitable to predict HR_{max} in a general population. The Fox equation may be superior as it is less likely to under or overestimate based on individual HR_{max} .

Figure 1. Bland-Altman plots showing levels of agreement between HR_{max} during GXT and the Fox (A) and Gulati (B) prediction equations



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

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PURPOSE: To investigate the accuracy of the Hillrunner.com treadmill speed incline conversion chart using ventilatory data, heart rate, subjective perceived effort, and blood lactate. **METHODS:** Two groups of experienced runners, divided based on their self-reported easy run pace, ran at 6 different speed/incline combinations for 5 minutes each. All stages were equivalent according to the HillRunner.com chart, and 1 minute standing rest was given between stages. Group 1 (n=11) ran at inclines up to 4%, while Group 2 (n=22) ran at inclines up to 10%. Oxygen consumption ($\dot{V}O_2$),

respiratory exchange ratio (RER), heart rate (HR), blood lactate (BL), overall rate of perceived exertion (RPE), and leg RPE (LRPE) were measured for each stage. VO_2 was compared against the VO_2 predicted by the ACSM equation (ACSM. VO_2). Stage order was randomized, and repeated-measures ANOVA was used to detect differences between stages and inclines. **RESULTS:** Measures of exercise intensity did not change as incline rose from 0% to 4% in Group 1 ($p>.05$). Increases in VO_2 (42.2±3.6 to 45.9±4.0 $\text{mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$; $p<.05$), HR (146±12 to 151±12 bpm; $p<.05$), BL (1.4±0.9 to 1.9±1.2 mM; $p<.05$) and LRPE (10±2 to 12±2; $p<.05$) were found as incline increased from 0% to 10% in Group 2. When compared with VO_2 , ACSM. VO_2 underestimated oxygen consumption at all inclines up to 8% ($p<.05$). ACSM. VO_2 was similar to VO_2 at an incline of 10% in Group 2 (45.9±4.0 vs. 46.7±2.4 $\text{mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$; $p>.05$). Within subjects, pooled results show moderate correlations between HR and BL at 0% and 2% ($R=0.478$, $R=0.587$; $p<.01$) but not at 4% ($R=0.309$; $p>.05$). Statistically significant correlations were also found between HR and BL at 6%, 8%, and 10% ($R=0.601$, $R=0.560$, $R=0.600$; $p<.01$) in the Group 2 participants. **CONCLUSIONS:** The HillRunner.com chart appears valid at relatively low inclines. However, at higher inclines, the decreases in speed may not prevent increases in exercise intensity as measured with VO_2 , HR, BL, and LRPE. The ACSM VO_2 prediction equation underestimates oxygen consumption in a trained population at inclines up to 8%.

245	Board #61	May 27 9:30 AM - 11:00 AM
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, comprehensive and reliable tests are needed. **Purpose:** The aim of this study was to determine the test-retest reliability of team-sports specific performance tests and to optimize test execution with respect to test quality. **Methods:** Single-limb standing balance (SB_left, SB_right), straight-line sprint over 10 m (SLS_10), foot tapping test over 3 and 15 s (FTT_3 and FTT_15), Countermovement Jump (CMJ) and Drop Jump (DJ) were evaluated. 16 healthy students (8 males, 8 females) participated in the study, which was conducted in two waves with $n=8$ each. From the findings of study 1 (s1), test execution modifications for 3 of 6 tests were defined in study 2 (s2). Therefore SLS_10, FTT_3 and FFT_15 were analyzed with $n=16$. Results of SB, CMJ and DJ refer separately to s1 and s2. Test-retest was assessed on two occasions within 1 week. Reliability was analyzed by use of intraclass correlation coefficient (ICC) and 95%-limits of agreement (LoA). Classification of reliability was based on the following ICC values: <0.5: poor, 0.5 < 0.75: moderate, 0.75 < 0.90: good, >0.90 excellent. **Results:** The overall ICC indicate an excellent reliability for SLS_10 (ICC 0.93; LoA -0.1 to 0.1 s). FTT_15 and FTT_3 show moderate to good reliability (FTT_15: ICC 0.74; LoA -1.4 to 0.8 Hz; FTT_3: ICC 0.77; LoA -1.4 to 0.9 Hz). CMJ demonstrate an excellent reliability for both studies with ICC 0.92 (s1) vs. 0.93 (s2) and LoA -2.5 to 6.2 cm (s1) vs. -1.2 to 4.5 cm (s2). SB_left (s1: ICC 0.66; LoA -139.2 to 199.1 mm; s2: ICC 0.68; LoA -97.6 to 83.8 mm) and SB_right (s1: ICC 0.61; LoA -70.8 to 200.7 mm; s2: ICC 0.67; LoA -81.9 to 111.4 mm) indicate a moderate reliability and DJ a good reliability (s1: ICC 0.77; LoA -5.6 to 7.4 cm; s2: ICC 0.81; LoA -5.2 to 5.4 cm) in both study groups. **Conclusion:** Except for tests of standing balance, all other tests revealed a good to excellent test-retest reliability by use of ICC with SLS_10 and CMJ as the outstanding tests. Test modifications towards s2 led to slight improvements in reliability. However LoA reveal remarkable intra-individual variations between s1 and s2 which should be kept in mind when testing and rating an athlete's performance.

246	Board #62	May 27 9:30 AM - 11:00 AM
Comparison Of Portable Metabolic Analyzers During Walking, Running, And Jogging		
Alex Toulouse ¹ , Patrick Davis ¹ , Dustin Joubert ² , Gary Oden ¹ . ¹ <i>Sam Houston State University, Huntsville, TX.</i> ² <i>Stephen F. Austin University, Nacogdoches, TX.</i>		
(No relevant relationships reported)		

Portable devices that accurately detect the composition of expired gases open new possibilities in research and accessibility of energy expenditure and aerobic capacity measurements.

PURPOSE: The purpose of this study was to compare the O_2 uptake measurements of the VO_2 Master Pro (VM) to the Cosmed K5 (K5) during walking, jogging, and running in field and lab conditions.

METHODS: Twelve proficient runners, with a current 10k pace of 5:19 min/km, performed 3 matched intervals at 3 different speeds (4.82, 8.05, 11.27 kph) on a treadmill and on an outdoor track, while expired gasses were measured. During walking intervals, the VM did not report data for the majority of participants, and were, therefore, excluded from analysis. Jogging and running measurements were analyzed

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 VO_2 (2284 vs. 1320 ml/min at jogging pace; 3,016 vs. 1,880 ml/min at running pace), Ve (51.1 vs. 40.7 ml/min at jogging pace; 71.02 vs. 57.11 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 ($p < .05$). Outdoor running analysis revealed a significant difference in VO_2 (2359 vs. 1354 ml/min at jogging pace; 3295 vs. 1969 ml/min at running pace) and Ve (53.4 vs. 40 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. 69.3 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.

247	Board #63	May 27 9:30 AM - 11:00 AM
Evaluation Of Maximal Oxygen Uptake Using Verification Phases Of Different Intensities Across Fitness Levels		
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(No relevant relationships reported)		

Confirmation of maximal oxygen consumption ($\dot{\text{V}}\text{O}_{2\text{max}}$) has relevance in both clinical and exercise settings. Though there are criteria in place to confirm $\dot{\text{V}}\text{O}_{2\text{max}}$ has been attained, they are inconsistently achieved. For example, a plateau in $\dot{\text{V}}\text{O}_2$ with a corresponding increase in workload is often absent, and other criteria such as a respiratory exchange ratio (RER) ≥ 1.15 or heart rate (HR) within 10 beats per min (bpm) of age predicted maximum can result in an inaccurate estimate of $\dot{\text{V}}\text{O}_{2\text{max}}$. Due to these shortcomings, some researchers have suggested the use of a verification phase (VP) to confirm the attainment of $\dot{\text{V}}\text{O}_{2\text{max}}$. **PURPOSE:** Therefore, this study aimed to provide further evidence for the need to use a VP with $\dot{\text{V}}\text{O}_{2\text{max}}$ testing protocols in populations of different fitness levels. **METHODS:** 49 participants (M: 27, F: 22; 21.9±2.6 y, 24.3±2.8 $\text{kg}\cdot\text{m}^2$) had their $\dot{\text{V}}\text{O}_2$ 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 $\dot{\text{V}}\text{O}_{2\text{max}}$ using norms adapted from American College of Sports Medicine (ACSM) $\dot{\text{V}}\text{O}_{2\text{max}}$ guidelines (poor, fair, good, excellent) resulting in 7, 19, 18, and 5 participants respectively. $\dot{\text{V}}\text{O}_{2\text{max}}$ from the graded treadmill test was confirmed with the VP and/or an additional test if the highest $\dot{\text{V}}\text{O}_2$ value achieved was no more than 2 x typical error (TE: 1.9 to 3.7 $\text{mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ across groups). **RESULTS:** Plateau was achieved on 43/147 tests (29%), RER ≥ 1.15 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 $\dot{\text{V}}\text{O}_2$ value attained on the initial $\dot{\text{V}}\text{O}_{2\text{max}}$ test was not different than either value attained following the VP at 95 or 105% of final $\dot{\text{V}}\text{O}_{2\text{max}}$ test workload or a second repeat test on a separate day ($P>0.211$). The 85% VP $\dot{\text{V}}\text{O}_2$ value was lower than the initial $\dot{\text{V}}\text{O}_{2\text{max}}$ test value ($P<0.001$). **CONCLUSION:** While traditional criteria to confirm the attainment of $\dot{\text{V}}\text{O}_{2\text{max}}$ 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 $\dot{\text{V}}\text{O}_{2\text{max}}$ value attained. Our data also suggests exercise studies employing only a single $\dot{\text{V}}\text{O}_{2\text{max}}$ test should consider these inconsistencies across a range of fitness levels.

248	Board #64	May 27 9:30 AM - 11:00 AM
DOES LOWER EXTREMITY FMS PERFORMANCE PREDICT VERTICAL JUMP HEIGHT IN FEMALE NCAA DIVISION III FOOTBALLERS		
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(No relevant relationships reported)

BACKGROUND: Functional Movement Screening (FMS) is typically used as a pre- and post-sports participation tool that examines the athlete's ability to maintain balance, core strength, range of motion, flexibility and stability, which are all components of optimal sports performance. In FMS, higher scores indicate a greater ability to perform one of seven movement patterns. This study aimed to identify which lower extremity FMS movement patterns (deep squat, hurdle step, in-line lunge, and active straight leg raise) would predict vertical jump height. **METHODS:** Twenty-four members of a NCAA Division III women's soccer team (mean ± SD): (age=19 ± 1 yrs.; height=1.7 ± 0.1 m; BMI=23.6 ± 2.5 $\text{kg}\cdot\text{m}^{-2}$; body fat=29.1 ± 4.3%) volunteered for FMS screening in addition to performance testing including vertical jump. All testing was conducted pre-season. **RESULTS:** This study suggests a relationship between deep squat FMS scores and vertical jump height. Stepwise multiple regressions ($p \leq 0.05$) indicated that there is a direct relationship between vertical jump

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, $p's = 0.82, 0.78, 0.27$ respectively). CONCLUSIONS: 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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(No relevant relationships reported)

The ventilatory threshold (VT) separates moderate intensity (<VT) and heavy intensity (>VT) domains and can be determined using a pulmonary gas exchange system in a laboratory setting. Knowledge of an exercise workload (i.e., velocity during running) in which the VT occurs is useful when prescribing individualized cardiorespiratory exercise. If wireless near-infrared spectroscopy (NIRS) systems could estimate the VT, more environment specific testing results could be obtained. PURPOSE: To investigate if the VT can be estimated via wireless NIRS responses from the medial gastrocnemius (G) or vastus lateralis (VL) during a running graded exercise test (GXT). METHODS: 17 healthy, recreationally active adults (age = 21 ± 4 years, height = 1.68 ± 0.11 m, weight = 66.3 ± 16.8 kg) completed a GXT on a treadmill to volitional fatigue. Every three minutes the velocity was increased by +1 km/hr (starting velocity = 5 km/hr) while the incline remained at 1%. Pulmonary gas exchange and NIRS (G, VL) data were continuously collected. The pulmonary gas exchange data was visually inspected (V-Slope, end-tidal pressures, and ventilatory equivalents) to identify the velocity at which the VT occurred (vVT). The last 15 seconds of NIRS data (G, VL) for each stage were averaged and the velocity at each NIRS threshold (vNIRS-G, vNIRS-VL) were determined by the distance maximum (Dmax) analysis. Concurrent validity of the NIRS thresholds (vNIRS-G, vNIRS-VL) were assessed against the VT (vVT) using Pearson correlation coefficients (r) and standard error of estimate (SEE). Statistical significance was established *a priori* at $p < 0.05$. RESULTS: vNIRS-G was not significantly related to vVT (vNIRS-G = 8.6 ± 1.2 km/hr, vVT = 8.1 ± 1.1 km/hr, $r = -0.08$, $p = 0.769$) and had an SEE of 1.2 km/hr. vNIRS-VL also was not significantly related to vVT (vNIRS-VL = 9.1 ± 1.6 km/hr, $r = 0.313$, $p = 0.221$) and had an SEE of 1.1 km/hr. CONCLUSION: The present results demonstrate poor concurrent validity between the NIRS thresholds and the VT during running exercise. Based upon the present results, it is suggested that the NIRS threshold not be determined by Dmax analysis during running GXT.

250 Board #66 May 27 9:30 AM - 11:00 AM
Maximal Oxygen Consumption Differences Between A Treadmill And A Combined Arm And Leg Ergometer Protocol

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(No relevant relationships reported)

There are different modes of exercise and equipment to measure maximal oxygen consumption ($\dot{V}O_{2\text{max}}$). 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 testing mode for accurate assessment of cardiorespiratory capacity. Purpose: The purpose of this study is to compare the relative $\dot{V}O_{2\text{max}}$ elicited from a common treadmill protocol (TM) to a simultaneous arm and leg ergometer protocol (AL). Methods: Participants completed two $\dot{V}O_{2\text{max}}$ trials, separated by 7-14 days, with the order of the trials randomized. The TM trial assessed $\dot{V}O_{2\text{max}}$ using the Bruce protocol. For the AL trial, participants used an arm and leg ergometer at the same time throughout the duration of the test. Resistance started at 50 watts on the electromagnetically-braked bike ergometer and increased by 30 watts for each two minute stage. The arm ergometer resistance started at 24.5 watts and increased 4.9 watts for each two minute stage. Cadence on the arm ergometer was set at 50 rpm while the leg rpm was self-selected. Results: Thirteen apparently healthy college-aged participants completed both TM and AL assessment trials (21 ± 1.68 , female $n = 9$). There was a difference ($p < .05$) between TM and AL in $\dot{V}O_{2\text{max}}$ ($\text{ml}/\text{kg}/\text{min}$) (45.0 ± 7.3 vs. 42.1 ± 6.7 , respectively), RER ($1.18 \pm .08$ vs. $1.13 \pm .06$, respectively), and completion time (10.9 ± 1.3 vs. 7.5 ± 2.2 min, respectively), with AL values at $93.6 \pm 5.7\%$ (range = 78.8-100.7%) of TM. Peak heart rate was not different between TM and AL (185.7 ± 8.3 vs. 188.3 ± 10.5 min, respectively). Conclusion: A standard treadmill protocol elicited a higher $\dot{V}O_{2\text{max}}$, 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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(No relevant relationships reported)

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

METHODS: Data were obtained from a systematic search of studies reporting temporal trends in handgrip strength for adults aged 20-89 years, and by examining national fitness datasets. Sample-weighted temporal trends were estimated using best-fitting regression models relating the year of testing to mean handgrip strength. International and national trends were estimated by a post-stratified population-weighting procedure. RESULTS: 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 $\dot{V}O_{2\text{max}}$ Of Healthy Active Canadian Men Aged 18-34 Years-old: Preliminary Results

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(No relevant relationships reported)

$\dot{V}O_{2\text{max}}$ 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 $\dot{V}O_{2\text{max}}$ is associated with higher risk of morbidity and mortality as well as low physical performance while higher $\dot{V}O_{2\text{max}}$ levels predict good performance in aerobic sports. Direct measurement of $\dot{V}O_{2\text{max}}$ 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 $\dot{V}O_{2\text{max}}$ using indirect calculation in sub maximal tests. The most commonly used equations are those developed by the American College of Sport Medicine (ACSM) and the research group of Fitness Registry and the Importance of Exercise National Database (FRIEND).

PURPOSE: This study aims to evaluate the accuracy of these two equations to estimate $\dot{V}O_{2\text{max}}$ comparatively to direct O_2 consumption measurement.

METHODS: 30 healthy active men aged between 18-34 years old (BMI: 23.9 ± 2.9 kg/m^2) who are avid runners performed a maximal treadmill test with direct $\dot{V}O_2$ measures ($\text{ml}O_2/\text{kg}/\text{min}$) using a metabolic cart (Vytus CPX). $\dot{V}O_{2\text{max}}$ 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 ≥ 55 y.o.).

RESULTS: Indirect $\dot{V}O_{2\text{max}}$ 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 ; Vytus: 53.0 ± 6.3 ; $p < 0.001$). The mean ACSM overestimation was $13.4 \text{ ml}O_2/\text{kg}/\text{min}$ while FRIEND equation was only $3.5 \text{ ml}O_2/\text{kg}/\text{min}$.

CONCLUSION: The $\dot{V}O_{2\text{max}}$ 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 $\dot{V}O_{2\text{max}}$ estimation formula.

253	Board #69	May 27 9:30 AM - 11:00 AM
Self-selected Music Effects Perceived Exertion But Not Metabolic Indices During VO₂ Max Testing In Women		
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VO₂max testing for research is often conducted in a highly controlled environment with only "encouragement" from testers to help ensure maximal effort is given. It has been hypothesized that music can have an ergogenic effect by either increasing the state of readiness to perform the exercise or create a state of disassociation from the task being performed to increase performance. For this reason, music is often discouraged during athletic testing. While there is a myriad of hypotheses and research on exercise with music, little research exists on the effect of music on optimal VO₂max testing conditions.

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

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

Results: Paired samples t-tests showed no significant difference for TTE (\bar{x} music = 684.18±86.07s; \bar{x} no music = 668.1±81.25s; $p=0.12$), VO₂max (\bar{x} music = 44.45±5.82ml/kg/min; \bar{x} no music = 43.9±7.27ml/kg/min; $p=0.36$), or VT (\bar{x} music = 27.29±6.52ml/kg/min; \bar{x} no music = 26.93±7.03ml/kg/min; $p=0.32$). However, paired samples t-tests revealed significant difference for RPE (\bar{x} music = 13.1±1.58; \bar{x} no music = 14.13±1.48; $p<0.05$) and VAS (\bar{x} music = 10.85±2.29cm; \bar{x} no music = 9.37±2.72cm; $p<0.05$).

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

254	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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Hop testing 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 takeoffs 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 ($r = 0.854-0.960$, $p<0.001$). There were large association between double leg single, double, and triple jumps ($r = 0.908-0.923$, $p<0.001$). There were large associations between single leg single jump and double leg double jump ($r = 0.939$, $p<0.0001$), single leg double jump and double leg single jump ($r = 0.886$, $p<0.0001$), 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 ($r = 0.900$, $p<0.0001$) 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 ($r = 0.905$, $p<0.0001$), 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.

255	Board #71	May 27 9:30 AM - 11:00 AM
ACSM And FRIEND Running Equations, Are They Valid For Healthy Active Women?: Preliminary Results		
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VO₂max 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 VO₂max is associated with higher risk of morbidity and mortality as well as low performance while higher VO₂max predict good performance in aerobic sports. Direct measurement of VO₂max is still the gold standard, however this method presents high cost and required sophisticated equipment. Therefore, several metabolic equations have been developed to estimate VO₂max using indirect calculation. 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: The aim of this study is to evaluate the accuracy of these two equations to estimate VO₂max comparatively to direct O₂ consumption measurement.

METHODS: 21 healthy active women aged between 22-50y.o. (mean: 37.1±7.4) (BMI: 23.0±2.5kg/m²) performed a maximal treadmill test using a metabolic cart (Vynthus CPX) to measure direct VO₂max (mlO₂/kg/min). VO₂max estimation was then calculated using ACSM and FRIEND running metabolic equations. Results were compared using repeated measures T-test. These preliminary results are part of a larger study which includes 180 men and women of all age group and fitness level (18-34, 35-54 and ≥ 55y.o.).

RESULTS: When compared to the direct measurement (Vynthus: 44.9±4.9), only the ACSM equation showed significantly higher results 53.0±6.6)(mean difference: 8.1; $p<0.01$). The FRIEND equation did not significantly differ from the metabolic cart result (45.5±4.7)(mean difference: 0.56; $p=0.5$). In the same direction, ACSM showed a large effect size (Hedge's $g = 1.29$) while Friend only showed a small effect size ($g = 0.11$).

CONCLUSION: The VO₂max calculated with the ACSM equation for running showed overestimated values in our female sample. The average difference between direct and indirect measurement when using the FRIEND equation suggests a better accuracy. More research is needed to evaluate the accuracy in different populations and different fitness level to optimize the VO₂ estimation formula.

256	Board #72	May 27 9:30 AM - 11:00 AM
Comparison Of Peak Lactate Levels Between A Wingate Test And Dune Climb		
Jennifer A. Ostrowski, Thompson C. Paige, Marlene Wenta. <i>Alma College, Alma, MI.</i> <i>(No relevant relationships reported)</i>		

The Wingate cycle test has been a widely accepted and utilized laboratory test to assess anaerobic power. Blood lactate levels measured during tests of maximal exertion, such as the Wingate, provide useful information regarding energy production pathways that are beneficial to training. Research has indicated that blood lactate levels measured during a cycling test may be lower than those measured during a treadmill test. However, we were unable to find research that compared peak blood lactate during a laboratory based Wingate cycle test to peak values immediately following a dune climb sprint. **Purpose:** The purpose of this study was to compare maximum blood lactate levels measured directly following a laboratory based Wingate test v. a sprint dune climb in healthy college subjects. **METHODS:** 11 participants (5 male, 6 female, mean age 201 years) that were enrolled in a cycling spring term course at Alma College voluntarily completed a sprint dune climb (approximately 70 feet uphill at 5% incline) and a Wingate test. Tests were performed 7 days apart to minimize effects of muscle fatigue. Blood lactate levels were measured immediately following cessation of exercise. **RESULTS:** There was no significant difference in maximum blood lactate level achieved between the two tests (w: 7.4±2.13 mg/dL v. dc: 6.35±4.19, $p = .235$). **CONCLUSION:** Peak blood lactate levels achieved following maximal anaerobic exercise does not appear to be altered by mode or environment (laboratory v. field based) in this study.

257	Board #73	May 27 9:30 AM - 11:00 AM	A Comparison Of Female Only Predictive Equations Versus Measured Resting Metabolic Rate Grace O'Connor ¹ , Ben Pike ¹ , Brian Miller ² , Justin P. Guilkey ¹ , Jakob D. Lauver ¹ , Kelly E. Johnson ¹ . ¹ Coastal Carolina University, Conway, SC. ² Mary Baldwin University, Staunton, VA. (Sponsor: William G. Lyerly, FACSM) Email: mgoconno@coastal.edu (No relevant relationships reported)
			Established prediction equations, such as Dore, Garrow and Weber (GW), and Cunningham (CH) were developed to predict resting metabolic rate (RMR) in females. However, these female prediction equations should be reexamined to determine if an update is required. PURPOSE: To examine several well-known female only RMR prediction equations ($RMR_{predict}$) against measured (RMR_{meas}) values in healthy females. METHODS: Fourteen female 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 $\leq 5\%$ of coefficient of variation was defined as the measured resting metabolic rate. A one-way repeated measures ANOVA was used to compare the RMR_{meas} against $RMR_{predict}$ (Dore, GW, and CH). Additionally, Bland Altman Limits of Agreement (LA) were reported as frequency of subjects outside of agreement compared to RMR_{meas} . For significant differences, Cohen's d effect sizes were reported. All results are expressed as $M \pm SD$ with significance set at $p \leq 0.05$. RESULTS: The GW (1408.3 ± 149.3 kcal/day) and CH (1497 ± 135.8 kcal/day) prediction equations did not differ from the RMR_{meas} (1485.4 ± 247.2 kcal/day) ($p > 0.05$). However, significant differences were observed for Dore (1104.5 ± 89.3 kcal/day; $d = 2.71$) prediction equation when compared to RMR_{meas} . 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 RMR_{meas} by $23.8 \pm 9.3\%$. CONCLUSION: Our preliminary data shows that the use of the Dore prediction equation underestimated RMR by 380.9 ± 157.9 kcal/day. Therefore, using this equation to estimate calories in females should be interpreted with caution. Although not statistically different from the RMR_{meas} , 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 RMR_{meas} in a healthy population of females.
258	Board #74	May 27 9:30 AM - 11:00 AM	Validation Of A Novel VO_{2max} Protocol Griffin Keith Green, Thomas S. Lyons, Whitley J. Stone, Danilo V. Tolusso. <i>Western Kentucky University, Bowling Green, KY.</i> Email: griffin.green463@topper.wku.edu (No relevant relationships reported)
			The Bruce treadmill protocol is commonly utilized when assessing maximal oxygen consumption (VO_{2max}). As the Bruce was developed originally for cardiac patients, and its initial stages are very slow coupled with a steep grade, it may not be an appropriate protocol for young or trained individuals with higher levels of cardiorespiratory fitness. Additionally, the steep grade used in the Bruce protocol elicits significant local muscular fatigue, which may cause participants to end the test prior to reaching their true VO_{2max} . 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 present limitations that can induce measurement error and underestimation of VO_{2max} in healthy or well-trained populations. PURPOSE: The purpose of this study is to validate a novel VO_{2max} protocol that may be better suited for healthy or well-trained populations. METHODS: Ten participants performed the Bruce, Astrand, and Novel protocols in a randomized and counterbalanced order with the following maximal values being recorded from each protocol: VO_{2max} , minute ventilation (Ve), respiratory exchange ratio (RER), heart rate (HR), rating of perceived exertion (RPE), and time to exhaustion (TTE). RESULTS: Paired samples t-tests revealed no differences in VO_{2max} when comparing the Novel versus both the Bruce ($p = .151$) and Astrand protocols ($p = .503$). Results from the Bland-Altman Analysis revealed that the Novel protocol exhibited a low degree of bias with tight limits of agreement when compared to the Bruce (mean bias $\pm 95\%$ LOA = 1.102 ± 4.357) and Astrand protocols (mean bias $\pm 95\%$ LOA = -0.440 ± 3.920). Additionally, the Novel protocol resulted in significantly lower TTE when compared to the Bruce ($p < .001$) and Astrand protocols ($p = .001$). CONCLUSION: The Novel protocol produces similar VO_{2max} values to that of the Bruce and Astrand protocols with lower TTE, or test duration, making it a quicker and more effective protocol for this population.
259	Board #75	May 27 9:30 AM - 11:00 AM	Swim Or Run? Comparison Of Flume And Treadmill Maximal Aerobic Capacities In Trained Swimmers Daniel J. Monarrez, Leonardo D. Dominguez, Merry A. Bestard, Veronica L. Pinedo, Cheryl A. Simmons, George H. Crocker. <i>Cal State LA, Los Angeles, CA.</i> (No relevant relationships reported)
			PURPOSE: Treadmill testing and cycle ergometry are the most common modes of exercise testing for assessing maximal aerobic capacity (VO_{2max}). Most sedentary subjects and trained runners have higher VO_{2max} measurements during treadmill testing compared to cycle testing, suggesting mode of exercise affects VO_{2max} . However, trained cyclists attain higher VO_{2max} values on cycle ergometry than treadmill testing due to the specific adaptations of cycle training. Front-crawl swimming is a dynamic exercise involving both upper and lower limbs. The purpose of this study was to determine if trained swimmers have higher VO_{2max} values when swimming compared to running. METHODS: Eight trained swimmers (3 M, 5 F; 21.6 ± 2.9 years) performed VO_{2max} testing on a treadmill and in a swim flume. For the flume test, subjects breathed through a 2-way non-rebreathing snorkel that collected their expired breath for analysis. For the treadmill test, subjects used a mouthpiece, nose clip, and 2-way non-rebreathing valve. For both modes of exercise, the subjects' expired air was collected into a mixing chamber and analyzed by a metabolic cart. The subjects exercised at increasing intensities until volitional fatigue on both tests. Blood lactate was assessed before and after each test. Metabolic measurements and heart rates (HR) were measured continuously and reported as 10-s averages. RESULTS: The subjects had higher VO_{2max} values on the treadmill than in the swim flume (56.2 ± 7.8 vs. 50.6 ± 11.5 ml kg $^{-1}$ min $^{-1}$, $p = 0.034$). At VO_{2max} , minute ventilation, tidal volume, and respiratory frequency were all higher on the treadmill than in the flume. Respiratory exchange ratio and HR were significantly higher following the treadmill test and post-run lactate tended to be higher on the treadmill test ($p = 0.055$). However, oxygen pulse (VO_2/HR), an index of cardiac stroke volume, did not differ between tests, as both VO_2 and HR were lower while swimming. CONCLUSIONS: Results from the study suggest that running elicits a greater cardiovascular demand than swimming even in trained swimmers. This may be due to greater involvement of the larger leg muscles in running than in swimming. Future studies should examine the other three competitive swimming strokes, as they are less efficient than the front crawl and more reliant on the lower body for propulsion.
260	Board #76	May 27 9:30 AM - 11:00 AM	VO_2Max And Ventilatory Threshold Comparison Between Boxing And Arm-crank Exercise Tests Enrique A. Sosa, Francisco Morales-Acuna, Manuel Gomez, Lisa Rodriguez, Paulina Caraveo, Janet Juarez, Alvaro N. Gurovich, FACSM. <i>University of Texas at El Paso, El Paso, TX.</i> (Sponsor: Alvaro N. Gurovich, FACSM) Email: easosa@miners.utep.edu (No relevant relationships reported)
			PURPOSE: Maximum oxygen uptake (VO_{2max}) and ventilatory thresholds (VT) obtained from an exercise test are indicators of functional capacity. Additionally, they can be employed to prescribe exercise and to evaluate the evolution of an exercise program. For upper-body exercise, the arm-crank exercise test is considered the gold standard to estimate VO_2 max. Recently, boxing training has been employed as an upper-body physical activity modality in cardiovascular disease populations to improve health outcomes, such as cardiorespiratory fitness. However, according to the specificity principle of exercise training, changes on physical fitness are better reflected if the same modality of exercise is being used during its assessment. Therefore, the purpose of this study was to compare VO_2 max and VT estimations between boxing and arm-crank exercise test. METHODS: Twelve subjects (8 males, 4 females) performed a boxing exercise test by repeatedly executing the boxing combination of right hook and left hook. A metronome set a tempo for participants to follow throughout the exercise protocol; for males, the metronome started at 140 Beats Per Minute (BPM) and increased by 30 BPM after every stage until exhaustion; for females, the tempo was set to 125 BPM and increased 30 BPM after every 2-minute stage until exhaustion. When performing the arm-crank exercise test, participants pedaled at a range of 50 to 60 revolutions per minute. Male subjects start pedaling at 50 Watts (W) resistance and would increase 15 W at the end of each 2-min stage until exhaustion. Female subjects pedaled at 40 W resistance and would increase by 10 W at the end of each stage until exhaustion. Throughout both exercise tests, VO_2 was constantly recorded. Statistical analysis included Bland-Altman analysis for agreement and Pearson correlation for strength of association. RESULTS: Although VO_2 max and ventilatory threshold showed statistical agreement between both exercise modalities (VO_2 max 95% CI [-7.6 to 6.7], VT 95% CI [-29.1 to 21.4]), clinical agreement was not obtained. Additionally, there was a strong association for VO_2 max ($r: 0.7$, $p < 0.05$) and a weak correlation for VT ($r: 0.2$, $p < 0.05$). CONCLUSIONS: Exercise tests should be specific for the exercise modality that is being used for training.

261	Board #77	May 27 9:30 AM - 11:00 AM
Contrasting Product Claims With Actual Physiological Measurements Of Popular “Exercise” Equipment		
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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) VO_2 was tested at rest and using the equipment with a Jeager MasterScreen CPX metabolic cart (CareFusion Corporation, San Diego, CA). Energy expenditure was calculated simultaneously from heart rate (Polar FT7, Kempele, Finland) (HRM), 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, in the highest setting, for 10 min (EXER). RESULTS: All data are Mean \pm SD. Subjects were 19.1 ± 1.0 y.o., 1.647 ± 0.073 m tall, and weighed 63.09 ± 10.13 kg; resting $\text{VO}_2 = 3.2\pm 0.7 \text{ mL}^{\cdot}\text{kg}^{-1}\text{min}^{-1}$. During EXER, calculated energy expenditure was highest with PED (63.3 ± 7.6 kcal, gross), registering 2099.1 ± 250.5 “steps”; HRM recorded 24.7 ± 7.9 kcal (gross), while ACC recorded 0.8 ± 1.2 kcal (net) during those 10 min. Exercise intensity was measured from VO_2 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 infomercial claim of 277 kcal in 10 min for a lean, small female runner. The actual net energy expenditure while using this equipment, as carefully measured in this study with indirect calorimetry, will result in an insignificant amount of body fat loss, even if used for a full hour every day. Users are advised to save their money and buy two or three good pairs of walking shoes instead.

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262	Board #78	May 27 9:30 AM - 11:00 AM
Constructing A Tool To Assess Orienteer'S Competence		
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<i>(No relevant relationships reported)</i>		

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 orienteers (9 males and 4 females, training experience: 3.6 ± 1.7 yrs., BMI: $21.8\pm 1.8 \text{ kg/m}^2$) were recruited to participate the study. Participants were asked to have 2 runs in the same test course wearing device of Garmin Forerunner® 935/HRM-Tri. The first run mimicked the real competition, which was followed by a second run after enough rest and reviewing the map in detail. Anaerobic threshold (AT: $10.0\pm 2.0 \text{ km/hr}$) and critical velocity (CV: $11.4\pm 2.0 \text{ km/hr}$) were measured in lab 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 exam the mean difference among the first run velocity, the second run velocity, AT and CV. Statistical significant difference is set at $p < .05$. RESULTS: The first run velocity was significantly lower than the second run velocity, AT and CV ($8.5\pm 1.2 \text{ km/hr}$ vs. $9.5\pm 1.5 \text{ km/hr}$, $10.0\pm 2.0 \text{ km/hr}$, $11.4\pm 2.0 \text{ km/hr}$). However, the second run velocity did not different from AT. The % HR_{\max} of the first run was also significantly lower than that of the second run ($85.7\pm 4.3\%$ vs. $89.8\pm 2.6\%$). To further assess individual map-reading ability and physical conditioning, we constructed a four-quadrant analysis tool to interpret the current state and future training direction. Two of participants showed excellent map-reading ability and good physical conditioning, which matched their achievements in formal competition. CONCLUSION: A tool for assessing orienteer's competence was developed. It may be helpful for a coach to prescribe individual training plan or select some talent athletes.

263	Board #79	May 27 9:30 AM - 11:00 AM
Physical Performance Testing For Entry-level Undergraduate Turkish Physical Education Students		
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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 athletic male undergraduate PE students (mean age= 19.5 , $SD=1.5$) individually performed laboratory cardiopulmonary 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 $\text{VO}_2 \text{max}$ was 64.21 mL/kg/min ($SD=7.3$) with a superior age-gender fitness classification ($>55 \text{ mL/kg/min}; >95^{\text{th}}$ percentile). Both the C12RT (Mean= 59.54 mL/kg/min , $SD=7.1$) and SRT (Mean= 60.67 mL/kg/min , $SD=3.8$) correlated with CPET ($p<0.05$). 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 , $SD=6.8$. **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.

264	Board #80	May 27 9:30 AM - 11:00 AM
Effects Of A Race Timer On The 3 Minute All-out Test For Critical Power		
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The Critical Power (CP) model provides a valuable insight into the physiological capacities of an individual to perform work by profiling both aerobic and anaerobic capacities. The 3 Minute All-Out Test for Critical Power (3MT) was developed as a time conscious method for obtaining CP as well as providing insights into the amount of work done above CP (WEP). Concerns about pacing during the test lead researchers to develop a protocol which blinds participants to time during the 3MT. Due to the role that knowledge of time plays in anticipation, pacing, and decision-making during exercise, this protocol may lead to inaccurate results obtained from the 3MT. PURPOSE: To investigate the effects of incorporating a race timer in the 3MT. METHODS: Twelve healthy active males (Age: 24.9 ± 2.2 yrs; Height: $180.4\pm 7.5 \text{ cm}$; Weight $78.1\pm 6.6 \text{ kg}$; VO2peak $53.9\pm 6.1 \text{ mL/kg.min}$) completed one VO2peak test and one 3MT familiarization trial before completing one standard 3MT and one 3MT with the presence of a countdown race timer in a randomized and counterbalanced order. Paired T-tests were used to compare CP, WEP, PPO, Mean Power, Total Work, VO2peak, & HRmax. RESULTS: CP was significantly higher in the timer condition (Timer: $276.7\pm 49.6 \text{ Watts}$ vs. Standard: $267.51\pm 44.54 \text{ Watts}$, $p=0.02$) while WEP was significantly lower in the timer condition (Timer: $12.47\pm 4.01 \text{ kJ}$ vs. Standard: $13.71\pm 4.34 \text{ kJ}$, $p=0.004$). No significant differences were observed in PPO, Mean Power, Total Work, VO2peak, & HRmax between trials. CONCLUSION: These results suggest that the knowledge of time (elapsed or remaining) may have a significant impact on CP and WEP in the 3MT. This impact may be due in part to the role that knowledge of time plays in pacing and decision making, and fits within the framework of the Affordances Competition Hypothesis. These findings warrant further investigation in more experienced cyclists in order to better understand what role knowledge of time plays in the 3MT.

265	Board #81	May 27 9:30 AM - 11:00 AM
Shuttle Run And Performance In Aerobic And Anaerobic Capacities.		
Nathaniel J. Holmgren, Gianna D. Maragliano, Lena Perry, Karlijn B. Roijakers, Courtney D. Jensen. <i>University of the Pacific, Stockton, CA.</i>		
<i>(No relevant relationships reported)</i>		

Field hockey is a physiologically demanding sport with intermittent bouts of aerobic and anaerobic performance. The ability to assess player condition is vital to coaching success. In place of VO_2 , the 20-meter shuttle run test (SRT) is a common alternative for on field determination of a player's aerobic fitness. Limited data supports the

relationship between shuttle run and anaerobic fitness in this population. **PURPOSE:** To determine the accuracy of a shuttle run test (SRT) as a predictor of field hockey performance. **METHODS:** We enrolled 19 D1 field hockey players (18-22 years old) in an 11-week prospective study. Goalies and injured players were excluded from the study. A 6-week program prior to the study consisted of a 20m shuttle run during practice. Speed was gradually increased by 0.5 km/h at a time, each increase in running speed was coded as a change in level. A Polar Pro GPS/heart rate recorder (Polar Electro Inc. Bethpage, NY) recorded effort parameters during 43 practices. Data included time in heart rate (HR) zone 4 (80-89%) (sec), time in HR zone 5 (90-100%) (sec), percentage of HR max (%) total distance covered (m), distance/min (m/min), maximum speed (km/h), number of sprints (acceleration >1.9 m/s²), and distance in speed zone 5 (>19.00 km/h) (m). Bivariate correlations and linear regressions tested relationships between SRT and on-field performance. **RESULTS:** SRT was significantly related to total distance covered ($r=0.090$, $p=0.022$), distance per minute ($r=-0.112$, $p=0.004$), maximum speed ($r=0.097$, $p=0.013$), distance in speed zone 5 ($r=0.119$, $p=0.002$), and number of sprints ($r=0.188$, $p<0.001$). No other relationships were detected. Better performance on the SRT corresponded to more (and more frequent) in-practice sprinting. **CONCLUSION:** Although the SRT may not provide a valid estimate of $\dot{V}O_{2\text{max}}$, it is a valid predictor for many components of on-field performance. It associates with total distance, distance per minute, maximum speed, distance in speed zone 5, and number of sprints in collegiate field hockey players.

266	Board #82	May 27 9:30 AM - 11:00 AM
Stroboscopic Vision-induced Sensory Reweighting During Postural Control		
Hwigeum Jeong, J. Ty Hopkins, FACSM, Seunguk Han, Hyunwook Lee. Brigham Young University, Provo, UT. (Sponsor: Ty Hopkins, FACSM) Email: hwiguem@gmail.com (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 balance tests (jump landing balance and single leg balance) with 3 sets of 10 second, respectively. While the jump landing test has three conditions (eyes-open (EO), and high and low strobe vision (HSV, and LSV) respectively), the single-leg balance has four conditions (EO, HSV, LSV, and eyes-closed (EC)). These two balance tests will be implemented on a firm surface and a foam surface. Main outcome measure were dynamic postural stability index (DPSI) and the center of pressure (COP) excursion with 2 directions (anterior-posterior (A/P) and medial-lateral (M/L)). For the surface conditions, student-t test was used. For DPSI and COP excursion, an analysis of variance with repeated measures was performed to determine difference in balance performance between these visual conditions. **RESULT:** In the jump landing balance, DPSI was greater on the foam than the firm ($p = .0474$). Likewise, in the single leg balance, CoP excursion was greater in both A/P and M/L on the foam than the firm ($p < .0001$). For the vision conditions, in the jump landing balance, DPSI was greater in HSV and LSV than EO ($p = .0100$ and $p = .0013$, respectively). In the single leg balance, CoP excursion was greater in EC, HSV, and LSV than EO ($p < .0001$). Additionally, CoP excursion in EC was greater than HSV and LSV ($p = .0012$ 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 reduced or altered somatosensory function.

267	Board #83	May 27 9:30 AM - 11:00 AM
Anaerobic Power Measurement Tests In Athletes		
Rodrigo D. Pandelo ¹ , Braulio H M Branco ² , Emilson Colantonio ³ , Romeu Candido, Jr ¹ , Domingos R. Pandelo, Jr ¹ . ¹ Centro de Alta Performance, Santos, Brazil. ² UNICESUMAR, Santos, Brazil. ³ UNIFESP, Santos, Brazil. Email: rodrigo.pandelo@hotmail.com (No relevant relationships reported)		

PURPOSE: The aim of the present study is to verify if Countermovement Jump (CMJ) and Countermovement Jump with arm swing (CMJA) can be used as an alternative for anaerobic power measurement in athletes, due to the higher physical and psychological demand demands required by the Wingate test (WAnT).

METHODS: Thirteen individuals were selected, all males and physically active. All participants had reported any known cardiovascular, orthopedic or neuromuscular problems. A protocol familiarization session was held before each test in order to

participants had the opportunity to learn about each protocol. WAnT was performed with 7.5% of the participants' body mass. For all tests data were collected for analysis of Peak Power (PP), Average Power (AP) and Fatigue Index (FI).

RESULTS: The results were as expected as the PP and AP indicators were higher in CMJA compared to CMJ. This was to be expected due to the increased power transfer rate through the use of the arms. The highest power measurements were found in the WanT test, which was also expected. However, when analyzing FI, WanT also has the highest index (6.33% in CMJ, 4.89% in CMJA, and 17.08% in WanT). Comparing 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 WanTxCMJ, 1.17 for WanTxCMJA, and 0.42 for CMJxCMJA. So, can be said that there is large difference, in practical terms, in the first 2 cases, and moderate in the third case

CONCLUSIONS: This study showed that there are significant differences between the 3 anaerobic lower limb power assessments tested (WanT, CMJ and CMJA). Therefore the WanT test should not be replaced by the CMJ and CMJA tests when we are evaluating anaerobic power of the lower limbs, since the existence of significant differences between them, as showed in the effect size analysis (Hedge's g). Remarks can be done in sports that have specific characteristics that recommend the adoption of one or another test, depending on the motor skill and other specific demands

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 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 [$F(2, 169)=511.861$; $p<.001$] with SQ ($\beta=.670$) being the stronger predictor. Eighty-three percent of variance in 1RM SQ is explained by DL and BP [$F(2,169)=415.904$; $p<.001$] with DL ($\beta=.798$) being the stronger predictor. And 71% of variance in 1RM BP is explained by DL and SQ [$F(2, 169)=201.718$; $p<.001$] with DL ($\beta=.624$) showing as the stronger predictor.

CONCLUSION: When taken together, scores from two of the three lifts may predict the score of the third lift. This allows regression equations to be developed for each of the lifts. The following equations were 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.

A-42 Free Communication/Poster - Youth Fitness and Sport

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

269	Board #85	May 27 9:30 AM - 11:00 AM
Relationship Between Academic Ability And Physical Fitness In Elementary And Middle School Students		
Kosho KASUGA ¹ , Takahiro NAKANO ² , Syunsuke YAMAJI ³ , Kazuo OGURI ⁴ , Tamotsu KITABAYASHI ⁵ , Tomoaki SAKAI ² . ¹ Gifu University, gifu, Japan. ² Nagoya Gakuin University, seto, Japan. ³ Fukui University, fukui, Japan. ⁴ Gifu Shotoku Gakuen University, gifu, Japan. ⁵ Tokyo University of Science, Noda, Japan. (Sponsor: Kiyoji Tanaka, FACSM)		
(No relevant relationships reported)		

PURPOSE: The purpose of this study was to clarify the relationship between physical fitness and academic ability of Japanese children. **METHODS:** The participants were 2,417 elementary school 6th graders and middle school 2nd graders. The overall physical fitness assessment determined from eight physical fitness tests was used as the evaluation value (A: Excellent, B: Slightly excellent, C: Standard, D: Slightly inferior, E: Very inferior). For evaluation of academic ability we used the number of correct answers for basic and applied questions in national language and mathematics, national language (basic and applied), mathematics (basic and applied), basic academic ability (national language and math), applied academic ability (national language and math), and the total number of correct answers for all tests were calculated and analyzed. An independence test was applied to verify the relationship between academic ability and physical fitness. **RESULTS:** As a result of the analysis, significant ($p < 0.01$) associations were found between all items of academic ability and the overall physical fitness assessments for elementary and middle school students. Significant χ^2 values were also found for all academic ability items in total number of correct answers by physical fitness evaluations. Residual analysis indicated that the rate of low correct answers was significantly lower, and the rate of high correct answers was significantly higher in children with higher levels of physical fitness. In other words, important evidence has emerged showing that children who have increased physical fitness owing to outdoor play and sports tend to have higher levels of academic ability. **CONCLUSIONS:** Elementary school students tended to have higher academic ability as their overall physical strength was higher. This tendency appears as a remarkable difference in applied academic ability. On the other hand, in middle school students, the academic ability levels of groups A, B, and C were similar. However, the level of academic ability in groups D and E was remarkably low, and it seems that students in the low physical fitness group lacked a positive approach to study.

270	Board #86	May 27 9:30 AM - 11:00 AM
Relationship Between Parental Granting Mobility License And After-school Physical Activity In Children		
Jie Feng, Wendy Y. Huang, Ruirui Xing. Hong Kong Baptist University, Hong Kong, China. (Sponsor: Stephen H.S. Wong, FACSM) Email: 19481233@life.hkbu.edu.hk (No relevant relationships reported)		

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 destinations, travel to other destinations, and active play. Children wore an ActiGraph accelerometer for 8 consecutive days to assess PA accumulated in after-school period during school days. Univariate and stepwise multiple regression analyses were performed to examine the associations between parental granting mobility license (in both overall score and the four domains) and after-school PA.

RESULTS: Ninety-five children (9.1 ± 0.7 years, 53.7% boys) provided valid 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: 0.322 to 1.901) and active play ($B = 1.633$, 95% CI: 0.473 to 2.792), showed significant associations

with after-school MVPA. However, only active play remained significant in the stepwise multiple regression models. Neither the overall score nor the 4 domains of parental granting mobility license was 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.

271	Board #87	May 27 9:30 AM - 11:00 AM
Exercise Capacity Vs. Mobile And Screen Time In Healthy Pediatric Population		
Ronen Bar-Yoseph ¹ , Lydia Shehadeh ¹ , Monnara Hanna ¹ , Merav Zucker-Toledano ¹ , Gur Mainzer ² , Mor Mizrachi-Elizarov ³ , Lee Bentur ¹ . ¹ Ruth Children's Hospital, Rambam Health Care Campus, Haifa, Israel. ² The Baruch Padeh Medical Center, Poriya, Israel. ³ Technion-Israel Institute of Technology, Haifa, Israel. Email: rbaryose@uci.edu (No relevant relationships reported)		

Background: Exercise capacity is related to morbidity and mortality in the general population. Screen time is related to sedentary behavior and physical inactivity in children and adults. There is a paucity of data on screen time vs. exercise capacity using cardiopulmonary exercise test (CPET) in children and adolescents. Our aim was to evaluate and compare exercise capacity using CPET and screen time in healthy pediatric population. **Methods:** Cross-sectional retrospective study assessing daily screen time (questionnaire) and CPET (cycle ergometer). Screen time was analyzed as "total screen time", "mobile devices" (smartphones and tablets) and "sedentary devices" (computer and television). **Results:** Seventy-two healthy non-obese children (mean age 13.6 ± 3.4 y/o, 47% Female, BMI^{1/2}tile 50 ± 30.3) were evaluated. Peak oxygen uptake (peak $\dot{V}O_2$ %predicted) was preserved (mean peak $\dot{V}O_2$ %pred $98.8 \pm 19.2\%$). A negative correlation was found between peak $\dot{V}O_2$ and "total screen time" ($r = -0.32$, $p < 0.007$) and peak $\dot{V}O_2$ and "mobile devices" ($r = -0.33$, $p < 0.004$) while no correlation was found for "sedentary devices". **Conclusions:** "Mobile devices" and "total screen time" were negatively correlated with exercise capacity in pediatric healthy population. Children and adolescents should be encouraged to decrease daily screen time and highlight mobile technology. Larger longitudinal studies are needed to better study the impact of screen time on morbidity in children.

272	Board #88	May 27 9:30 AM - 11:00 AM
Comparing $\dot{V}O_{2\text{max}}$ Assessed By The 20-m Shuttle-run And Maximal Treadmill Test In Adolescents With Obesity		
Bryan L. Haddock, FACSM ¹ , Raphael Mendes Ritti-Dias ² , Jason Ng ¹ , Joao Paulo Botero ³ , Breno Quintella Farah ⁴ , Wagner Luiz do Prado ¹ . ¹ California State University, San Bernardino, San Bernardino, CA. ² Universidade 9 de Julho, São Paulo, Brazil. ³ Universidade Federal de São Paulo, Santos, Brazil. ⁴ Universidade Federal Rural de Pernambuco, Recife, Brazil. Email: bhaddock@csusb.edu (No relevant relationships reported)		

Cardiorespiratory fitness (CrF) is a strong predictor of health. The 20-m shuttle-run test is widely used to estimate CrF in children. However, it is not clear if it provides reliable data in adolescents with obesity.

PURPOSE: To compare CrF assessed by the 20-m shuttle-run test and a maximal graded exercise test (GXT) in adolescents with obesity.

METHODS: Thirty-seven adolescents (16 boys: 15 ± 2 y, 32.5 ± 2.9 kg·m⁻² and $41.9 \pm 6.6\%$ fat and 21 girls: 15 ± 2 y, 34.6 ± 3.3 kg·m⁻² and $48.5 \pm 8.5\%$ fat) underwent two CrF assessments on different days (7-days wash-out between). For the 20-m shuttle-run test, adolescents were instructed to run between two points separated by 20 meters at a predetermined pace that started at 8.5 km·h⁻¹ and increased by 0.5 km·h⁻¹ until the participant failed twice to keep up with an auditory signal or reached exhaustion. Maximum oxygen uptake ($\dot{V}O_{2\text{max}}$) was estimated using Barnett and colleague's equation. For the GXT, participants exercised on a treadmill with a speed that started at 3.0 km·h⁻¹ and increased by 1.0 km·h⁻¹ each minute until failure. During the GXT, $\dot{V}O_2$ was measured using open circuit spirometry.

RESULTS: Estimated $\dot{V}O_{2\text{max}}$ was higher in the shuttle-run test (33.4 ± 4.6 ml·kg⁻¹·min⁻¹) compared to the GXT (24.6 ± 6.7 ml·kg⁻¹·min⁻¹, $p < 0.01$). Estimated $\dot{V}O_{2\text{max}}$ obtained in the shuttle-run test was not related to $\dot{V}O_{2\text{max}}$ obtained in the GXT ($\rho = -0.03$; $p = 0.85$). However, the $\dot{V}O_{2\text{max}}$ obtained in GXT was associated with final speed ($\rho = 0.58$; $p < 0.01$) and number of completed stages ($\rho = 0.59$; $p < 0.01$) on the shuttle-run test.

CONCLUSIONS: Performance indicators from the 20-m shuttle-run test are significantly associated with directly measured $\dot{V}O_{2\text{max}}$. However, the predictive equation to estimate $\dot{V}O_{2\text{max}}$ based on 20-m shuttle run test is not adequate for adolescents with obesity.

273	Board #89 Pilot Study Of A 12 Week Intervention (AERIAL®) To Teach Youth To Head The Ball Safely	May 27 9:30 AM - 11:00 AM
	Sara PD Chrisman ¹ , Rachel Hays ² , Roger Levesque ³ , Christine MacDonald ¹ , Stanley A. Herring, FACSM ¹ , Samuel R. Browd ¹ . ¹ The Sports Institute at UW Medicine, Seattle, WA. ² Seattle Children's Research Institute, Seattle, WA. ³ VICIS, Seattle, WA. (Sponsor: Stanley Herring MD, FACSM)	
	Email: sara.chrisman@seattlechildrens.org	
	Reported Relationships: S.P. Chrisman: Receipt of Intellectual Property Rights/Patent Holder; The AERIAL program was co-developed by The Sports Institute at UW Medicine and VICIS and both hold ownership. No fees are associated with this program.	
	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 (4.60/5, SD 0.28), parents (4.52/5, SD 0.86), and coaches (3.83/5, SD 0.55). Heading confidence significantly improved in females in both games and practice from baseline to 6 weeks (Wilcoxon matched-pairs signed rank, p=0.0033 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.	
274	Board #90 Effects Of Athletic Performance Training On Injury Prevention And Psychosocial Health In Female Adolescent Athletes	May 27 9:30 AM - 11:00 AM
	Calvin L. Cole, Kostantinos Vasalos, Gregg Nicandri, Michael D. Maloney, Edward M. Schwarz. <i>University of Rochester, Rochester, NY.</i> (Sponsor: Leslie Brandon, FACSM)	
	Email: calvin_cole@urmc.rochester.edu	
	(No relevant relationships reported)	
	Two major health concerns with female adolescent athletes are psychosocial wellness and sports-related injuries. It is also known that these health concerns are much greater for minority students who attend high school in economically depressed cities.	
	PURPOSE: To complete a pilot study on urban underrepresented minority and suburban female high school athletes, to determine the feasibility and utility of using Functional movement screening (FMS) to assess injury risk and Patient-Reported Outcomes Measurement Information System (PROMIS) to assess psychosocial health in this population during 10-weeks of athletic training.	
	METHODS: In this feasibility pilot study, female student-athletes from an urban minority high school (n=10) and suburban high schools (n=10) were recruited into a 10-week athletic training study. The primary goals of this study were to: 1) recruit and retain the human subjects throughout the study period, 2) evaluate global health (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: Fifteen students completed the 10-week training, and no adverse events of the training or study were reported. Anxiety (45.8 ± 7.4 vs. 41.4 ± 7.0 , $p=0.006$), peer relationships (51.5 ± 6.8 vs. 54.1 ± 6.5 , $p=0.02$), pain interference (47.0 ± 6.4 vs. 44.1 ± 7.8 , $p=0.02$), were significantly improved, while depression (47.0 ± 7.9 vs. 44.1 ± 6.8 , $p=0.08$) trended towards significance. Bench Press (70.2 ± 10.7 vs. 82.0 ± 13.9 , $p=0.0009$), Pro Agility (5.8 ± 0.5 vs. 5.4 ± 0.4 , $p=0.005$), and Total FMS (20.3 ± 4.6 vs. 30.4 ± 4.5 , $p<0.0001$) were all significantly improved. Surprisingly, 10 students (67%) were in peril of sports-related injury (FMS<14) at the start of the program, and all but 1 (90%) eliminated this serious risk factor.	

CONCLUSION: PROMIS and FMS are effective outcome measures to quantify changes in psychosocial wellness and sport-related injury risk in high school female athletes. In addition, exercise improves mood and overall health. Supported by William & Sheila Konar Foundation

275	Board #91 An Investigation Of Factors Predicting Injury Among Adolescent Softball Players	May 27 9:30 AM - 11:00 AM
	Chelsea Martin ¹ , Kaylee Pobocik ¹ , Mallory Faherty ² , Srikant Vallabhajosula ¹ , Mary Kay Hannah ¹ . ¹ Elon University, Elon, NC. ² Duke University, Durham, NC. (Sponsor: Dr. Stephen Bailey, FACSM)	

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(No relevant relationships reported)

Upper extremity (UE) injury risk is a concern among adolescent softball players. Previous studies have found injury rates among adolescent softball players to be between 0.95 to 5.6/1000 athlete exposures. Few studies exist that investigate that seek to predict injury in adolescent softball players via musculoskeletal characteristics (MSC) or outcome measures. Understanding factors that can predict injury is important to clinicians for mitigating injury risk. **PURPOSE:** To investigate which MSC and outcome measures can predict injury in adolescent softball athletes. **METHODS:** 67 adolescent softball athletes participated (Age: 15.8±3.3 years). MSC and outcome measures were assessed prior to the start of the high school season, and each athlete was interviewed at the mid-season (8 weeks) and end of season (16 weeks) time points to update injury status. For MSC, the dominant side throwing UE and ipsilateral hip were established. ROM assessments included internal (IR), external rotation (ER), and total range of motion (TROM) of glenohumeral and hip joints. Strength included IR and ER of glenohumeral and hip joint, and hip abduction. Flexibility assessments included pectoralis minor length, and posterior shoulder tightness. Postural measurements included forward head posture and forward shoulder posture. Outcome measures included the QuickDASH with Sport Module, the Kerlan-Jobe Orthopaedic Clinic Shoulder and Elbow questionnaire (KJOC), and the Functional Arm Scale for Throwers. A ROC curve analysis was performed to assess all aforementioned variables and outcome measures ability to predict injury. **RESULTS:** 27 participants experienced an injury from the mid-season to end-season. The QuickDASH Sport Module displayed fair accuracy to predict injury (Area under curve = 0.721). All other measurements had either poor accuracy or failed to predict injury altogether (Area under curve < 0.7). **CONCLUSION:** The QuickDash Sport Module may be used prior to the start of the season as a tool to identify those at a greater risk of injury with caution. Further research is needed to investigate predictors of injury among the softball adolescent population with increased sample size and considering differences among those who play year around, specialize in softball, or amongst different positions.

276	Board #92 Does The Mixed Relay Triathlon Affect Respiratory Function In Healthy Junior Triathletes?	May 27 9:30 AM - 11:00 AM
	Michael D. Kennedy ¹ , Scott C. Forbes ² , Joao Henrique Falk Neto ¹ . ¹ University of Alberta, Edmonton, AB, Canada. ² Brandon University, Brandon, MB, Canada. (Sponsor: Darren DeLorey, FACSM)	

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(No relevant relationships reported)

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

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

277 Board #93 May 27 9:30 AM - 11:00 AM

Dynamic Warm-up Effects On Maximal Treadmill Exercise Performance In Children: A Pilot Study

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Dynamic warm-up protocols (DWP) consisting of moderate- and high-intensity exercise movements have been found to enhance strength and power performance in youth; however, the effects of DWP on maximal treadmill exercise performance in children are unclear. Prior to pediatric exercise testing participants typically perform low-intensity treadmill walking (TW). **PURPOSE:** To compare the effects of a DWP with a TW warm-up protocol on maximal exercise performance in children. **METHODS:** 11 healthy children (10.8 ± 1.5 yrs) were tested for peak oxygen uptake (VO_2peak) on 2 nonconsecutive days following different 6 min warm-up protocols performed in random order. DWP consisted of 9 progressive body weight movements including dynamic stretches, lunges, hip bridges, and jumps whereas the TW protocol consisted of walking on a motor-driven treadmill at 2.2 mph and 0% grade. Comparisons between trials were made with a paired t-test. **RESULTS:** VO_2peak was significantly higher ($p=0.04$) following DWP than TW (56.9 ± 9.1 vs 52.7 ± 9.4 ml/kg/min) and a trend ($p=0.08$) towards greater maximal heart rate was noted following DWP vs TW (192.5 ± 7.5 vs 190.9 ± 7.1 bpm, respectively). No significant differences between DWP and TW trials were observed for maximal minute ventilation (70.7 ± 17.5 vs 64.0 ± 10.4 L/min, respectively), maximal respiratory exchange ratio (1.08 ± 0.05 vs 1.08 ± 0.07 , respectively) and total exercise test time (640.9 ± 77.8 vs 638.0 ± 97.4 sec, respectively). No order effects between test day 1 and test day 2 were observed for any variable. **CONCLUSIONS:** These findings indicate that the design of the warm-up protocol can influence the cardiopulmonary responses to maximal treadmill exercise and that a DWP can result in a higher VO_2peak than a low intensity TW protocol in healthy children.

278 Board #94 May 27 9:30 AM - 11:00 AM

Differences Of Children's Physical Fitness Between Villages And Cities In Middle China

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(No relevant relationships reported)

PURPOSE: Physical fitness during childhood is an important indicator of current and future health. School-based physical activity (PA) outcomes may be mediated by physical self-concept. Low physical self-concept may negatively impact PA engagement, compromising childhood and adolescent physical fitness, which may translate into adulthood. To establish the physical fitness of children in middle China, and examine differences between boys and girls for physical self-concept, and engagement in school-based and extra-curricular PA.

METHODS: 456 (girls =223) healthy primary school participants were chosen, and the average age is 7.1 ± 0.3 y. Demographics questionnaires and fitness assessment were performed to identify the differences of physical fitness between the villages and city children in the middle of China. Physical self-description questionnaire were asked to answer 'yes' or 'no' to whether they participated in school-based and extra-curricular PA.

RESULTS: The results showed in table 1Table 1 The physical fitness differences between villages

Variables	Girls		Boys	
	Villages	Cities	Villages	Cities
Standing long jump (cm)	95.1±18.2	91.2±21.3	104.6±13.8	106.1±17.0
Tennis ball throwing (m)	6.2±2.2	6.4±2.4	9.4±2.7*	7.3±2.4
Sit-and-reach (cm)	8.7±4.4	8.2±4.6	8.1±3.8*	6.3±4.4
Turn back to run (s)	7.1±0.7	6.9±1.1	6.7±0.9	6.6±1.1
Walking on the balance beam (s)	7.7±5.6	8±4.4	5.8±4.5	5.9±2.1
Continuous foot jump (s)	6.9±2	6.6±1.4	5.9±1.8	6.1±1.2

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

279 Board #95 May 27 9:30 AM - 11:00 AM

Sprint Speed And Musculoskeletal Fitness Test Performance In Youth

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(Sponsor: Dr. Dale Brown, FACSM)

(No relevant relationships reported)

Sprint speed is a common focus of adult strength and conditioning programming and research. However, the links between sprint speed and other tests of musculoskeletal fitness (MSF) have not been extensively studied in youth. **PURPOSE:** To investigate the relationship between sprint speed and tests of jumping performance, muscular strength/endurance, agility, and anaerobic capacity in children and adolescents.

METHODS: The analysis included 402 boys and 148 girls (ages 7 to 18 years) participating in a baseline MSF evaluation. Sprint speed was assessed via a 10-yard and 20-yard sprint. Agility and anaerobic capacity were assessed via the pro-agility and 200-yard shuttle run, respectively. Muscular strength and endurance were assessed by maximal number of chin-ups and jumping performance was assessed via the vertical jump, broad jump, and 5-hop jump tests. Pearson correlations were used to determine the associations between each fitness test relative to the 10- and 20-yard sprints, controlling for age and sex. **RESULTS:** Correlations were generally larger between 20-yard dash and other MSF tests than for the 10-yard dash. For example, the strongest correlation with both sprints was the pro-agility test, with $r = 0.755$ ($p < 0.001$) for the 20-yard sprint and $r = 0.655$ ($p < 0.001$) for the 10-yard sprint. Similar associations were found between the sprints and the 200-yard shuttle run, with correlations of $r = 0.758$ ($p < 0.001$) and $r = 0.640$ ($p < 0.001$) for the 20-yard and 10-yard dashes, respectively. While similar, the broad jump ($r = -0.657$ [$p < 0.001$]) had a slightly better correlation with the 20-yard sprint than either the vertical jump ($r = -0.633$ [$p < 0.001$]) or 5-hop test ($r = -0.629$ [$p < 0.001$]). The chin-up test had the smallest correlation with 20-yard sprint speed out of the MSF battery ($r = -0.414$ [$p < 0.001$]). **CONCLUSIONS:** Stronger relationships to the 10- and 20-yard sprints were found for the agility and anaerobic capacity tests compared to all MSF tests; however, all the MSF tests had greater associations to the 20-yard sprint overall. All three jumping tests were similarly associated with sprint speed. Future research is needed to determine if interventions targeting these MSF tests would lead to proportional alterations in the sprinting speed of youth.

280 Board #96 May 27 9:30 AM - 11:00 AM

Measurement Properties Of Agility And Movement Skill Assessment In Children: A Rasch Analysis

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(No relevant relationships reported)

PURPOSE: To investigate the measurement properties (including rating scale performance, unidimensionality, and differential item functioning) of the motor quotient scale of Chinese version of Agility and Movement Skill Assessment(AMSA) in children, by using the Rasch analysis.

METHODS: A total of 1116 children (aged 7 to 9 years, 51.3% boys) were recruited in China for this prospective study. Each child was evaluated with the AMSA that consists of 28-item motor scale. Construct validity of the Chinese version of AMSA was investigated using Rasch analysis, whereas inter-rater and test-retest reliabilities were evaluated using Kappa coefficients ($n=12$).

RESULTS: The result indicated that the Kappa coefficients for the interrater and test-retest reliabilities were 0.81 (ranging from 0.76 to 0.99) and 0.87 (ranging from 0.80 to 0.99), respectively. No ceiling or floor effects were observed and only one item exhibited misfit to the Rasch model expectations. Item 24 "Dribbling2" exhibited marginal misfit (outfit =1.38), but it did not affect the unidimensionality of the scale. **CONCLUSIONS:** The Chinese version of the AMSA demonstrated satisfactory measurement properties. It showed good indicators of validity and reliability to be used for the assessment of motor quotient of children for 7-9 years old.(This study was supported by NPOPSS Grant 15CTY011)

item	M	Dif	Infit	Outfit
CMS1:Jumping1	0.94	-3.25	1.01	0.88
CMS2:Jumping2	0.94	-3.32	1.00	0.88
CMS3:Sliding1	0.87	-2.11	1.00	0.97
CMS4:Sliding2	0.92	-2.92	1.02	0.83
CMS5:Catching1	0.62	-0.62	1.00	0.99
CMS6:Throwing1	0.39	0.58	1.00	0.97
CMS7:Hopping1	0.65	-0.88	1.01	1.00
CMS8:Hopping2	0.78	-2.00	1.00	0.94
CMS9:Climbing1	0.64	-0.65	1.00	1.00
CMS10:Climbing2	0.87	-2.40	0.99	1.07
CMS11:Skipping1	0.72	-1.03	1.00	0.99
CMS12:Skipping2	0.88	-2.20	0.99	1.04
CMS13:Balancing1	0.83	-1.83	0.98	1.06
CMS14:Balancing2	0.66	-0.74	1.00	1.02
CMS15:Moving1	0.76	-1.30	0.99	1.01
CMS16:Moving2	0.68	-0.95	1.00	1.00
CMS17:Catching2	0.53	-0.18	0.99	1.01
CMS18:Throwing2	0.47	0.15	0.99	1.05
CMS19:Controlling1	0.33	0.89	1.01	0.96
CMS20:Controlling2	0.61	-0.60	1.01	1.01
CMS21:Rolling1	0.55	-0.21	1.00	1.00
CMS22:Rolling2	0.77	-1.33	1.00	1.01
CMS23:Dribbling1	0.66	-0.75	1.00	1.02
CMS24:Dribbling2	0.89	-2.85	0.94	1.36
CMS25:Rolling3	0.73	-1.14	1.01	0.96
CMS26:Rolling4	0.88	-2.27	0.97	1.15
CMS27:Kicking1	0.48	0.11	1.00	1.01
CMS28:Kicking2	0.44	0.30	1.00	1.01

281 Board #97 May 27 9:30 AM - 11:00 AM

The Influencing Factor Of Chinese Adolescents' Scientific Fitness Literacy

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(No relevant relationships reported)

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 ± 5.81 yrs, 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 ($F_{(1,4661)}=80.224$, $P=0.000<0.05$), females (28.60±3.69) were higher than males (27.58±4.07); (2) Age differences ($F_{(2,4660)}=30.332$, $P=0.000<0.05$), 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 (26.75±4.43); (4) Region differences ($F_{(2,4660)}=11.165$, $P=0.000<0.05$), CR (28.63±3.84)>WR (28.15±3.76)>ER (27.85±4.13); (5) Differences of exercise patterns ($F_{(3,4659)}=205.194$, $P=0.000<0.05$), regular exercise (30.09±3.96)>less regular exercise (28.70±3.51)>occasional exercise (27.92±3.42)>no exercise (25.94±4.00). **CONCLUSIONS:** Age, gender, education, region and exercise patterns are the main factors affecting the Chinese adolescents SFL. Female's SFL is higher than males, pre-youth than juveniles, and CR and WR are higher than ER. The higher education levels, SFL can; the more regular the exercise, SFL can. (3# is corresponding author)

282 Board #98 May 27 9:30 AM - 11:00 AM

Exercise Type, Physical Activity Level And Bmi: Association With Cardiorespiratory Fitness In Adolescents

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(No relevant relationships reported)

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

METHODS: Descriptive correlational study, conducted with 350 adolescents (16.26 ± 0.66 years old), from Curitiba, Brazil. Gender, age, type of exercise (sport practice, other type of exercise practice, or not engaged in any type of physical exercise) and physical activity level (at least 420 minutes a week) were evaluated through self-reported questionnaires. The BMI was calculated using kg/m^2 equation. The pacer physical test was applied to evaluate the cardiorespiratory fitness ($\text{VO}_{2\text{max}}$). Poisson regressions, with robust variance, adjusted for gender and age, were calculated to verify the variables associated with $\text{VO}_{2\text{max}}$, adopting $p<0.05$. **RESULTS:** Adolescents who practiced sports had a 2.04 times higher prevalence of having $\text{VO}_{2\text{max}}$ in the healthy zone (PR: 2.04; 95% CI: 1.21-3.44) than those who did not exercise. The $\text{VO}_{2\text{max}}$ 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 $\text{VO}_{2\text{max}}$ (PR: 1.56; 95% CI: 1.02-2.41) than those who were classified as insufficiently active. BMI showed no significant associations with $\text{VO}_{2\text{max}}$. **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.

283 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

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PURPOSE: To determine the influence of under- or overweight and obesity on force and power production as well as on lower limb asymmetry.

METHODS: A cross-sectional study including 14- to 15-year-old adolescents was performed. Anthropometric measures and 20-m sprint time were measured and countermovement jump (CMJ) was measured. Force and power production were determined using a portable force plate.

RESULTS: CMJ and 20-m sprint performances were significantly influenced by BMI categories (both, $p<0.001$), with obese subjects performing worse than their normal weight counterparts. Peak force and peak power were significantly higher ($p < 0.001$), especially in obese adolescents, whereas relative peak power was worse in overweight and obese adolescents ($p < 0.001$). Multiple regression analysis revealed that 66.3% of the variance in CMJ and 70.0% of the variance in 20-m sprint may be predicted by gender, body fat percentage, peak force and power. In 13.6% of the participants, limb asymmetries above 15% were detected when limb symmetry index (LSI) was calculated using peak force as underlying factor, whereas only 4.5% had asymmetries in power production between left and right leg. LSI_{power} was higher in obese when compared to underweight children ($p = 0.040$).

CONCLUSIONS: Findings of variations in peak force and power between body composition categories, with obese subjects having lowest performance scores, particularly when results are expressed in relation to body mass. Most importantly, a slightly higher LSI was detected among obese adolescents adding to the deleterious effects of childhood obesity on health.

284	Board #100	May 27 9:30 AM - 11:00 AM
Physical Fitness In Relation With Attention Capacity In Latin-american Youth With Overweight And Obesity		
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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. Lineal regression and moderation analyses were conducted.

Results: Linear regression analysis adjusted for potential confounders (age, sex, body fat, peak height velocity, mother education and study [i.e., Active-Start or HEPAFIT]) revealed association between speed agility ($\beta=-.7$; $p=0.030$) and cardiorespiratory fitness ($\beta=4.5$; $p<0.001$) 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.

285	Board #101	May 27 9:30 AM - 11:00 AM
Impact Of School Fitness Environment On Children'S Fitness: A Mixed Method Study		
Zhiyuan Ma. UIUC, Urbana, IL. (Sponsor: Weimo Zhu, FACSM) Email: zym61801@gmail.com (No relevant relationships reported)		

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

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

RESULTS: A total 219 students (106 boys, 113 girls) in School A and 235 students (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 comparing with their rating and some discussions, School A was rated having a better school fitness environment and students' fitness performance (running time in seconds) and corresponding t-test comparison further supported the observation:

	School A	School B	P
Boys (1000-M in s)			
Total	234.0 ± 28.4	242.5 ± 30.8	<.05
HSEE Good & Above	221.4 ± 14.5	227.1 ± 11.8	<.05
Girls (800-M in s)			
Total	216.1 ± 22.6	231.0 ± 27.8	<.05
HSEE Good & Above	211.3 ± 14.4	215.6 ± 13.1	<.05

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.

286	Board #102	May 27 9:30 AM - 11:00 AM
Physical Activity, Physical Fitness And Body Mass Index Among Elementary School Children In The Arctic Area		
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The World Health Organization recommends that children accumulate at least 60 minutes of moderate-to-vigorous-intensity physical activity (MVPA) daily. However, knowledge about the association between physical activity (PA), physical fitness and body mass index (BMI) among elementary school children in the Arctic is limited.

PURPOSE

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

METHODS

Elementary school children in 1st, 3rd, 5th and 7th grade were 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 by using Test of Physical Fitness (Fjørtoft et.al. 2011) consisting of a nine-item compound motor activity score that includes various combinations of endurance, strength, agility, balance, and motor coordination, which is calculated as total physical fitness based on z-scores. BMI (kilogram/height²) was used as body composition measure.

RESULTS

In total, 94 (43%) of 216 the children reached the recommendation of 60 min MVPA per day. There was a significant difference ($p<0.001$) in total physical fitness score between boys (3.01) and girls (-2.35). A positive association between physical fitness score and reaching the PA recommendations was observed in 3rd, 5th and 7th grade ($p<.05$). BMI was inversely associated with physical fitness in 5th and 7th grade ($p<0.05$) but not in 1st and 3rd grade. There was no significant association between those who achieved the PA recommendations and BMI.

CONCLUSION

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

287	Board #103	May 27 9:30 AM - 11:00 AM
Talk Test As A Measure Of Exercise Intensity In Children		
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INTRODUCTION: The Talk Test (TT) is a well-accepted measure of exercise intensity and is a useful surrogate of ventilatory (VT) and respiratory compensation (RCT) thresholds in sedentary, fit, athletic, and cardiac populations. Recently, the TT has also been shown to reflect these same markers in children. **PURPOSE:** The present study was designed 1) to replicate TT results during incremental exercise in children, and 2) to evaluate the ability of the TT to predict when the subjects would be above (-TT) or below (+TT) VT intensity during interval exercise. **METHODS:** Healthy pre-pubertal children (5m, 5f) were studied using the TT and gas exchange during incremental exercise to determine the match between TT stages and VT. Another group of healthy pre-pubertal children (7m, 6f) were studied both during incremental and stochastic exercise, in order to determine how well TT responses during stochastic exercise predicted whether the children were above or below VT.

RESULTS: During incremental exercise, there was good correspondence between the VO_2 @ VT and the VO_2 @ 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

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.

- 288** Board #104 May 27 9:30 AM - 11:00 AM
Abstract Withdrawn

- 289** Board #105 May 27 9:30 AM - 11:00 AM
Effect Of Exercise Intervention On Physical Fitness Factors In Elementary School Children
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Sports have been very popular after-school activities for children. It is quite likely that sports have a positive effect on child growth in many ways. The Ministry of Education, Culture, Sports, and Technology of Japan has reported that the total scores of physical fitness tests differ greatly between those who exercise regularly and those who do not. However, it is not clear how exercise habits affect physical fitness factors during childhood. Such detailed knowledge would be useful in promoting long-term athlete development and improving physical fitness throughout life. **PURPOSE:** To explore the effect of exercise intervention on physical fitness factors in elementary school children. **METHODS:** The subjects of this study were 1,079 1st- to 6th-grade male elementary school students. A questionnaire survey was conducted to investigate the exercise and lifestyle habits and the results of physical fitness tests conducted at Japanese elementary schools. The existence or not of exercise habits after-school activities and the results of physical fitness tests were used for the analysis. The physical fitness test includes measurements of grip strength, sit-ups, sitting front stretches, side steps, twenty-meter shuttle run, fifty-meter run, standing long jump, softball throw, height, and weight. **RESULTS:** There were no significant differences between grades in the existence or not of exercise habits about height and weight. After the 3rd grade, children with exercise habits showed higher performance on sit-ups, side steps, the twenty-meter shuttle run, the fifty-meter run, and softball throw than children with no exercise habits. There was little difference in grip strength, sitting front stretches, and long jump between children with exercise habits and those without. **CONCLUSION:** Endurance, speed, and agility develop greatly in elementary school children who exercise regularly. However, exercise habits have little effect on single strength and power. In addition, differences between children with and without exercise habits are observed after the 3rd grade.

- 290** Board #106 May 27 9:30 AM - 11:00 AM
Changes In Cardiorespiratory Fitness Among Children In The Hearts And Parks Healthy Lifestyle Intervention
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(No relevant relationships reported)

In children, resting heart rate (RHR) and heart rate recovery (HRR) serve as markers of cardiorespiratory fitness (CRF), predicting future cardiovascular morbidity and mortality risk. The 2018 Physical Activity Guidelines for Americans recommends children should engage in at least 60 minutes of daily, moderate-to-vigorous exercise. However, less than one-quarter of children in the U.S. meet this recommendation. The Hearts and Parks randomized controlled trial utilizes a novel clinic-community intervention consisting of clinic-based behavioral support and nutrition education, as well as physical activity through the Bull City Fit program for children 5-17 y with a body mass index (BMI) $\geq 95^{\text{th}}$ percentile. One aim of the trial is to assess the efficacy of the intervention for improving CRF.

PURPOSE To examine the effect of the Hearts and Parks intervention program on RHR and 1-min HRR.

METHODS To date, 49 participants (age: 9.9 ± 3.3 y; non-Hispanic: 61%; males: 45%) completed ≥ 6 months of the Hearts and Parks intervention program and were included in this preliminary analysis. Pre- and post-intervention anthropometric and physical fitness assessments occurred at Duke Children's Primary Care Clinic. CRF was assessed via the 3-min YMCA Bench Stepping Test, adapted for children 5-18. Heart rate was measured via pulse-oximetry prior to the test (RHR), immediately upon test completion, and 1-min after the test. HRR was calculated as the difference between the 1-min post-test and immediate post-test values. Gender-specific paired t-tests were used to determine whether post- minus pre-intervention values were significantly different ($\alpha = 0.05$).

RESULTS In females only, there was a significant decrease of 5.3 ± 13.0 BPM in RHR following the intervention ($p=0.02$). There was no significant change in HRR following the intervention for males or females.

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 any 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.

- 291** Board #107 May 27 9:30 AM - 11:00 AM
COMPARISON BETWEEN OBESITY RATES AND PHYSICAL ACTIVITY LEVELS AMONG ADOLESCENTS IN SINGAPORE
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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 $\text{k} \cdot \text{m}^{-2}$, body fat percentage (BF%): $21.54 \pm 10.21\%$)) 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: $20.21 \pm 4.22 \text{ k} \cdot \text{m}^{-2}$; $r = 0.90$, $p = 0.00$), BMI and BF% (BMI: $20.21 \pm 4.22 \text{ k} \cdot \text{m}^{-2}$; BF%: $21.54 \pm 10.21\%$; $r = 0.78$, $p = 0.00$), vigorous exercise (VE) and moderate exercise (ME) (VE: 3.19 ± 2.07 days ; ME: 3.06 ± 2.06 days; $r = 0.46$, $p = 0.00$). Negative significant correlation was found between VE and WT (3.19 ± 2.07 days; WT: 51.98 ± 13.41 kg; $r = -0.06$, $p = 0.03$). No significant correlation was observed between ME and BMI (3.06 ± 2.06 days; $20.21 \pm 4.22 \text{ k} \cdot \text{m}^{-2}$; $r = -0.04$, $p = 0.13$), VE and BF% (VE: 3.19 ± 2.07 days; BF%: $21.54 \pm 10.21\%$; $r = -0.04$, $p = 0.09$). 89.5% adolescents participated in ME (3.06 ± 2.06 days), 10.5% did not indicate participation. 70.7% adolescents participated in VE (3.19 ± 2.07 days), 12.1% did not indicate participation. 2.8% adolescents adhered to the American College of Sports Medicine (ACSM)'s recommendation of 60 minutes of PA daily. A slightly higher percentage of adolescents sat for more than 8 hours daily (48.9%) than adolescents who sat for 1 to 8 hours daily (43.0%). 9.1% of adolescents did not report their sedentary duration.

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

- 292** Board #108 May 27 9:30 AM - 11:00 AM
Relationship Between Muscle Strength And Body Composition In Young Athletes
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Introduction: A lower cardiometabolic risk in adulthood has been suggested when a better development of the cardiopulmonary and strength condition is reached at an early age. It is important to be able to assess the cardiometabolic risk against variables such as strength in the upper and lower limbs. **Purpose:** To explore the correlation between anthropometric and strength condition variables in upper and lower limbs in boys and girls assigned to sports training schools (soccer, volleyball, skating) in the municipality of Madrid (Colombia). **Method:** A total of 110 children and adolescents were evaluated using long jump test and handgrip strength (HS). The anthropometrics characteristics are, for boys and girls, respectively: weight (kg): 50.5 ± 12.9 and 49.2 ± 11.9 ; height (m): 158.3 ± 11.8 and 152.6 ± 9.2 ; age (years): 13.7 ± 13.8 and 12.9 ± 2.2 . The Pearson's correlation coefficient (r) was used to calculate the correlations regardless of gender and divided by boys and girls. The correlations studied were between the anthropometric variables (weight, height, body mass index (BMI), waist circumference and fat%), compared to long jump test (LJT), right HS (RHS) and left

HS (LHS). The results of r are indicated with a statistical level of significance of $p < 0.001$. **Results:** In the general analysis, $r = 0.81$ was obtained for height versus RHS and LHS and, for weight, $r = 0.68$ and 0.67 was found in RHS and LHS, respectively. When correcting by gender, the height in girls shows $r = 0.7$ and 0.65 in RHS and LHS; while, in children, it was 0.61 , 0.85 and 0.89 for SL, RHS and LHS, respectively. The weight in girls showed $r = 0.6$ for RHS and, in boys, 0.8 and 0.84 for RHS and LHS, in whom $r = 0.6$ and 0.63 for RHS and LHS were also found when compared were made in front of BMI. No associations were found with LJT. **Conclusions:** The results indicated that the strength in the upper limbs (measured through the determination of handgrip strength) is a strong and moderate association in relation to height and weight respectively and regardless of gender. When comparing by gender, this relation is maintained in boys but the association in height went to a moderate level in girls. Thus, the results suggest that the development of strength measured through HS is closely related to the anthropometric characteristics of young athletes, especially height and weight.

- 293** Board #109 May 27 9:30 AM - 11:00 AM
Accuracy Of Multi-frequency BIA In %Fat Change During Weight Loss Among Competitive Girl Runners
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(No relevant relationships reported)

Periodical measurement of %fat with accuracy is crucial for optimizing the health and performance in competitive runners who need strict weight control. Multi-frequency bioelectrical impedance analysis (MFBIA) is feasible for routine use but the evidence of the accuracy is limited to cross-sectional evaluation and no data is available for tracking of %fat change in competitive runners.

PURPOSE: To 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 Ekiden championship. MFBIA was performed at the preparatory season (PRE) and repeated after 5.6 ± 0.5 months at the competitive season (CMP) with dual energy X-ray absorptiometry (DXA) as reference. Weight loss period was defined as that between PRE and CMP and changes in %fat ($\Delta\%$ 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 for $\Delta\%$ fat. 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. $17.9 \pm 5.4\%$ and 12.7 ± 3.1 vs. $12.2 \pm 2.6\%$, respectively. Thus, systemic error (the mean difference) of $\Delta\%$ fat between the 2 methods was 1.2 percentage points [pp] (DXA, -6.9 vs. MFBIA, -5.7 pp, $p = 0.008$). Random error (the limits of agreement) was -3.0 to 5.5 pp 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 $\Delta\%$ 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.

- 294** Board #110 May 27 9:30 AM - 11:00 AM
Physical Qualities Discriminate Playing Level In Elite Youth Hockey Players
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(No relevant relationships reported)

PURPOSE: The purpose of this study was to compare physical test results between playing levels and positions in youth elite hockey players. **METHODS:** Subjects ($n=49$) came from 3 distinct levels: *Bantam AAA Relève* (the lowest, $n=16$), *Bantam AAA Major* (the second highest, $n=17$), and *Midget Espoir* (the highest, $n=16$). Physical characteristics and qualities were measured. The stationary broad jump was utilized to measure lower-body power. Jump distance was measured from toes to the closest landed heel. The best of two attempts was marked as the final score. The seated medicine ball throw was utilized to measure upper-body power. Throw distance was measured from the back of the wall to where the ball first made contact with the ground. The 20-meter shuttle run test was utilized to measure aerobic capacity. $\text{VO}_{2\text{max}}$ was estimated from the last level completed with the Leger-Lambert formula. Results are presented as mean and standard deviation. A single factor (level or position) ANOVA and when significant a post-hoc analysis was also performed by using the least significant difference (LSD) for pairwise comparisons between groups tests results. Statistical significance was set at $p < 0.05$. Analysis was conducted with IBM SPSS Statistics for Windows version 25. **RESULTS:** Hockey

players of the two higher levels were significantly ($p < 0.05$) taller (1.73 ± 0.08 m and 1.74 ± 0.08 m, respectively, vs 1.63 ± 0.09 m), heavier (66.68 ± 8.09 m and 68.60 ± 10.96 m respectively vs 53.52 ± 8.73 m), jumped further (2.25 ± 0.13 m and 2.26 ± 0.12 m respectively vs 2.01 ± 0.20 m), and had greater aerobic capacity (3.87 ± 0.52 L/min and 3.84 ± 0.57 L/min respectively vs 2.96 ± 0.49 L/min) than the hockey players from the lower level. However, the higher level players, scored lower than the middle level at the seated medicine ball throw (3.74 ± 0.49 m vs 4.60 ± 0.48 m), even though the middle level scored higher than the lower level (4.60 ± 0.48 m vs 3.49 ± 0.53 m). Results also show that the goaltenders were significantly taller than the other hockey players (1.77 ± 0.10 m vs 1.72 ± 0.08 m for defensemen and 1.67 ± 0.10 m for forwards). **CONCLUSION:** The stationary broad jump, the seated medicine ball throw and the 20 meters shuttle run are field tests that could be used in order to discriminate playing levels in youth elite hockey players.

- 295** Board #111 May 27 9:30 AM - 11:00 AM
Comparison Of Adolescents Fitness Status Between Shanghai And Taipei
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INTRODUCTION: Chinese communities have a tight knit culture with similar culture practices such as lifestyle choices which have a direct impact on health and fitness level. **PURPOSE:** To investigate the health components of adolescents in Shanghai and Taipei. **METHOD:** A total of 3207 adolescents were recruited for the study from Shanghai ($N = 1588$) and Taipei ($N = 1619$). All adolescents had their percentage body fat (%BF) taken by a bio-impedance analysis machine. The health status, muscle strength and flexibility were measured with a handgrip strength test (HGST), one-minute sit-up test (SUT) and a single-leg flexibility test (SLFT) respectively. The HGST was taken three times per arm in alternate turns. The best result of each side was taken and summed for analysis. Adolescents had to complete as many repetitions of sit-ups within one minute for the SUT. The SLFT was taken thrice on each side consecutively and the best score was used for analysis. Their cardiovascular fitness was measured by a 15m Youth Progressive Aerobic Cardiovascular Endurance Run (PACER) test. Adolescents were paired up for the PACER 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 PACER test results slip. The test ceased upon the third unsuccessful run. **RESULTS:** Significant differences were identified between both countries for %BF (Shanghai: $22.22 \pm 9.64\%$, Taipei: $23.29 \pm 10.30\%$, $p = 0.03$), SUT (Shanghai: 36.21 ± 9.25 count, Taipei: 33.03 ± 9.71 count, $p = 0.00$), flexibility [left side] (Shanghai: 54.59 ± 9.95 cm, Taipei: 51.36 ± 11.52 cm, $p = 0.00$), flexibility [right side] (Shanghai: 55.30 ± 9.91 cm, Taipei: 52.18 ± 11.51 cm, $p = 0.00$), HGST (Shanghai: 55.23 ± 14.08 kg, Taipei: 50.86 ± 14.66 kg, $p = 0.00$) and cardiovascular fitness (Shanghai: 40.12 ± 16.04 laps, Taipei: 37.75 ± 18.87 laps, $p = 0.00$). **CONCLUSION:** Shanghai's adolescents had significantly higher scores than Taipei's in all health components. Though both countries may have similar lifestyle choices, Shanghai's adolescents may have higher energy expenditure with a healthier diet than Taiwan's adolescents. Both countries' adolescents should continue with regular physical activity to maintain their health.

- 296** Board #112 May 27 9:30 AM - 11:00 AM
Association Between Body Composition And Physical Skills In Early Adolescent Athletes
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(No relevant relationships reported)

PURPOSE: This study aimed at appraising the strength of association of body composition components with a set of physical skills in early adolescent athletes. **METHODS:** A sample of 505 subjects (283 boys and 222 girls) was studied (Age = 13.6 ± 0.8 years, BMI = $20.1 \pm 2.4 \text{ kg} \cdot \text{m}^{-2}$; mean \pm SD). Anthropometric assessments were carried out, and the four-compartment model of De Rose and Guimaraes (1980) was applied to estimate body fat, muscle and bone mass percentages (%FM, %MM and %BM). The model was updated using the simple regression equations for male and female athletes proposed by Withers *et al.* (1987; cited by Norton, 1996) to calculate body density, and Siri equation (1961) was then applied to compute the percentage of fat mass. The three body composition components were correlated with the following physical skill tests: Handgrip strength (HAST), Abalakov jump (ABJ), 10 m Sprint test

(10ST), Sit and reach flexibility (SARF) and Simple eye-hand reaction time (SEHRT). Pearson's r was used to test correlations within each gender stratum. Statistical significance was fixed at the 0.05 level.

RESULTS: HAST showed negligible to low correlations with %FM, %MM and %BM ($|r| < 0.3$); statistical significance was found in all cases except in the correlations with %FM and %MM observed in girls. On the other hand, the correlations of ABJ with %FM and %MM reached moderate magnitudes in the male stratum ($r = -0.51$ and $r = 0.51$, respectively); ABJ evidenced significant associations with the three body composition components in both genders. Despite the opposite signs of the coefficients, 10ST presented similar degrees of association to the ones of ABJ. And SARF and SEHRT also showed negligible to low correlations with the three body composition components ($|r| < 0.3$), being statistically significant the ones of SARF with %FM and %MM found in boys, the one of SARF with %MM found in girls, and the one of SEHRT with %MM found in boys.

CONCLUSIONS: The athletes, especially the male ones, with lower %FM and higher %MM tended, though not strongly, to have higher performances in the physical skill tests where the power is decisive. In general, %BM showed weak degrees of association with the physical skills.

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

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

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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 3×10 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 ($p=0.03$, $\eta^2 = 0.62$). One minute after the 50 m sprint, heart rate was significantly higher in the control condition compared to the TS ($P=0.046$, $\eta^2 = 0.27$).

CONCLUSIONS: The present study showed that 3×10 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.

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

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

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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 triaxial accelerations during practices (P) and games (G) of the two teams over two seasons. Impacts were identified using Impact Processor (Zephyr, MD). Impacts greater than 6 g (Z3, Z4, Z5 and above) were used as previously validated for PII. Triaxial accelerations were used to generate absolute intensity metrics 30 minute exponentially weighted Dynamic Accelerations (DYNAs) and session DYNAs. Relative intensity metrics Individual Hustle Score (IHS) and Intensity factor (IF) were based on session DYNAs relative to

Dynamic functional threshold (DFT). Intensities and PII of two teams were compared between sessions and teams using MANOVA with Tukey post hoc ($\alpha = 0.05$; SPSS 26.0, IBM, NY)

Results: 7288 sessions (1400 G, 2802 P; U17 and 1039 G and 2047 P; U18) were compared. For all combined sessions, impacts were greater for U18 (6.4 ± 7.7) than U17 (5.4 ± 7 ; $p < 0.05$). Interestingly, impacts in G were not significantly different. Therefore, differences between teams were solely the result of higher impacts in P for U18 (5.8 ± 7.3) vs U17 (4.1 ± 6.3 ; $p < 0.05$). For workload intensity, overall, 30-min DYNAs and Session DYNAs were not different between teams 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.

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

Vibration Platform Stretching Increases ROM Acutely, With No Long-term Effect In Junior Olympic Women'S Gymnasts

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Flexibility, particularly range of motion (ROM) of the hips, is critical for gymnasts' performance. Despite consistent flexibility training, many competitive gymnasts still need greater ROM. **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 $8.4 (\pm 5.5)$ degrees ($p=0.002$), while the control group's ROM increased by $5.8 (\pm 8.0)$ degrees ($p=0.064$). There was no significant difference between groups ($p=0.435$). A single VP treatment increased ROM by $3.6 (\pm 7.3)$ 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.

300 Board #116 May 27 9:30 AM - 11:00 AM

Functional Bilateral Asymmetries In Adolescent Competitive Skiers

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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 medicine ball throw) and balance (Y-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-

body strength (dominant: 565.5 ± 38.5 N, non-dominant: 549.9 ± 38.1 N, $p=0.063$), lower-body power ($p=0.572$), or balance in the anterior ($p=0.153$), posterior-medial ($p=0.880$) or posterior-lateral ($p=0.164$) directions. **CONCLUSIONS:** In the present study adolescent skiers demonstrated asymmetrical rotational power and non-significant trends asymmetrical lower-body strength but no other noteworthy differences in power or balance. In skiing, rotational power is necessary for rapid initiation of turns away from their dominant side. Training to correct this asymmetry may help athletes when turning towards their dominant side.

- 301** Board #117 May 27 9:30 AM - 11:00 AM
Determinants Of Head Impact Exposure In Youth Football
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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 that occurred "outside the hash marks" (61.75 g) and in the "redzone" (59.40 g) had the highest 95th percentile LA rankings among horizontal and vertical field positions, respectively. When players did not anticipate being hit ($n = 53$; 1.9% of all impacts), head impacts had a 95th percentile LA of 69.52 g, compared to 47.02 g when they anticipated the impact. Head impacts resulting from players' helmets hitting the ground (95th percentile LA: 72.94 g) accounted for 11.6% of all impacts ($n = 323$).

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).

- 302** Board #118 May 27 9:30 AM - 11:00 AM
Relationship Between Mixed Relay Performance And Physiological Measures Of Fatigue And Metabolism In Junior Triathletes.
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The mixed relay triathlon is a new event in the Summer Olympics consisting of teams of 2 females and 2 males whom each complete a super-sprint triathlon (~20 min per athlete) in sequential order. Given the duration of the event, the intensity will likely be higher than longer distance triathlons. Thus, muscular power and anaerobic metabolism may be more important determinants of performance. To date, no research has investigated the physiological determinants nor the muscular fatigue associated with the event.

PURPOSE: The primary purpose was to determine the changes in leg muscle power (to assess muscular fatigue) and anaerobic metabolism during a mixed relay triathlon. A secondary purpose was to determine the relationships between leg muscle power and anaerobic metabolism with overall and leg specific (swim, bike, run) performance.

METHODS: Twelve highly-trained junior (5 female, 7 male) triathletes (age: 17.6 ± 1.3 years) competed in the Canadian Mixed Relay Championships (300 m swim, 6 km bike, 1.6 km run). Before and immediately after the race vertical jump height (VJH)

and blood lactate (BLA) were measured. Paired sample t-tests were used to compare pre- and post-race differences. Pearson correlations were used to determine the relationships between finishing time, and swim, bike, and run times with BLA and VJH. **RESULTS:** Mean race time was 22.4 ± 1.4 min, including transitions (swim 4.5 ± 0.4 min, bike 10.3 ± 0.6 min, run 6.05 ± 0.5 min). VJH increased pre- to post-race (pre: 43.8 ± 8.4 cm; post: 46.1 ± 8.0 cm, $p=0.05$) in 7 out of 12 participants. A significant correlation between VJH pre-race and bike time was determined ($r=-0.60$, $p=0.03$). BLA significantly increased from pre-to post-race (pre: 1.3 ± 0.4 mmol·L⁻¹; post: 10.7 ± 2.4 mmol·L⁻¹, $p<0.001$) and significantly correlated to bike and overall finishing time (bike: $r=-0.71$, $p=0.02$; finishing time: $r=-0.76$, $p<0.001$). **CONCLUSIONS:** Based on the high BLA after the race, the mixed relay event requires a large contribution from anaerobic metabolism and faster athletes had greater post-race BLA. Despite the high physiological demands, muscular fatigue was not found in most participants. Furthermore, the relationship between VJH and bike performance demonstrates the importance of muscular power in the mixed relay event.

- 303** Board #119 May 27 9:30 AM - 11:00 AM
Does 45 Minutes Of Daily Pe Impact Health Related Fitness Of Under-resourced Middle School Females?
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(No relevant relationships reported)

Girls have a greater decline in physical activity compared to boys do during adolescence. **PURPOSE:** The purpose of this study was to examine the impact of 45 minutes of daily PE on the fitness levels of African American middle school females. **METHODS:** An analysis of variance (ANOVA) mixed effect linear model was used to evaluate the effectiveness of 45 minutes of daily physical education on the Progressive Aerobic Cardiovascular Endurance Run (PACER), push-ups, curl-ups and BMI among youth in grades 6th-8th attending Legacy Early College, a Title I school in the southeastern US. Gain scores (final post-test assessment in May 2019 - original pre-test assessment in September 2018) were calculated and analyzed for significance. The interaction between school and time was estimated for each outcome. Each analysis was stratified by gender and adjusted by age to control for baseline differences by school. A Title I control school that provided physical education for only one semester was identified and utilized as a comparison. **Summary of RESULTS:** African American females at Legacy Early College ($N=374$) observed significant differences compared to control middle school females ($N=393$) who did not receive daily PE on the PACER, curl-ups and push-ups assessments at post-test ($P=.000$, $P=.004$ and $P=.003$, respectively). A decrease in aerobic capacity was observed for females at both schools, however this decrease was less at Legacy, but was not significant ($F=1.38$, $P>.05$). BMI of control school females increased significantly ($F=8.206$, $P=0.005$), compared to Legacy students. **CONCLUSIONS:** 45 minutes of daily physical education led to increases in PACER laps, push-ups and curl-ups, as well as decreases in BMI among under-resourced middle school students.

Supported by Campbell Young Leaders

- 304** Board #120 May 27 9:30 AM - 11:00 AM
Evaluation Of Bioelectrical Impedance Analysis For Estimating Percent Body Fat In Children.
 Sierra Barnhart¹, Meghan Fetterman¹, Kyle S. Beyer¹, Curt B. Dixon, FACSM², Joseph L. Andreacci, FACSM¹. ¹*Bloomsburg University of Pennsylvania, Bloomsburg, PA.* ²*Lock Haven University of Pennsylvania, Lock Haven, PA.* (Sponsor: Joseph L. Andreacci, FACSM)
(No relevant relationships reported)

PURPOSE: To compare percent body fat (%BF) measurements estimated by bioelectrical impedance analysis (BIA) with dual-energy x-ray absorptiometry (DXA) in children.

METHODS: Forty-nine children (28 girls; 21 boys) volunteered to participate in this study (age = 14.5 ± 2.9 years; body mass index = 22.4 ± 5.6 kg/m²). During the assessment, %BF was measured using hand-to-hand bioelectrical impedance analysis (HBIA; Omron HBF-306), leg-to-leg bioelectrical impedance analysis (LBIA; Tanita 300-A), segmental bioelectrical impedance analysis (SBIA; Tanita BC-418), and DXA, which served as the criterion. %BF data from the four devices was assessed using one-way repeated measures ANOVA with Bonferroni-adjusted post-hoc tests. Alpha level was set a priori to $p<0.05$.

RESULTS: LBIA ($24.2 \pm 9.7\%$, $p < 0.001$) and SBIA ($26.4 \pm 8.0\%$, $p = 0.028$) significantly underestimated mean %BF when compared to DXA ($28.7 \pm 11.5\%$) while no differences were observed between DXA and HBIA ($28.4 \pm 7.3\%$, $p = 1.0$). Linear regression revealed significant ($p < 0.001$) correlations between %BF determined by DXA and the BIA methods: LBIA ($r = 0.87$), SBIA ($r = 0.91$), and HBIA ($r = 0.65$).

For a large percentage of the children (LBIA = 37%, SBIA = 53%, HBIA = 67%), %BF values were outside the $\pm 3.5\%$ 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 secretory bone cells that regulate bone homeostasis and for this reason, are often coined as the "brain of the bone". *In vitro* studies demonstrated that mechanically stimulated osteocytes release interleukins and growth factors that help coordinating bone formation and resorption, however, their secretome remains largely unknown.

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

Methods: The murine MLO-Y4 (Kerafast) cell line was cultured according to Kerafast instructions. Human adipose stem cells (ATCC® PCS -500-011™) were expanded and differentiated into osteocyte-like cells (hOC) according to ATCC instructions. Cells were cultured in a computer-controlled bioreactor (Flexcell Int) for mechanical loading (3.4%, 2Hz, 5h). Static cultures were used as control. Relative expression of 84 key genes of the WNT signalling pathway (Sabiosciences) was quantified by RT-qPCR. Relative protein expression was estimated by western blotting. The secretome was analysed by quantitative mass spectrometry (TripleTOF 6600, SCIEX) using SWATH and iDA and processed using OneOmics (SCIEX) software.

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

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

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

Identifying Triad Risk Factors In Ultramarathon Runners

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(No relevant relationships reported)

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

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

METHODS: Runners who qualified to compete in a 100-mile endurance race were recruited pre-race to complete a survey assessing eating behaviors, menstrual history, training, and injury history; and dual-energy x-ray absorptiometry to assess bone

mineral density (BMD). A cumulative Triad risk score was calculated using energy availability, body mass index (BMI), age of menarche and oligomenorrhea (for women), BMD, and history of bone stress injury.

RESULTS: 123 runners (40 female and 83 male) participants had a mean age, respectively, of 41.8 and 46.2 years. 57.5% 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 disorders. 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 79.5% of males reported at least one prior bone stress injury.

CONCLUSIONS: 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 ($\beta = -0.002$, $p < 0.001$) and positive linear associations between LM and BMD ($\beta = 0.006$, $p < 0.001$) 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 ($\beta = -0.004$, $p = 0.02$; $\beta = -0.002$, $p = 0.03$ respectively), whereas the associations between LM and BMD were consistent between sexes ($\beta = 0.006$, $p < 0.001$; $\beta = 0.006$, $p = 0.002$ 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 ($\beta = -0.007$, $p < 0.001$; $\beta = -0.005$, $p < 0.001$ respectively) whereas a larger positive beta between LM and BMD were found in 45+ as compared to 20-44 year age group ($\beta = 0.007$, $p < 0.001$; $\beta = 0.005$, $p < 0.001$; respectively).

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

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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Bone metabolism is determined by the balance of bone formation (osteoblast) and bone resorption (osteoclasts). Osteoprotegerin (OPG) and receptor activator of nuclear factor kB 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) ($ES = .572$, 95% CI= .220, .925, $p = .001$). Moderator analysis results showed that exercise type (resistance, endurance, a combination of both) partially explained the heterogeneity of ESs ($Q_{\text{between}} = 7.704$, $df = 2$, $p = .021$). 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 YOUNG 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; NOR) history. **METHODS:** We recruited 169 Women (57 YNG/NOR (34.1 9.9 yrs.), 34 MEN/NOR (55.4 10.4 yrs.), 51 YNG/RUN (40.0 8.7 yrs.), and 27 MEN/RUN (56.9 8.9 yrs.) and evaluated them for differences and relationships between BMD, blood pressure (BP) and BF%. **RESULTS:** Although the MEN women were older, the MEN women did not differ for weight, BMI or body fat%, but did differ for BMD (MEN 1.17 vs YNG 1.24). Weight and central adiposity as measured by waist circumference was related to BMD ($p < 0.05$) in both RUN and NOR. Consistent with expectation, both MEN/RUN and MEN/NOR had lower BMD ($p < 0.05$) than the YNG/RUN and YNG/NOR. The MEN/RUN had a higher BP than the other groups and this may have contributed to their BMD response not being higher than the NOR. **CONCLUSIONS:** Although further study is needed to validate the findings in this study, these data indicate that a history of running does not result in a higher BMD in MEN women. This may have been partially due to the fact that body composition was not different between the groups and therefore the runners were not placing greater stress on the bones.

- 310** Board #126 May 27 10:30 AM - 12:00 PM
Relationships Of Bone Mineral Density And Muscular Performance In College Students
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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 (23.7 ± 1.9 years; 171.9 ± 6.7 cm; 81.8 ± 11.4 kg) and twenty females (23.1 ± 1.9 years; 161.8 ± 6.1 cm; 64.9 ± 15.3 kg), volunteered for the study. Scans of total body, lumbar spine, dual femur and dual forearm were obtained by the iDXA 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)

BMD Sites	Muscular Performance	R-value	P-value
Right Total Hip	Hamstring PT	.610	0.000
	Jump PP	.640	0.000
Right Femoral Neck	Hamstring PT	.690	0.000
	Jump PP	.722	0.000

PT: Peak Torque; PP: Peak Power

- 311** Board #127 May 27 10:30 AM - 12:00 PM
Female Distance Runners Display Altered Bone Remodeling In Fasted Blood And 24 Hour Urine Biomarkers
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An increase in underlying bone remodeling is associated with increased fracture risk. The International Osteoporosis Foundation recommend overnight fasted plasma C-terminal cross linked telopeptide type 1 collagen (CTX) and N-terminal propeptide of type 1 procollagen (P1NP) as bone turnover markers (BTM) of homeostatic bone remodeling. Reflected by an increase in plasma CTX, endurance exercise increases bone resorption acutely for a number of hours post-exercise. Female distance runners (FDR) engage in frequent weight-bearing endurance exercise that may alter homeostatic bone remodeling and fracture risk.

PURPOSE: To compare bone remodeling in FDR and non-athletic controls (CON).

METHODS: Daily 24 h urine samples and fasted morning blood samples were collected for 7 consecutive days of habitual activity in 7 FDR (training volume ≥ 60 km/week; mean \pm SD age: 24.1 ± 4.6 y, height: 1.70 ± 0.05 m, mass: 58.5 ± 5.5 kg, fat %: $18 \pm 4\%$ and 11 CON (≤ 3 h/week intentional vigorous physical activity; mean \pm SD age: 23.9 ± 4.1 y, height: 1.67 ± 0.05 m, mass: 64.5 ± 4.4 kg, fat %: $33 \pm 6\%$) who provided prior informed consent for a study which had ethical approval. Plasma CTX and P1NP was measured by automated immunoassay (Roche Diagnostics) and urinary N-terminal cross linked telopeptide type 1 collagen (NTX) by ELISA (Osteemark). Data were pooled and analyzed independent of participant. Data violated the assumption of normality and are reported as the median (IQR). Groups were compared by Mann-Whitney U test.

RESULTS: Median CTX was 31.4% lower ($0.393(0.147)$ vs $0.573(0.333)$ ng/ml; $p < 0.001$; $d = 0.7$) and P1NP was 14.5% lower ($55.12(32.39)$ vs $64.43(16.73)$ ng/ml; $p = 0.012$; $d = 0.5$) in FDR compared to CON. In contrast, median 24 h NTX was 36.7% higher in FDR ($434.2(572.7)$ vs $317.6(302.6)$ nM bone collagen equivalents; $p = 0.033$; $d = 0.4$) compared to CON.

CONCLUSION: Lower overnight fasted CTX and P1NP are deemed devoid of influence exerted by previous exercise or food intake and may indicate an adaptive, regulatory effect of chronic exercise training on systemic (homeostatic) bone remodeling in FDR. By contrast, 24 h urine NTX captures total bone resorative activity, including response to exercise and diet accrued during the previous 24 h and appear to confirm significantly greater net daily bone resorption in FDR compared to CON.

312	Board #128	May 27 10:30 AM - 12:00 PM
Bone Mineral Density And Muscle Mass Determine Handgrip Strength Only When Multiple Tests Are Performed		
Maijian Zhu ¹ , Sareena Hanim Hamzah ² , Boon-Hooi Lim ² , Te Chao ¹ , Jinfu Wu ¹ , Chia-Pei Lin ¹ , Chiung-Yun Chang ¹ , Wen-Hsin Feng ¹ , Peng-Wen Chen ¹ , Chao-Chieh Hsieh ¹ , Min-Jung Hsieh ¹ , Kuen-Jyh Chen ¹ , TingAn Shih ¹ , I Jong Liu ¹ , Li Fan Lai ¹ , Yi Chen Chen ¹ , Che Chun Chiang ¹ , Tania XY Lee ¹ , Yu-Wnn Lu ¹ , Yun Hsuan Huang ¹ , Yu-Wen Hsieh ¹ , Po-Hao Huang ¹ . ¹ University of Taipei, Taiwan, Taipei, Taiwan, ² University of Malaya, Malaysia, Kuala Lumpur, Malaysia. (Sponsor: Chia-Hua Kuo, FACSM)		
Email: zhumaijian@gmail.com (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 have recruited 728 volunteers aged ≥ 20 y. Maximal handgrip strength and average handgrip strength were measured in 10-consecutive attempts with maximal efforts. Rest interval between each grip was 3 s. Bone density and muscle mass of all participants were measured using iDXA.

RESULTS: Our data show that average handgrip strength of 10 repeated tasks was highly linearly correlated with lean body mass ($r=0.76$, $p<0.01$) and moderately 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 superior in reflecting muscle mass and bone mineral density than single maximal value of handgrip strength.

313	Board #129	May 27 10:30 AM - 12:00 PM
Trabecular Bone Score And Bone Mineral Density In Older Adults		
Matthew C. Scott ¹ , James Stampley ¹ , Brett Davis ¹ , Heather Quirriarte ¹ , Eunhan Cho ¹ , Bailey Theall ¹ , Josh Granger ¹ , Neil M. Johannsen ¹ , Steve B. Heymsfield ² , Frank Greenway ² , Brian A. Irving, FACSM ¹ . ¹ Louisiana State University, Baton Rouge, LA, ² Pennington Biomedical Research Center, Baton Rouge, LA. (Sponsor: Brian A. Irving, FACSM)		
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The Trabecular Bone Score (TBS) is an estimate of the healthiness of bone microarchitecture that is based on the mathematical reconstruction of 3D micro-computed tomography (μ CT) scans using 2D Dual-energy X-ray Absorptiometry (DXA). Compared to bone mineral density (BMD), TBS is a relatively new DXA-derived metric for predicting fracture risk. **PURPOSE:** This study examined the associations between classically measured vertebral bone mineral density (BMD) and TBS in inactive older adults. **METHODS:** For the present analyses, we included pre-training data from 19 older adults ($X \pm SD$; 71 ± 4.2 y, 4 black, 6 males) participating in an ongoing exercise intervention (REALPA). Whole-body and lumbar spine scans were acquired using a Hologic Horizon®A DXA scanner to determine BMD. TBS iNsight™ was used to determine the TBS score from lumbar spine DXA scans. Multivariate analyses were used to determine associations between whole-body and lumbar spine BMD with TBS scores, and sex differences were assessed by t-tests. **RESULTS:** A strong correlation between both whole-body BMD and lumbar spine TBS ($r=0.815$, $p<0.0001$) was observed; this was also true for lumbar spine BMD and lumbar spine TBS ($r=0.834$, $p<0.0001$). Sex differences were found (males vs. females) for Whole-body BMD (g/cm^2 ; 1.156 ± 0.12 vs 0.972 ± 0.10 , $p<0.009$), lumbar spine BMD (1.150 ± 0.20 vs 0.920 ± 0.15 , $p<0.05$), and lumbar spine TBS (1.409 ± 0.10 vs 1.285 ± 0.09 , $p<0.05$). **CONCLUSION:** The sex differences for BMD and TBS are consistent with the literature, with males having higher BMD and TBS. Strong correlations between BMD and TBS suggest that TBS bone has construct validity. However, future studies are still warranted to determine whether TBS scoring provides clinically meaningful insight into fracture risk beyond traditional BMD. Furthermore, future research studies are warranted to determine whether exercise induced changes TBS are sensitive markers for exercise induced bone remodeling, which would provide additional insight into the clinical utility of TBS.

This study was supported by the NIH 5R21AG058181-02.

314	Board #130	May 27 10:30 AM - 12:00 PM
Bone Mineral Density Amongst Collegiate Male Athletes Across Endurance And Strength-based Sports		
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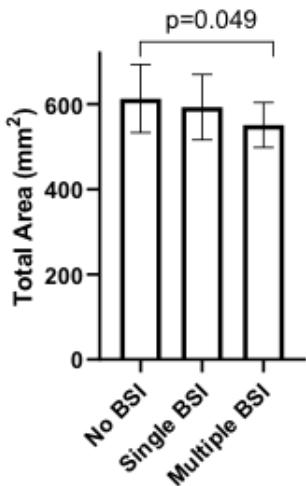
PURPOSE: The primary aim is to compare body composition, specifically bone mineral density (BMD) and associated Z-score, in male National Collegiate Athletic Association (NCAA) athletes across five different sports. Secondary measures include lean body mass (LBM) and body fat percentage (BF%). **METHODS:** In this observational, cross-sectional study, five collegiate sports team athletes representing endurance-dominant (soccer, running, swimming) versus strength-based sports (football, basketball) consented to participate in a pre-season whole-body dual energy x-ray absorptiometry (DXA) scan. One-way ANOVA (Brown-Forsythe) with multiple comparisons tests were used to statistically compare BMD (and associated Z-score), LBM, and BF% values between sports, with significance set at $p<0.05$. **RESULTS:** 165 male athletes participated, with ANOVA tests revealing statistical differences between sports for all body composition parameters measured ($p<0.0001$). Football players ($n=99$) demonstrated the highest while swimmers ($n=19$) had the lowest BMD ($1.37 \pm 0.10 g/cm^2$ vs. $1.14 \pm 0.07 g/cm^2$, $p < 0.001$). There were no differences ($p>0.05$) in BMD between football vs. basketball ($n=16$) players ($1.33 \pm 0.09 g/cm^2$) or soccer players ($N=20$; $1.26 \pm 0.06 g/cm^2$) compared to cross-country runners ($N=11$; $1.17 \pm 0.07 g/cm^2$). While BMD was similar ($p>0.05$) between swimmers and cross-country runners. In comparisons between sports for Z-scores ($F=39.73$; $p<0.0001$), football players had the highest scores (1.48 ± 0.09) followed by basketball players (0.77 ± 0.75), soccer players (0.42 ± 0.77), cross country (0.00 ± 0.57) and swimmers (-0.57 ± 0.77). Basketball players had the highest LBM ($78.7 \pm 8 kg$) next to football ($72.0 \pm 12 kg$) while football had the highest %BF ($24 \pm 6\%$) across sports. **CONCLUSION:** Football and basketball requires greater high intensity resistance training over endurance (vertical + non-vertical loading) training, whereas cross country, swimming and soccer requires greater endurance over resistance training. Furthermore, soccer and cross-country have similar running demands and showed no significance in BMD. We believe that the osteogenic contributions of resistance training on BMD are underappreciated and warrant further investigation as a strategy for maximizing skeletal health in young adults.

315	Board #131	May 27 10:30 AM - 12:00 PM
Female Runners With Multiple Bone Stress Injuries Have Smaller Bone Area Compared To Healthy Runners		
Kristin L. Popp ¹ , Sara Rudolph ² , Signe Caksa ² , Julie M. Hughes ¹ , Adam S. Tenforde ³ , Kathryn E. Ackerman, FACSM ⁴ , Mary L. Bouxsein ⁵ . ¹ United States Army Research Institute of Environmental Medicine, Natick, MA. ² Massachusetts General Hospital, Boston, MA. ³ Havard Medical School, Boston, MA. ⁴ Boston Children's Hospital, Boston, MA. ⁵ Beth Israel Deaconess Medical Center, Boston, MA. (Sponsor: Kathryn Ackerman, FACSM) Email: kpopp@mgh.harvard.edu (No relevant relationships reported)		

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 Eating Disorder Examination Questionnaire (EDE-Q) scores and prevalence of amenorrhea than no BSI ($p<0.05$). Adjusting for height and weight, multi BSI had smaller total tibial bone area ($p=0.049$, Fig.), and a trend for greater total and trabecular volumetric BMD (vBMD; $p=0.07$, $p=0.09$, respectively) compared to no BSI. 1 BSI had higher BMSi compared to no BSI and multi BSI ($p=0.04$), and lower cortical porosity compared to no BSI ($p=0.048$). Among the cohort, BMSi was significantly associated with cortical porosity ($p=0.04$), but not with cortical vBMD, cortical tissue mineral density, or aBMD. EDE-Q score was inversely associated with total bone area ($p=0.02$). **CONCLUSIONS:** Our findings suggest runners with multi BSI have smaller bones and higher EDE-Q scores than no BSI. Total and trabecular vBMD appear to be higher

in multi BSI compared to no BSI, though due to the small sample size, differences were not significant. Collectively, our findings suggest several bone properties and eating behaviors distinguish women with multi BSI and 1 BSI from no BSI.

Total Tibial Bone Area



- 316** Board #132 May 27 10:30 AM - 12:00 PM
A Two-year Examination Of Bone Mineral Density In Division I Cross-country Runners
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(No relevant relationships reported)

There have been few longitudinal studies beyond one year examining bone mineral density (BMD) in collegiate distance runners. Weight-bearing activity such as running tends to be osteogenic, however runners often experience bone injuries and may have site-specific deficiencies compared to norms. **PURPOSE:** Examine the BMD of Division I cross country runners across a two-year time frame. **METHODS:** BMD of 19 collegiate cross-country runners (12 men & 7 women) were measured via dual energy x-ray absorptiometry at the beginning of the season for three consecutive years (v1, v2, v3). A repeated measures multivariate analysis of covariance (whole body lean mass as covariate) was used to compare BMD values of men and women runners at four sites: AP spine (APBMD), femoral neck (FNBMD), whole body (WBBMD), and the non-dominant forearm (FABMD). **RESULTS:** Women had a significant decrease from v1 to v2 ($1.240 \pm 0.048 \text{ gm}\cdot\text{cm}^{-2}$ vs $1.194 \pm 0.048 \text{ gm}\cdot\text{cm}^{-2}$, $p=0.003$) and v1 to v3 ($1.240 \pm 0.048 \text{ gm}\cdot\text{cm}^{-2}$ vs $1.185 \pm 0.043 \text{ gm}\cdot\text{cm}^{-2}$, $p=0.002$) in WBBMD and men had a significant increase from v1 to v3 ($0.414 \pm 0.029 \text{ gm}\cdot\text{cm}^{-2}$ vs $0.450 \pm 0.028 \text{ gm}\cdot\text{cm}^{-2}$, $p=0.018$) and v2 to v3 ($0.425 \pm 0.026 \text{ gm}\cdot\text{cm}^{-2}$ vs $0.450 \pm 0.028 \text{ gm}\cdot\text{cm}^{-2}$, $p=0.003$) 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, which may be explained by dietary intake. For males, BMD was consistent across two years, with a significant increase in the FABMD, however, 50% of men had a low z-score at this site. Males of this age may still be accruing bone at the AP spine and FA.

- 317** Board #133 May 27 10:30 AM - 12:00 PM
Bilateral Bone Strength Differences In Division II Female Volleyball Players
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(No relevant relationships reported)

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 (Haapasalo 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.tb), total bone mineral content (Total BMC), total area (TotA), and compressive strength index (BSIc). Cortical bone variables (66% diaphyseal site) included cortical density (CoD), cortical area (CoA), strength strain 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. tb (-0.45%), Total BMC (0.99%), TotA (-0.63%). The side to side percent (%) 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.

- 318** Board #134 May 27 10:30 AM - 12:00 PM
Exercise Therapy For Bone Health: Translation To Clinical Practice
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Reported Relationships: B.R. Beck: Ownership/interest/stock; Owner and Director, The Bone Clinic.

We previously reported that high-intensity resistance and impact training (HiRIT) 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 HiRIT 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 HiRIT 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 HiRIT (63.6 ± 7.1 yrs, 162.3 ± 6.8 cm, 60.6 ± 10.0 kg, LS T-score -2.0 ± 1.1 , FN T-score -2.0 ± 0.7 , compliance $69.1 \pm 39.6\%$). 70 clients were on bone medications at baseline but only 18 at follow-up. Improvement was observed in weight ($0.8 \pm 3.8\%$, $P < 0.0001$), LS ($2.2 \pm 5.1\%$, $P < 0.0001$), TH ($1.0 \pm 3.7\%$, $P < 0.0001$) and FN BMD ($1.4 \pm 4.8\%$, $P < 0.0001$), lean mass ($2.3 \pm 5.5\%$, $P < 0.0001$), fat percent ($-4.5 \pm 10.7\%$, $P < 0.0001$), functional reach ($7.2 \pm 13.4\%$, $P < 0.0001$), timed up and go ($-9.8 \pm 12.0\%$, $P < 0.0001$), tandem walk ($-20.6 \pm 35.1\%$, $P < 0.0001$), sit to stand ($-9.9 \pm 15.9\%$, $P < 0.0001$), BES ($20.6 \pm 35.1\%$, $P < 0.0001$), and kyphosis ($5.1 \pm 54.8\%$, $P < 0.05$). Clients increased daily dietary calcium ($23 \pm 67\%$, $P < 0.0001$) and total calcium ($19 \pm 68\%$, $P < 0.0001$). 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.

- 319** Board #135 May 27 10:30 AM - 12:00 PM
Acute Response Of Biochemical Bone Turnover Markers Induced By Three Different Jumps For Postmenopausal Women
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(No relevant relationships reported)

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), diagonal-drop jump (DDJ). A fourth day without jumping served as control (C). Blood samples were collected before (PRE), after (POST), and 2-hours after (2Hr) exercise. Procollagen type-1 amino-terminal propeptide (P1NP), Osteocalcin (OC) and C-terminal telopeptide of type-1 collagen (CTX) were evaluated by a fully automated immunoassay system (iSYS, Immunodiagnostic Systems Ltd., Bolton, England) by the method of Chemiluminescence. Peak sagittal (Fx), transversal (Fy), and vertical (Fz) GRF were measured by an AMTI (©Advanced Mechanical Technology Inc., Watertown, MA 02472-4800 USA) SGA6-4 force platform and the combined three-axis peak GRF was calculated. The BTM differences between PRE, POST, and 2Hr were tested with linear mixed models, and the differences in GRF between the jumps were tested with repeated ANOVA. Linear regression analyses were used to assess the correlation between ΔBTM and the associated GRF in each type of jump. **RESULTS:** At POST, P1NP was increased ($p < 0.01$) by $7.7 \pm 1.8\%$ (CMJ), $9.4 \pm 1.3\%$ (DJ), and $10.6 \pm 1.6\%$ (DDJ), which were higher ($p < 0.01$) than C. OC was increased ($p < 0.05$) by $5.5 \pm 1.8\%$ (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, ΔP1NP 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.

- 320** Board #136 May 27 10:30 AM - 12:00 PM
The Effect Of Age On The Lumbar Spine Of Cricket Fast Bowlers
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(No relevant relationships reported)

Senior cricket fast bowlers (FB) have high lumbar spine bone mineral, particularly on the contralateral side to their bowling arm. It is thought that bone possesses its greatest ability to adapt to loading during adolescence but is unknown at what age asymmetry develops in FB and how adaptation develops with age.

PURPOSE: To determine how lumbar bone mineral and geometrical properties differ according to age in FB.

METHODS: With NHS and institutional ethics approval, 107 elite adolescent and senior male FB aged 14 to 35 years received a single AP lumbar spine DXA scan (GE Lunar iDXA, GE Healthcare, USA). Bone mineral density (BMD) and bone mineral content (BMC) were derived for each vertebra, along with average vertebral height and width, area and Z-score (Lunar enCore v17, GE Healthcare, USA). Custom regions of interest derived the bone mineral in the lateral third of the non-dominant (ND) and dominant (D) sides of the vertebral body (relative to bowling arm). FB were split into 14-15 (n=27), 16-17 (n=28), 18-19 (n=22), 20-24 (n=16), and 25+ (n=14) age groups. ANOVAs were used to compare the age group means for each variable, with FFM as covariate.

RESULTS: Lumbar spine BMD, BMC, Z-score, area, width and height significantly differed between age groups at all vertebral levels ($P < 0.01$), but differences in area and height were no longer significant with FFM included as a covariate ($P \geq 0.38$). Mean BMD (\pm SD) L1-L4 Z-scores increased progressively with age from $+0.83 \pm 1.24$ at age 14-15 to $+2.69 \pm 1.17$ at age 25+. BMD and BMC on the ND and D sides significantly differed with age ($P \leq 0.04$) and side ($P < 0.01$), and by age on each side ($P \leq 0.04$) as highlighted at L3 in figure 1.

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

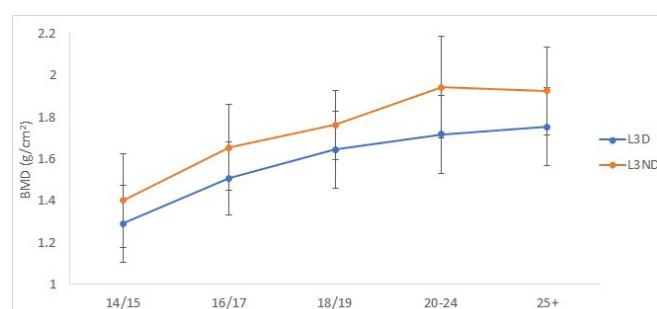


Figure 1: The mean BMD \pm 95% CI of the dominant and non-dominant sides of L3 of each age group.

- 321** Board #137 May 27 10:30 AM - 12:00 PM
Feasibility Of Using A Bisphosphonate In Sleeve Gastrectomy Patients For Bone Loss Prevention
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Among older adults with severe obesity, the sleeve gastrectomy (SG) procedure yields rapid weight loss and cardiometabolic improvement; however, it is also associated with significant bone loss and increased fracture risk. Bisphosphonate use reduces osteoporotic fracture risk and may be effective in minimizing bariatric surgery associated bone loss; yet, this hypothesis has not been formally tested.

PURPOSE: The purpose of this study is to determine the feasibility of recruiting, enrolling, treating, and following 24 SG patients (40+ years old) into a randomized controlled trial (RCT) examining the efficacy of Risedronate, a bisphosphonate, use (versus placebo) in the prevention of bariatric surgery associated bone loss.

METHODS: Feasibility metrics include recruitment, retention, adherence, and adverse event reporting. Self-reported demographic characteristics and dual energy X-ray absorptiometry (DXA) acquired T-scores and 10-year major osteoporotic fracture (MOF) and hip fracture risk were also collected at baseline.

RESULTS: Study recruitment occurred over 17 months (3/5/18-8/31/19). A total of 70 patients met initial eligibility criteria and were referred by the clinic; of those, 32 were screened by telephone (n=8 excluded after screening), and 24 were randomized to Risedronate or placebo (recruitment yield: 34%; n=12/group). On average, participants were 56 ± 7 years old at baseline, with a BMI of 44.8 ± 6.1 kg/m². The majority of the study sample was female (83%), white (79%), and postmenopausal (75%). Three participants (12%) presented with osteopenia, and MOF and hip fracture risk was low ($5.0 \pm 3.2\%$ and $0.3 \pm 0.4\%$, respectively). Data collection is ongoing. As of 11/3/2019, two participants have withdrawn, three mild adverse events have been reported (out of 125 contacts; one related and two unrelated), and among active participants, 95% of pills (124 out of 131 total) have been taken (n=22>80% compliant with medication protocol).

CONCLUSIONS: Use of Risedronate as a novel therapeutic to preserve bone density among SG patients appears feasible and well tolerated. Forthcoming intervention effects will be used to generate effect size estimates to appropriately power a subsequent trial.

- 322** Board #138 May 27 10:30 AM - 12:00 PM
LARC Implant Use Does Not Exacerbate Bone Loss Associated With Hindlimb Unloading
 Heather C. Allaway, Jon P. Elizondo, Sarah E. Little, Harry A. Hogan, Susan A. Bloomfield, FACSM. Texas A&M University, College Station, TX. (Sponsor: Susan Bloomfield, FACSM)
(No relevant relationships reported)

Combined oral contraceptives (COC; ethinyl estradiol and progestin) reduce exercise-induced gains in bone mineral density (BMD), possibly by suppressing bone turnover. Long-acting reversible contraceptives (LARC; progestin-only) provide many practical advantages over COC and will likely be recommended for female astronauts on long-duration missions; however, the impact on bone health with unloading is unknown.

Purpose: To determine if LARC use will blunt loss of bone associated with hindlimb unloading (HU)

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

Results: Despite increasing their food intake during HU ($p<0.01$), HU animals lost weight and weighed less than WB animals starting on HU week 2 ($p<0.01$). Irrespective of pellet type, HU resulted in a loss of total and cancellous volumetric BMD (vBMD) at the PTM ($p<0.01$), reduced cortical thickness at the PTM and TD ($p<0.01$), and reduced endosteal and periosteal mineralization (MS/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 BV/TV and Tb.Th were greater in PL-WB animals compared to PL-HU animals only ($p<0.04$). Similarly, ultimate force was greater in PL-WB animals compared to PL-HU animals only ($p<0.02$).

Conclusions: On balance, LARC implantation did not blunt nor worsen the bone response to unloading. LARC appear to be a viable option for premenopausal female astronauts selected for long-duration missions.

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

323 Board #139 May 27 10:30 AM - 12:00 PM

Differences In Bone Mineral Density At The Femoral Neck And Lumbar Regions Across Female Soccer Players, Olympic Lifters And Power Lifters

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(No relevant relationships reported)

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

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

RESULTS: All three athletic groups had greater total BMD than RA (1.071 ± 0.066 g·cm $^{-2}$). OL (1.306 ± 0.08 g·cm $^{-2}$) had greater total BMD than PL (1.071 ± 0.07 g·cm $^{-2}$), but it was not different than SP. At the femoral neck, OL (1.127 ± 0.09 g·cm $^{-2}$) and SP (1.212 ± 0.10 g·cm $^{-2}$) [but not PL (1.075 ± 0.16 g·cm $^{-2}$)] had greater BMD than RA (0.971 ± 0.09 g·cm $^{-2}$). 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 at 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.

324

Board #140

May 27 10:30 AM - 12:00 PM

Middle-and Long-term Endurance Runners Exhibit Healthier Fat Distribution Compared To Matched Controls

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(No relevant relationships reported)

PURPOSE: Aerobic exercise training has many known cardiovascular benefits that may promote healthy ageing. Long-term long-distance running is a common aerobic exercise modality, but the number of individuals involved in endurance running decreases with increasing age. This cross-sectional study assesses structural findings, e.g. 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 mean(standard deviation; SD) age of $49(4)$ yr, height of $178.9(4.9)$ cm, weight of $67.8(5.8)$ kg and body mass index (BMI) of $21.4(1.4)$ kg/m 2 that had been running $82.6(27.9)$ 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 $176.0(72.8)$ cm, weight of $72.8(7.1)$ kg and BMI of $23.7(2.1)$ kg/m 2 . Only BMI statistically differed between the groups ($P=0.010$). 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 less total body (8.6kg), arm (58%), leg (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.

325

Board #141

May 27 10:30 AM - 12:00 PM

Reliability Of Leg Length Measures Using Dual Energy X-ray Absorptiometry (dxa) Scans In Young Children.

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(No relevant relationships reported)

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

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

RESULTS: Intratester reliability for Invest 1 right leg length (66.48 ± 1.01 versus 66.49 ± 1.02 cm; $r^2 = 0.999$) and left leg (66.64 ± 1.00 versus 66.60 ± 1.01 cm; $r^2 = 0.998$); and for Invest 2 right leg length (66.25 ± 1.01 versus 66.26 ± 1.00 cm; $r^2 = 0.999$) and left leg (66.43 ± 1.00 versus 66.47 ± 1.00 cm; $r^2 = 0.999$) resulted in no significant group mean differences, and significant explained variance. Subsequently, the group mean of the right and the left leg lengths were used for both Invest 1 and Invest 2 to determine the intertester reliability. Similarly, no significant group mean differences and significant explained variance were found for the right leg length (66.49 ± 1.02 versus 66.26 ± 1.00 cm; $r^2 = 0.988$) and the left leg (66.62 ± 1.00 versus 66.45 ± 1.00 cm; $r^2 = 0.973$). Bland Altman plotting resulted in mean differences of 0.23 cm and 0.17 cm; with the 95% confidence intervals ranging from 2.55 to -2.08 cm and 2.60 to -2.26 cm for the right and left legs, respectively. **CONCLUSION:** Leg lengths measured from total body DXA scans provide highly reliable measures and may provide greater accuracy than traditional measures using anthropometric tapes due to the elimination of soft tissue.

326	Board #142	May 27 10:30 AM - 12:00 PM	Bone Density Is Lower And Differentially Related To Body Composition In Adults Using ADHD Medications Shannon L. Mathis ¹ , Sims K. Lawson ¹ , Harshvardhan Singh ² , Gary R. Hunter, FACSM ² , Gordon G. MacGregor ³ . ¹ University of Alabama Huntsville, Huntsville, AL, ² University of Alabama Birmingham, Birmingham, AL, ³ Alabama College of Osteopathic Medicine, Dothan, AL. (Sponsor: Gary R. Hunter, FACSM) Email: shannon.mathis@uah.edu (No relevant relationships reported)	328	Board #144	May 27 10:30 AM - 12:00 PM	Effect Of Running And Swimming On Bone Mineral Density Throughout The Lifespan Eric Shamus ¹ , Taylor Millheim ² , Kenna Valdovinos ¹ . ¹ Florida Gulf Coast University, Fort Myers, FL, ² Select Physical Therapy, Pembroke Pines, FL. Email: eshamus@fgcu.edu (No relevant relationships reported)
			<p>PURPOSE: Stimulant medications, such as amphetamines, lead to increased activation of osteoclast-mediated bone resorption resulting in decreased bone mass and are first-line medications for Attention-Deficit Hyperactivity Disorder (ADHD). PURPOSE: To determine the effect of stimulants on bone mineral density (BMD) and body composition in young adults with ADHD. METHODS: Stimulant (methylphenidate or amphetamine) users (ADHD; 14 male, 11 female) and 28 healthy controls (CON; 17 male, 11 female) participated (N=53, 19-27 years of age). Physical activity (PA) was measured with Bone-Specific Physical Activity Questionnaire. Whole body (WB) bone mineral content (BMC), BMD z-scores (to adjust for gender, race, body weight, and age) of the lumbar spine (L1-L4), total hip, and femoral neck, body composition, and relative skeletal mass index (RSMI) were measured by dual X-ray absorptiometry. Independent sample t-tests, multiple regression, and step-wise regression were used to analyze the data. RESULTS: Independent sample t-test showed no differences in age, percent body fat, or RSMI between the groups. In the ADHD group, PA was lower compared to CON (-15.9, p = .003). WB BMC was lower in ADHD vs. CON (-304.5 g, p = .02); and, BMD z-scores of WB (z = -0.9, p = .01) and lumbar spine (z = -0.77, p = .04) were lower in ADHD than CON with no differences in total hip and femoral neck. Linear regression analysis showed group and RSMI were independently related to WB BMD z-scores ($r = -0.68$, $p = .05$; $r = 0.33$, $p = .005$, respectively); PA was not related to WB BMD z-score ($r = 0.003$, $p = .75$). The WB BMD z-score was $z = 0.68$ lower in the ADHD group than the control group. When controlling for PA, sex, age, height, and weight, stepwise regression analyses showed that: In ADHD, lean mass was not related to BMD at any of the sites ($p > .05$), but fat mass was negatively related to hip ($r = -.58$, $p = .006$), neck ($r = -.72$, $p < .001$), and WB BMC ($r = -.76$, $p < .001$). In CON, lean mass was positively related to spine and hip BMD ($r = .45$, $p = .03$; $r = .45$, $p = .03$, respectively) and WB BMC ($r = .56$, $p = .004$); fat mass was negatively related to hip BMD ($r = -.43$, $p = .04$) and WB BMC ($r = -.56$, $p = .004$). CONCLUSIONS: Lower indices of bone health in the ADHD group and the differential relationship between muscle mass and bone density in ADHD vs. CON may be due to adverse metabolic effects of stimulant medication.</p>				<p>PURPOSE: Bone mineral density (BMD) is used as an indirect indicator of risk of osteoporosis and bone fracture. Both swimming and running have been found to have a positive effect on bone mineral density. A comparison of the effects of swimming and running on bone mineral density in humans has not yet been performed. The purpose of this study was to compare the effects of running and swimming on bone mineral density in young individuals versus mature individuals and to compare intrinsic variables of body weight, height, gender, years swimming or running, distance ran or swam per week, and hours of physical activity per week. METHODS: This was a quantitative, correlational study that sought to determine whether statistically significant differences in bone mineral density exist between swimmers and runners across the lifespan. Heel bone mineral density of each participant was assessed using the GE Achilles Ultrasoundometer. 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 difference 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.</p>
327	Board #143	May 27 10:30 AM - 12:00 PM	Effect Of High Intensity Intermittent Exercise On Blood Ionized Calcium And Serum Parathyroid Hormone Jun Hamano ¹ , Takayuki Shimizu ¹ , Katsuori Tsuji ¹ , Yuzhong Xu ¹ , Masanari Togo ¹ , Wendy M. Kohrt, FACSM ² , Izumi Tabata, FACSM ¹ . ¹ Ritsumeikan University, Kusatsu City, Shiga Prefecture, Japan, ² University of Colorado, Aurora, CO. (Sponsor: Izumi Tabata, FACSM) (No relevant relationships reported)	329	Board #145	May 27 10:30 AM - 12:00 PM	Association Between Dietary Cholesterol, Saturated Fat And Bone By Calcium Intake Levels. Stephanie Marie Otto. Gustavus Adolphus College, St. Peter, MN. Email: sotto@gustavus.edu (No relevant relationships reported)
			<p>Purpose: Increased serum parathyroid hormone concentration (PTH) during moderate-intensity exercise has been reported, suggesting that such exercise may stimulate bone resorption. On the other hand, certain data also suggest that supramaximal intensity exercise causes neither a decrease in serum calcium nor increase in PTH. This study was undertaken to observe the effects of high intensity intermittent exercise (HIIIE), which improves both aerobic and anaerobic fitness maximally, on bone metabolism. Method: Seven young subjects exercised on two days after an overnight fast. On the HIIIE day, subjects performed 6-7 exhaustive 20-sec cycling bouts (170% $\dot{V}O_{2\text{max}}$) with intervening 10-sec rest intervals. On the moderate-intensity exercise (MIE) day, subjects cycled for 60 min at 70% $\dot{V}O_{2\text{max}}$. Blood was sampled before and after 10 min of warm-up at 50% $\dot{V}O_{2\text{max}}$, and immediately after and 10, 20, 30, 60, 90 min after the HIIIE. For MIE day, blood was obtained before, immediately after, and 10, 30, 60, 90 min after the exercise. Result: HIIIE induced an increase in iCa (Pre: 1.13 ± 0.06 mmol/l, post: 1.22 ± 0.03 mmol/l, $p < 0.001$) and a decrease in PTH (Pre: 30 ± 5 pg/ml, 10 min after HIIIE: 22 ± 4 pg/ml, $p < 0.05$), while MIE significantly elevated serum PTH without a change in iCa. No changes in serum C-terminal telopeptides of Type I collagen (marker of bone resorption) or osteocalcin (marker of bone formation) were observed up to 90 min after HIIIE and MIE. Conclusion: It is concluded that HIIIE does not induce a decrease in blood iCa or increase in PTH, suggesting that HIIIE might not deteriorate bone metabolism.</p>				<p>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/cm^2) 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 $\geq 75\%$ of the recommended intake) and a calcium deficient group (calcium intake $< 75\%$ of the recommended intake). RESULTS: Among the calcium sufficient group, a significant positive correlation ($p < .05$) was found between lumbar spine BMD and dietary cholesterol intake ($r = .41$, $p = .020$) even after controlling for dietary protein intake ($r = .41$, $p = .024$). A significant positive correlation 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 among the calcium deficient group. Among the calcium sufficient group, regression analysis indicated that dietary cholesterol was a significant predictor of lumbar spine BMD only $F(1,30) = 6.02$, $MSE = .03$, $p = .020$, $Adj. R^2 = .14$. CONCLUSIONS: Among a group of calcium deficient women, it appears that other nutrients are not associated with BMD. For women who are receiving an adequate amount of calcium, cholesterol and saturated fat intake are both associated with higher BMD. Of particular interest was the positive correlation between dietary cholesterol and lumbar spine BMD even after controlling for protein intake which might indicate the importance of animal sources of protein for bone health. Future research should examine the role of animal protein compared to non-animal protein on BMD. IRB# 1213-0223</p>

330	Board #146	May 27 10:30 AM - 12:00 PM
Association Among Percent Body Fat, Areal Bone Mineral Density, And Handgrip Strength In Young Adults		
SoJung Kim ¹ , Harshvardhan Singh ² , Eliana Casamassima ¹ . ¹ University of Massachusetts, Lowell, MA. ² University of Alabama, Birmingham, AL.		
Email: sojung_kim@uml.edu (No relevant relationships reported)		

PURPOSE: The purpose of this cross-sectional study was to examine the relationships among percent body fat (%BF), areal bone mineral density (aBMD) and non-dominant handgrip strength in healthy college-aged students. **METHODS:** Healthy college-aged women (n=73, 20.4±1.3 years; 163.5±7.1 cm; 64.7±11.3 kg) and men (n=59, 21.1±1.4 years; 177.4.5±7.7 cm; 77.7±10.6 kg) between the ages of 18 and 25 years were recruited from the University of Massachusetts Lowell. Body composition (%BF) and aBMD of the non-dominant side of femur (FN: femoral neck, TH: total hip) and lumbar spine (L1-L4) were measured by dual energy X-ray absorptiometry. Isometric handgrip test was measured by JAMAR Dynamometer, and the average of three trials of the non-dominant side was used for data analysis. The total bone-specific physical activity (tBPAQ, average of past and current BPAQ) score was used to obtain a comprehensive account of lifetime physical activity related to bone health. **RESULTS:** Partial correlation tests showed significantly negative relationships between %BF and aBMD of the non-dominant FN ($r_{partial} = -.387$, $p=.002$), TH ($r_{partial} = -.458$, $p=.0001$), and lumbar spine ($r_{partial} = -.299$, $p=.034$) in young women, while controlling for tBPAQ and BMI. Similarly, FN ($r_{partial} = -.453$, $p=.001$), TH ($r_{partial} = -.425$, $p=.001$), and lumbar spine ($r_{partial} = -.291$, $p=.034$) were found in young men. In addition, higher %BF had a negative impact on isometric hand grip strength in both women ($r_{partial} = -.446$, $p=.0001$) and men ($r_{partial} = -.410$, $p=.002$), respectively. **CONCLUSIONS:** Our data suggests that regardless of BMI and physical activity, %BF can adversely affect musculoskeletal health in young adults. These results have important implications for prevention of future loss of abMD in young adults, individuals who may be overweight or obese, and individuals undergoing weight loss.

331	Board #147	May 27 10:30 AM - 12:00 PM
Prior Tobacco Use Is Associated With Tibial Microarchitecture In U.S. Army Recruits: A Preliminary Analysis		
Colleen M. Castellani, Theresa N. Faller, Katelyn I. Guerriere, Julie M. Hughes, Stephen A. Foulis, Kathryn M. Taylor. <i>Military Performance Division, United States Army Research Institute of Environmental Medicine, Natick, MA.</i>		
(No relevant relationships reported)		

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

A-44 Free Communication/Poster - Disability

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

332	Board #148	May 27 10:30 AM - 12:00 PM
Effects Of Testosterone And Resistance Training On Protein Expression And Mitochondrial Functions Following Spinal Cord Injury		
Ashraf S. Gorgey, FACSM ¹ , Zachary A. Graham ² , Robert A. Adler ¹ , Edward J. Lesniewsky ¹ , Christopher P. Cardozo ³ . ¹ Hunter Holmes McGuire VA Medical Center, Richmond, VA. ² Birmingham VA Medical Center/ University of Alabama, Birmingham, AL. ³ James J. Peters VA Medical Center/ Icahn School of Medicine, Bronx, NY.		
Email: ashraf.gorgey@va.gov (No relevant relationships reported)		

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-3 increased ($P=0.0001$) in both TRT+RT (1764±665 to 2548.5±853 ng/ml) and TRT (1918.5±587 to 2778±967 ng/ml). GLUT4 was elevated in the TRT+RT group compared to the TRT only ($P=0.005$). Total Akt ($P=0.06$) and phosphorylated Akt^TSer389 ($P=0.049$) 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.

333	Board #149	May 27 10:30 AM - 12:00 PM
Trabecular Bone Quality In Spinal Cord Injury Following Open Chain Resistance Training And Testosterone Replacement		
Matthew E. Holman ¹ , Adam P. Sima ² , Gregory Chang ³ , Robert A. Adler ¹ , Ashraf S. Gorgey, FACSM ¹ . ¹ Hunter Holmes McGuire VA Medical Center, Richmond, VA. ² Virginia Commonwealth University, Richmond, VA. ³ NYU Langone Health, New York, NY. (Sponsor: Ashraf Gorgey, FACSM)		

(No relevant relationships reported)

Spinal cord injury (SCI) adversely effects testosterone levels and bone quality. Resistance training (RT) and testosterone replacement therapy (TRT) have been shown to improve muscle quality in humans following SCI. Such improvements to muscle quality may also result in improved bone quality. **PURPOSE:** To examine if combining open kinetic chain RT and TRT (TRT+RT) can be beneficial to trabecular bone quality following SCI. **METHODS:** Nine subjects with SCI were randomized into a TRT+RT group for a 16-week intervention. Each subject also underwent magnetic resonance imaging (MRI) prior to (BL) and following the intervention (PI). MRI microarchitecture techniques were used to evaluate trabecular bone quality, measured as plate width (PW; μm), trabecular bone thickness (TBTh; mm), trabecular bone spacing (TBSp; mm), and network area (NA; $1/\text{mm}^2$) for the right proximal tibia (ProxT) and distal femur (DistF). Mixed models with random effects were used to calculate differences between BL and PI ($MD \pm SE$) and were then transformed to effect sizes similar to Cohen's d (d , 95% CI [effect size]). **RESULTS:** : Following the intervention, ProxT PW ($MD: 30.56 \pm 22.52$; $d: 0.48$, -0.21 to 1.17 [small]), TBTh ($MD: 0.02 \pm 0.01$; $d: 0.70$, 0.01 to 1.39 [medium]), and NA ($MD: 0.04 \pm 0.02$; $d: 0.64$, -0.05 to 1.33 [medium]) all increased from BL measures. In contrast, TBSp ($MD: -0.25 \pm 0.17$; $d: -0.52$, -1.22 to 0.17 [medium]) decreased from BL. The DistF similarly presented with increases in bone quality from BL for PW ($MD: 11.7 \pm 42.70$; $d: 0.10$, -0.60 to 0.79 [negligible]), TBTh ($MD: 0.01 \pm 0.01$; $d: 0.29$, -0.41 to 0.98 [negligible]), and NA ($MD: 0.03 \pm 0.03$; $d: 0.39$, -0.30 to 1.08 [small]), as well as decreases in TBSp ($MD: -0.25 \pm 0.17$; $d: -0.52$, -1.22 to 0.17 [medium]) decreased from BL. The DistF similarly presented with increases in bone quality from BL for PW ($MD: 11.7 \pm 42.70$; $d: 0.10$, -0.60 to 0.79 [negligible]), TBTh ($MD: 0.01 \pm 0.01$; $d: 0.29$, -0.41 to 0.98 [negligible]), and NA ($MD: 0.03 \pm 0.03$; $d: 0.39$, -0.30 to 1.08 [small]), as well as decreases in TBSp ($MD: -0.25 \pm 0.17$; $d: -0.52$, -1.22 to 0.17 [medium]) decreased from BL. The DistF similarly presented with increases in bone quality from BL for PW ($MD: 11.7 \pm 42.70$; $d: 0.10$, -0.60 to 0.79 [negligible]), TBTh ($MD: 0.01 \pm 0.01$; $d: 0.29$, -0.41 to 0.98 [negligible]), and NA ($MD: 0.03 \pm 0.03$; $d: 0.39$, -0.30 to 1.08 [small]), as well as decreases in TBSp ($MD: -0.25 \pm 0.17$; $d: -0.52$, -1.22 to 0.17 [medium]) decreased from BL. 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(MD: -0.22 ± 0.16 ; d: -0.47, -1.16 to 0.23 [small]). **CONCLUSIONS:** When combined with TRT, the mechanical stresses induced via open kinetic chain RT displays the potential to improve trabecular bone quality following a longer duration intervention. This was particularly evident within the ProxT as these effect sizes were comparably larger than the DistF. Such differences are likely due to the tissue stress induced on the ProxT through contractions of the quadriceps muscles. Supported by VA-RRD CDA2 (B7867-W).

334	Board #150	May 27 10:30 AM - 12:00 PM
Hypermobility Characterization In Participants With Down Syndrome Attending An Instructor Led Controlled Adaptive Exercise Setting		

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(No relevant relationships reported)

Introduction/Background: Joint hypermobility (JHM) and hypotonia are features shown in people with Down Syndrome (DS). Adaptive Exercise Programs adapt not only to the physical but also to behavioral and intellectual challenges. This study characterized JHM and related measures in a sample of adults with DS attending an adaptive exercise program. **Methods:** Thirteen adults with DS (11 males and 2 females, 28.5 ± 3.2 y height: 138.6 ± 45.8 cm, body mass = 78.22 ± 15.03 kg) participated. Participants attended adaptive exercise programming twice a week for ≥ 9 months. Tests included active range of motion (AROM) measured three times (median score reported), JHM was determined through the 9-point Brighton scale, upper body (hand-grip dynamometer) and lower body (30-second sit-to-stand) strength. **Results:** Means \pm SD for AROM included: shoulder extension = $21.3 \pm 8.9^\circ$, shoulder flexion = $179.0 \pm 9.7^\circ$, shoulder abduction = $174.9 \pm 8^\circ$, shoulder medial rotation = $59.2 \pm 13.2^\circ$, shoulder lateral rotation = $86.1 \pm 11.6^\circ$, hip extension = $14.3 \pm 5.8^\circ$, hip flexion = $94.0 \pm 13.6^\circ$, hip abduction = $27.8 \pm 8.4^\circ$, hip adduction = $17.1 \pm 4.5^\circ$, hip medial rotation = $31.5 \pm 6.3^\circ$, hip lateral rotation = $31.9 \pm 5.6^\circ$, ankle dorsiflexion = $16.6 \pm 8.2^\circ$, ankle plantarflexion = $44.9 \pm 8.2^\circ$, subtalar inversion = $25.9 \pm 6.0^\circ$, and subtalar eversion = $19.2 \pm 9.6^\circ$. Participants presented with: no JHM 38.4% (n=5) and with JHM 60.14% (n=8). Strength was 26.4 ± 6 kg and the sit-to-stand included 20 ± 6 movements. There were not significant correlations between JHM and muscle strength ($r=-0.338$, $p=.259$) or physical function ($r=-0.085$, $p=.220$). **Discussion/Conclusion:** Adults with DS that participated in an instructor-led adaptive exercise setting showed lower AROM compared to norms in adults without DS, potentially because of persistent hypotonia. Despite the sizable incidence of JHM, JHM was more prominent in hands (50% of 8). Participants showed comparable upper-body strength but higher lower body strength than shown in DS. The program focused on strengthening large muscle groups with less emphasis on wrist or hand muscles which can potentially explain why only 1/3 of participants presented with the overall JHM and good lower body strength. Future studies should evaluate changes in JHM, AROM and muscle strength in response to adaptive exercise training in DS.

335	Board #151	May 27 10:30 AM - 12:00 PM
Lean Mass Changes After 10-week Resistance Training Intervention In Adults With Down Syndrome		

Emily M. Post, Madison L. Kackley, Lydia K. Caldwell, Matthew K. Beeler, Carl M. Maresh, FACSM, Brian C. Focht, FACSM, Jeff S. Volek, William J. Kraemer, FACSM. *The Ohio State University, Columbus, OH.* (Sponsor: William Kraemer, FACSM)
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(No relevant relationships reported)

PURPOSE: To examine changes in body composition (i.e. lean mass) after a 10-week resistance training intervention in individuals with Down syndrome. **METHODS:** Data was collected on willing 18 - 40-year-old moderately active men and women with Down syndrome (age 24.4 ± 6.3 years, height 149.2 ± 11.2 cm, weight 72.02 ± 24.5 kg). Twelve participants completed 24 resistance training sessions (duration 45-60 minutes per session). Dual x-ray absorptiometry (DXA) was used to assess body composition both pre- and post-intervention (i.e. body fat, lean tissue mass, fat tissue, bone density). A nonlinear periodized resistance exercise program was implemented; made of light, moderate, and heavy resistances. The participants began the first two weeks of the intervention with exercises using light 12-15 RM Zone repetitions and moderate 8-10 RM Zone progressing from 1-3 sets over the two-week period of time. After that flexible period, using light, moderate, and heavy (4-6 RM zone) for 3 sets were rotated with toleration of the work out noted each training session. The resistance training intervention utilized a body part bodybuilding training program 3 days per week (consisting of 1 upper body, 1 lower body, 1 full body exercises). The exercises consisted of body weight exercises, machine based, resistance bands, and free weight exercises. Each program was individualized per participant regarding specific exercises based off of movement kinetics, understanding, skill, and strength

levels. Participants were kept in a light to moderate intensity heart rate range via heart range chest monitoring straps. **RESULTS:** There was no significant difference between pre- and post-intervention for overall body mass ($p=0.23$), body fat ($p=0.75$), or bone mineral density ($p=0.078$). However, there was a significant increase between pre- and post-intervention in lean mass ($p=0.033$). **CONCLUSIONS:** A 10-week moderate resistance training intervention is a great enough stimulus to significantly increase lean muscle tissue in adults with Down syndrome. Therefore, implementing resistance training into an individual's weekly routine for adults with Down syndrome is a viable option to increase lean muscle mass, which could also increase potential strength and motor skill, then increasing overall quality of life.

336	Board #152	May 27 10:30 AM - 12:00 PM
Alterations In Musculoskeletal Function And Body Composition In Children With Autism Spectrum Disorder		

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(No relevant relationships reported)

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 control adults, TDC and ASD had lower BMI (20.1 ± 0.7 TDC, 22.3 ± 4.4 ASD vs. 27.2 ± 2.3 Adults, kg/m^2). All groups had similar percent body fat (26.4 ± 2.3 Adults, 29.8 ± 1.83 TDC, 32.9 ± 3.84 ASD, %) and percent lean body mass (69.5 ± 2.2 Adults, 66.8 ± 1.7 TDC, 64.4 ± 3.6 ASD, %). However, compared to TDC, ASD children had significantly lower bone mass percentage (2.7 ± 0.3 ASD vs. 3.2 ± 0.2 TDC, %). Waist-to-hip ratio was significantly higher for ASD (0.91 ± 0.04 ASD vs. 0.85 ± 0.01 TDC). The maximal forearm and leg strength were significantly lower in ASD compared to TDC normalized for their body weight (30.2 ± 5.2 ASD vs. 42.8 ± 2.5 TDC, kg). There is a significant inverse relationship with muscular strength and regional percent fat in the forearm.

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.

Supported by CASA RSCA Infusion, Central RSCA, and Undergraduate Research Grant, SJSU

337	Board #153	May 27 10:30 AM - 12:00 PM
Acute Effects Of Photobiomodulation Therapy On Muscle Force Recovery In Persons With Multiple Sclerosis		

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(No relevant relationships reported)

Symptomatic fatigue, as well as muscle fatigue, are common in persons with multiple sclerosis (PwMS), and both can negatively affect quality of life (QOL). Photobiomodulation Therapy (PBMT), comprising light in a 600-1000 nm bandwidth, is an emerging therapeutic modality thought to enhance mitochondrial function. There is evidence that PBMT can improve muscle fatigue, inflammation, and psychological status and thus might be beneficial for PwMS.

PURPOSE: To investigate PBMT on muscle force recovery after a fatiguing contraction in PwMS. A secondary aim was to determine if self-reported symptom outcomes influenced the response to PBMT.

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

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 z transformation.

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

CONCLUSIONS: PBMT at 120J may improve muscle force recovery in PwMS. Those reporting greater depression, or lower QOL may benefit most from PBMT. Supported by a pilot grant from the National MS Society

338 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. Raczynski, 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 ± 0.08 pre vs. 0.88 ± 0.04 post, g/cm^2)]; however, they did not show statistical differences in muscular strength [extensor peak torque (27 ± 9 pre vs. 32 ± 10 post, ft-lbs), flexor peak torque (13 ± 4 pre vs. 12 ± 5 post, ft-lbs)], or balance on limit of stability test [e.g. overall score (32 ± 7 pre vs. 31 ± 6 post)]. 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 balance in adults with CP, specifically only those who significantly gained BMD after resistance training.

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

339 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 Sawazaki², Hiroshi Akima³. ¹Chukyo University, Toyota, Japan. ²Kajinoki Medical Clinic, Gifu, Japan. ³Nagoya 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 contractile 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 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. $1.93 \pm 1.00 \text{ cm}^2$, $p < 0.05$). Middle to higher ranged EI areas were significantly decreased after the exercise (100-149; 0.44 ± 0.20 vs. $0.24 \pm 0.15 \text{ cm}^2$, 150-199; 0.08 ± 0.05 vs. $0.03 \pm 0.04 \text{ cm}^2$, $p < 0.05$).

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.

340 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. Shaefner, Stephanie C. Clark, Jacob L. Sellon, 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 (JTF, 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/m^2 (22.33 to 45.36 kg/m^2), 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-portion 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

disorder (1 [2%]), Sjogren's syndrome (1 [2%]), hyperparathyroidism (1 [2%]), and HIV (1 [2%]). **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.

341 Board #157 May 27 10:30 AM - 12:00 PM

Does Muscle Architecture Affect Strength In Patients With Multiple Sclerosis?

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(No relevant relationships reported)

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

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

RESULTS: Pennation angles of RF, BF, TA were lower in MS patients (respectively, $p=0.042$, $p=0.023$, $p=0.002$). There was no difference in fiber length of all muscles. Only in rectus femoris, thickness was lower than control group ($p=0.015$). Moreover, there was a positive correlation between rectus femoris muscle thickness and knee extensor muscle strength ($p=0.014$, $r=0.744$).

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

342 Board #158 May 27 10:30 AM - 12:00 PM

Measurement Of Muscle Thickness In The Forearms Of Rock Climbers Using Ultrasound

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(No relevant relationships reported)

The flexor muscles of the forearm are repeatedly found to be the rate limiting factor in performance for rock climbers. Previous studies have shown that cross sectional area (CSA) measurements via Magnetic Resonance Imaging (MRI) have a strong correlation to ultrasound measured muscle thickness (MT) in the forearm flexors. However, few studies have employed this relatively low-cost alternative to MRI to assessing forearm muscles of rock climbers. **PURPOSE:** To compare differences in MT of the finger flexors in the forearms of early-stage rock climbers and non-rock climbers using ultrasound. **METHODS:** The study consisted of 22 climbers (22.23 ± 3.01 year; 68% male) and 11 controls (21.91 ± 1.97 ; 55% male). Body fat percentage and BMI were measured in all participants. An image of the thickest portion of the forearm, from the ulna and radius to the muscle-skin interface, was captured with ultrasound, and MT was measured using Image J. Independent samples t-tests were conducted to compare MT over the ulna and radius between climbers and controls. **RESULTS:** Climbers had an average of 2.44 ± 1.24 years of experience, and had lower body fat percentages (19.14 ± 6.99) than controls (30.02 ± 7.6) ($p < .001$). BMI was similar for climbers and controls at 21.77 ± 3.23 and $22.62 \pm 22.62 \text{ kg/m}^2$, respectively. Both ulnar and radial MT values were significantly higher in climbers, $4.23 \pm .39 \text{ cm}$ and $2.32 \pm .39 \text{ cm}$ ($p < .001$) respectively, and $3.61 \pm .6 \text{ cm}$ and $1.84 \pm .31 \text{ cm}$ in controls ($p < .001$). **CONCLUSION:** Despite a relatively low average climbing experience rock climbers had larger MT values than controls. The present study demonstrated that ultrasound can be used to detect differences in flexor MT in rock climbers compared to controls. Future studies should examine longitudinal changes in MT in climbers as they progress in training.

343

Board #159

May 27 10:30 AM - 12:00 PM

Assessment Of Changes In Muscle Glycogen Content Across The Menstrual Cycle

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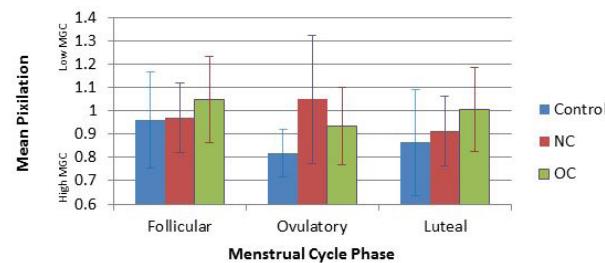
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(No relevant relationships reported)

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

PURPOSE: The aim of this study was to compare changes in muscle glycogen scores across the menstrual cycle using ultrasound imaging. **METHODS:** Twenty-eight subjects (10 male; 18 female) ages $18-30$ (24.0 ± 2.78) participated in this study. Subjects were divided into Control (CON; 10 male), Non-Contraceptive (NC; 8 Female), and Oral-Contraceptive (OC; 10 Female) groups. Measurements at 22, 56, & 73% of the thigh were taken on the vastus medialis, vastus lateralis, & rectus femoris of the dominant leg using ultrasound. Subjects were measured at the follicular, ovulatory & luteal phases of the menstrual cycle. Using ImageJ, muscle pixelation values were determined by capturing a 25×8 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 $p > .05$). 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.

Figure 1 - Muscle Glycogen Content Across the Menstrual Cycle



344

Board #160

May 27 10:30 AM - 12:00 PM

Reliability Of Ultrasound Panoramic Imaging Of Muscle Size For The Transversus Abdominis

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(No relevant relationships reported)

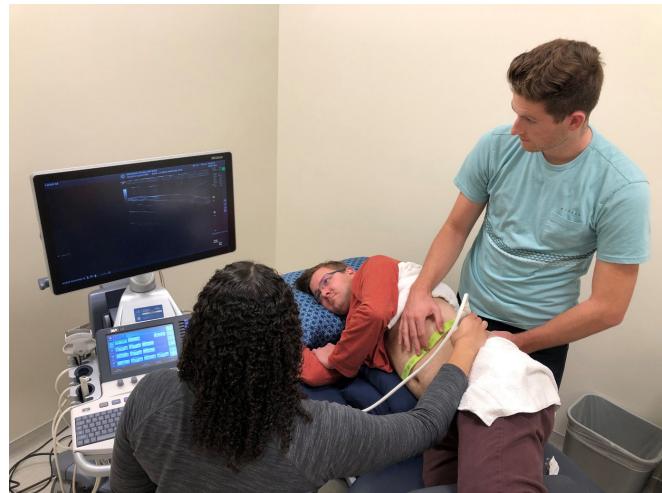
PURPOSE: The transversus abdominis (TrA) is a key muscle in core stability.

Measurements of its morphology might shed some light on structure, function and 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 the degree to which this technique produces stable and consistent results.

METHODS: 6 female participants; age(years)= 21.3 ± 1.6 ; height(cm)= 167.5 ± 5.1 ; weight(kg)= 65.5 ± 11.0 volunteered for this study. With the participants in side-lying position, muscle length, muscle area and thickness were scanned using GE Logic S8 (6-15 MHz probe). The right and left TrA muscles were imaged twice on each subject at spinal levels L1, L3 and L5 and later measured by two separate investigators. Test-retest reliability was calculated using interclass correlation coefficient (ICC) (random subjects and fixed raters) along with the Standard Error of Measurement (SEM).

RESULTS: Our panoramic measures showed excellent intertester reliability for length, area and thickness measurements ($ICC=0.981, 0.982, 0.985$, respectively). In addition, the SEM for length, area and thickness were $SEM= 0.178, 0.078, 0.046$, respectively.

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



345 Board #161 May 27 10:30 AM - 12:00 PM

Validity Of Lower Leg Muscle Cross-sectional Area Measurements Using Ultrasound Imaging Compared To MRI

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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 (females 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), and fibularis longus (FL) assessed with both US and MRI at 30% of the distance from the knee joint line to the lateral malleolus, while the flexor digitorum longus (FDL) and fibularis brevis (FB) were 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: High correlations were seen between US and MRI size measurements (TA r = 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 FDL r = 0.94, p=0.000. CSAs from MRI were larger than those measured from US by an average of 0.17 cm^2 .

Conclusion: Measurements of CSA using US in selected leg muscles were comparable to those on MRI scans with MRI assessment larger than US. This difference may be due to difficulty in seeing fascial borders in the MRI images. 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.

346 Board #162 May 27 10:30 AM - 12:00 PM

Between-limb Differences In Ultrasound Spatial Frequency Analysis Parameters Following Acute Hamstring Strain Injury

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(No relevant relationships reported)

Treatment following hamstring strain injury (HSI) is complicated by a lack of prognostic indicators and high rates of re-injury. Spatial frequency (SF) analysis, a quantitative ultrasound method to assess structural tissue organization, could complement clinical evaluations. **PURPOSE:** To characterize differences in SF parameters between injured and uninjured limbs following acute HSI in Division I collegiate athletes. **METHODS:** Ultrasound imaging was performed within one week of HSI, also confirmed by MRI. Longitudinal B-mode images (Aixplorer, Supersonic Imagine, Aix-en-Provence, France) were acquired by a single musculoskeletal-trained sonographer using a linear array transducer (2-10 MHz) at the injury site of maximum tenderness and corresponding location for the uninjured limb. A region of interest (ROI) was drawn about the site of injury and location-matched on the images of the uninjured limb. A 2D Fourier Transform was performed on all possible 5 mm square kernels within the ROI. Peak spatial frequency radius (PSFR), a parameter corresponding to the frequency of the fascicular banding pattern, and Mmax%, a ratio comparing the prominent banded pattern relative to the background, were computed for each kernel. PSFR and Mmax% from all kernels were averaged across respective ROIs. Paired t-tests were used to compare parameter differences between limbs.

RESULTS: Seven male athletes sustained HSI (mean age = 19.1 ± 0.8 yrs). PSFR ($1/\text{mm}$) was lower ($p = 0.005$) in the injured limb (0.81 ± 0.22) compared to the uninjured limb (0.95 ± 0.18). Mmax% was also lower ($p = 0.023$) in the injured limb (1.44 ± 0.41) compared to the uninjured limb (2.03 ± 0.56). Both measures indicated decreased tissue organization in the injured limb, characterized by disruption of the reflected fascicular banded pattern. **CONCLUSION:** SF analysis successfully detected differences between injured and uninjured muscle tissue. Although differences in SF parameters between limbs cannot differentiate whether alterations are due to mechanical disruption of fascicles or presence of edema, this method may have promise in identifying structural changes following HSI and in monitoring changes throughout recovery. Supported by NBA & GE Healthcare Orthopedics and Sports Medicine Collaboration and NIH Grant UL1TR002373 and TL1TR002375.

347 Board #163 May 27 10:30 AM - 12:00 PM

Spatial Frequency Analysis Identifies Altered Local Micromorphology In Adolescent Athletes With Achilles Tendinopathy

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(No relevant relationships reported)

Site specific intratendinous Achilles morphology measured with ultrasound image spatial frequency analysis (SFA), quantifies the degree of collagen fiber density and organization. As tendon pain varies in location, and is not always related to hypoechogenicity, it is of interest to establish if spatial frequency parameters discriminate regions of tendon pain where hypoechoic alterations are not readily observable.

Purpose: This study aims to analyze intratendinous micromorphology in adolescent athletes (AA) with Achilles tendinopathy and without sonographic evidence of tendinosis.

Methods: 22 AA (14m/8f, 13.2 ± 1.4 y, 161 ± 11 cm, 47 ± 11 kg) with Achilles tendinopathy (history of tendon pain and pain on palpation) and no visible sonographic hypoechogenicity or focal tendon thickening were included in this analysis. Longitudinal ultrasound scans of the Achilles tendon were acquired. SFA was performed on regions of interest (ROI) corresponding to tendon pre-insertion and midportion, as well as the site of subjectively-reported tendon pain on palpation. Higher values of SFA parameters suggest greater collagen fiber density and alignment. Calculated SFA parameter values were compared using a one-factorial or Wilcoxon ANOVA ($\alpha < 0.05$).

Results: Significantly lower values for three SFA parameters were found at the symptomatic area as compared to tendon pre-insertion ROI, and for two parameters at the symptomatic area as compared to tendon midportion ROI (Table 1).

Conclusion: As indicated by SFA, intratendinous morphology was altered at the painful area, whereas standard ROIs reveal comparable values to previous findings in healthy AA. These results indicate that painful, yet sonographically inconspicuous regions of tendons, have lower fiber density and alignment.

Table 1: SF parameters at tendon pre-insertion (I), midportion (M), and pain site (P) [mean \pm SD]

Location	PSFR	P6 Width	Q6 Factor	Mmax	Mmax%	Axis Ratio	Ellipse Rotation	Sum
I	1.88 ±0.21*	0.71 ±0.07*	2.77 ±0.33**	7041 ±1703	7.13 ±1.36*	1.73 ±0.14	90.5 ±0.8	99237 ±15788*
M	1.93 ±0.25*	0.71 ±0.07*	2.83 ±0.32*	6565 ±1327	7.67 ±1.37	1.73 ±0.16*	90.4 ±0.7	86203 ±12907*
P	1.59 ±0.36**	0.71 ±0.08*	2.33 ±0.46**	6290 ±1179	7.98 ±1.12*	1.73 ±0.18*	90.7 ±1.5	79404 ±14094*

* Data not normally distributed. **Significant differences ($p < 0.0003$).

- 348** Board #164 May 27 10:30 AM - 12:00 PM
A Time Course Of Changes In Echo Intensity Following Resistance Exercise In Untrained Individuals
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(No relevant relationships reported)

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 exposure to exercise. **PURPOSE:** To examine the changes in biceps muscle thickness (MT), EI and isometric strength (ISO) before, immediately after, and 24, and 48 hours after 4 sets of biceps curls. **METHODS:** 27 resistance trained individuals visited the laboratory 4 times. During visit 1, paperwork and maximum strength were measured. During visit 2 (2-7 days later) participant's MT and ISO were measured in both arms before performing 4 sets of biceps curls in a randomized arm. Additional measures were taken immediately after exercise, as well as 24 and 48 hours after exercise. MT images were saved for EI measurement. Results are displayed as means (SD). **RESULTS:** For MT there was an interaction ($p < 0.001$). MT increased from pre [2.88 (.64) cm] to post [3.27 (.67) cm] exercise and remained elevated above baseline 24 [2.92 (.66) cm] and 48 [2.98 (.68) cm] hours post. There were no changes for MT in the control group from pre [2.88 (.66) cm] to post [2.88 (.66) cm] exercise, or 24 or 48 hours post. For EI there was an interaction ($p = 0.012$). In the experimental group EI increased from pre [22.9 (9.6) AU] to post [29.1 (12.3) AU] exercise and was depressed below baseline 24 hours post [20.4 (9.9) AU]. For the control condition, EI was different between pre [24.8 (10.2) AU] and 48 hours [21.5 (10.7) AU]. In addition, EI were lower 24 [23.3 (11.4) AU] and 48 hours post exercise compared to immediately post exercise [27.4 (13.0) AU]. For ISO, there was an interaction ($p < 0.001$). In the experimental condition ISO decreased from pre [40.6 (14.7) Nm] to post exercise [24.8 (9.4) Nm] and remained depressed 24 [32.2 (11.3) Nm] and 48 hours [33.9 (11.4) Nm] post exercise. **CONCLUSIONS:** Naïve exposure to resistance exercise produced a swelling response, which was elevated 48 hours post exercise. This swelling was accompanied with a prolonged decrease in ISO, which is likely indicative of muscle damage. Despite an increase in MT, EI was only elevated immediately post exercise. In addition, EI changed in the control condition despite no changes in MT.

- 349** Board #165 May 27 10:30 AM - 12:00 PM
Influence Of Achilles Tendon Structure On Passive Mechanical Characteristics
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(No relevant relationships reported)

Investigations into tissue (muscle and tendon) stiffness have focused on the whole musculotendinous unit through imaging and dynamometry. However, few studies have examined the relationship between individual structural components of the tendon (e.g., thickness, cross-sectional area, and length) and their contributions on isolated mechanical characteristics of the free tendon (FT) (e.g. elasticity, stiffness, etc.). **PURPOSE:** Evaluate the relationship of FT structure (length, FT_L ; cross-sectional area, FT_{CSA} ; thickness, FT_T) and the mechanical characteristics (stiffness; ST, elasticity; EL, and mechanical stress relaxation time; MSRT) as assessed by myotonometry (MYO). **METHODS:** Ten male (mean \pm SD: age = 20.7 ± 1 year) participants laid in a prone position with their ankle at 90° . Ultrasonography (US) FT_{CSA} (cm^2) and FT_T (cm) images were scanned in a transverse position at 4 cm proximal to the osteotendinous junction. FT_L (cm) was captured in the extended-field of view setting starting at the calcaneal tuberosity and ending at the most distal muscle fascicles of the soleus. All US image measurements were analyzed using a third-party image analysis software. FT mechanical properties were assessed via MYO, through 5 automated mechanical oscillations and the average ST (N/m), EL, and MSRT (ms) measures were identified and used for statistical analysis of each variable. Pearson product-moment correlation coefficients (r) were used to examine the relationships between FT_L , FT_{CSA} , FT_T and ST, EL, and MSRT with a level of significance of $p = \leq 0.05$. **RESULTS:** A significant, strong correlation for FT_T and MSRT ($r = 0.637$; $R^2 = 0.406$; $p = 0.048$), and a

significant, strong, negative correlation for FT_T and ST ($r = -0.676$; $R^2 = 0.457$; $p = 0.032$) were observed. There were no significant correlations between FT_T and EL or FT_L and FT_{CSA} with ST, EL, and MSRT ($p = \geq 0.05$). **CONCLUSION:** These findings indicate that a greater FT_T 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.

- 350** Board #166 May 27 10:30 AM - 12:00 PM
Abstract Withdrawn

- 351** Board #167 May 27 10:30 AM - 12:00 PM
Lateral Abdominal Muscle Symmetry And Risk Of Sports Injury In Baseball Players
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(No relevant relationships reported)

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

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

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

RESULTS: The EO thickness was significantly greater in the dominant side than in the non-dominant side (6.85 ± 1.13 vs. 5.05 ± 1.46 mm, $p < 0.001$), and the TA thickness was significantly greater in the non-dominant side than in the dominant side (4.21 ± 0.85 vs. 3.49 ± 0.60 mm, $p = 0.003$). Only the asymmetry ratio of TA was significantly correlated with the FMS composite score ($r = 0.54$, $p = 0.040$).

CONCLUSIONS: High school baseball players showed side-to-side thickness asymmetry in the EO and TA. The significant correlation between the TA asymmetry ratio and FMS composite score suggests an increased risk of sports injury. High school baseball teams should consider integrating TA training into players' routine training program.

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

- 352** Board #168 May 27 10:30 AM - 12:00 PM
Evaluation Of Muscle Swelling After Concentric Muscle Contraction Using Bioelectrical Impedance Analysis
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(No relevant relationships reported)

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

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

METHODS: Nine male subjects (20.0 ± 0.8 yrs, 175.4 ± 2.4 cm, 65.2 ± 6.3 kg) performed isokinetic (60 deg/s) concentric knee extension (6 repetitions \times 10sets, 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

(before exercise: 269.2 ± 30.4 Nm, immediately after exercise: 233.6 ± 28.7 Nm, $P<0.05$). However, BIA value, muscle thickness and circumference did not change significantly after the exercise ($p>0.05$ for all variables).

CONCLUSIONS: Resistance exercise consisting of concentric muscle contraction did not affect local BIA. The finding was not consistent with that in our previous study using the resistance exercise consisting of both concentric and eccentric muscle contraction.

353 Board #169

May 27 10:30 AM - 12:00 PM

A Time-Efficient NIRS Protocol For Cross- And Within-limb Comparisons Of Muscle Oxidative Capacity

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(No relevant relationships reported)

The non-invasive determination of muscle mitochondrial oxidative capacity via Near Infrared Spectroscopy (NIRS) typically involves voluntary contraction of a single limb and requires as many as 22 brief ischemic occlusions per measurement. This limits the number of oxidative capacity measurements that can be completed in a given test session and also makes cross-limb muscle comparisons challenging. **PURPOSE:** To establish the efficacy of a recently developed protocol that utilizes fewer (i.e. 6) ischemic occlusions combined with surface electrical stimulation (E-stim) in both limbs simultaneously. **METHODS:** The test employs 2 upper thigh cuffs and 2 NIRS sensors placed directly over the vastus lateralis (VL) muscles (supine position) or the semi-tendinosus (ST) muscles (prone position). Metabolic rate is temporarily increased via E-stim pads placed above and below each NIRS sensor. A standard 6Hz frequency is employed using a pre-modulation setting, with the intensity (mV) increased sufficient to raise metabolic rate (≥ 3 fold), but within the tolerance of each participant. The mitochondrial capacity protocol involves 4 separate sets of 30 sec of E-stim followed by 6 x 5 sec cuff inflation/5 sec cuff deflation cycles. Analysis consists of calculating oxygenation recovery rate constants (Tc) for each muscle (i.e., 4 repeated measurements per muscle, per limb) using a customized software program. **RESULTS:** Within a group of moderately active younger adults without a history of knee surgery (n=3), Tc averaged 34.8 sec in the VL and 40.2 sec in the ST ($p = 0.21$). Variability of repeated tests (CV % based on 4 replicates/muscle) averaged 9.9% in the VL (n=14 subjects) and 11.1% in the ST (n=3 subjects). Compared to the traditional unilateral 22-cuff occlusion method, this protocol enabled twice as many replicates per muscle in significantly less time (~30 min less). **CONCLUSIONS:** This bilateral E-stim protocol is time efficient and has the potential to facilitate within- and cross-limb comparisons of muscle mitochondrial capacity.

A-46 Free Communication/Poster - Injury, Injury Prevention, Recovery, and Rehabilitation

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

Room: CC-Exhibit Hall

354 Board #170

May 27 10:30 AM - 12:00 PM

Characterization Of Muscle Inflammation Susceptibility: A Potential Prognostic Factor For Optimal Post-surgical Rehabilitation

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(No relevant relationships reported)

Background: Many individuals with end-stage osteoarthritis undergo elective total hip/knee arthroplasty (THA/TKA) to relieve pain and improve mobility and quality of life. However, ~35% suffer long-term mobility impairment following surgery. Previously, we have shown this may be in part due to muscle inflammation susceptibility (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 expression 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 Fn14 which drives pro-inflammatory signaling via NFkB. 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 $P \leq 0.05$. **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 Fn14 mRNA) or MuIS⁽⁻⁾ (n=23). SX thigh muscle mass (TMM), quadriceps power and torque were lower ($P<0.05$) than the contralateral limb (CTR). Additionally, skeletal muscle fibrosis and type II cross-sectional area were greater in the SX leg and MuIS⁽⁺⁾ respectively ($P<0.05$). Tumor necrosis factor- α receptor and IL-6 trended higher in MuIS⁽⁺⁾ ($P>0.05$). Phosphorylated (P)-RPS6 was lower in the SX leg and P⁴⁴E-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: R01HD084124

355 Board #171

May 27 10:30 AM - 12:00 PM

Myostatin Mediates Quadriceps Muscle Atrophy And Fibrosis Rapidly After ACL Transection In Novel Murine Model

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(No relevant relationships reported)

Anterior cruciate ligament (ACL) injury results in quadriceps muscle atrophy and strength loss that may never fully recover. Underlying mechanisms driving these maladaptations have not been thoroughly investigated.

PURPOSE: Develop an animal model recapitulating observed clinical phenotype after ACL injury to identify the early molecular and morphological signature within quadriceps muscle and clarify the rapidity with which therapies should be administered. **METHODS:** Surgical ACL transection (ACL-T) was performed unilaterally on mice (n=5) followed by 5-Ethynyl-2'-deoxyuridine (EdU) injection. 7d after ACL-T, quadriceps muscle was harvested from injured and uninjured limbs. Immunoblotting measured myostatin signaling, and immunohistochemical techniques assessed morphology. In vivo knee extensor peak torque was measured on a separate group of mice (n=3) before and 7d after ACL-T. **RESULTS:** Myostatin and p-SMAD3 expression increased 7d after ACL-T by 131% (1.6 ± 0.2 vs 0.7 ± 0.1 AU, $p=0.02$) and 174% (1.1 ± 0.1 vs 0.4 ± 0.1 AU, $p<0.01$). Fibroblast density increased ($Tcf4+/fiber$: 45%, $p=0.08$; $Tcf4+/mm^2$: 106%, $p=0.04$), as did fibroblast proliferation (215%, $p=0.02$). Extracellular matrix (ECM) content increased 53% ($p=0.03$), along with a 31% decrease in fiber cross sectional area (CSA) (1394 ± 91 vs 2011 ± 134 μm^2 , $p<0.01$). Knee extensor peak torque decreased 21% ($p=0.04$). Myostatin signaling was correlated with fiber CSA and fibrotic indices 7d after ACL-T (Table 1).

CONCLUSIONS: Myostatin signaling is starkly and rapidly upregulated 7d after ACL-T in mice, promoting robust decrements in muscle size, quality, and function. Our findings suggest that myostatin-mediated muscle dysfunction represents a modifiable therapeutic target. Pharmacological myostatin inhibition immediately after ACL injury, preceding surgical and loading interventions, may mitigate quadriceps maladaptations and partially preserve strength.

Support: R01 AR072061, T32AG000270

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

	myostatin R value	p-SMAD3 P value	myofiber CSA R value	p-SMAD3 P value
fibroblast density ($Tcf4+/fiber$)	0.7446	0.0341	0.6499	0.0811
fibroblast density ($Tcf4+/mm^2$)	0.9441	0.0004	0.7827	0.0217
fibroblast proliferation ($EdU+ Tcf4+$)	0.7291	0.0401	0.628	0.0954
ECM content	0.5681	0.1418	0.7564	0.0299
myofiber CSA	-0.8349	0.0084	-0.8575	0.0065

356	Board #172 The Effect Of Robotic Gait Training On Spinal Cord Transected Rat Femurs	May 27 10:30 AM - 12:00 PM
	Michele LeBlanc ¹ , Michael Soucy ² , Moustafa Moustafa-Bayoumi ³ , Dalziel Soto ⁴ , Jeff A. Nessler ⁴ . ¹ <i>California Lutheran University, Thousand Oaks, CA</i> , ² <i>Oregon State University, Corvallis, OR</i> , ³ <i>Helwan University, Cairo, Egypt</i> , ⁴ <i>California State University, San Marcos, CA</i> . Email: mleblanc@callutheran.edu (No relevant relationships reported)	

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 (Karakis et al., 2017). The effect of the training on other important mechanical properties of bone is unknown. PURPOSE: To determine the effects of 8 weeks of robotic locomotor training on mechanical properties of rat bones. METHODS: Twelve female Sprague-Dawley rats received spinal cord transections at 5 days old. At 3 weeks old, half of them were randomly assigned to a Training group and half to a Control group. The Training group received 5 minutes of robotic gait training with 90% body support for 5 days a week for 8 weeks. The Control group received no exercise. At the conclusion of the 8 weeks, the animals were euthanized and the right femurs were harvested for testing. Anthropometric measures and 3-point bending tests using an Instron material testing system (Norwood, MA) were performed. Independent t-tests were used to determine differences between the two groups ($p < 0.05$). RESULTS: There was no difference in body mass between the two groups prior to group assignments, but after 6 weeks of training the Control group had greater mass ($p = 0.035$) and at the end of training this difference continued (mass = 210.3 ± 36.0 g vs. 166.7 ± 14.5 g; $p = 0.012$). The Control group's femur mass was significantly larger ($p = 0.041$), but when considered as a percentage of body mass, the Training group's femur mass was larger ($p = 0.014$). Peak load and rupture loads were not different between the two groups, but when normalized for body mass the Training group had larger load values than the Control group ($59.0 \pm 2.7\%$ and $53.3 \pm 12.1\%$ for the Training and $52.4 \pm 2.0\%$ and $41.6 \pm 8.7\%$ 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.

357	Board #173 Effect Of Gastrocnemius Post-exercise Needling Treatment On Achilles Tendon Tendinopathy Prevention	May 27 10:30 AM - 12:00 PM
	Bo Wang, YuYi Liu, Lin Wang. <i>Beijing Sports university, Beijing, China</i> . Email: wangbodc002@163.com (No relevant relationships reported)	

PURPOSE: Long-term post-exercise high intensity gastrocnemius tension can induce the Achilles tendon tendinopathy. The gastrocnemius post-exercise needling treatment can reduce gastrocnemius tension. Therefore, the gastrocnemius post-exercise needling may decrease the risk of Achilles tendon tendinopathy by reduce gastrocnemius tension.

METHODS: 32 male 12 weeks old SD rats divided into 4 groups: the needling group (NED group); exercise group (EX group); exercise and needling group (EXNED group) and control group (CON group). The animal treadmill protocol was 60% average VO_{max} intensity (16.5m/min) eccentric running at -11° condition lasting 90 minutes for 24 days. The EXNED and NED groups accepted needling treatment with 0.25mm diameter needle which penetrate 5mm on gastrocnemius for 5 minutes after exercise each day. Gastrocnemius and Achilles tendon were harvested at the 26th day then measured collagen I/III, MMP-1, mechanical growth factor (TGF-β₁, IGF-1) expression and cell apoptosis ratio by western-blot, Immunofluorescence and TUNEL staining. Data was analyzed by SPSS 20.0.

RESULTS: The gastrocnemius TGF-β₁ in EX group was significantly higher than other three groups (0.20 ± 0.01 VS 0.11 ± 0.01 , 0.13 ± 0.02 , 0.14 ± 0.01 , $P < 0.05$); IGF-1 was no significant difference. In Achilles tendon, TGF-β₁ in EX group was significantly higher than other three groups (733.58 ± 306.82 VS 291.92 ± 156.19 , 153.74 ± 114.96 , 192.67 ± 112.36 , OD/μm², $P < 0.05$); IGF-1 was no significantly difference either. Collagen I in EX and EXNED group were significantly lower than CON and NED group (557.26 ± 210.54 , 798.89 ± 122.06 VS 958.59 ± 176.41 , 1133.60 ± 251.62 , OD/μm², $P < 0.05$); collagen III in EX group was significantly higher than other three groups (1101.25 ± 196.37 VS 393.03 ± 60.13 , 492.25 ± 103.16 , 779.32 ± 140.25 , OD/μm², $P < 0.01$), and it was significantly higher in EXNED group than in CON and NED group (779.13 ± 140.42 VS 393.17 ± 60.15 , 492.20 ± 103.11 , OD/μm², $P < 0.05$). The MMP-1

in the EX group was significantly higher than other three groups (624.09 ± 176.62 VS 393.51 ± 119.66 , 264.9 ± 78.4 , 289.4 ± 85.68 , OD/μm², $P < 0.05$). Cell apoptosis ratio was no significant difference.

CONCLUSION: The gastrocnemius post-exercise needling treatment can decrease the risk of Achilles tendon tendinopathy by reduce gastrocnemius tension.

358	Board #174 Effects Of Hip-knee Muscle Strengthening Combined With Whole-body Vibration Training On Patellofemoral Pain Syndrome	May 27 10:30 AM - 12:00 PM
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PURPOSE: This study aimed to investigate the effect of whole-body vibration (WBV) training combined with hip-knee muscle strengthening training on adult patellofemoral pain syndrome(PFPS).

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

CONCLUSIONS: The WBV training plus hip-knee strengthening training and hip-knee strengthening training can both effectively improve pain, knee function and quality of life on adult patients with PFPS. However, whether the WBV training is more effective than hip-knee strengthening training need to be further research.

359	Board #175 Relationship Between Isokinetic Muscle Strength Test Of Knee And Hip In Knee Osteoarthritis Patients	May 27 10:30 AM - 12:00 PM
	Chun Zhang ¹ , Chun jiang He ¹ , Hai Shen ² . ¹ <i>Chengdu Sports University, ChengDu, China</i> . ² <i>Sichuan Provincial Orthopedic Hospital, ChengDu, China</i> . Email: 767903515@qq.com (No relevant relationships reported)	

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 periarticular muscle strength of Knee and Hip in KOA in old people remains unknown.

PURPOSE: To explore the relationship between periarticular muscle strength of Knee and Hip. METHODS: Forty patients with Knee Osteoarthritis (24females and 16males, Age: 55.31 ± 7.05 years)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 $60(^{\circ})$ -s-1and $180(^{\circ})$ -s-1, respectively. Pearson Correlation Analysis and multiple Regression analysis were used to measure the muscle strength between knee flexors-extensors and hip flexor-extensor, adductor-abductor. RESULTS:(1)Pearson Correlation Analysis showed that in the case of $60(^{\circ})$ -s-1 and $180(^{\circ})$ -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 ($p < 0.05$);(2)Multiple regression analysis showed that there was a positive linear relationship between knee flexor, extensor and hip flexor PT/BW at $60(^{\circ})$ -s-1($r=3.342$, $p=0.002 < 0.05$, $r=2.824$, $p=0.007 < 0.05$, respectively);There was a positive linear relationship between knee flexors and hip extensors ($r=2.305$, $p < 0.05$). At $180(^{\circ})$ -s-1PW/BW,there was a negative linear relationship between hip extensor and knee flexor($r=-2.417$, $p=0.02 < 0.05$),and a positive linear relationship between knee flexors and hip adductors ($r=2.772$, $p=0.008 < 0.05$). CONCLUSION: In this test, the knee flexor and extensor function was affected by the same hip muscles strength.In the case of $60(^{\circ})$ -s-1,the hip flexor is not only involved in the knee extension function, The knee flexors are also controlled by the 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.

360	Board #176	May 27 10:30 AM - 12:00 PM
Correlation Between The Elbow Ulnar Collateral Ligament And Generalized Joint Hypermobility In Young Adults		
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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 Brighton score of $\geq 5/9$. 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 A&P I classes completed the Brighton score, including measures of elbow hypermobility. Ultrasound images of the participants' ulnar collateral ligament were obtained in both arms under a gravity induced valgus force in supine.

RESULTS:

Overall, 48 of 330 participants (14.6%) reported generalized joint hypermobility (GJH) based on a Brighton score ≥ 5 . Sixty-three participants reported hypermobility in at least one elbow; there was no difference in prevalence of hypermobility between elbows (Right: $r = .483$, $p < .001$; Left: $r = .465$, $p < .001$). Hypermobility in one elbow was strongly correlated with hypermobility in both elbows ($r = .828$; $p < .001$). We found moderate correlations between UCL thickness and joint gapping for left and right elbows ($r = .422$, $r = .324$, $p < .001$)

We found no difference in UCL thickness or joint width between participants with hypermobile elbows and those without (e.g., right elbow joint width under valgus stress: Normal = .231799, Hypermobile = .228415; $t(251) = .301$, $p = .763$) Left elbow joint width under valgus stress was weakly correlated ($r = .167$, $p = .006$) with GJH overall but not specifically with left elbow hypermobility.

CONCLUSION:

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

361	Board #177	May 27 10:30 AM - 12:00 PM
Effect Of Forearm Flexors/extensors Strength Training On Functional Capacity After Open Carpal Tunnel Release		
Evangelos Tzamis ¹ , Dimitrios Bourlos ² , Maria Maridakis ³ , Michael Koutsilieris ¹ , Anastassios Philippou ¹ . ¹ <i>Medical School, National and Kapodistrian University of Athens, Goudi - Athens, Greece.</i> ² <i>251 Airforce General Hospital, Goudi - Athens, Greece.</i> ³ <i>School of Physical Education and Sport Science, National and Kapodistrian University of Athens, Dafne - Athens, Greece.</i> Email: vagtzanis@yahoo.gr <i>(No relevant relationships reported)</i>		

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:** Seven patients with CTS (5 females and 2 males (age: 57.7 ± 4.8 yrs, height: 169.0 ± 2.5 cm, body mass: 82.0 ± 4.1 kg, BMI: 28.7 ± 1.4) underwent OCTR and then were randomly divided into two groups, the control group (CG; $n=4$) which received usual physical therapy care, and the intervention group (IG; $n=3$) which, in addition to the usual 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 \pm SE. **RESULTS:** No 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 ± 6.5 kg), HPS (IG: 7.1 ± 4.1 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.

362	Board #178	May 27 10:30 AM - 12:00 PM
THE EFFECTS OF ISOLYTIC AND STATIC POSTERIOR SHOULDER STRETCHING IN INDIVIDUALS WITH SUBACROMIAL IMPINGEMENT SYNDROME		
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Static posterior shoulder stretching exercise (PSSE) in modified cross-body position (MCBP) improves posterior shoulder tightness (PST) and glenohumeral internal rotation deficit (GIRD). Isolytic stretching (isotonic eccentric contraction) is a form of muscle energy technique. The effects of isolytic PSSE were not investigated in shoulder pathologies.

PURPOSE: To investigate the effects of isolytic and static PSSE in MCBP on shoulder internal rotation (IR) and external rotation (ER) range of motion (ROM) and strength, PST, subacromial space (SAS), supraspinatus tendon thickness (SsTT), supraspinatus tendon occupation ratio (STOR), functionality and disability level in individuals having subacromial impingement syndrome (SIS) with GIRD.

METHODS: Sixty-three participants having SIS with GIRD were randomly divided into three groups. Isolytic Stretching Group (ISG) and Static Stretching Group received standard physiotherapy and isolytic or static PSSE in MCBP. The control group (CG) received physiotherapy without PSSE. Shoulder ROM and PST were assessed with bubble inclinometer, strength with hand-held dynamometer, SAS (at 0° and 60° scapular plane shoulder elevation), SsTT, and STOR with ultrasonography, functionality and disability level with Modified Constant-Murley Scale and Quick Disability of the Arm-Shoulder-Hand Questionnaire. GIRD was determined by the difference in bilateral shoulder IR ROM. Data were analyzed with two-way ANOVA with repeated measures.

RESULTS: All groups improved in terms of shoulder mobility, strength, SAS, STOR, functionality, and disability level after 4-weeks of treatment ($p<0.05$). IR ROM and SAS increased, PST, GIRD, and STOR decreased more in stretching groups compared to CG ($p<0.001$). Improvements in stretching groups were similar ($p>0.05$). ER ROM, strength, functionality, and disability levels improved more in ISG compared to CG ($p<0.05$).

CONCLUSIONS: Standard physiotherapy including PSSE in MCBP is superior to treatment program without PSSE to improve shoulder mobility, SAS and STOR. Both isolytic and static stretchings are equally effective. Standard physiotherapy plus isolytic PSSE provided a greater improvement in ER ROM, strength, functionality and disability levels compared to treatment program without PSSE. Research was not founded.

363	Board #179	May 27 10:30 AM - 12:00 PM
Effects Of Age And Duration Of Manual Wheelchair Use On The Incidence Of Shoulder Pathology		
Omid Jahanian, Brianna M. Goodwin, Meegan G. Van Straaten, Jonathan D. Barlow, Naveen S. Murthy, Melissa M. B. Morrow. <i>Mayo Clinic, Rochester, MN.</i> Email: Jahanian.Omid@mayo.edu <i>(No relevant relationships reported)</i>		

Rotator-cuff injuries are one of the most common causes of shoulder related disability in manual wheelchair (MWC) users with spinal cord injury (SCI), which could lead to decreased quality of life. **PURPOSE:** To investigate the prevalence of rotator-cuff and biceps tendon tears in MWC users with SCI and the effects of age and duration of wheelchair use on incidence of the shoulder muscle tendon pathology. **METHODS:** Under Mayo Clinic IRB approval, forty-two MWC users were recruited (34 males, age (SD): $41.3 (12.1)$ yrs, injury level: C6 -L1, years of MWC use (SD): $10.7 (10.8)$ yrs). A standard clinical MRI protocol was used to image the bilateral shoulders of all participants. The MRIs were assessed by a board-certified musculoskeletal radiologist. Spearman's correlation and logistic regression were used to investigate the association of age and duration of wheelchair use with the presence of the shoulder muscle tendon tears. **RESULTS:** The total prevalence of the shoulder muscle tendon tears (involving dominant or non-dominant shoulder) was 67%. The total prevalence of tendon tears in

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.

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364 Board #180 May 27 10:30 AM - 12:00 PM

Impaired Ankle Proprioception In Individuals With Chronic Nonspecific Low Back Pain

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(No relevant relationships reported)

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.

365 Board #181 May 27 10:30 AM - 12:00 PM

FE Analysis Of Meniscus Injury In A Square Stance Tennis Forehand Drive-a Case Study

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(No relevant relationships reported)

Meniscus tears are common among tennis players. Currently, little is known regarding knee joint kinematic and kinetic characteristics during a square stance tennis forehand that may lead to an increased risk of a meniscus injury. **PURPOSE:** To study loading characteristics of meniscus during a square stance tennis forehand swing using a dynamics model and a three-dimensional (3D) finite element model. **METHODS:** Two female Chinese players (age 14 y) with 6 years of competitive tennis experience

performed three square stance tennis forehand drives. Of the two players, one had a lateral meniscus tear of the left knee joint and the other had no history of knee injury. Three-dimensional kinematic motion and ground reaction force data were collected using VICON and AMTI (120 Hz/1200Hz)and then imported into the OpenSIM software to obtain movement data of the tibia and femur. CT and MRI were used to image a healthy human knee that included the femur, tibia, cartilage layers, menisci and ligaments. 2D data were imported into Mimics software to develop a 3D finite element model of the healthy human knee. The 3D model was imported into HyperWorks software to compute the 3D finite-element models of the knee. Last, the loading data of the movement obtained from OpenSIM was imported and transformed into HyperWorks to obtain the distribution stress of the meniscus. **RESULTS:** Compared with the non-injury player, the athlete with the meniscus tear exhibited excessive tibia rotation, showed a higher level of biomechanical stress of the lateral meniscus and demonstrated greater peak value (figure 1,figure 2). **CONCLUSION:** In the acceleration stage of the square stance tennis forehand, differences were observed in the tibial rotation of the healthy and injured players leading one to speculate that the rotation of the knee joint may be related to meniscus injury. Additional studies are needed to verify this speculation and to infer causality.

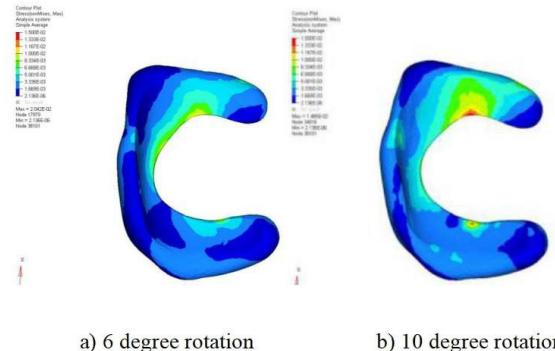


Figure1. Stress distribution of the meniscus of the injured player

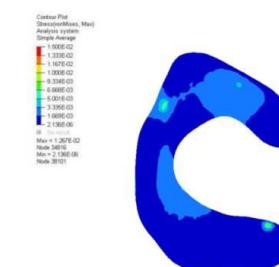


Figure2. Peak stress distribution of the meniscus of the healthy player

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

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(No relevant relationships reported)

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

clinical diagnoses of the respective injuries of the athletes participating in this study. Peripheral venous blood samples for DNA extraction and genotyping for known SNPs (SNP arrays) from all study subjects were collected. The comparison of allelic frequencies of these SNPs was made between cases and controls. For statistical analysis, we used the software PLINK. To estimate the magnitude of the effectiveness OR was used to estimate the magnitude of the effectiveness, and *p*-values for the significance of ORs were calculated using the χ^2 - test. The *p* value of 10^{-8} was set as a threshold for genome-wide statistical significance. To display significant SNPs, the Manhattan plot was used.

RESULTS: Association analysis revealed 2 genes that could be important as risk factors for investigated injuries, the *PAPP42* (chr 1: rs1158045, OR 13.8, *p*= $1.64 \cdot 10^{-5}$) and the *GNG12* (chr 1: rs28435277 OR 13.8, *p*= $1.64 \cdot 10^{-5}$) with the *p*-value remaining at the level of "suggestive significance" (*p*= $5 \cdot 10^{-5}$).

CONCLUSIONS: Our study results identified suggestive significance in allelic differences of *PAPP42* and *GNG12* between case and control groups. It is important to continue with further research of genetic risk profile to understand the biological processes associated with injury risk.

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

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

METHODS: Patellar tendon injury was induced in male Wistar Rats with a 2mm biopsy punch. Rats then recovered with normal cage activity for 15 days to allow a mature scar to form. Following scar formation, groups received either an isometric load (4 x 30 second contraction, 2 min rest) or an equivalent time under tension using dynamic loads (360 contractions lasting 333ms each). The injured region of the tendon was collected 18 hrs after loading and immediately frozen. RNA was isolated from the tendon for RT-qPCR determination of genes involved in tendon (collagen I, III, lysyl oxidase, and scleraxis) and fibrocartilage (collagen II, aggrecan, tenascin C, and Sox9) formation.

RESULTS: Tendon scar formation was confirmed by visual inspection. The injured region showed increased vascularity and greater volume. Our preliminary findings suggest that RNA within the tendon increases from $154.4 \pm 20.5 \mu\text{g}$ at baseline to $497.9 \pm 128.1 \mu\text{g}$ two weeks after injury. Acute isometric exercise of the scarred tendon decreased RNA in the injured region slightly to $341.1 \pm 16.8 \mu\text{g}$. At the time of submission the gene expression studies are being completed.

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

368	Board #184	May 27 10:30 AM - 12:00 PM
Early Physiological Changes To The Vastus Lateralis After Non-invasive Anterior Cruciate Ligament Injury		
Emily R. Hunt ¹ , Steven M. Davi ² , Douglas W. Van Pelt ¹ , Christian Lattermann ³ , Esther E. Dupont-Versteegden ¹ , Timothy A. Butterfield, FACSM ¹ , Lindsey K. Lepley ⁴ . ¹ University of Kentucky, Lexington, KY. ² University of Connecticut, Storrs, CT. ³ Brigham and Women's Hospital, Harvard Medical School, Cambridge, MA. ⁴ University of Michigan, Ann Arbor, MI. (Sponsor: Timothy A. Butterfield, FACSM) (No relevant relationships reported)		

Insufficient recovery of quadriceps muscle strength is commonly reported after anterior cruciate ligament (ACL) injury. Although weakness is secondary to a complex manifestation of inhibition, the extent and time course of the morphological changes in muscle are largely unknown. Using a novel, translational animal model of ACL injury, a longitudinal study was performed to illuminate the mechanisms underlying acute muscle atrophy. **Purpose** To investigate the role of atrophic pathways after non-invasive ACL rupture. **Methods** Male Long-Evans rats were randomly assigned to 8 groups (n=8 per group): 1 control group and 7 ACL injury groups (6, 12, 24, 48-hours, and 1, 2, 4-weeks). The right hindlimbs of ACL injury rats were exposed to a single impulse, longitudinal tibial compression, to induce a non-invasive ACL rupture, followed by normal cage activity. After which rats were euthanized as per assigned group. Right and left vastus lateralis muscles (VL) were harvested, weighed and flash

frozen in liquid nitrogen. The VL were immunoreacted for dystrophin to quantify fiber cross sectional area (CSA), and RNA was isolated to measure the abundance of MuRF-1, MAFbx (markers of protein degradation) and 45s (marker of translational capacity). rRNA expression was determined using RT-PCR. One-way ANOVAs with Bonferroni post-hoc were used to determine differences between groups, and paired t-tests were used to detect VL differences between limbs (*P*<0.05). **Results** ACL injury resulted in a decrease in muscle wet weight (*p*=0.0003) and a trend toward reduced CSA (*p*=0.06) at 1-week post injury, compared to control, 2- and 4-week time points. CSA of the ACL injured limb VL was smaller than the VL of the contralateral limb at 1-week only (*p*=0.01). MAFbx abundance was significantly increased at 48-hours post-ACL injury (*p*=0.0001), with no differences for 45s rRNA, total RNA concentration or MuRF-1. **Conclusions** Results indicate that ACL injury induces atrophy which is transient and not related to a decrease in ribosome biogenesis but likely due to increased protein degradation. Future studies should focus on a comprehensive analysis of atrophic pathways after ACL injury, to establish key therapeutic windows for targeting therapy-resistant quadriceps weakness after ACL injury. Supported by K01AR071503.

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

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

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

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 ± 2.4 yr., mass= 80.9 ± 21.6 kg, ht= 173.3 ± 10.6 cm) with an acute LAS and 20 healthy matched controls (8 males and 12 females, age= 21.9 ± 2.8 yr., mass= 79.1 ± 20.2 kg, ht= 172.5 ± 9.8 cm) participated in the study. ATFL thickness was measured with a LOGIQ Book diagnostic ultrasound. The examiner orientated the probe to visualize the cross sectional view of the lateral malleolus, lateral talar articular surface, and the neck of the talus. Once those landmarks and the ATFL were located, images were saved. Thickness of the ATFL was measured at the midpoint of the ligament between the attachments on the lateral malleolus and talus. The main outcome measures 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 post-injury ATFL thickness and both the IPAQ and

NASA physical activity scales. As ligament thickness increased, "average time spent performing vigorous physical activity" significantly decreased ($p=.04$, $r^2=.86$) and "average time spent performing moderate physical activity" ($p=.02$, $r^2=.84$) also decreased one year after injury. As ligament thickness increased in subjects with a LAS, time spent walking ($p=.01$, $r^2=.92$), days per week where vigorous activity ($p=.02$, $r^2=.81$) or moderate activity ($p=.04$, $r^2=.85$) was pursued one year after their sprain significantly decreased. **Conclusions:** The changes in ATFL 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.

371	Board #187	May 27 10:30 AM - 12:00 PM
Sex Differences In The Morphology Of The Vastus Lateralis After An Anterior Cruciate Ligament Tear		
Madalyn G. Romines, Lauren N. Erickson, Peter A. Hardy, Anders H. Andersen, Brian Noehren, FACSM. <i>University of Kentucky, Lexington, KY.</i>		
(No relevant relationships reported)		

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, 21.8 ± 5.0 y, 25.0 ± 3.7 kg/m², days since injury 24.6 ± 16.2) underwent magnetic resonance imaging including multi echo T1p, DTI, and 2D turbo spin echo. Data was post-processed in MATLAB, where a mono exponential decay curve was fitted to analyze the T1p signal. Muscle fiber 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: T1p times (M: 0.031 ± 0.003 s; F: 0.028 ± 0.002 s; $p = 0.06$) and pennation angle (M: $16.6 \pm 2.6^\circ$; F: $14.9 \pm 1.8^\circ$) 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: 335.9 ± 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.

372	Board #188	May 27 10:30 AM - 12:00 PM
Skeletal Muscle Metabolic Gene Profile Associates With Rheumatoid Arthritis Improvements Following High Intensity Interval Training		
Brian J. Andonian ¹ , David B. Bartlett ¹ , Monica J. Hubal ² , Leslie Willis ¹ , Megan A. Reaves ¹ , William E. Kraus, FACSM ¹ , Kim M. Huffman ¹ . ¹ Duke University School of Medicine, Durham, NC. ² Indiana University-Purdue University Indianapolis, Indianapolis, IN. Email: brian.andonian@duke.edu (No relevant relationships reported)		

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

PURPOSE: To identify baseline skeletal muscle pathways linking HIIT with improvements in RA inflammatory disease activity and CRF. **METHODS:** Participants with RA (n=13; mean age= 63.9 ± 7.2) underwent RA disease activity (DAS), physiologic, and biologic assessments pre- and post-10 weeks of supervised HIIT. Cardiopulmonary exercise testing measured CRF as rVO₂ peak (mL/kg/min). Skeletal muscle RNA was isolated from vastus lateralis biopsies. Illumina Human HT-12v4 Expression BeadChips and Ingenuity Pathway Analysis were used for quantitative whole genome RNA analyses. Differential Spearman correlations ($p < 0.05$) assessed associations for baseline gene expression with ADAS and ΔCRF (post - pre). **RESULTS:** HIIT improved RA DAS (+23.8%; $p < 0.001$) and CRF (+8.2%; $p < 0.001$). 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, NDUV3, GLDC, AGL, BCKDHB, PDK2, LDHB, ACSS2, PANK2) and inflammatory pathways (n=4; FCRL6, TNFRSF19, CMTM4, NKG7). In contrast, ΔCRF was strongly correlated with baseline expression of 16 genes; only 1 (NDUFB4) involved in cellular metabolism and 0 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 metabolic and inflammatory pathways. Thus, exercise training may improve RA inflammation via coordinated regulation of muscle and immune cell energy metabolism.

373	Board #189	May 27 10:30 AM - 12:00 PM
Effects Of Methyl Sulfonyl Methane On Knee Laxity In Females Throughout The Menstrual Cycle.		
Vera Weijer, Tayler Smith, Karine Schaal, Dana Lis, Keith Baar, FACSM. <i>UC Davis, Davis, CA.</i> Email: veraweijer@live.nl (No relevant relationships reported)		

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

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

METHODS: Healthy women (ages 18-30) were followed over a 5-month period. Knee laxity measured using a GNRB knee arthrometer (Prothia, Worcester, MA) at menstruation and ovulation during baseline (month 1&2) and intervention phases (month 4 & 5). In a double-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 (n=20, Group A=n=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.

374	Board #190	May 27 10:30 AM - 12:00 PM
Asymmetric Somatosensory Nerve Excitability In Professional Rugby Players With History Of Calf Muscle Strain		
Tomonori Kawai ¹ , Masayasu Takahashi ² , Satoshi Kunitsugu ³ . ¹ School of Medicine Keio University, Tokyo, Japan. ² Konan Medical Center, Kobe, Japan. ³ Professional Trainers Team, Nishinomiya, Japan. (No relevant relationships reported)		

Muscle Strain Injury has been notorious for its high incidence and high recurrent ratio in a wide variety of sports. Severe muscle strain alters morphological properties of the connective tissue. Connective tissue, especially fascia which surrounds muscles, is highly sensory innervated. Therefore, we hypothesize that previous muscle strain injury affects sensory nerve transmission. Altered proprioceptive feedback will affect the muscle function which consequently may lead to muscle strain re-injury.

PURPOSE: This pilot study aimed to compare the differences between injured and uninjured leg in sensory nerve excitability of the tibial nerve in professional rugby players. Moreover, we wanted to compare it with muscle-tendon junction stiffness of gastrocnemius muscles.

METHODS: Five male professional rugby players (age/ height/ weight, ± 3.9/181.2±10.5/101±12.46) who have a history of calf strain (confirmed by MRI) were selected. The measurement was performed at least 6 weeks after injury. To evaluate sensory excitability, we examined somatosensory evoked potentials (SEPs) elicited by tibial nerve stimulation on both injured and uninjured side. Muscle stiffness (strain ratio) was also assessed by strain elastography in both injured and uninjured leg. The relationship between SEPs and strain ratio was analyzed.

RESULTS: The SEPs of the injured side was lower than that of the uninjured side (mean latency injured side/uninjured side, 7.26 m/s±1.21/9.34 m/s±2.01, $p < 0.05$). However, there was no difference in muscle stiffness between the legs (mean strain ratio injured side/uninjured side, 0.128/0.124, $p = 0.37$). The relationship between SEPs and muscle stiffness was found on non-significant ($p = 0.74$).

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 Zaslow¹, Gene Yu², Adriana Conrad-Forrest¹, Tishya Wren¹. ¹Children's Hospital Los Angeles, Los Angeles, CA. ²University of Southern California, Los Angeles, CA.
(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 timepoints. 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 tracking (-1.04, SE 0.53, p=0.048), and variability of overshoot (-2.59, SE 1.04, p=0.013) decreased from baseline to RTP. Undershoot 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 Kim³, Ty Hopkins, FACSM¹. ¹Brigham Young University, Provo, UT. ²Cha University, Seongnam, Korea, Republic of. ³West Chester University, West Chester, PA. (Sponsor: J Ty Hopkins, FACSM)
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(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±2 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 eversion, inversion, and hip abduction. Two days after MVIC tests, subjects performed 2 practices, followed by 3 testing trials of 10% and 20% of their MVIC for 15 seconds for submaximal force steadiness and accuracy measures with and without the stroboscopic glasses. The central 10-sec (20-80% of the total time) of three testing trials was analyzed. Main outcome measures were force steadiness, which was one standard deviation (SD), and force accuracy was a root mean square across the 10-sec data. Force steadiness and accuracy were analyzed by 3 (groups) x 2 (visual conditions) ANOVAs.

RESULTS: The CAI and copers subjects exhibited greater errors than controls in 20% eversion MVIC in force steadiness ($p<.0001$ and $p=.01$, respectively). CAI subjects demonstrated less steadiness in 20% eversion and hip abduction under strobe vision (SC) compared with eyes open (EO) ($p=.02$, both). Additionally, CAI subjects showed less accuracy than copers and controls in 20% eversion MVIC ($p=.0001$ and $p<.0001$, respectively). CAI subjects demonstrated less accuracy in 20% eversion under SC compared with EO ($p=.002$).

CONCLUSIONS: Individuals with a history of a lateral ankle sprain (LAS) showed reduced force steadiness than healthy controls. Only CAI patients relied more on visual input during force steadiness and accuracy tasks. A LAS injury (coper) reduced the ability to control fine force, but recurrence of 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
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(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 adaption 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 35.87% 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 ($p=.001$) and NT ($p=.031$).

CONCLUSIONS: KT and AT could not facilitate postural control for CAI individuals during static and voluntary measurements. However, they could provide effective support to cope with sudden perturbation. In addition, KT improved perception stability and comfort, whereas AT improved perception stability but provided the least comfort.

- 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
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Stroboscopic 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

stance/hopping on stable/unstable surface), and lasted for 6 weeks, 3 times per week, with a single session lasting about 20 minutes. BTSV was comprised of the same exercises as BT, but exercises were performed under SV. The following outcomes were assessed before and after intervention: (1) dynamic balance, quantified by Star Excursion Balance Test (SEBT) and (2) perceived joint instability, measured by Cumberland Ankle Instability Tool (CAIT). SEBT was composed of 3 directional single leg reaching tasks: anterior (A), posteromedial, and posterolateral. Reaching distances were normalized to height, with higher percentage values indicating better balance. CAIT was used to quantify the severity of ankle instability, with a lower score indicating worse ankle instability. For statistical analysis, we calculated pre-post change scores of each group for each outcome and performed a one-way ANOVA. **RESULTS:** There were significant group differences for all outcomes ($p<0.001$). Both BT and BTSV groups significantly improved relative to the control group, with very large effect sizes (Cohen's $d=1.46$ to 7.79). Besides, BTSV induced greater improvements for the SEBT-A performance ($p=0.001$: pre-BT= $78.0\pm3.5\%$, post-BT= $85.7\pm3.5\%$; pre-BTSV= $77.3\pm4.7\%$, post-BTSV= $88.0\pm4.0\%$) and CAIT scores ($p=0.042$: pre-BT= 15.3 ± 4.7 pts, post-BT= 20.8 ± 4.7 pts; pre-BTSV= 15.1 ± 4.8 pts, post-BTSV= 23.5 ± 2.8 pts). **CONCLUSION:** The current study was the first to demonstrate that CAI patients benefit from a visually challenging rehabilitation environment created by SV.

380	Board #196	May 27 9:30 AM - 11:00 AM
Effects Of Stroboscopic Vision On Postural Control In Individuals With And Without Chronic Ankle Instability		
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Chronic ankle instability (CAI) patients have consistently displayed postural control deficits. Previous research postulated that CAI patients rely more on the utilization of visual feedback than controls to compensate for the proprioceptive deficits after lateral ankle sprains. However, little is known about how reduced visual feedback would alter dynamic postural control in CAI patients relative to controls and copers. **PURPOSE:** To identify the effect of visual feedback disruption via stroboscopic glasses on dynamic postural control among groups of CAI, coper, and control. **METHODS:** 20 CAI (10M, 10F, 23.6 ± 3.9 yr, 174.5 ± 11.8 cm, 76.3 ± 17.5 kg), 20 coper (10M, 10F, 22.2 ± 1.4 yr, 176.4 ± 10.2 cm, 69.3 ± 10.9 kg), and 20 control (10M, 10F, 22.6 ± 2.7 yr, 174.4 ± 7.2 cm, 80.0 ± 24.4 kg) subjects were categorized according to the Foot and Ankle Ability Measure (FAAM) and Modified Ankle Instability Index (MAII) questionnaires. Each subject performed three trials of a single-leg-hop stabilization test with eyes open (EO) and stroboscopic vision (SV). Force data (200 Hz) were collected using an in-ground force plate to calculate the dynamic postural stability index (DPSI) and directional stability indices (medial/lateral, anterior/posterior, vertical). Two-way repeated ANOVAs (group \times 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 ($p=0.003$) but no differences between CAI patients and copers ($p=0.45$). For the directional stability indices, each group displayed no differences between visual conditions. **CONCLUSION:** CAI patients rely more on visual feedback during dynamic postural control than copers and controls. However, they may have decreased ability to compensate for the disrupted visual feedback during dynamic movement. Stroboscopic glasses could be effective visual-disruption devices during dynamic movement tasks regardless of lateral ankle sprain history.

381	Board #197	May 27 9:30 AM - 11:00 AM
Activities Of Hip Muscles In Response To Perturbed Walking In Individual With Chronic Ankle Instability		
Chiao-I Lin, Mina Khajoei, Alexandra Nair, Mika Heikkila, Hannes Kaplick, Engel Tilman, Frank Mayer. University of Potsdam, Potsdam, Germany. Email: chialin@uni-potsdam.de (No relevant relationships reported)		

Chronic ankle instability (CAI) is not only an ankle issue, but also affects sensorimotor system. People with CAI show altered muscle activation in proximal joints such as hip and knee. However, evidence is limited as controversial results have been presented regarding changes in activation of hip muscles in CAI population. **PURPOSE:** To investigate the effect of CAI on activity of hip muscles during normal walking and walking with perturbations. **METHODS:** 8 subjects with CAI (23 ± 2 years, 171 ± 7 cm and 65 ± 4 kg) and 8 controls (CON) matched by age, height, weight and dominant

leg (25 ± 3 years, 172 ± 7 cm and 65 ± 6 kg) walked shod on a split-belt treadmill (1 m/s). Subjects performed 5 minutes of baseline walking and 6 minutes walking with 10 perturbations (at 200 ms after heel contact with 42 m/s^2 deceleration impulse) on each side. Electromyography signals from gluteus medius (Gmed) and gluteus maximus (Gmax) were recorded while walking. Muscle amplitudes (Root Mean Square normalized to maximum voluntary isometric contraction) were calculated at 200 ms before heel contact (Pre200), 100 ms after heel contact (Post100) during normal walking and 200 ms after perturbations (Pert200). Differences between groups were examined using Mann Whitney U test and Bonferroni correction to account for multiple testing (adjust α level $p \leq 0.0125$). **RESULTS:** In Gmed, CAI group showed lower muscle amplitude than CON group after heel contact (Post100: $18 \pm 7\%$ and $47 \pm 21\%$, $p < .01$) and after walking perturbations ($31 \pm 13\%$ and $62 \pm 26\%$, $p < .01$), but not before heel contact (Pre200: $5 \pm 2\%$ and $11 \pm 10\%$, $p = 0.195$). In Gmax, no difference was found between CAI and CON groups in all three time points (Pre200: $12 \pm 5\%$ and $17 \pm 12\%$, $p = 0.574$; Post100: $41 \pm 21\%$ and $41 \pm 13\%$, $p = 1.00$; Pert200: $79 \pm 46\%$ and $62 \pm 35\%$, $p = 0.505$). **CONCLUSIONS:** People with CAI activated Gmed less than healthy control in feedback mechanism (after heel contact and walking with perturbations), but not in feedforward mechanism (before heel contact). Less activation on Gmed may affect the balance in frontal plane and increase the risk of recurrent ankle sprain, giving way or feeling ankle instability in patients with CAI during walking. Future studies should investigate the effect of Gmed strengthening or neuromuscular training on CAI rehabilitation.

382	Board #198	May 27 9:30 AM - 11:00 AM
Verbal Encouragement Improves Star Excursion Balance Test Performance In Patients With Chronic Ankle Instability		
Susan Saliba, Abbas Haider Jaffri. University of Virginia, Charlottesville, VA. (Sponsor: Jay Hertel, FACSM) Email: saf8u@virginia.edu (No relevant relationships reported)		

PURPOSE: The Star Excursion Balance Test (SEBT) is a common dynamic balance test. Functional limitations on the SEBT are associated with CAI, but psychological constraints such as kinesiophobia or a lack of confidence may affect performance. The purpose of this study was to investigate the effects of verbal encouragement (VE) on maximum reach distance performance between CAI and healthy participants on the SEBT and to explore the role of kinesiophobia with this functional.

METHODS: Thirty-four individuals: 17 CAI (10 F/7 M; age = 21.06 ± 3.19 yr; height = 171.2 ± 11.9 cm; weight = 67.7 ± 10.8 kg) and 17 healthy controls (10 F/7 M; age = 19.41 ± 1.23 yr; height = 169.35 ± 6.36 cm; weight = 64.89 ± 8.76 kg) volunteered. Independent variables included condition (VE vs No VE) and group (CAI vs Healthy). The Fear Avoidance Beliefs Questionnaire (FABQ) was administered. Participants completed 3 SEBT trials per condition, starting with No VE followed by VE to eliminate the effect of heightened motivation with a randomized order. Analysis of Variance (ANOVA) examined group differences and whether VE affected performance for Anterior (ANT), Posteromedial (PM), and Posterolateral (PL) reach distances. FABQ was compared between the CAI and Healthy groups using a t-test; all alpha levels were <0.05 a priori.

RESULTS: With No VE, a significant group-by-condition interaction was observed in both the ANT (CAI: 66.90 ± 5.50 vs Healthy: 70.65 ± 4.52) and PM (CAI: 77.60 ± 7.70 vs Healthy: 81.89 ± 8.25 reach directions, which diminished with VE: ANT (CAI: 70.43 ± 4.52 vs Healthy: 71.77 ± 5.10) and PM (CAI: 85.41 ± 7.19 vs Healthy: 86.45 ± 8.71), showing that the two groups behaved similarly with VE. There was no statistically significant interaction ($p=0.48$) for the PL reach direction without VE (CAI: 73.60 ± 7.84 vs Healthy: 75.16 ± 11.72) or with VE (CAI: 80.18 ± 9.79 vs Healthy: 80.06 ± 11.93). The CAI group had significantly higher FABQ scores (10.53 ± 9.45) than the healthy group (0.41 ± 1.70) ($p<.001$).

CONCLUSIONS: The CAI group had lower performance on the SEBT without VE, but with VE, the scores were comparable to healthy controls. Clinicians and researchers should acknowledge the impact that motivation and psychological stresses have on functional performance in patients with pathologies such as CAI.

383	Board #199	May 27 9:30 AM - 11:00 AM
Comparison Of Gender Differences In Ankle And Knee Proprioception		
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It was reported that in same sports program and training intensity, knee and ankle injury in female is 2-8 times higher than males. The decline of posture control is an important cause for sports injuries. Postural control is accomplished by the combination of proprioception, central and neuromuscular control. Proprioception is a crucial component in maintaining the body stability. **PURPOSE:** The purpose of this study was to investigate whether there exist gender differences in knee and ankle

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 : 59.83±12.69kg; 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=1.000) and extension (male: 0.55±0.23 °; female: 0.43±0.17 °, p=0.132) in male and follicular female.

CONCLUSIONS: There were no significant gender differences on ankle and knee proprioception. Therefore, proprioception may not be the cause of the decline in posture control of female.

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

Altitude Training Mask Alters Ankle Joint Kinetics During Treadmill Walking

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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 propulsion in the second (M2) and tenth (M10) of the CON and RI conditions.

Condition	Moment		Power	
	M2	M10	M2	M10
CON	-1.24 (0.32)	-1.25 (0.34)	2.11 (0.45)	2.12 (0.54)
RI	-1.25 (0.35)	-1.31 (0.35)	2.26 (0.54)	2.50 (0.50)

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

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Ankle range of motion (ROM) is believed to be one of the contributing factors in balance deficits. Multiple studies have investigated balance in reference to vision, strength, vestibular function, proprioception, and sensation. However, most of these studies have utilized geriatric, athletic, or injured populations focusing on static

balance measures. **PURPOSE:** Although there are multiple factors that play a role in balance, the purpose of this study was to assess the influence of ankle flexibility on dynamic single leg balance in fit and unfit males. **METHODS:** Twenty-five male subjects (age = 22 ± 2 years; ht. = 179 ± 7 cm; wt. = 85.6 ± 15 kg) were recruited for this study. Ankle flexibility (which includes dorsiflexion, plantarflexion, eversion, and inversion) was measured in degrees for both legs with a goniometer. Subjects then completed four trials, of which the first two trials were familiarization, of the single leg balance test for each leg on a dynamic balance system. Mean stability index (SI) was calculated for the last two trials and both a 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 = .704), and inversion (p = .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

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(No relevant relationships reported)

PURPOSE: 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 a dynamic balance test.

METHODS: Subjects were males and females 18-35 years old (n=25, age= 23.8 ± 1.8 yr.). All subjects completed the Cumberland Ankle Instability Tool (CAIT) to measure perceived ankle instability (lower CAIT scores are associated with greater perceived instability). Dynamic balance was assessed using 3 repetitions in each direction (anterior, postero-medial, and postero-lateral) of the Y-Balance Test (YBT). Asymmetries in CAIT scores and reach distances were calculated by subtracting right leg values from left leg values. Further comparisons were analyzed between groups of bilaterally highest (>80%) and lowest (<20%) combined CAIT scores.

RESULTS: There was a significant positive moderate correlation between CAIT asymmetries and asymmetries in the anterior reach ($r=0.526$, $p=0.007$) and the posteromedial 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 posteromedial reach (101.60 ± 9.91 vs 86.80 ± 5.89 , $p=0.02$), right posterolateral reach (96.40 ± 7.70 vs 76.80 ± 4.87 , $p=0.001$), and right composite score (89.96 ± 5.93 vs 78.44 ± 3.85 , $p=0.007$).

CONCLUSION: Subjects reporting increased perceived ankle instability demonstrated decreased YBT performance on the side of perceived instability. Decreased reach distances may be attributable to neuromuscular consequences of ankle injury, changes in movement strategy associated with apprehension, or both. In fact, the larger the perceived asymmetries the greater the performance deficits. These findings may help clinicians contextualize sensorimotor assessment results in patients with a history of ankle sprain.

387 Board #203 May 27 9:30 AM - 11:00 AM

Static Platform Model Evaluation For Study Of Sudden Ankle Movement.

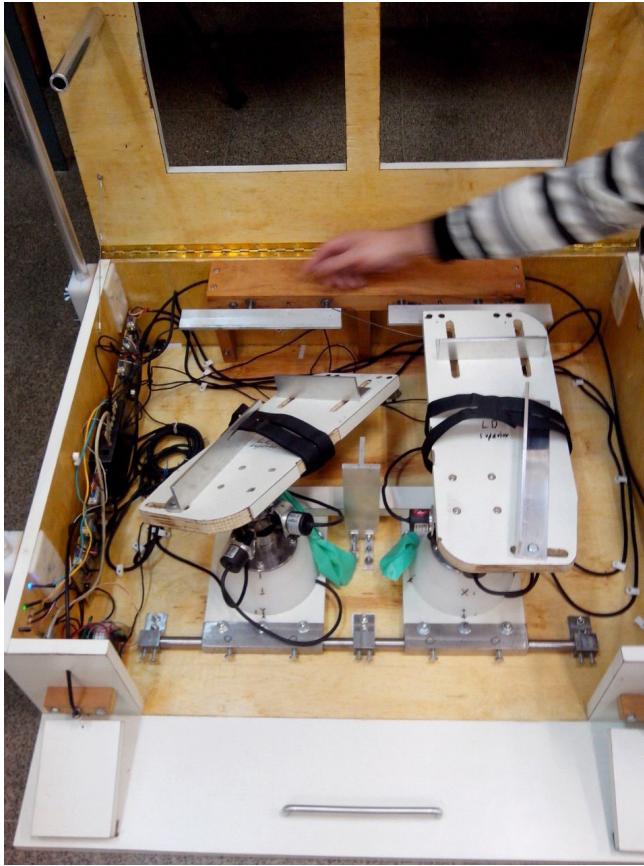
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(No relevant relationships reported)

PURPOSE: 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° plantar flexion, 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

old without history of ankle sprain were studied at the ankle assessment platform. Each athlete was randomly subjected to ankle sprain movement on the platform for 10 repetitions (five on each limb), associated with electromyography of the anterior tibial and fibular muscles. Friedman statistical tests were performed with related samples of nonparametric quantitative data, in cases where there was significance ($p<0.05$) Dunn's post-test was performed. **RESULTS:** There was no statistical difference ($p>0.05$) between latency of movement (0.9 ± 0.2 ms) and to reach the maximum range of motion during plantar flexion (78 ± 4.2 ms) and medial rotation (120 ± 2.3 ms). There was an increase in the angular velocity of inversion ($p<0.05$) during the attempts (230 ± 20.6 %). There was no difference ($p>0.05$) in latency time of the anterior tibial (25 ± 5.2 ms) and fibular muscles (33 ± 4.1 ms). **CONCLUSION:** The sudden static platform was reliable to evaluate the movements performed by the ankle during mechanical sprain, with no difference in the mechanical and electromyographic behavior evaluated during the 10 repetitions.



388 Board #204 May 27 9:30 AM - 11:00 AM
Side Comparison Of Knee Muscle Activities In Response To Perturbed Walking Of Unilateral Ankle Instability

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(No relevant relationships reported)

Acute ankle sprain leads in 40% of all cases to chronic ankle instability (CAI). CAI is related to a variety of motor adaptations at the lower extremities. Previous investigations identified increased muscle activities while landing in CAI compared to healthy control participants. However, it remains unclear whether muscular alterations at the knee muscles are limited to the involved (unstable) ankle or are also present at the uninvolved leg. The latter might potentially indicate a risk of ankle sprain or future injury on the uninvolved leg. **Purpose:** To assess if there is a difference of knee muscle activities between the involved and uninvolved leg in participants with CAI during perturbed walking. **Method:** 10 participants (6 females; 4 males; 26 ± 4 years; 169 ± 9 cm; 65 ± 7 kg) with unilateral CAI walked on a split-belt treadmill (1 m/s) for 5 minutes of baseline walking and 6 minutes of perturbed walking (left and right side, each 10 perturbations). Electromyography (EMG) measurements were performed at biceps femoris (BF) and rectus femoris (RF). EMG amplitude (RMS; normalized to MVIC) were analyzed for 200ms pre-heel contact (Pre200), 100ms post heel contact (Post100) and 200ms after perturbation (Pert200). Data was analyzed by paired t-test/Wilcoxon

test based on presence or absence of normal distribution (Bonferroni adjusted α level $p \leq 0.0125$). **Results:** No statistical difference was found between involved and uninvolved leg for RF (Pre200: $4 \pm 2\%$ and $11 \pm 22\%$, respectively, $p = 0.878$; Post100: $10 \pm 5\%$ and $18 \pm 31\%$, $p = 0.959$; Pert200: $6 \pm 3\%$ and $13 \pm 24\%$, $p = 0.721$) as well as for BF (Pre200: $12 \pm 7\%$ and $11 \pm 6\%$, $p = 0.576$; Post100: $10 \pm 7\%$ and $9 \pm 7\%$, $p = 0.732$; Pert200: $7 \pm 4\%$ and $7 \pm 7\%$, $p = 0.386$). **Discussion:** No side differences in muscle activity could be revealed for assessed feedforward and feedback responses (perturbed and unperturbed) in unilateral CAI. Reduced inter-individual variability of muscular activities at the involved leg might indicate a rather stereotypical response pattern. It remains to be investigated, whether muscular control at the knee is not affected by CAI, or whether both sides adapted in a similar style to the chronic condition at the ankle.

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

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

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

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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 ± 3 yrs, 1.7 ± 0.1 m, 64 ± 10 kg) completed an agility drill requiring two 90° turns and one 180° turn. This was completed in isolation (baseline) and under three dual-task conditions: counting backwards by seven (S7), dribbling a soccer ball (BH), and combined ball dribbling and counting tasks (BHS7). Agility drill DTC (aDTC) was calculated as the percent change in completion time between dual-task and baseline conditions. A jump-and-jump task from a 30 cm box was also completed while 3D kinematics and kinetics were recorded. Dual task jump conditions included working memory (WM), working memory + visual attention task (WMV), and unanticipated working memory + visual attention task (UWMV) tasks. Biomechanical DTC (bDTC) was calculated as the percent change in peak knee valgus moment (pkVM) between dual-task jump landings and a single-task jump landing. Spearman's rho correlations were run between all combinations of aDTC and bDTC (Figure 1). **RESULTS:** Increases in 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., $p>0.05$). **CONCLUSION:** Dual-task ability spanned clinical and laboratory assessments when the secondary task was an anticipated cognitive task. Further research is needed to establish the clinical utility of these relationships.

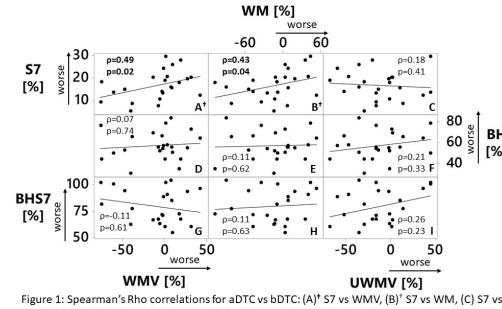


Figure 1: Spearman's Rho correlations for aDTC vs bDTC: (A) S7 vs WMV, (B) S7 vs WM, (C) S7 vs UWMV, (D) BH vs WMV, (E) BH vs WM, (F) BH vs UWMV, (G) BH57 vs WMV, (H) BH57 vs WM, and (I) BH57 vs UWMV. *indicates $p<0.05$

390	Board #206	May 27 9:30 AM - 11:00 AM
Relationships Between Feedforward And Feedback Movement Control Strategies And The Star Excursion Balance Test.		
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PURPOSE: The Star-Excursion Balance Test (SEBT) is commonly used to assess dynamic balance. While the maximum reach distance (MRD) of the posteromedial (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 (GMED), and Soleus (Sol). EMG and kinematics during feedforward (FF) (-50-0 ms) and feedback (short-latency reflex (SLR) 0-50ms, long-latency reflex (LLR) 50-200ms) motor control were compared to MRD. Pearson Correlations were calculated for SLS EMG and kinematics (hip, knee, and ankle) to MRD. Step-Wise Regression to predict MRD was performed using significantly correlated SLS variables.

RESULTS: Significant correlations between SLS EMG and MRD: FF H (Flexing: $p=0.014$, $R=-0.540$; Upright: $p=0.015$, $R=-0.537$), SLR H (Flexing: $p=0.044$, $R=0.454$; 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: $p=0.042$, $R=0.458$). Significant correlations between SLS kinematics and MRD: SLR Hip flexion (Flexing: $p=0.018$, $R=-0.522$) and LLR Hip flexion (Flexing: $p=0.021$, $R=-0.512$). Step-wise regression results: LLR H Flexing explained 33.8% of the variance in 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.

391	Board #207	May 27 9:30 AM - 11:00 AM
Sex Differences In Lower Extremity Kinematics During Overhead And Single Leg Squat Tests		
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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. **PURPOSE:** To determine if biomechanical differences exist between male and female collegiate athletes during performance of an OHS and SLS. **METHODS:** 75 female (18.1 ± 0.4 ; 166.9 ± 6.5 cm; 64.1 ± 10.2 kg) and 58 male (18.7 ± 1.2 ; 184.4 ± 7.1 cm; 86.9 ± 15.2 kg) collegiate athletes completed OHS and SLS testing as part of their pre-participation exam. Men's sports included football (n=24), baseball (n=19), lacrosse (n=10), and swimming (n=5); women's sports included track and field (n=23), field hockey (n=12), softball (n=12), lacrosse (n=9), swimming (n=7), soccer (n=6), golf (n=3), tennis (n=2), and gymnastics (n=1). Participants completed 4 OHSs followed by 4 SLSs on each leg. A Microsoft Kinect sensor using Athletic Movement Assessment software (PhysiMax®) was used to measure all kinematic variables. Differences between males and females were assessed with independent *t*-tests. **RESULTS:** For the OHS, males displayed greater peak knee varus (M: $25.7\pm9.6^\circ$; F: $19.8\pm8.2^\circ$; $P<0.001$), peak hip flexion (M: $-93.6\pm14.41^\circ$; F: $-86.9\pm14.5^\circ$; $P<0.05$), and peak trunk flexion angles (M: $11.5\pm10.9^\circ$; F: $6.3\pm9.2^\circ$; $P<0.01$). Females displayed greater peak ankle dorsiflexion angles (F: $-28.7\pm-5.8^\circ$; M: $-26.5\pm-6.3^\circ$; $P<0.05$). For the SLS (dominant limb), males displayed greater peak trunk flexion (M: $32.2\pm5.6^\circ$; F: $27.6\pm6.6^\circ$; $P<0.001$) and lateral pelvic angles (M: $4.2\pm3.9^\circ$; F: $2.9\pm2.7^\circ$; $P<0.05$). For the non-dominant limb, females displayed greater peak knee valgus angles (F: $-12.5\pm-9.1^\circ$; M: $-8.9\pm-9.1^\circ$; $P<0.05$) whereas males displayed greater peak trunk flexion angles (M: $31.7\pm5.5^\circ$; F: $27.5\pm6.9^\circ$; $P<0.001$). **CONCLUSION:** Male and female collegiate athletes displayed different movement strategies during performance of an OHS and SLS. Injury prevention programs may need to target sex-specific biomechanical patterns to improve movement capacity.

392	Board #208	May 27 9:30 AM - 11:00 AM
Difference In Healthy Male & Female EMG Activity During The Y Balance Test		
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Y balance test kit™ (YBT) is commonly used for the clinical assessment of dynamic balance. YBT is an instrumented version of the Star Excursion Balance test (SEBT) that has Anterior (A), Posteromedial (PM), and Posteriorlateral (PL) directions of the SEBT. Reach distance and kinematic difference on the YBT have been reported to differ across gender.

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

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

RESULTS: Females showed significantly higher EMG than males for GMED (31 ± 16 vs 15 ± 8 %MVIC; $P=0.01$), AT (61 ± 14 vs 42 ± 14 %MVIC; $P<0.01$), and MG (60 ± 29 vs 35 ± 20 %MVIC; $P=0.04$) 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 (67 ± 18 vs 43 ± 10 %MVIC; $P=0.01$) directions and for MG in A (61 ± 22 vs 36 ± 19 %MVIC; $P=0.01$) and PL (74 ± 34 vs 42 ± 22 %MVIC; $P=0.02$) directions of the YBT.

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

393	Board #209	May 27 9:30 AM - 11:00 AM
Kinetic Factors Influencing Y-Balance Test Performance		
Kinetic Factors Influencing Y-Balance Test Performance		

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(No relevant relationships reported)

The Y-Balance Test (YBT) is a movement screen which assesses dynamic stability and neuromuscular control of the lower extremity. Several studies have analyzed kinematic predictors of YBT performance, but kinetic factors determining YBT performance are not well understood. **PURPOSE:** To determine relationships between sagittal, frontal, and transverse plane joint kinetics and YBT performance. **METHODS:** 31 healthy individuals (15M, 16F; age 23.1 ± 7.3 ; height 172.3 ± 9.1 cm; mass 59.05 ± 9.8 kg) participated in this study. Whole body kinematics were recorded using a motion capture system while dominant limb YBT trials were performed on a single force plate. Joint moments were calculated using inverse dynamics. Maximum reach distances normalized to leg length in the anterior (A), posterior-medial (PM), and posterior-lateral (PL) directions were calculated. Joint moment values at maximum reach in each direction were determined. All joint kinetic variables which were correlated with max reach distances at the $p < 0.1$ level were entered into a stepwise linear regression. **RESULTS:** In the A direction, a model containing knee extensor moment explained 21% of the variance in reach distance ($p = .01$). In the PM direction, a model containing hip extensor and knee rotator moments explained 67% of the variance in reach distance ($p < .001$). In the PL direction, a model containing hip extensor moments explained 34% of the variance in reach distance ($p=.001$). **CONCLUSIONS:** Performance on the YBT is primarily influenced by the joint moments at the hip and knee. These results support previous claims that YBT performance is an indicator of neuromuscular control of the lower extremity, and at the hip and knee in particular. Further studies should evaluate the extent to which muscular strength influences both the moments generated during YBT and relationships between joint kinetics and YBT performance.

Table 1: Stepwise multivariable regression results for relationship between joint moments at peak reach direction and YBT performance.

Reach Direction	Variables in Final Regression Model	Beta	p-value	Lower 95%	Upper 95%
Anterior	Knee extensor moment (Nm/kg)	0.044	0.01	0.012	0.077
Posteromedial	Hip extensor moment (Nm/kg)	-0.125	<0.001	-0.175	-0.076
	Knee rotator moment (Nm/kg)	-0.248	<0.001	-0.362	-0.134
Posterolateral	Hip extensor moment (Nm/kg)	-0.164	0.001	-0.251	-0.076

- 394** Board #210 May 27 9:30 AM - 11:00 AM
The Association Between Previous Injury And Two Lower Extremity Functional Tests
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(No relevant relationships reported)

Previous injury to the lower extremity may increase an athlete's risk for future injury. Functional screening is one way to determine if an athlete is at a higher risk of future injury. By assessing athletes' performance on these tests, there is potential for medical providers to implement intervention strategies to decrease risk of future injury. **PURPOSE:** To determine the association between previous history of injury and two lesser known lower extremity functional tests, the single-leg hip bridge (SLHB) and the single-leg 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 78.66 ± 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 a previous injury. There was a statistically significant association between a previous injury and the SLHB for the right leg (Relative Risk (RR) = 0.93; 95% Confidence Interval (CI): 0.76-0.93), but not statistically significant association between previous injury and SLHB for the left leg (RR = 0.98; 95% CI: 0.86-1.05). There was no statistically significant association between the SLWS time on either the right (mean difference = 5.57 seconds; 95% CI: -14.17-3.04) or left (mean difference = 5.68 seconds; 95% CI: -13.37-2.02) with previous injury. **CONCLUSION:** These findings indicate that previous injury to the lower extremity may not affect SLWS time. The SLHB count could be affected depending on the side the injury was on, but additional research is warranted.

- 395** Board #211 May 27 9:30 AM - 11:00 AM
Reliability Estimates Of The Tuck Jump Assessment Following A Standardized Training Session
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The Tuck Jump Assessment (TJA), is a "clinician-friendly" test used to assess technique flaws during a 10-second, high intensity, jumping bout. Although the TJA has broad clinical applicability, there is no standardized training to maximize the measurement properties of the TJA. **PURPOSE:** To determine the reliability of the TJA using a variety of healthcare professionals following an online standardized training program. **METHODS:** A website was created by a physical therapist (PT) with videos and written descriptors of the 10 TJA technique flaws and examples of what constituted no flaw, minor flaw, or major flaw (0,1,2) using published standards. The website content was then validated (both face and content) by 4 experts (2 athletic trainers (AT) and 2 PTs). Three raters of different professions: a PT, an AT, and a Strength and Conditioning Coach Certified (SCCC), were selected due to their expertise with injury and athletic performance. The raters scored 41 videos of participants' TJAs after reviewing online standardized training scored the same 41 videos 2 weeks later. Reliability estimates were determined using intraclass correlation coefficients (ICCs) for summative scores of the 10 flaws and Krippendorff α ($K\alpha$) for the individual technique flaws (ordinal). **RESULTS:** Of all individual technique flaw reliability estimates, only 11 (50 total) were above the acceptable level ($K\alpha = 0.80$). The summative score had moderate interrater reliability in both sessions (Session 1: $ICC_{2,2} = 0.64$; 95% CI (Confidence Interval) (0.34-0.81); Standard Error Measurement (SEM) = 0.66 flaws and Session 2: $ICC_{2,2} = 0.56$; 95% CI (0.04-0.79); SEM = 1.30). Rater 1 (PT) had a good reliability ($ICC_{2,2} = 0.76$; 95% CI (0.54-0.87); SEM = 0.26),

rater 2 (SCCC) had a moderate reliability ($ICC_{2,2} = 0.62$; 95% CI (0.24-0.80); SEM = 0.41) and rater 3 (AT) had excellent reliability ($ICC_{2,2} = 0.98$; 95% CI (0.97-0.99); SEM = 0.01). **CONCLUSION:** All raters, across professions, had at least good reliability estimates for the summative score; yet the same level of consistency was not seen when evaluating each technique flaw. These findings suggest that the summative score may not be as accurate when compared to individual technique flaws, and should be used with caution.

- 396** Board #212 May 27 9:30 AM - 11:00 AM
Serial 7'S Do Not Discriminate Between Sports-related Concussion And Controls: Alternative Dual-task Paradigms
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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 I 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 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 ± 7.5 s) took significantly longer to complete DT compared to the CON group (M time= 17.2 ± 5.1 s, $p=0.03$, $d=1.0$). 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.

A-49 Free Communication/Poster - Maternal and Child Health

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

- 397** Board #213 May 27 10:30 AM - 12:00 PM
Objectively Measured Physical Activity During The First Trimester And Glucose Tolerance At 24-28 Weeks Gestation
Samantha F. Ehrlich¹, Monique M. Hedderson², Susan D. Brown², Scott E. Crouter, FACSM¹, Paul R. Hibbing¹, Juanran Feng², Ai Lin Tsai², Assiamira Ferrara². ¹*UTK, Knoxville, TN.* ²*Kaiser Permanente Northern California, Oakland, CA.*
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Physical activity (PA) during pregnancy may improve glucose tolerance and reduce the risks of adverse outcomes associated with pregnancy hyperglycemia (e.g., pregnancy and delivery complications, delivering a large infant, and developing diabetes later in life), yet the evidence to date has primarily relied on self-reported PA via questionnaire. **PURPOSE:** To examine whether objectively measured PA during the first trimester of pregnancy is associated with glucose tolerance at 24-28 weeks' gestation. **METHODS:** Study participants (n=261) were a subsample of the Gestational Weight Gain and Optimal Wellness (GLOW) trial conducted at Kaiser Permanente Northern California in 2014-2016 to test whether a lifestyle intervention prevents excess gestational weight gain in women with overweight/obesity, as compared to usual medical care. Participants wore an ActiGraph wGT3X-BT for 7 days on the non-

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. Wrist-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.

398 Board #214 May 27 10:30 AM - 12:00 PM

Patterns Of Sedentary Behavior In Pregnant Women During The Third Trimester

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(No relevant relationships reported)

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 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 $26.6 \pm 7.2 \text{ kg/m}^2$. A majority of participants were White (75.0%), married (86.2%) and had a college degree (58.6%). Women spent 63.8% of waking hours sedentary (549.5 ± 153.5 minutes), engaging in 77.2 ± 17.7 total bouts per day, with each lasting on average, 7.7 ± 2.4 minutes. Time spent sedentary was similar across (1) time of day: 62.8% of morning, 62.5% of afternoon, and 63.2% of evening and (2) type of day: 64.2% weekdays and 62.9% 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.

399 Board #215 May 27 10:30 AM - 12:00 PM

Heart Rate Response Is Influenced By Antenatal Physical Activity On The Third Trimester.

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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 measured 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: Regression analysis revealed significant influences on mean HR at exercise ($R= .907$; $R^2=.823$; $F(3, 17)=8.147$; $p=.009$) with PA-3T as strongest predictor ($b=.133$; $p=.005$); and on mean HR at recovery ($R=.839$; $R^2=.704$; $F(3, 17)=4.154$; $p=.049$) where PA-3T and BMI were significant predictors ($b=.196$; $p=.007$) and ($b=1.887$; $p=.049$) respectively. PA-3T was predictive of minimum HR at rest ($b=-.128$; $p=.041$), as well as BMI was for minimum HR at recovery ($b=1.739$; $p=.033$).

CONCLUSIONS: Higher levels of PA in 3T increase HR values in the different stages of an exercise protocol. Whether this is a cardiac adaptation due to the pregnancy to higher PA levels needs further investigation; as generally a lower HR would have been expected as a result of an active lifestyle.

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400 Board #216 May 27 10:30 AM - 12:00 PM

"Optimal Physical Activity Cut-off Value" For Preventing Gdm Among Pregnant Women In Beijing

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

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

METHODS: A total of 321 pregnant women who took regular prenatal examination in outpatient clinics 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 based on the standard methods. Difference 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, $t=3.63$, $P<0.05$), the proportion of participants with low education level (25.42% vs 8.78%, $\chi^2=19.31$, $P<0.05$) and overweight or obese before pregnancy (38.98% vs 24.05%, $\chi^2=7.19$, $P<0.05$) in GDM group are significantly higher. The area under the ROC curve is $0.82(0.77\sim 0.86)$ ($P<0.05$), and the "optimal physical activity cut-off value" is 834 MET*min per week.

CONCLUSIONS: Older age, lower education level and overweight 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.

401 Board #217 May 27 10:30 AM - 12:00 PM

Pelvic Floor Function, Core Stability And Aerobic Capacity In Postpartum Women Following Functional Training

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

METHODS: Sixteen postpartum women (age: 32 ± 3.0 years, ≤ 1 year post-delivery) completed an 8-week functional training intervention (60 minutes each time, 4 times per week). The functional training including pelvic floor muscle bio-feedback training,

T-spine mobility exercise, breathing exercises and inner core activation. Before and after the intervention, a pelvic floor bio-feedback test (PFBFT) 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-posteromedial, and PL-posterolateral) bilaterally were measured. And, during the AME, three muscle groups (F-Flexor, E-Extensor and bilateral lateral flexor-LFL&LFR) were recorded. Paired t-tests were used to compare the 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 PFBFT composite score was improved by 33.8% ($p<0.01$), the YBT scores for the directions of AL, PL, PMR, PLL and PLR were improved by 13.4%, 13.2%, 7.1% 13.5%, and 8.5%, respectively (all $p<0.01$), the AMET scores for abdomen E, F, LFL and LFR were improved by 56.6%, 30%, 26.5% and 30.1%, respectively (all $p<0.01$), and the ST score was improved by 19.9% ($p<0.05$).

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

402 Board #218 May 27 10:30 AM - 12:00 PM

Examining Barriers To Physical Activity For Breastfeeding Mothers Through A Socioecological Lens

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Background: Mothers who are physically active after the birth of a child can experience a range of mental and physical health benefits. However, only 1 in 5 women in the postpartum period are currently meeting physical activity recommendations of 150 minutes of moderate-intensity physical activity per week. Further, breastfeeding women experience additional barriers to physical activity. A multi-system approach is needed to better support breastfeeding women's ability to engage in physical activity. The use of a framework like the socio-ecological model (SEM) provides a unique opportunity to understand barriers to physical activity from perspectives at varying levels (i.e., individual, interpersonal, community, organization and policy). **PURPOSE:** The present study was conducted to examine barriers to physical activity among breastfeeding women from SEM representatives. **METHODS:** A total of 49 representatives were identified at various levels of the SEM based on their occupation or if they were a currently breastfeeding mother. All individuals participated in a telephonic interview between May and August of 2019. A direct content analysis was performed as well as a cross-case analytic strategy to determine differences between level representatives. **RESULTS:** General themes found included a lack of time and lack of ability for self-care. In addition, key differences were seen across SEM levels. For example, representatives of the individual level (breastfeeding mothers) reported lack of time as their critical barrier however those at the interpersonal (significant others) and community level (community lactation counselors) saw the greatest barrier to be associated with an inability to provide self-care due to prioritizing the baby. At the organizational level (healthcare administrators) and policy level (state coordinator; breastfeeding medicine experts) a lack of knowledge or misinformation was more frequently cited. **Conclusion:** Future interventions to increase physical activity among breastfeeding women should recognize the differences seen across SEM levels. Further, interventions should focus on enhancing maternal desire for self-care, opportunities to engage in activity with baby and increasing education on how to be active while breastfeeding.

403 Board #219 May 27 10:30 AM - 12:00 PM

Impact Of Postpartum Exercise On Maternal Health And Infant Physical Activity And Sleep Behaviours

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(No relevant relationships reported)

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

METHODS: Forty-six women voluntarily enrolled in the Active Mom, Active Baby

Intervention. Measures were taken at baseline ($t1$), 5-weeks ($t2$; mid-intervention), and 10-weeks ($t3$; post-intervention). At each time point, maternal weight (kg) was used to calculate BMI (kg/m^2), and maternal physical activity (MPA) levels were measured using the self-reported International Physical Activity Questionnaire-long form (IPAQ-L). Infants were assessed using the Rothbart Infant Behaviour Questionnaire-Revised (IBQ-R) for PA and sleep behaviours. A nonparametric test was conducted to determine if there was a significant change in maternal weight, BMI, and PA levels (light, moderate, and vigorous) across the intervention. Comparisons in IPA and ISB were made using a one-way ANOVA with repeated-measures. A post hoc comparison was completed using the Bonferroni test through the three time points. **RESULTS:** Maternal age of participants ($n=46$) was 32.0 ± 3.5 years at 16.6 ± 7.5 weeks postpartum. The results showed a significant ($p<0.001$) decrease in maternal weight ($-1.4 \pm 0.04\text{kg}$) and BMI ($-0.5 \pm 0.005\text{kg}/\text{m}^2$) across the intervention. There was no significant difference in light- or moderate- PA in the mother, however, vigorous-intensity PA increased from $t1$ ($214.2 \pm 331.3\text{MET-mins/week}$) to $t2$ ($837.3 \pm 516.7\text{MET-mins/week}$; $p<0.001$) and was maintained until $t3$ ($736.0 \pm 582.6\text{MET-mins/week}$; $p>0.001$). There was a significant increase in scores for IPA from $t1$ (3.89 ± 0.85) to $t2$ (4.47 ± 0.83 ; $p<0.001$) to $t3$ (4.80 ± 0.93 ; $p<0.001$). No change in infant sleep behaviour was found between time points. **CONCLUSION:** A postpartum exercise intervention with babies can increase physical activity in both mother and infant, resulting in maternal weight loss.

404 Board #220 May 27 10:30 AM - 12:00 PM

Prescribed Physical Activity In Postpartum Period Helps Women Increase Physical Activity And Decrease Body Weight

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(No relevant relationships reported)

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 pre-pregnancy 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 , mean BMI= $27.8 \pm 5.6 \text{ kg/m}^2$) 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 PA and body weight between groups over time were examined using two-way ANOVA with repeated measures and Tukey post hoc analysis. **RESULTS:** The intervention protocol was successful at increasing women's overall PA during the postpartum period (main effect: $2.9 \times 10^6 \pm 0.4 \times 10^6$ vs. $2.6 \times 10^6 \pm 0.4 \times 10^6$ counts, $p<0.05$) but the only significant differences in PA by time between groups was at the initial 3 month postpartum visit ($2.7 \times 10^6 \pm 0.3 \times 10^6$ vs. $2.4 \times 10^6 \pm 0.4 \times 10^6$ counts, $p<0.05$) as the intervention did not lead to a further significant increases 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 ($2.4 \times 10^6 \pm 0.4 \times 10^6$ vs. $2.8 \times 10^6 \pm 0.4 \times 10^6$ 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. 72.6 ± 16.8 kg, $p<0.05$). **CONCLUSION:** Increased PA habits during the postpartum period may help women more successfully return to pre-pregnancy 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

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(No relevant relationships reported)

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

habits such as walking 10,000 steps/day (active), and consuming 1800-2252 kilocalories/day (kcal), whereas most pregnant woman 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 a 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-Ramie¹, Neil M. Johannsen², Timothy S. Church³, Mark A. Sarzynski, FACSM¹. ¹*University of South Carolina, Columbia, SC*, ²*Louisiana State University, Baton Rouge, LA*, ³*Pennington Biomedical Research Center, Baton Rouge, LA*. Email: raflynn@email.sc.edu
(No relevant relationships reported)

Purpose: Elevated levels of circulating branched-chain amino acid (BCAA) and ketone bodies are recognized as biomarkers for cardiovascular disease (CVD) and other pathological conditions in type-2 diabetes mellitus (T2DM). Aerobic exercise interventions have previously shown decreases in levels of these markers, suggesting improved metabolic status and reduced risk of CVD. However, the efficacy of resistance training and concurrent programs in reducing BCAA and ketone body levels has not been well researched.

Methods: The current study was performed as a secondary analysis of the HART-D trial, a 9-month randomized, controlled exercise-training trial of 262 participants with T2DM. Participants were randomized to one of four groups; non-exercise control, aerobic training (AT), resistance training (RT), or a combined aerobic-resistance training (ATRT). The effects of the 9-month intervention on BCAs (leucine, valine, and isoleucine) and ketone bodies (β -hydroxy-butyrate, 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; ATRT, 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=0.01) concentrations (shown as mean \pm SE in $\mu\text{mol/L}$) decreased in the RT group compared to the control group. Acetone also decreased in ATRT compared to the control group ($-10.2 \pm 3.5 \mu\text{mol/L}$, p=0.004).

Conclusions: Our results suggest that RT and ATRT programs could improve ketone body metabolism in those with T2DM.

407 Board #223 May 27 9:30 AM - 11:00 AM Does Exercise Intensity Influence Dietary Protein Requirements Of Male Endurance Athletes?

Carolyn P. Adams, Jenna B. Gillen, Daniel W.D. West, Daniel R. Moore. *University of Toronto, Toronto, ON, Canada*.
(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 ± 3 y, 76 ± 16 kg; 62 ± 6 ml O₂·kg⁻¹·min⁻¹; mean \pm SD) completed two trials in a randomized order with exercise (20-km run) performed at a low (LOW; $72 \pm 1\%$ HRmax, $55 \pm 5\%$ VO₂peak) or high (HIGH; $88 \pm 1\%$ HRmax, $75 \pm 7\%$ VO₂peak) intensity. After 2 days of exercise and dietary ($1.4\text{ g} \cdot \text{kg}^{-1} \cdot \text{d}^{-1}$ protein) control, participants consumed $0.6\text{ g} \cdot \text{kg}^{-1}$ CHO before a 20-km treadmill run with continuous HR monitoring and periodic measurement of gas exchange (indirect calorimetry). During the 8h post-exercise recovery period, participants consumed $8.6\text{ g} \cdot \text{kg}^{-1} \cdot \text{d}^{-1}$ CHO and hourly meals providing $0.93\text{ g} \cdot \text{kg}^{-1} \cdot \text{d}^{-1}$ 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. $1.96 \pm 0.52 \text{ g} \cdot \text{min}^{-1}$, p<0.01). Exercise duration was shorter in HIGH vs LOW (86 ± 18 vs. 112 ± 23 min, p<0.01). F¹³CO₂ was not different between trials (HIGH: 0.94 ± 0.25 vs. LOW: $0.89 \pm 0.14 \text{ umol} \cdot \text{kg}^{-1} \cdot \text{h}^{-1}$, 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.

408 Board #224 May 27 9:30 AM - 11:00 AM 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. Wilson¹, Lee M. Margolis¹, John W. Carbone³, Robert R. Wolfe², Amy A. Ferrando², Stefan M. Pasiakos, FACSM¹. ¹*U.S. Army Research Institute of Environmental Medicine, Natick, MA*, ²*Donald W. Reynolds Institute on Aging, University of Arkansas for Medical Sciences, Little Rock, AR*, ³*Eastern Michigan University, Ypsilanti, MI*. (Sponsor: Stefan M. Pasiakos, FACSM)

(No relevant relationships reported)

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 (0.25-0.30 g protein/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/kg/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 \pm SD; age: 22.9 ± 5 y; BMI: 25.4 ± 2.7 kg/m²) completed a randomized, double-blind crossover study consisting of two, 5d periods of controlled energy deficit ($30 \pm 4\%$), 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 ²H₅-phenylalanine infusions. Drinks providing standard (0.10g/kg/meal, 7.87 ± 0.87 g) and high (0.30g/kg/meal, 23.5 ± 2.54 g) 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 ($0.047 \pm 0.3\%$ /h) and high ($0.045 \pm 0.02\%$ /h). In the postprandial state, and independent of EAA, MPS at rest (standard, $0.055 \pm 0.01\%$ /h; high, $0.061 \pm 0.02\%$ /h) and post-exercise (standard, $0.055 \pm 0.01\%$ /h; high, $0.065 \pm 0.02\%$ /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: $2915 \pm 569 \mu\text{mol/L}$; AUC: $228485 \pm 54783 \mu\text{mol/L}/240\text{min}$) than standard (peak: $1843 \pm 497 \mu\text{mol/L}$; AUC: $75727 \pm 32254 \mu\text{mol/L}/240\text{min}$; 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

- 409** Board #225 May 27 9:30 AM - 11:00 AM
Correlation Between Plasma Creatinine, Lean Body Mass, And Grip Strength In Inactive Vegetarians And Vegans
Eric Bartholomae, April Incollingo, Maricarmen Vizcaino, Christopher Wharton, Carol Johnston. *Arizona State University, Phoenix, AZ.*
(No relevant relationships reported)

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 vegetarians and vegan adults. Additionally, to determine any change in creatinine levels following an 8 week protein supplementation intervention. **METHODS** Twenty-six inactive (<150min exercise/wk) vegetarians and vegans ($34y \pm 8.9$; $n=19$ 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 supplementation 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 (0.77 ± 0.11 mg/dL) and LBM (40.1 ± 8.8 kg) ($r=0.513$, $n=26$, $p<0.008$) as well as grip (25.5 ± 7.8 kg) ($r=0.445$, $n=26$, $p<0.024$). There was a positive correlation between follow-up creatinine and LBM (0.78 ± 0.12 mg/dL) and LBM (40.2 ± 8.7 kg) ($r=0.480$, $n=26$, $p<0.014$) but not grip (25.5 ± 7.6 kg) ($r=0.390$, $n=26$, $p=0.054$). The change in creatinine (0.004 ± 0.060 mg/dL) was not correlated to change in LBM (0.08 ± 0.76 kg) ($r=-0.015$, $n=26$, $p=0.943$) 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 $F(1,24) = 0.983$, $p=0.331$. **CONCLUSION** While there was no significant change 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.

- 410** Board #226 May 27 9:30 AM - 11:00 AM
Does Muscle Hypertrophy Relate To Resistance Training-Induced Changes In Myofibrillar Protein Synthesis In Women?
Julia M. Malowany¹, Sidney Abou Sawan¹, Cassidy Tinline-Goodfellow¹, Nathan Hodson¹, Daniel W. D. West¹, Jenna B. Gillen¹, Dinesh Kumbhare², Daniel R. Moore¹. ¹*University of Toronto, Toronto, ON, Canada.* ²*Toronto Rehabilitation Institute, Toronto, ON, Canada.*
(No relevant relationships reported)

Resistance exercise (RE) elevates skeletal muscle myofibrillar protein synthesis (MyoPS) for up to 48h, which can be measured under 'free-living' conditions using deuterium oxide (D_2O). The accumulation of repeated bouts of RE (resistance training—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 RE and their relationship to hypertrophic adaptations has yet to be investigated in women. **PURPOSE:** The present study examined the MyoPS response over 48h 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 ± 5 yr, 62.3 ± 12.0 kg, $23.7 \pm 7.4\%$ body fat; mean \pm SD) underwent ~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-follicular 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 D_2O . Muscle biopsies were obtained at pre-RE (0h), 24h and 48h 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; $P < 0.01$). Forthcoming 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.

- 411** Board #227 May 27 9:30 AM - 11:00 AM
High Protein Supplementation Facilitates Weight Training Induced Bone Mineralization In Baseball Players
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(No relevant relationships reported)

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 delimited by high protein supplementation. Total BMD of athletes cannot be further elevated by weight training.

- 412** Board #228 May 27 9:30 AM - 11:00 AM
Potato Protein Stimulates Muscle Protein Synthesis At Rest And With Resistance Exercise
Sara Y. Oikawa¹, Ravninder Bahniwal¹, Chris McGlory², Steven K. Baker¹, Stuart M. Phillips¹. ¹*McMaster University, Hamilton, ON, Canada.* ²*Queens University, Kingston, ON, Canada.* (Sponsor: Stuart M. Phillips, FACSM)
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(No relevant relationships reported)

Potato protein stimulates muscle protein synthesis at rest and with resistance exercise Sara Y. Oikawa¹, Ravninder Bahniwal¹, Chris McGlory², Steven K. Baker¹, Stuart M. Phillips¹

¹*McMaster University, Hamilton, Ontario, Canada*

²*Queens University, Kingston, Ontario, Canada*

Skeletal muscle protein synthesis (MPS) is increased in response to amino acid feeding and to resistance exercise (RE) where RE enhances MPS above feeding alone. The use of vegetable based proteins have 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.

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. Myofibrillar 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

Consuming PP in addition to a habitual diet increased rates of MPS at rest and there was a further increase with RE. PP may serve as a high quality, vegetable-based protein supplement to augment muscle protein anabolism in healthy young women.

Support by The Alliance for Potato Research & Education

413	Board #229	May 27 9:30 AM - 11:00 AM
Leucine-Enriched Essential Amino Acids Enhance Post-Exercise Muscle Recovery Independent Of 'Free-Living' Myofibrillar Protein Synthesis		
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Reported Relationships: M. Waskiw-Ford: Industry contracted research; Ajinomoto Co. Inc..		

Leucine-enriched essential amino acids (LEAA) can acutely enhance post-exercise muscle protein synthesis and may facilitate muscle damage recovery, although the relationship between these outcomes during the prolonged post-exercise recovery period is unclear. **PURPOSE:** We aimed to determine the effect of LEAA on 'free-living' rates of myofibrillar protein synthesis (MyoPS) and its relationship to markers of muscle damage after an unaccustomed bout of resistance exercise (RE) in recreationally-active men. **METHODS:** Twenty healthy males (24.1 ± 4.3 yrs) consuming a controlled diet (1.2g/kg/day of protein) were randomized to consume 4.0g of LEAA (containing 1.6g 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. Total muscle torque (sum of isometric and 60 and 270°/s isokinetic torques; SUM) of the knee extensors, thigh muscle soreness (SOR), Z-band streaming, and muscle heat shock protein (HSP) 25 and 70 expression were measured at rest and during recovery. **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 outcomes ($P > 0.05$). **CONCLUSION:** Daily consumption of LEAA mitigates muscle strength loss and may moderately alleviate muscle damage during 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.

414	Board #230	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 Andre ¹ , Robert Sanders ¹ , Hannah Nelson ¹ , Neil Schwarz ² , Melinda Valliant ¹ , Josh Hogg ¹ . ¹ University of Mississippi, OXFORD, MS. ² University of South Alabama, Mobile, AL. (No relevant relationships reported)		

Increases in morning resting energy expenditure (REE) have been observed following late evening ingestion 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 ; $\text{VO}_2\text{max} = 44.1 \pm 5.3$ 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) (cocoa 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 min of steady state before and after exercise. The exercise protocol consisted of 20 min of aerobic exercise on a treadmill at 40-50% of VO_2max . Total calories during exercise were used to compare exercise energy expenditure (EEE). For the statistical analyses, Paired-samples t-tests and two-way repeated measures ANOVA. Results were considered significant at ≤ 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 x 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.

415	Board #231	May 27 9:30 AM - 11:00 AM
Pre-sleep Or Post-exercise Protein Intake Does Not Augment Resistance Training Adaptations In Older Adults		
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Resistance training (RT) and protein consumption are recommended to attenuate decreases in muscle mass and strength with age. Immediate post-exercise (Post-ex) 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 Post-ex (n=9), 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 $p \leq 0.05$. **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 cm) and 1RM strength (Pre: 155.9 ± 30.0 ; Mid: 170.1 ± 36.0 ; Post: 184.2 ± 47.1 kg). There were no group x 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: 6.70 ± 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.

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416	Board #232	May 27 9:30 AM - 11:00 AM
Effect Of Whey Protein Isolate On Cortisol Awakening Response In Recreationally Active Women		
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Introduction: The hypothalamus-pituitary-adrenal (HPA) axis plays a major role during 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; $\text{VO}_2\text{max} = 31.6 \pm 4.5$ 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 (WH)) was given between 8am - 9am and 30min 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% VO_2max (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 8am, immediately upon waking and every 15 min for the next hour. Saliva 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 (33.36 ± 2.0 $\mu\text{g} \cdot \text{hr}^{-1} \cdot \text{dL}^{-1}$) and WH (30.88 ± 0.8 $\mu\text{g} \cdot \text{hr}^{-1} \cdot \text{dL}^{-1}$). No significant difference ($p = 0.149$) in WAnT fatigue index means occurred between PL ($20.79 \pm 6.1\%$ Day 2 & $21.97 \pm 6.4\%$ Day 3) and WH trials ($22.52 \pm 6.2\%$ Day 2 & $22.78 \pm 6.4\%$ Day 3).

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

417 Board #233 May 27 9:30 AM - 11:00 AM

The Influence Of A Whey Protein Preload Prior To Carbohydrate Consumption On Cycling Performance

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(No relevant relationships reported)

INTRODUCTION: The consumption of carbohydrates during a bout of endurance exercise has been shown to promote a glycogen sparing effect and lead to an improvement in exercise performance. The consumption of whey protein prior to a prolonged bout of endurance exercise may augment insulin secretion and further spare muscle glycogen.

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

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

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

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

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(No relevant relationships reported)

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 iso-caloric CP, CP+WP, or CHO at a dose relative to LBM on recovery following an evening lower-body resistance exercise (RE) bout. **METHODS:** Fifteen active males (age: 21±1yrs, body fat:14.2±2.7%) participated in this randomized, double-blind, crossover study. One-repetition maximums were performed on the leg press and extension machines to determine RE intensity. Participants performed an evening (1600–1900) lower-body RE bout and were provided with 0.4g/kg/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 (Biodex™) of the right thigh muscles were assessed the following morning. ANOVAs were used for analyses and significance was accepted at $p < 0.05$. **RESULTS:** There was no significant difference in perceived morning recovery, soreness and fatigue between pre-sleep supplements. There was a significant difference in pressure-pain threshold at the rectus femoris ($p=0.001$), vastus medialis ($p=0.001$) and vastus lateralis ($p<0.001$). Both CP (98.0±17.3N), and CP+WP (98.2±21.7N) had a greater pressure-pain threshold (i.e. less soreness) than the PLA (80.6±21.7N) at the rectus femoris. Average power was similar between supplements. Hunger was significantly greater after CP than CP+WP (52.2±17.2 vs. 39.9±15.9 mm; $p= 0.048$). There was no difference for satiety and desire to eat. **CONCLUSIONS:** Pre-sleep consumption of

CP and CP+WP at a dose relative to LBM may enhance overnight recovery to a greater extent than CHO as a result of less muscle soreness the following morning after an acute evening RE bout.

419 Board #235 May 27 9:30 AM - 11:00 AM

Effects Of Vespa Amino Acid Mixture On Submaximal And Maximal Cycling Performance

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(No relevant relationships reported)

Introduction: The ability to increase fat utilization during exercise and VO_{2max} could dramatically improve exercise performance, especially among endurance athletes.

Prior research suggests that the chronic use of a Vespa Amino Acid Mixture (VAAM) may increase fat metabolism and VO_{2max} among elderly women (Sasai 2011). VAAM consumption provides a unique combination of amino acids (tyrione, phenylalanine, proline, and alanine) that are effective at increasing Krebs' Cycle activity, thereby facilitating increased aerobic metabolism. **Purpose:** The purpose of this study was to determine if a single pre-exercise dose of VAAM increased fat metabolism, VO_{2max}, or ventilatory threshold during cycling exercise. **Methods:** In this single-blind pilot study, three highly active male cyclists (age 37.3 ± 10.1 years) completed two exercise tests separated by one week. Prior to each exercise test, in random order, subjects consumed either an 8 ounce drink containing 100mg of VAAM (Vespa CV-25. Vespa Power Products LLC, Davis CA) or an 8 ounce isocaloric placebo. On a cycle ergometer subjects completed four 5-minute submaximal exercise stages, followed immediately by a VO_{2max} test. Fat metabolism (FM, kcal/min), maximal oxygen uptake (VO_{2max}, ml/kg/min), and ventilatory threshold intensity (VT, Watts) were measured. **Results:** The results of these tests demonstrated an increase in submaximal FM, VO_{2max}, and VT following the consumption of VAAM. **Discussion:** The findings of this study indicate a potential improvement in aerobic exercise performance through increased fat metabolism, VO_{2max}, and VT intensity when consuming a single 100mg dose of VAAM prior to exercise compared to a placebo.

420 Board #236 May 27 9:30 AM - 11:00 AM

Effect Of Protein Supplementation On Running Exercise-induced Muscle Damage And Soreness: A Randomized Controlled Trial

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(No relevant relationships reported)

Purpose: The benefits of protein supplementation on endurance exercise-induced muscle damage and soreness remain inconclusive. Therefore, we assessed whether a protein supplementation protocol with optimized timing and amounts could attenuate running-induced muscle soreness and muscle damage compared to iso-caloric placebo supplementation.

Methods: A double-blind randomized controlled trial was performed among 323 recreational runners (age 44±11 years, 56% male) participating in a 15-km road race. Participants received 2 supplements per day containing 80% caseinate and 20% whey protein (intervention) or carbohydrate (placebo). Supplements were consumed post-race (at the finish line and prior to sleep) and during 3 consecutive days (at breakfast and prior to sleep). Habitual protein intake was assessed using 24hr recalls at baseline, on the day of the race and 1, 2 and 3 days post-race. Race characteristics were determined and muscle soreness was assessed with the Short-Form Brief Pain Inventory at baseline and 1 day, 2 days and 3 days post-race. In a subgroup ($n = 149$), muscle soreness was measured with a strain gauge algometer and concentrations of the muscle damage markers creatine kinase (CK) and lactate dehydrogenase (LDH) were measured 25 to 48hr post-race.

Results: At baseline, no group-differences were observed for habitual protein intake (79.9 ± 26.5 g/d versus 82.0 ± 26.8 g/d, $P = 0.49$) and Numeric Pain Rating Scale muscle soreness (0.45 ± 1.08 versus 0.44 ± 1.14 , $P = 0.96$) in the protein group compared to the placebo group. Subjects completed the race at an exercise intensity of 94±6% of HRmax and a running speed of 12±2 km/h. The protein group reported higher muscle soreness 24hr post-race compared to the placebo group (2.96 ± 2.27 versus 2.46 ± 2.38 , $P = 0.039$), but no differences were observed on day 2 and 3 post-race. Similarly, we found a lower pressure pain threshold for the quadriceps muscle in the protein group compared to the placebo group (71.8 ± 30.0 N versus 83.9 ± 27.9 N, $P = 0.019$). Similar concentrations of CK and LDH were found post-race in both groups.

Conclusion: Post-exercise protein supplementation is not more preferable than carbohydrate supplementation to reduce muscle soreness or damage in recreational athletes with a protein intake of 1.14 ± 0.35 g/kg/d running a 15-km road race.

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		

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Protein ingestion is recommended to maximize muscular adaptations post resistance training (RT). Eggs are a rich food source commonly consumed post-workout to meet protein requirements. Although removing egg yolk is often promoted for the improvement of body composition (BC), whole-egg (WE) consumption has been shown to cause a greater stimulation of post-exercise muscle protein synthesis than egg-white (EW). However, changes in BC and skeletal muscle regulatory markers to chronic RT coupled with WE or EW consumption have not been evaluated. **PURPOSE:** To compare the effects of WE vs. EW ingestion after 12 wks of RT on BC and skeletal muscle regulatory markers in RT men. **METHODS:** Thirty RT men [age (24 ± 2 yrs), were randomized to either a WE (n=15) or EW (n=15) consumption group for 12 wks. The WE group ingested three WE while the EW group ingested six EW immediately post-workout and at the same time on non-training days. RT consisted of 10 exercises/session, 3x wk. Three sets of 3-14 reps (load was progressed) were performed for each exercise. Body weight, fat mass (FM), skeletal muscle mass (SMM) as well as serum follistatin (FOL), myostatin (MYO) and basic fibroblast growth factor (FGF-2) levels were measured at baseline and after 12 wks. **RESULTS:** Significant main effects of time were observed for body weight, SMM, FOL and FGF-2 which significantly ($P < 0.05$) increased, and for FM and MYO which significantly ($P < 0.05$) decreased. However, no significant group × time interactions were noted for any markers. Although non-significant, the WE group had ~1 Kg of extra FM loss than EW group. **CONCLUSIONS:** There are no differences in the changes achieved in BC and skeletal muscle regulatory factors after 12 wks of RT between WE and EW consumption. Although BC did not differ between groups, the ~1 Kg of extra FM loss seen after WE consumption may be an advantage for fitness enthusiasts with aesthetic goals.

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)

In seniors with type 2 diabetes mellitus (SDM2), skeletal muscle LOSS is two to four times higher than in non-diabetics. In addition, SDM2 have a greater reduction in neuromuscular function and worse performance in functional tests. Hence, the recommendation of physical exercise is consensual for this population. Exercise-induced muscle damage is known to hinder motor learning and carbohydrate with protein intake reduces this damage, possibly improving the functional outcomes from exercises. **PURPOSE:** Verify the role of protein or glycemic intake on muscle strength and functionality of SDM2 undergoing resistance training. **METHODS:** This is an experimental, controlled, randomized, double-blind study. Twenty-six males SDM2 with a mean age of 68.5 (± 4.3) years randomly put into two groups: Protein Group (GP) (13) and Carbohydrate Group (GC) (13). The training sessions were held twice a week for 12 weeks. Eight exercises were performed for the main muscle groups, being 3 sets of 8 to 12 repetitions. The intensity was continuously adjusted

between 7 - 8, according to the Subjective Effort Perception (1 to 10). Ingestion of macronutrients was performed immediately after strength training, using 20 g of water-diluted whey protein for the GP group and 20 g of water-diluted maltodextrin for the GC group. Muscle strength was assessed by isokinetic dynamometry of knee extensors and flexors, upper limbs by the Hand Grip Strength Test (HGS) and functionality by the Short Physical Performance Battery Test (SPPB). **RESULTS:** No significant differences were found between the groups, nor before and after training in relation to the dominant side muscle strength (DS) - Extensors torque peak = ($F = 1.51 = 0.247$; $p = 0.62$; $\eta^2 = 0.005$) and flexors ($F = 1.51 = 0.345$; $p = 0.56$; $\eta^2 = 0.007$); non-dominant side (NDS) - Peak torque of extensors ($F = 1.51 = 0.143$; $p = 0.70$; $\eta^2 = 0.003$) and flexors ($F = 1.51 = 0.187$; $p = 0.66$; $\eta^2 = 0.004$); FPM (DS) (kg / f) ($F = 1.51 = 0.455$; $p = 0.50$; $\eta^2 = 0.009$); HGS (NDS) (kg / f) ($F = 1.51 = 0.020$; $p = 0.88$; $\eta^2 = 0.000$). In functionality there was a significant gain in the protein group in the interaction between groups * condition (pre and post) ($F = 1.51 = 6.23$; $p = 0.01$; $\eta^2 = 0.115$). **CONCLUSION:** Ingestion of both macronutrients does not produce an increase in muscle strength alone, but protein supplementation shows improvements in functionality.

423	Board #239	May 27 9:30 AM - 11:00 AM
Effects Of Protein Intake On Gastrointestinal Symptoms In Runners - A Pilot Study		

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(No relevant relationships reported)

PURPOSE: Gastrointestinal (GI) symptoms often hinder running performance and are responsive to nutrient intakes. Currently, the recommendation is to "limit" protein intakes to minimize symptoms, but a threshold has not been established. The purpose of this study was to examine the effect of a highprotein (HP) vs a low protein (LP) shake on running induced GI symptoms. **METHODS:** Five (n=2 male) endurance trained runners were administered a HP (0.4 g/kg body weight) or LP (0.15 g/kg/ body weight) shake one hour prior to a 10 km run at 85% of their race pace in a single-blind, randomizedcross-over design. Carbohydrate and water intakes remained consistent across trials. Exercise induced GI symptoms were measured pre-shake, 60 minutes post-shake, and post-run. Symptoms were rated on a 10 point scale and included six upper abdominal problems, seven lower abdominal problems, and five systemic problems. **RESULTS:** Symptoms experienced during the LP run included belching (2), stomach cramps (2), intestinal cramps (3), flatulence (1), urge to defecate (1), stitch (1), dizziness (1), muscle cramp (1), urge to urinate (2), and fullness (1). Severity was consistently low with only urge to urinate rated as a 4. Symptoms experienced during the HP run included re-flux (1), belching (2), bloating (1), stomach cramps (2), intestinal cramps (1), flatulence (1), stitch (1), and fullness (1). Severity was consistently low with a maximum of 3. There was no significant difference in the severity of symptoms experienced between the two trials and no difference in the number of symptoms. **CONCLUSIONS:** A pilot trial indicates no difference in exercise-induced GI symptoms with a HP or LP shake pre-run and suggests intakes up to 0.4g/kg body weight can be well tolerated. Supported by a Mount Royal UniversityInnovation Grant.

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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Preschool menus must meet the Dietary Guidelines for Americans however, what is actually served and consumed by children is not restricted, potentially affecting consumption of a balanced diet. **PURPOSE:** Compare preschool lunch menus that meet dietary guidelines to what is actually served and consumed by children. **METHODS:** Fifty-two preschool children (mean±SD, age 3y and 10m ± 8m) from a university early childhood center participated in the 10-week study. Each day, 15 children were randomly selected for nutritional analysis of their lunch. Prior to and immediately after consumption, a picture of the child's tray was taken using digital photography. If a child had additional food (second's), additional pictures were taken. Analysis of energy and nutrient content for menus, food served, and food consumed was completed using Food Processor Nutrition Analysis by ESHA. Food color (white, brown, orange, yellow, red, green, other) was determined by observation during analysis. A food preference survey was administered orally to children immediately after each meal. **RESULTS:** There was a significant ($p<0.05$) difference for total kilocalories (kcals) between menu (448 ± 130), served (523 ± 148) and consumed (361 ± 178). There was a significant ($p>0.05$) difference for grams of carbohydrate between menu (55.3 ± 18.9 g) and served (56.5 ± 20.5 g) compared to what was consumed (38.5 ± 21.7 g). There was a significant ($p<0.05$) difference for grams of fat between menu (15.9 ± 8.7 g), served (21.2 ± 9.7 g) and consumed (14.5 ± 10.0 g). There was a

significant ($p<0.05$) difference for protein between menu ($21.7 \pm 5.7\text{g}$), served ($27.9 \pm 10.6\text{g}$) and consumed ($19.5 \pm 11.8\text{g}$). 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 amounts, 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.

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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 dietitian. Men in the P3X group, were instructed to ingest the recommended amount of protein ($1.6-2.2\text{g/kg}$), 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 ± 0.58 to $10.76 \pm 0.56\text{cm}^2$; P5X: 8.53 ± 0.61 to $9.64 \pm 0.59\text{cm}^2$, $p=0.014$), VL (P3X: 30.19 ± 1.54 to $33.60 \pm 1.49\text{cm}^2$; P5X: 31.95 ± 1.62 to $34.13 \pm 1.57\text{cm}^2$, $p=0.003$), and in the sum of the CSA of both muscles (P3X: 40.16 ± 1.70 to $44.36 \pm 1.72\text{cm}^2$; P5X: 40.48 ± 1.79 to $43.77 \pm 1.81\text{cm}^2$, $p=0.002$). 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

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(No relevant relationships reported)

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.

METHODS: This 12-week, parallel-group randomized clinical trial included 26 men (means \pm SEs; age, 20.8 ± 0.4 years; BMI, $21.8 \pm 0.4 \text{ kg/m}^2$). 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:** No significant difference in TotalFFM was observed between the 2 groups at baseline (HBR vs LBR: 52.4 ± 1.3 vs $53.4 \pm 1.2 \text{ kg}$). After completing the 12-week diet plan and RT program, both the groups gained significant TotalFFM ($2.1 \pm 0.2 \text{ kg}$, $4.0 \pm 0.4\%$), with the HBR group having greater changes in TotalFFM than the LBR group [HBR vs LBR, 2.5 ± 0.3 vs $1.8 \pm 0.3 \text{ kg}$; $P = 0.056$; 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).

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

Effects Of Protein Pre-run On Glucose And Perceived Exertion - A Pilot Study

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(No relevant relationships reported)

Purpose: Protein recommendations pre-running have yet to be established and will need to consider performance responses as well as the potential for exercise-induced gastrointestinal symptoms. The purpose of this study was to examine the impact of a high protein (HP) shake consisting of 0.4 g/kg body weight (BW) protein vs. a low protein shake (LP) 0.15 g/kg BW protein pre-run on glucose, gut fullness, and perceived exertion. **Methods:** Five (n=2 male) endurance trained runners were administered a HP or LP shake one hour prior to a 10 km run in a randomized cross-over design. Carbohydrate and water intakes remained consistent across trials. Blood glucose was measured at fasting, 30, and 60 minutes post-shake and post-run using a glucose meter. Perceived exertion was measured using Borg's scale. Exercise induced gastrointestinal symptoms were measured at fasting, pre-run and post-run using a 10-point questionnaire. Gut fullness was measured using a visual analogue scale at fasting, 15, 30, 60 minutes post-shake and post-run. **Results:** Blood glucose peaked at 30 minutes post-shake and there was no difference between the HP and LP shakes. There was a significant interaction between time and shake ($p=0.044$), however no main effect of time or shake. There was no difference in perceived exertion between the two interventions. Gut fullness changed over time ($p=0.005$), however, was not affected by the composition of the shake. There was no difference in the number of exercise-induced gastrointestinal symptoms experienced on the HP and LP shakes.

Conclusion: The results from this pilot study suggest that the inclusion protein in the pre-run meal is feasible and provides support for a fully powered trial.

Supported by Mount Royal University Innovation Grant

428 Board #244 May 27 9:30 AM - 11:00 AM

Human Skeletal Muscle Mrna Expression In Response To Treadmill-based Endurance Training And Post-exercise Protein Supplementation

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(No relevant relationships reported)

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.

PURPOSE: To examine the influence of post-exercise protein ingestion on mRNA gene expression in response to six-weeks treadmill running. **METHODS:** In a randomized parallel group design, 15 individuals ($\text{VO}_{2\text{max}} 55 \pm 6 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$) completed six weeks of treadmill running (4 sessions per week), progressively increasing in both duration (30-60 min) and intensity (70-75 % $\text{VO}_{2\text{max}}$). Participants were randomly assigned to a group receiving a supplement containing carbohydrate (CHO; $1.6 \text{ g sucrose} \cdot \text{kg}^{-1}$; n= 7) or carbohydrate-protein (CHO-P; $0.8 \text{ g sucrose} \cdot \text{kg}^{-1}$ and $0.8 \text{ g whey protein hydrolysate} \cdot \text{kg}^{-1}$; n=8) ingested immediately post-exercise and then 1 h later. To determine mRNA expression of several mitochondrial, mitogenic signaling, protein synthesis and lipid/carbohydrate metabolism genes, muscle biopsy samples were collected at baseline and follow-up, with 48 h of lifestyle standardization to exclude any acute effects on transcriptional changes. **RESULTS:** An up-regulation in mammalian target of rapamycin (mTOR) gene expression was shown in CHO-P

(+46%; $p=0.025$) relative to CHO (+4%) following the intervention. Mitochondrial transcription factor A (TFAM) up-regulation was shown in CHO-P group (26%) when compared with CHO (13%), albeit this did not reach statistical significance ($p=0.07$). No changes in the expression of other mitochondrial, lipid/carbohydrate metabolism, mitogenic signaling genes were observed between groups ($p>0.05$). **CONCLUSION:** post-exercise protein supplementation up-regulates the expression of mTOR in skeletal muscle over six-weeks of treadmill-based endurance exercise training, indicating that post-exercise protein supplementation may have a potential role in accentuating skeletal muscle adaptations to endurance exercise training. Funder: Health Sciences Research Center, Lifestyle & Health Research Center (LHRC), Princess Nourah bint Abdulrahman University.

429 Board #245 May 27 9:30 AM - 11:00 AM
Varying Postprandial, Postexercise Nutrient Timing: Effects On Substrate Oxidation And Protein Retention In Resistance-trained Men

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Dietary protein and/or carbohydrate consumption augments postexercise recovery by facilitating the rebuilding of damaged contractile tissues and restoring energy reserves, particularly in a postabsorptive state. It is unclear how altering postexercise nutrient timing when in a postprandial state affects the shift towards fat utilization and changes in net protein retention after a resistance training bout. **PURPOSE:** To examine the effects of immediate versus delayed postexercise nutrient intake on substrate oxidation and protein retention during recovery. **METHODS:** In a single-blinded, crossover design, resistance trained (≥ 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 whole body exercises, 2-3 minutes rest). Participants then consumed one of three postexercise beverages: immediate consumption of a whey protein concentrate (0.35 g/kg) and dextrose (1.0 g/kg) beverage (IMM), delayed consumption (2 h) of a whey and dextrose beverage (+2H), or placebo (flavoring with water) (PLA). Participants recovered (3 h) while expired carbon dioxide and oxygen were analyzed. Carbohydrate and fat oxidation was determined and body protein breakdown was investigated via analyses of salivary cortisol and urinary nitrogen excretion. **RESULTS:** Nitrogen balance in PLA (-0.02 ± 0.01 g) was significantly lower than +2H (5.21 ± 0.63 g, $p<0.001$, ES=11.61) and IMM (5.21 ± 0.64 g) ($p<0.001$, ES=11.59) during the three-hour recovery. There were no significant differences in nitrogen balance between IMM and +2H ($p=1.0$). Carbohydrate oxidation in IMM was significantly higher than +2H at 60 minutes postexercise (0.21 ± 0.13 g/min vs. 0.11 ± 0.12 g/min, respectively; $p=0.014$). Fat oxidation was higher in +2H than IMM at minute 90 ($p>0.05$, ES=0.60), minute 120 ($p>0.05$, ES=0.40), and minute 150 ($p>0.05$, ES=0.50). There were no significant differences in salivary cortisol among groups (all $p=1.0$). **CONCLUSION:** In the postprandial state, +2H promoted higher fat utilization than IMM, whereas IMM promoted greater carbohydrate oxidation earlier in the recovery period. Both interventions resulted in similar net protein retention. Thus, postponing postexercise nutrient intake when in a postprandial state may be implicated in body composition improvements.

430 Board #246 May 27 9:30 AM - 11:00 AM
Walking Or Body Weight Squats May Improve Muscle Dietary Amino Acid Sensitivity During Prolonged Sitting

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(No relevant relationships reported)

Low physical activity (e.g. reduced daily steps) reduces the ability of dietary amino acids (AA) to support muscle protein synthesis, leading to eventual muscle loss. Interrupting prolonged sitting with short bouts of intermittent exercise can improve carbohydrate and lipid metabolism, however its ability to sensitize skeletal muscle to dietary AA has yet to be investigated. **PURPOSE:** To determine the ability of interrupting prolonged sitting with practical ‘activity snacks’ to enhance the postprandial incorporation of dietary AA into myofibrillar protein. **METHODS:** As a subset of a larger study, twelve participants (7 males and 5 females; ~23y; ~40.0mlO₂/kg/min; ~25.1kg/m²; ~4676 steps/d) completed three 7.5 hr trials in a randomized order consisting of prolonged sitting (SIT), sitting with intermittent walking (WLK; 2 min at 3.1mph every 30 min) or sitting with intermittent squatting (SQT; 15° chair stands with calf raise every 30 min). Mixed-macronutrient meals (~55:30:15% carbohydrate:fat:protein) were provided at 20% (breakfast) and 30% (lunch) of daily energy requirements to be consistent with Western feeding patterns. Meals were

enriched to 15% with *ring-[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 beginning of trial 2 were used to determine change in AA enrichment (LC/MS/MS) in the myofibrillar protein fraction (Δ Myo). **RESULTS:** Δ Myo was 0.032 ± 0.004 MPE 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.

431 Board #247 May 27 9:30 AM - 11:00 AM
Measured Versus Predicted Resting Metabolic Rate In Overweight Men And Women Following Weight Loss

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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 $27 < \text{BMI} < 40 \text{ kg/m}^2$ 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 Johannsen et al. (J). T-test, ANOVA and χ^2 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 (RMR_b) and after (RMR_a) RMR measurements: M: $\text{RMR}_a = 132.82 + 28.37(\text{W}) - 250.595(\text{H}) + 9.464(\text{FFM}) - 2.871(\text{A}) - 25.932(\text{FM})$ M: $\text{RMR} = 1862.68 - 7.779(\text{W}) + 1716.697(\text{H}) + 18.091(\text{FFM}) + 1.964(\text{A}) + 14.972(\text{FM})$ W: $\text{RMR}_b = 553.971 + 16.601(\text{W}) + 1033.839(\text{H}) - 13.734(\text{FFM}) - 10.930(\text{A}) - 19.668(\text{FM})$ W: $\text{RMR} = 552.850 + 7.288(\text{W}) + 340.730(\text{H}) + 8.932(\text{FFM}) - 5.064(\text{A}) - 5.015(\text{FM})$. **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 vs. 28 ± 3 ; W: 32 ± 4 vs. 27 ± 3 , $P\leq 0.01$) and FM in kg (M: 37 ± 7 vs. 26 ± 9 ; W: 40 ± 9 vs. 27 ± 8 , $P\leq 0.01$); 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. -69 ± 128); but only accurate was W before WL ($P=0.351$). RMR calculations with the new equations were more accurate and closest to measured RMR before and after WL in M (-0.05 ± 154 vs. 0.03 ± 197) but only after WL in W (-30 ± 116). **CONCLUSION:** The study illuminates the need to adopt different equations for assessment of individuals' RMR before and after weight loss.

A-51 Free Communication/Poster - Behavioral Aspects, Correlates and Predictors of Exercise

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

432 Board #248 May 27 10:30 AM - 12:00 PM

Do Genetic Variations Predict Physical Activity Response To Lifestyle Intervention Among Obese Adults With Diabetes?

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PURPOSE: Those who are prone to high physical activity (PA) in natural environments may respond better to a PA promotion intervention than those who are prone to low PA. A genome-wide association study (GWAS) and a candidate gene study identified 4 single nucleotide polymorphisms (SNPs) related to PA: rs978656 near *DNAPTP6*, rs10887741 near *PAPSS2*, rs7279064 near *C18orf2*, and rs6265 near *BNDF*. We hypothesized that the 4 SNPs will predict greater change in PA phenotypes in response to a lifestyle intervention.

METHODS: This is a secondary analysis of Look AHEAD, a multi-center randomized controlled trial among participants who are overweight/obese and have type 2 diabetes (ages 45-76). Look AHEAD is designed to test the health benefits of an intensive lifestyle intervention (ILI), combining calorie restriction and PA promotion for weight loss, as compared to diabetes support and education alone. We examined the moderating effects of the 4 SNPs individually and in a weighted genetic score (GS). Of the 3649 participants who were successfully genotyped for all the 4 SNPs, we examined only those cases that also completed Paffenbarger PA questionnaire (PPAQ) and cardiorespiratory fitness (CRF) measures at baseline, year 1, and year 4 (n=2675). We used linear mixed effects models to regress PA phenotypes (PPAQ and CRF) on genetic variations, time, intervention, as well as interactions between the three. Models controlled for age, sex, body mass index, ancestry principal components (for population stratification), and study sites and included a Bonferroni correction for multiple testing. Additive, recessive, and dominant models were tested.

RESULTS: None of the individual SNPs or the GS were associated with baseline CRF or PPAQ. The rs978656 interacted with time (year1) and intervention ($p=0.04$), such that the main effect of the intervention on CRF was significant ($p=0.04$) only among A allele carriers (less-PA-prone) at year 1; however, this finding did not persist following Bonferroni correction ($\alpha<0.006$). GS was not predictive of change in CRF or PPAQ. Individual SNPs were not predictive of change in PPAQ.

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

433 Board #249 May 27 10:30 AM - 12:00 PM

Motives And Barriers To Initiation And Exercise Adherence In A Fitness Club Setting.

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(No relevant relationships reported)

PURPOSE: Worldwide, about 183 million adults are fitness club members and there is a need of more understanding why some individuals adhere to exercise, and others drop-out. The main aims of the present study were to examine proportions reporting regular exercise, non-regular exercise and drop-out, as well as identify motives and barriers to exercise throughout the first year of fitness club membership. In addition, we wanted to compare motives between those who reported regular exercise at three, six and 12 months, with those who did not (irregular exercise or drop-out).

METHODS: New fitness club members (<four weeks membership) were followed for one year. At onset (n = 250), and after three (n = 224), six (n = 213) and 12 (n = 187) months, participants completed an electronic questionnaire (including background variables, exercise involvement, motives and barriers to exercise), and 184 answered at

all time-points. According to exercise involvement, participants were categorized into: *Regular exercise*: ≥two sessions/week, and *non-regular exercise*: ≤one session/week, exercise relapse or drop-out. Cochran's Q test, independent t-tests or χ^2 were used as appropriate.

RESULTS: Of 184 participants, 37.0% reported regular exercise throughout the follow-up. At three, six and 12 months; 23.0%, 28.3% and 34.8% reported exercise drop-out. At all follow-up, positive health (79.1% to 85.5%), increase in mobility (59.4% to 70.7%), and strength/endurance (58.3% to 66.3%) were reported as most important exercise motives. Among exercise drop-out, priority (60.9% to 71.7%) was perceived as most important barrier throughout one-year follow-up. Other barriers were reported by <20.0%. The intrinsic motives enjoyment and challenge were perceived as more important among regularly exercisers compared with non-regular exercisers ($p \leq 0.05$) throughout the first year of fitness club membership.

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

434 Board #250 May 27 10:30 AM - 12:00 PM

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

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(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 completed 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 temporary shifts in resting HRV were 37.6 and 38.7% for the CON and TREAT conditions, respectively. Within CON, shifts in HRV resulted in less motivation (mean diff. = -4.00%; 95%CI = -7.56, -0.44; $F = 4.86$, $p = 0.028$) and more physical fatigue (mean diff. = 4.79%; 95%CI = 1.85, 7.74; $F = 10.24$, $p < .001$). Spectral domain metrics (i.e., LF:HF ratio) were significantly lower (mean diff. = -0.14 au; 95%CI = -0.27, -0.01; $F = 4.715$, $p = .030$) during HRV shifts. Within TREAT, shifts in HRV resulted in no change in motivation (mean diff. = 2.58%; 95%CI = -6.54, 1.38; $F = 1.63$, $p = .202$) with reduced physical fatigue (mean diff. = -5.94%; 95%CI = -9.56, -2.32; $F = 10.40$, $p = .001$). Within TREAT, LF:HF ratio was higher (mean diff. = 0.13 au; 95%CI = 0.23, 0.24; $F = 5.59$, $p = .018$) during HRV shifts. **CONCLUSIONS:** These data establish a link between expected shifts in heart rate variability throughout high-intensity exercise programs with motivation to participate and physical fatigue. Additionally, modulation of training volume, in response to these shifts, can optimize adherence-related behavioral responses during high-exercise programs.

435 Board #251 May 27 10:30 AM - 12:00 PM

AUTONOMY AND VARIATION IN HIGH-INTENSITY INTERVAL TRAINING: IMPACTS ON POST-EXERCISE ENJOYMENT, SELF-EFFICACY, AND INTENTION

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Benefits associated with high-intensity interval training (HIIT) are established and research demonstrates that HIIT is well-tolerated in a variety of populations, protocols, and modalities. However, relatively little is known about the impact of variation and self-selection of work intervals on post-exercise perceptions. **PURPOSE:** The purpose of this study was to determine the impact of autonomy and variation on exercise enjoyment and both self-efficacy for and intention to repeat HIIT exercise. **METHODS:** Twenty-one physically active participants (12 male, 9 female; mean BMI = 27 ± 3 ; mean age = 28 ± 6) completed three, 20-minute HIIT trials after

completion of maximal testing. All experimental trials included a total of 10 minutes of work and 10 minutes of recovery. Work and recovery were conducted at 90% and 10% of peak work, respectively. Trials included: a standard interval bout with repeating 60-sec work and recovery segments (Traditional), an interval bout with a mix of predetermined 30-, 60-, 90-, & 120-second segments (Varied), and a bout with a self-selected number of 30-, 60-, 90-, & 120-second segments (Autonomous). In-task affective valence and enjoyment were measured four times during work and recovery. Data was analyzed using dependent t-tests. **RESULTS:** Enjoyment measured via questionnaire post-exercise revealed no significant differences between the three trials ($P > 0.05$) suggesting similar levels of enjoyment for all trials. All three trials were deemed to be enjoyable exercise sessions (scores ranging from 95-100 on the 18-126 scale). Self-efficacy for completing HIIT (measured on a 0-100 scale) was greater for the Autonomous trial compared to the Varied trial (77% vs. 70%; $P < 0.05$) and intention to exercise (measured on a 1-7 scale) was not different across trials, but there was a trend towards Autonomous HIIT producing stronger intentions than Varied HIIT (4.3 vs. 3.7; $P < 0.10$). **CONCLUSIONS:** Findings indicate that each trial of HIIT was enjoyable and produced relatively positive ratings for exercise self-efficacy and intention. These findings suggest that provision of autonomy during HIIT exercise sessions can produce more desirable psychological responses for self-efficacy and possibly exercise intention.

436

Board #252 May 27 10:30 AM - 12:00 PM
Perceived And Actual Motor Competence And Physical Activity In Children With And Without Asthma

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(No relevant relationships reported)

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

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

METHODS: Eleven children with persistent asthma (age=11.1 \pm 0.7 years; 54.5% female; BMI percentile=53.4 \pm 9.8) and 20 children without asthma (age=11.1 \pm 0.6 years; 50.0% female; BMI percentile=60.3 \pm 6.2) participating in the Exercises for a Healthy Asthma Lifestyle and Enjoyment (ExHALE) study have been analyzed to date. Asthma diagnosis was verified by the child's physician. MC was measured using the Movement Assessment Battery for Children-2. PMC was measured using the Athletic Competence domain from the Self-Perceptions Profile for Children. MVPA was assessed via accelerometry.

RESULTS: Children with asthma reported lower PMC than children without asthma (2.5 \pm 0.1 vs. 2.9 \pm 0.1, $p=0.04$) with no significant differences in MC between groups (7.0 \pm 0.9 vs. 7.6 \pm 0.5, $p=0.55$). Children with asthma engaged in 16 fewer minutes of MVPA per day compared to their healthy peers (27.7 \pm 5.5 vs. 44.1 \pm 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: $\beta=0.95\pm 1.70$, PMC: $\beta=14.6\pm 9.3$; $p>0.05$), and there were no differences by asthma status ($p>0.05$).

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

437

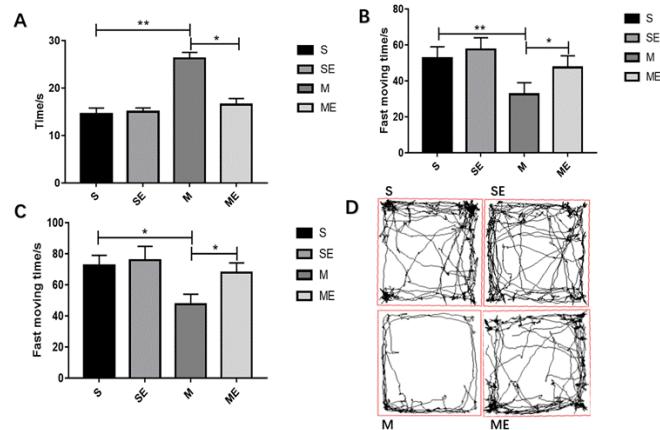
Board #253 May 27 10:30 AM - 12:00 PM
Aerobic Exercise Enhances Behavior Features In Model Of Parkinson'S Disease Mice Via Pink1/parkin Pathway

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(No relevant relationships reported)

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

PINK1/Parkin in MPTP-induced Parkinson's (PD) mice by treadmill exercise, and to explore the effect of aerobic exercise on mitochondrial function. **METHODS:** 32 C57BL/6J male mice were divided into 4 groups: Saline group (S), Saline+ Exercise group (SE), MPTP group (M), and MPTP + Exercise group (ME). M and ME mice were injected with MPTP to construct a PD model. SE and ME mice were subjected to 8 weeks treadmill training. Behavioral tests were performed after exercise; immunofluorescence and histochemistry, and Western Blot to detect molecular indicators. **RESULTS:** (1) The time of passing the balance beam, M group was longer than the S group ($P<0.01$), and the ME group was shorter than the M group ($P<0.05$) (Fig1A); In the forced swimming test (Fig1B) and the open field experiment (Fig1C/D) the mouse fast moving time, M group was shorter than the S group ($P<0.05$), while the ME group was longer than the M group ($P<0.05$). (2) The expression of α -Syn was up-regulated in the M group ($P<0.01$), but in the ME group was decreased after exercise ($P<0.05$) (Fig2). (3) The expression of Tyrosine hydroxylase (TH)(Fig3), TOM-40(Fig4) in group M was lower than that in group S ($P<0.05$), while ME group was higher than that M group ($P<0.05$). (4) The protein of Parkin and PINK1 were increased after exercise ($P<0.05$) (Fig5). **CONCLUSION:** Exercise can enhance the mitochondrial autophagy ability, improve the mitochondrial transport function, promotes behavior features in PD mice.

Key words: aerobic exercise; mitochondria; autophagy; Parkinson's disease
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438

Board #254 May 27 10:30 AM - 12:00 PM
Age Differences For Relationships Between Perceived Health, Exercise Motivation And Self-efficacy Factors After HIFT

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Reported Relationships: **K.M. Heinrich:** Consulting Fee; I received payment for consulting on two outside legal cases regarding the same exercise program as used in my abstract.

Health benefits are a frequent exercise motive, despite mental and fitness improvements occurring sooner. Key cross-sectional participation motives in high intensity functional training (HIFT) 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 HIFT participation. **PURPOSE:** To investigate how perceived changes in health and motivation related to SE changes by age. **METHODS:** Data were from an ongoing program evaluation study at a university HIFT gym. Participants ($n = 35$; 52% female, 97% white, 26.5 ± 26.6 months HIFT 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 HIFT adherence. Participant age ranged from 20-76 years; three age cohorts (C) were used for analysis: C1 (20-34 years, $n = 10$), C2 (35-64 years, $n = 13$), and C3 (65+ years, $n = 10$). Difference scores were compared using bi-variate correlations.

RESULTS: No C1 participants reported changes in health; a slight decrease in motivation (-0.4 ± 1.0) was not correlated with changes in any SE factors. For C2 participants, the slight improvement in health (0.2 ± 0.4) was significantly correlated with SE for adherence ($r = 0.68$, $p = .011$), describing fitness goals/weaknesses ($r = 0.81$, $p = .001$), 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 ($r = 0.78$, $p = .008$); and a slight motivation increase (0.4 ± 1.5) was correlated with SE for adherence ($r = 0.65$, $p = .04$).

and agility ($r = 0.78$, $p = .006$). **CONCLUSIONS:** Perceived health improvements for participants ages 35+ increased SE for adherence, as well as mental factors for middle-age participants, while increased motivation was only related to increased SE for adherence among older adults. Age differences must be considered for HIFT program design and delivery, and future research might examine these relationships in comparison to other fitness programs.

439	Board #255	May 27 10:30 AM - 12:00 PM
Physical Activity, Sedentary Behavior, And Social Media Use In College Students		
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There is currently a gap in the literature regarding the relationship between physical activity (PA), sedentary behavior, and social media use. It is unclear if hours per day of social media use is associated with activity patterns of college students. Additionally, it is unclear if type of social media accounts followed influence activity patterns. **Purpose:** To examine the relationship between PA, sedentary behavior, and social media use in college students. **Methods:** College students completed a one-time online questionnaire. PA and sedentary behavior were assessed using the International Physical Activity Questionnaire-Short Form. **Results:** Two-hundred ninety-two students provided informed consent and were eligible to participate in the study. Activity patterns were self-reported [median (25th, 75th percentile)]. Participants reported 120 (80, 240) min/wk of moderate intensity PA, 240 (120, 360) min/wk of vigorous intensity PA, and 250 (165, 360) min/wk of sedentary behavior. Only 30.8% of the sample engaged in a minimum of 150 of moderate intensity activity each week, and 61.4% in the recommended minimum of 75 minutes of vigorous intensity PA. Furthermore, 31.6% of participants did not report any engagement in moderate intensity PA and 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 an undesirable relationship with vigorous intensity PA and sedentary behavior. Future studies should examine the longitudinal influence of social media on PA and use objective PA monitoring.

440	Board #256	May 27 10:30 AM - 12:00 PM
Influence Of Resistance-exercise Training On Total Physical Activity In Gulf War Veterans With Chronic Pain		
Aaron J. Stegner ¹ , Neda E. Almassi ¹ , Ryan J. Dougherty ¹ , Laura D. Ellingson, FACSM ² , Nicholas P. Gretzon ¹ , Jacob V. Ninneman ¹ , Stephanie M. Van Riper ¹ , Patrick J. O'Connor, FACSM ³ , Dane B. Cook, FACSM ⁴ . ¹ Univ. of Wisconsin, Madison, WI. ² Western Oregon University, Monmouth, OR. ³ Univ. of Georgia, Athens, GA. ⁴ William S. Middleton Memorial Veterans Hospital, Madison, WI. (Sponsor: Dane B. Cook, FACSM) (No relevant relationships reported)		

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). Previously our lab has observed lower levels of total physical activity (PA) in civilian CMP patients compared to their healthy peers. In general, CMP patients with lower levels of PA are at risk for greater disability. While exercise-training interventions may have demonstrated benefits for fitness and health related outcomes, their influence on total PA, particularly in CMP patients, is an open question.

PURPOSE: To quantify the influence of a 16-week resistance exercise training (RET) trial on self-reported and actigraphy measures of total PA in Gulf War Veterans (GV) with CMP.

METHODS: Fifty-five GV with CMP were randomly assigned to 16 weeks of RET ($n=28$) or a wait-list control ($n=27$). The RET consisted of twice weekly sessions with a personal trainer, initiated at a low intensity (25-35% 1 RM) with progression as tolerated. At baseline, 6 weeks, 11 weeks, and 17 weeks, all participants completed the International Physical Activity Questionnaire (IPAQ) and wore 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 computed for the IPAQ and ACTI measures, using baseline values as a covariate to control for initial differences.

RESULTS: GV assigned to RET completed 88% of training sessions and exhibited strength increases of >20% for 7 of 8 lifts. Estimates for the fixed effects and their interaction were not significant for either measure (IPAQ: $F_G = 0.17$, $F_{TP} = 0.02$, $F_{G \times TP} = 0.09$, $p < 0.05$; ACTI: $F_G = 0.47$, $F_{TP} = 0.09$, $F_{G \times TP} = 0.22$, $p < 0.05$).

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 #I01CX000383

441	Board #257	May 27 10:30 AM - 12:00 PM
Acute Effects Of Intermittent Physical Activity On Psychological Stress And Insecurity In Children And Adolescents With And Without Asthma		
Tiwaloluwa A. Ajibewa, Lexie R. Beemer, Katherine Q. Scott-Andrews, Indica Sur, Leah E. Robinson, FACSM, Toby C. Lewis, Rebecca E. Hasson, FACSM. <i>University of Michigan, Ann Arbor, MI.</i> (Sponsor: Rebecca E. Hasson, FACSM) Email: tajib@umich.edu (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: 113.8 ± 2.9 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, Indica Sur, Leah E. Robinson, FACSM, Toby Lewis, Rebecca E. Hasson, FACSM. <i>University of Michigan, Ann Arbor, MI.</i> (Sponsor: Rebecca Hasson, FACSM) Email: abeemer@umich.edu (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 durations 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. Mood was assessed via the Feeling Scale at the midpoint of each condition. **RESULTS:** There was a significant effect of condition on mood across activities ($p<0.02$) with lower mood reported during the step test compared to the walk test, resistance circuit, and activity video (step test: 2.1 ± 0.3 vs. walk test: 3.6 ± 0.3 , resistance circuit: 3.2 ± 0.3 , activity video: 3.4 ± 0.3 , all $p<0.01$). There was no effect of condition on enjoyment with children reporting high levels of enjoyment across activities (walk test: 3.6 ± 0.1 , resistance circuit: 3.9 ± 0.1 , activity video: 3.9 ± 0.1 , obstacle course: 3.9 ± 0.1 , step test: 3.7 ± 0.2 ; $p>0.05$). There were no differences by asthma status on mood or enjoyment across activity conditions (all $p\geq0.05$). **CONCLUSIONS:** Participants reported lower mood during the higher intensity tempo-paced activity, but similar levels of enjoyment for all activities. These findings suggest intermittent activity of varying intensities and durations is an enjoyable form of exercise for both children with and without asthma.

443 Board #259 May 27 10:30 AM - 12:00 PM

Alcohol, Tobacco And Marijuana Use In A Population Of Ultramarathon Runners

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(No relevant relationships reported)

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

Methods: This was a pilot survey involving 2018 John F. Kennedy 50 Mile ultramarathon race participants held in Hagerstown, MD. Predefined CV risk factors included current or prior history of smoking, diabetes, hypertension, dyslipidemia, and obesity (BMI >30). Health behaviors included use of alcohol and marijuana.

Results: Of the 868 registered runners, 292 (34%) completed the survey. 106 (36.3%) runners had at least one CV risk factor and 15 (5.2%) had known CV disease. Overall, 1.4% of runners reported being a current smoker, 25.3% were prior smokers, 31.3% lived with a smoker, 2.8% consumed alcohol during ultra events, 45.7% consumed alcohol after ultra events, 13.8% were told they drink too much, and 12.4% regularly used marijuana. Runners with at least one CV risk factor were more likely to have consumed alcohol during ultra events ($p=0.025$) and were told they drink too much ($p<0.001$). Using marijuana was marginally associated ($p=0.082$) with having at least one CV risk factor.

Conclusions: These findings suggest that use of alcohol may be associated with increased CV risk in this unique population. Further study is required to explore whether elevated CV risk is the result of extreme doses of exercise, lifestyle habits (alcohol and marijuana use), or a combination of both factors that have not been accounted for in large observational studies.

444 Board #260 May 27 10:30 AM - 12:00 PM

Perceived Barriers And Motivators For Physical Activity In Women With Perinatal Depression

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(No relevant relationships reported)

Physical activity (PA) may help reduce severity of depressive symptoms in women with perinatal depression (depression during pregnancy or postpartum). However, less than one third of pregnant and postpartum women meet national PA recommendations, and PA is likely even lower in women with perinatal depression. Barriers and motivators for PA among women with perinatal depression are not well understood. **PURPOSE:** The aim of this study was to identify barriers and motivators for PA among women with perinatal depression. **METHODS:** Pregnant and postpartum women with perinatal depression were identified using Kaiser Permanente Northern California's universal perinatal depression screening program. We conducted 8 focus groups totaling 35 women with prenatal ($n=15$) and postpartum depression ($n=20$). Focus groups were analyzed using an inductive approach. **RESULTS:** Pregnant women were, on average, 27 weeks gestation (range: 11-37) with mild to moderately severe depressive symptoms (Patient Health Questionnaire (PHQ)-8 mean: 10; range:

4-19). Postpartum women were, on average, 12.5 months postpartum (range: 8.5-16.5) with no to moderately severe depressive symptoms (PHQ-8 mean: 7; range: 0-16). Perceived barriers to PA identified by pregnant and postpartum women included low energy and mood, limited time due to other priorities, feeling discouraged when comparing to pre-pregnancy self, and limited geographic accessibility and high cost of group exercise classes. Unique barriers identified by pregnant women were physical discomfort and fear of judgement from others. Postpartum women identified lack of childcare as an additional barrier. Motivators for PA identified by pregnant and postpartum women included self-care ("me time"), improved mood after PA, making progress toward goals, being strong and fit to keep up with their children, and having a social support system. **CONCLUSIONS:** Interventions to increase PA in pregnant and postpartum women with perinatal depression should include components addressing motivation, time, geographic accessibility, and cost barriers. Interventions can also increase PA by promoting potential mood benefits, fostering a sense of accomplishment, and leveraging social support as motivators in pregnant and postpartum women with perinatal depression.

445 Board #261 May 27 10:30 AM - 12:00 PM

Exercise Interests, Identity, And Motivations Across Levels Of Activity And Exercise Preferences: What Moves You?

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(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 ($p\leq0.001$) 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 (11.8 ± 2.7 ; $p\leq0.005$ for all). Further, people who prefer sports had higher competition interest (11.1 ± 2.9) than group (8.1 ± 3.0), individual (8.6 ± 2.9), or outdoor activities (8.4 ± 3.4 ; $p\leq0.006$ 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, exercise preference could be determined using the Exercise Interest Scale. Future research should investigate the association between exercise interests, identity and motivations and long-term adherence to MVPA in previously inactive individuals.

446 Board #262 May 27 10:30 AM - 12:00 PM

The Effects Of Frequency Framing On Fitness Center Commitment Contracts

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(No relevant relationships reported)

Research from the field of behavioral economics indicates that different frames of similar or equal situations can impact decision making. Rather than only focusing on maximizing utility, decision-makers are influenced by other, nonrational factors, such as the way choices are presented. **PURPOSE:** The purpose of this study was to analyze if the framing effect applied to the context of fitness center commitment contracts. **METHODS:** 145 adults (mean age [SD]: 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 ($p = .434$), 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.

447 Board #263 May 27 10:30 AM - 12:00 PM

An Examination Of Mental Toughness And Physical Activity Among College Students

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(No relevant relationships reported)

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 (MTQ48) was used to measure MT while the International Physical Activity Questionnaire – Short Form (IPAQ-SF) was used to measure PA. Pearson's Product-Moment Correlations were used to assess correlations between MT and PA. Independent samples *t*-tests were used to determine whether MT and PA varied according to sex (male vs female), race (White vs non-White), or athlete status (athlete vs non-athlete). **Results:** There were no significant 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 athletic status should be examined further.

448 Board #264 May 27 10:30 AM - 12:00 PM

Do Race, Physical Activity, Body Mass Index, And Sleep Quality Affect Mental Toughness?

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(No relevant relationships reported)

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 lower 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 $p < 0.05$. All analyses were performed using SPSS^c. **RESULTS:** PA was positive correlated ($r = .246$, $p = .027$) and SQ was negatively associated with MT ($r = -.470$, $p = .000$). Race was negatively associated with MT ($r = -.234$, $p = .033$). SQ had a main effect on MT ($F_{3,1} = 18.568$, $p = .000$, $\eta^2 = .382$). PA and BMI interaction had an effect on MT ($F_{3,1} = 5.572$, $p = .009$, $\eta^2 = .271$). The interaction of race and BMI had an effect on MT ($F_{3,1} = 2.805$, $p = .043$, $\eta^2 = .272$). **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.

449 Board #265 May 27 10:30 AM - 12:00 PM

FUNCTIONAL FITNESS LEVELS REFLECT COGNITIVE HEALTH STATUS

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(No relevant relationships reported)

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:** : The purpose of this evaluation was 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 ($p = .08$). **CONCLUSIONS:** Functional fitness assessments distinguished between CIN and CIM groups. As these results indicate, functional fitness may be an indicator of cognitive status. Future investigations should longitudinally track both functional fitness and cognitive function to further elucidate this relationship.

450 Board #266 May 27 10:30 AM - 12:00 PM

Do Perceptions Of Physical Environment Predict Physical Activity Intention Among International College Students?

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Purposes: International college students were at higher risk of being sedentary compared to domestic students (Yan et al., 2015). Physical environmental factors, such as accessibility and environmental safety, were previously found to predict physical activity (Strand et al., 2010). However, it is not clear whether environmental factors would have an impact on international college students given the fact that most universities have accessible recreation centers and other facilities. This study aimed to examine whether the perceptions of environmental safety and accessibility to physical activity are associated with the physical activity intention among international college students.

Methods: Participants were 249 international college students from a public university in Southern US (48.2% female; $M_{age} = 27.48$, $SD = 6.12$). The perception of the environmental safety and accessibility to physical activity were measured by a validated scale adapted from Yan (2012). Exemplar question was "It is safe to walk or jog alone where I live during the day". Physical activity intention was measured by three questions on a 7-point Likert scale (Blanchard et al., 2003; Trost et al., 2002). Gender and age were also measured.

Results. The independent T-test showed that males perceived the environment safer than females to do physical activity, $t(245)=1.94$, $p=.05$. No gender difference in the perception of physical activity accessibility, $t(245)=.64$, $p>.05$. The multiple regression model on intention, controlling gender and age, was significant. Perception of environmental safety significantly predicted the physical activity intention ($\beta=.48$, $P <.001$), but not the environmental accessibility ($\beta=.13$, $P >.05$).

Conclusion. Compared to accessibility to physical activity, perception of environmental safety is more important for international college students to participate in physical activity. Colleges and universities should make sure the campus and community are safe for international college students to engage in physical activity.

451	Board #267 The Desire To Move And Rest: Trait Or State? Crave Scale Validation Across 2 Years	May 27 10:30 AM - 12:00 PM
	Miguel Blacutt ¹ , Matthew Stults-Kolehmainen ² , Nia Fogelman ³ , Carol E. Garber, FACSM ¹ , John B. Bartholomew, FACSM ⁴ , Rajita Sinha ^{3, 1} <i>Teachers College, Columbia University, New York, NY. ²Yale New Haven Hospital, New Haven, CT. ³Yale University, New Haven, CT. ⁴University of Texas at Austin, Austin, TX.</i> (Sponsor: Carol Ewing Garber, FACSM) Email: meb2305@tc.columbia.edu (No relevant relationships reported)	

Purpose

The CRAVE (Cravings for Rest and Volitional Energy Expenditure) Scale measures the intrinsic desire or want for movement and sedentary behaviors, as assessed "right now". The purpose of the current study was to test the reliability of the CRAVE Scale: a) at 6-month intervals over 24-months and b) over 2 time points within the same test day.

Methods

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

Results

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

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

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

Time (months)	Move (Point 1)	Move (Point 2)	Move Scores (r)	Rest (Point 1)	Rest (Point 2)	Rest Scores (r)
0	32.7 ± 15.2	35.9 ± 12.8	0.95	25.1 ± 13.9	20.9 ± 11.9	0.89
6	28.4 ± 12.9	26.7 ± 14.5	0.74	24.3 ± 14.2	24.3 ± 16.7	0.73
12	30.6 ± 13.7	28.8 ± 13.6	0.79	24.4 ± 14.6	23.9 ± 15.8	0.82
18	29.0 ± 13.0	29.4 ± 13.1	0.86	28.0 ± 15.9	24.5 ± 15.2	0.76
24	29.9 ± 11.6	28.0 ± 11.7	0.82	26.4 ± 16.0	25.4 ± 16.3	0.84

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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452	Board #268 Understanding College Students' Motivation In Virtual Reality-Based Exercise: An Expectancy-Value Approach	May 27 10:30 AM - 12:00 PM
	Joonyoung Lee, Tao Zhang, Ana West, Leigh A. Karch, Jordan Reys. <i>University of North Texas, Denton, TX.</i> Email: Joonyoung.Lee@unt.edu (No relevant relationships reported)	

With technology advances, virtual reality (VR)-based exercise has been widely used in clinical and rehabilitation training applications. Given the fact that numerous Kinesiologists have investigated the potential benefits of VR-based exercise among college students, it is needed to understand college students' motivation in VR-based exercise in order to promote their health and well-being.

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

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

RESULTS: The correlation analysis indicated the positive associations among the study variables. A multiple regression analysis revealed a statistically significant effect, $F(3,68) = 30.162$, $p < .001$, $R^2 = 57.1\%$. The utility value ($\beta = .409$), attainment value ($\beta = .296$), and intrinsic value ($\beta = .269$) were three significant predictors of students' intention for future participation in VR-based exercise, but the expectancy-related belief was not a significant predictor of students' intention for future participation in VR-based exercise.

CONCLUSIONS: The findings indicated that VR-based exercise is useful, important, and interesting that can enhance college students' intention to participate in VR-based exercise in the future. VR technology could be considered as an efficient motivational tool to promote exercise, but further research is needed to examine the effects of VR-based exercise on college students' health outcomes using an experimental research design.

453	Board #269 Determining The Influence Of The Conative Modus Operandi On Physical Fitness	May 27 10:30 AM - 12:00 PM
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PURPOSE: Using the Kolbe A™ Index, this study measured observable behaviors produced from striving instincts to determine the influence of the conative modus operandi on physical fitness changes during a 15-week wellness course. **METHODS:**

Thirty-four volunteers participated in this study. Participants' height, body weight, percent body fat, aerobic capacity, muscular endurance, muscular strength, and flexibility were measured during week one and week 15. After pre-assessments, the Kolbe A Index was administered. A one-way ANOVA was used to compare the mean gain scores between conative modus operandi groups, and to compare the mean gain scores between the Zones of Operation of Initiating Action, ReActing, and CounterActing for each Kolbe Action Mode™. Cohen's d effect sizes were calculated to quantify the effect the conative modus operandi group or Zone of Operation had on changes in physical fitness measures. A Pearson product-moment correlation was used to examine the relationship between the conative modus operandi numbers ranging from 1-10 for each Kolbe Action Mode and gain scores. **RESULTS:** Physical fitness gain scores did not differ between conative modus operandi groups. When comparing Zones of Operation, the ReActing Quick Start zone gained a greater amount of weight than the CounterActing (1.59, 95% CI [-0.01, 3.19], $p = .052$, Cohen's $d = 0.90$) and Initiating Action zones (1.99, 95% CI [-0.20, 4.18], $p = .081$, Cohen's $d = 1.34$). The Initiating Action Follow Thru zone reported greater improvements in aerobic capacity than the ReActing zone $F(1, 29) = 4.593$, $p = .041$, Cohen's $d = 0.87$. The Initiating Action Fact Finder zone improved in number of sit-ups, and the ReActing zone completed fewer sit-ups (12.70, 95% CI [0.285, 25.12], $p = .044$, Cohen's $d = 1.04$). The values of correlation between the conative modus operandi numbers for Quick Start and gain scores in body fat were significant at the 0.05 level (2-tailed). **CONCLUSION:** No statistically significant differences between conative modus operandi groups and physical fitness changes were found; Zones of Operation influenced physical fitness changes to some degree. Therefore, measuring and understanding Zones of Operation may help practitioners promote and encourage changes in physical fitness.

454	Board #270	May 27 10:30 AM - 12:00 PM
The Role Of Motivation On Physical Activity And Screen Time Among Parent-adolescent Dyads: The Flashe Study		
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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 (FLASH-E) 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 ($\beta=0.40$ vs. 0.25, p 's <.001). Parent's and adolescent's motivation did predict each other's motivation ($p<.001$) and their own behaviors but not the PA and ST of their dyad partners. **CONCLUSIONS:** Although SDT explains intrapersonal effects, it may not extend adequately to a dyadic setting. Motivational self-regulation of parents and adolescents are related; however, longitudinal studies conducted to evaluate whether changes in SDT variables are associated with change in parent-adolescent PA and ST patterns over time are needed.

455	Board #271	May 27 10:30 AM - 12:00 PM
Self-perception Differences Between Crossfitters And Other Recreational Exercise Participants		
Lauren E. Mihalek, Eric E. Hall, FACSM. Elon University, Elon, NC. Email: lmihalek@elon.edu (No relevant relationships reported)		

Improved mental health is an important benefit of physical activity participation. However, understanding the benefits that might occur based on different modes of recreational exercise is not often examined. **PURPOSE:** To compare physical activity levels and self-perceptions of CrossFit participants and participants of other exercise modes. **METHODS:** 103 female participants with various exercise habits took an online survey that consisted of questions about subject demographics and the following scales of physical activity, personality and mental health: The Preference for and Tolerance of the Intensity of Exercise Questionnaire, Aerobics Center Longitudinal Study Physical Activity Questionnaire, Multidimensional Body-Self Relations Questionnaire (MBSRQ), Satisfaction with Life Scale (SWLS), Rosenberg Self-Esteem, and the Physical Self-Efficacy Scale. **RESULTS:** Correlation analyses revealed that total mets performed was significantly correlated with tolerance, perceived physical ability, appearance evaluation, fitness evaluation and orientation, health evaluation and orientation, and body area satisfaction ($p<0.05$). CrossFitters ($n=11$) scored significantly higher than those who participate in other modes of exercise ($n=102$) in total METs of physical activity, preference, tolerance, fitness orientation, health orientation, body area satisfaction, and self-esteem ($p<0.05$). **CONCLUSIONS:** Participants of all modes of exercise who performed more physical activity exhibited more positive self-perceptions and approach to exercise. Those who participate in CrossFit are more likely to perform more exercise overall, be more satisfied with the size and appearance of their bodies, and have greater self-esteem. 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.

456	Board #272	May 27 10:30 AM - 12:00 PM
The Desire To Move And Rest: Validation Of The Crave Scale Using A Treadmill Test		
Philip R. Stanforth, FACSM ¹ , Miguel Blacutt ² , Matthew Stults-Kolehmainen ³ , Susannah Williamson ⁴ , John B. Bartholomew, FACSM ¹ , Todd A. Gilson ⁵ , Rajita Sinha ⁶ . ¹ The University of Texas at Austin, Austin, TX. ² Teachers College, Columbia University, New York, NY. ³ Yale-New Haven Hospital, New Haven, CT. ⁴ Texas A&M University, College Station, TX. ⁵ Northern Illinois University, De Kalb, IL. ⁶ Yale University Medical School, New Haven, CT. Email: p.stanforth@austin.utexas.edu (No relevant relationships reported)		

Purpose

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

Methods

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

Results

Desire to move significantly decreased (39.9 ± 9.6 vs. 29.5 ± 10.7 , $p<0.01$) while desire to rest significantly increased (17.8 ± 12.3 vs. 29.1 ± 18.1 , $p<0.01$) 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 ($r=0.53$, $p=0.014$). 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 the desire to move and rest are moderately associated with feelings of physical energy/fatigue but not mental energy/fatigue.

457	Board #273	May 27 10:30 AM - 12:00 PM
Relationships Between Confidence To Adhere To Crossfit, Enjoyment, Motivation, And Ability To Do Various Exercise- And Sport- Related Tasks		
Blake Goodman. Kansas State University, Manhattan, KS. Email: blakedgoodman@gmail.com (No relevant relationships reported)		

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 investigate how one's SE for participation in HIFT is related to enjoyment, motivation, and SE for performing various exercise tasks in older adults. High values in self-efficacy for participation in HIFT was expected to positively correlate with self-efficacy values for performing various exercise tasks. **Methods:** Data were from an ongoing program evaluation study including a cohort of 13 older adults (age $M=69.1 \pm 7.1$ years, 62% female) participating in a functional fitness and mobility class with workouts modified to fit their needs and abilities. Participants completed an online questionnaire that included demographics, social, and mental measures. Participants assessed their ability to continue HIFT exercise, rated enjoyment and motivation, and assessed their confidence level on a scale of 1 "I cannot do this activity at all" to 10 "I am certain that I can do this activity successfully" for 11 sport and exercise-related tasks. **Results:** SE to continue HIFT was significantly correlated to general exercise motivation ($r = .85$, $p = .000$), 'I can recognize my strengths and weaknesses in different situations' ($r = .80$, $p = .002$), 'I enjoy doing

exercise' ($r = 0.65$, $p = .017$), and 'I can do physical exercises that require resistance' ($r = 0.59$, $p = .036$). **Discussion:** SE for continued HIFT participation was positively related to exercise enjoyment and motivation as well as SE for self-awareness and resistance exercises, which can influence group class design. Older adults who have these attributes will have the confidence and knowledge to gauge their intensity appropriately and participate in exercises that may push their functional limits. Future research should analyze if continued HIFT adherence positively influences SE and functional capacity.

- 458** Board #274 May 27 10:30 AM - 12:00 PM
The Role Of Academic, Cultural, And Language Stresses On Physical Activity Among International College Students
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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 & FitzPatrick, 2015). Further, previous studies also indicated that the U.S. cultural may facilitate participation in physical activity for international students (Yan & Cardinal, 2013). It is unclear whether those 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; $M_{age} = 27.48$, $SD = 6.12$) enrolled in a public research university in Southern U.S.. MVPA was measured by the International Physical Activity Questionnaire (Craig et al., 2003). Previously validated scales were used to measure students' perceived academic stress (e.g., "I worry about my academic performance"); cultural stress (e.g., "It's hard for me to develop opposite-sex relationships here"); and language stress (e.g., "My English embarrasses me when I talk to people"). Time in the U.S. was measured by asking how many months they had been in the U.S.. Finally, gender and BMI were also measured. **RESULTS:** The independent T test showed that males participated significantly more MVPA than females (Male: $M = 293.71$ METs; Female: $M = 241.79$ METs); $t(245) = 3.09$, $p < .01$. The multiple regression model with gender and BMI controlled was statistically significant, $F(6,242) = 3.37$, $p < .01$, $R^2 = 7.7\%$. Cultural stress significantly predicted MVPA ($\beta = -.21$, $p < .01$), with higher cultural stress was associated with lower MVPA. Language stress, academic stress, and time in the U.S. did not predict MVPA. **CONCLUSION:** The results indicated that cultural stress was related to MVPA among international college students. However, it is unclear whether experiencing more cultural stress 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.

- 459** Board #275 May 27 10:30 AM - 12:00 PM
An Executive Function Benefit Persists For Between 30- And 60-min Post-exercise: Evidence From Task-switching
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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 AABB 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 HR_{max}). **RESULTS:** The pre-exercise oculomotor assessment revealed a reliable unidirectional switch-cost (22 ms, $SD=18$) ($p < .001$) and the magnitude of this cost decreased at the immediate (9 ms, $SD=12$) and 30-min (11 ms, $SD=15$) post-exercise assessments ($ps < .01$). 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.

- 460** Board #276 May 27 10:30 AM - 12:00 PM
Examining The Socioecological Correlates Of Physical Activity Among Middle-aged And Older Women
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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 socioecological 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 ages: 56.79). The International Physical Activity Questionnaire was used to assess PA levels in leisure-time (LTPA). Individuals were categorized into the three PA groups (i.e., no-LTPA and low-/upper-LTPA groups based on 50th percentile of LTPA levels). Perceived neighborhood characteristics were measured using the Neighborhood scale consisting of 31 items with the Likert scale across seven environmental dimensions (e.g., walkability, safety, social cohesion). SSS was assessed using a 10-rung ladder ranking with higher rungs indicating higher SSS in their neighborhood. A multinomial logistic regression model was established to examine the associations of perceived neighborhood characteristics and SSS with LTPA, after controlling for study covariates including demographic characteristics (i.e., age, race, marital status), objective social status (i.e., education, household income), and health conditions (i.e., body mass index, number of chronic diseases). **RESULTS:** Overall, neighborhood walkability was the environmental characteristic significantly associated with greater odds of being low- (OR = 1.43; 95% CI = 1.10, 1.86) and upper-LTPA (OR = 1.76; 95% CI = 1.34, 2.31), when compared to no-LTPA. Additionally, women with higher SSS demonstrated greater odds of being low- (OR = 1.72; 95% CI = 1.09, 2.71) and upper-LTPA (OR = 1.88; 95% CI = 1.18, 2.99). **CONCLUSIONS:** The present study identified perceived walking environment within a neighborhood as a potential ecological factor determining PA levels in middle-aged and older women. Further, it is suggested that SSS has a unique impact on PA levels, independent of objective social status indicators.

- 461** Board #277 May 27 10:30 AM - 12:00 PM
The Effects Of Acute Mental Imagery Training On Force Output In College-age Students
John C. Colleran, Matthew R. Stenson, Mary C. Stenson. *The College of Saint Benedict and Saint John's University, St. Joseph, MN*.
(No relevant relationships reported)

Mental imagery training can be an effective tool to enhance endurance and skill-based sport performance, especially long-term mental imagery training. The effects of mental imagery on muscular force production, especially in the field of resistance training, are not as well researched. The effects of acute mental imagery training are also not well studied. **PURPOSE:** To determine the effects of acute mental imagery training on handgrip strength in college-age participants. **METHODS:** A repeated measures design was utilized. 34 participants (17 men, 17 women, $173.3 \text{ cm} \pm 8.9 \text{ cm}$, $77.0 \text{ kg} \pm 16.2 \text{ kg}$, $20.2 \text{ yrs} \pm 1.3 \text{ yrs}$) over two sessions, separated by 48 hours. Handgrip dynamometry was used to assess maximal and average force production over three consecutive trials following a control treatment (passive sitting) or a 10-minute mental imagery treatment. Mental imagery consisted of learning about imagery and practicing with a premade imagery script. **RESULTS:** Average force production was higher overall ($38.17 \text{ kg} \pm 13.03 \text{ kg}$ vs. $35.65 \text{ kg} \pm 13.52 \text{ kg}$; $t(33) = 4.158$; $p = 0.000$; $d = 0.190$), for men ($48.80 \text{ kg} \pm 8.55 \text{ kg}$ vs. $46.01 \text{ kg} \pm 10.00 \text{ kg}$; $t(16) = 3.549$; $p = 0.003$; $d = 0.3004$), and for women ($27.54 \text{ kg} \pm 6.08 \text{ kg}$ vs. $25.28 \text{ kg} \pm 7.00 \text{ kg}$; $t(16) = 2.388$; $p = 0.030$; $d = 0.3445$) after acute mental imagery training. Maximal force production was higher overall ($40.08 \text{ kg} \pm 13.10 \text{ kg}$ vs. $38.14 \text{ kg} \pm 13.85 \text{ kg}$; $t(33) = 3.007$; $p = 0.005$; $d = 0.140$) and for men ($50.98 \text{ kg} \pm 8.35 \text{ kg}$ vs. $49.02 \text{ kg} \pm 9.98 \text{ kg}$; $t(16) = 2.352$; $p = 0.032$; $d = 0.2135$) following mental imagery training. Women experienced greater maximal force production after mental imagery training, but not significantly greater than the control treatment ($29.18 \text{ kg} \pm 5.65 \text{ kg}$ vs. $27.25 \text{ kg} \pm 6.65 \text{ kg}$; $t(16) = 1.898$; $p = 0.076$; $d = 0.3118$). **CONCLUSION:** Acute mental imagery training improves handgrip force production. Mental imagery training may be effective in short term settings and for resistance training and strength and power athletes.

462	Board #278 Relating Lifestyle Factors To Adolescent Non-Prescription Steroid Use Timothy A. Brusseau ¹ , Ryan D. Burns ¹ , You Fu ² . ¹ <i>University of Utah, Salt Lake City, UT</i> ; ² <i>University of Nevada, Reno, NV</i> . Email: Tim.brusseau@utah.edu (No relevant relationships reported)	May 27 10:30 AM - 12:00 PM	464	Board #280 Effects Of Exercise Desks On Activity And Reading Skills In Youth With Neurodevelopmental Disorders Sara F. Michaliszyn ¹ , Kathleen Aspiranti ² , Meghan Kulisek ¹ , Hannah Crites ¹ . ¹ <i>Youngstown State University, Youngstown, OH</i> ; ² <i>University of Kentucky, Lexington, KY</i> . Email: sbmichaliszyn@ysu.edu (No relevant relationships reported)	May 27 10:30 AM - 12:00 PM
463	Board #279 The Relationship Between Mental Toughness And The Ergogenic Effects Of Music During Exercise Kayla Baker ¹ , Dano Tolusso ¹ , Jeanette Garcia ² . ¹ <i>Western Kentucky University, Bowling Green, KY</i> ; ² <i>University of Central Florida, Orlando, FL</i> . Email: kayla.baker@wku.edu (No relevant relationships reported)	May 27 10:30 AM - 12:00 PM	465	Board #281 Compulsive Exercise And Physical Activity Among Early Adolescents Bratland-Sanda Solfrid, Sabrina K. Schmidt, Michael M. Reinboth. <i>University of South-Eastern Norway, BØ I TELEMARK, Norway</i> . (Sponsor: Jorunn Sundgot-Borgen, FACSM) Email: solfrid.bratland-sanda@usn.no (No relevant relationships reported)	May 27 10:30 AM - 12:00 PM
462	<p>No study has examined multidimensional factors associating with non-prescription anabolic steroid use within a large representative sample of US adolescents.</p> <p>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.</p> <p>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.</p> <p>RESULTS: The lone cognitive factor relating with non-prescription steroid use was a history of concussion (OR=2.06, 95%CI:1.37-3.13, p = 0.001). The psychosocial variable relating with non-prescription steroid use was feelings of sadness and/or hopelessness (OR=2.47, 95%CI:1.72-3.56, p < 0.001). Lifestyle factors relating with non-prescription steroid use included cigarette smoking (OR=2.06, 95%CI:1.10-3.84, p = 0.023), smokeless tobacco use (OR=2.33, 95%CI:1.19-4.56, p = 0.015), and alcohol consumption (OR=4.54, 95%CI:2.69-7.68, p < 0.001). No activity-related variables (daily physical activity, sports participation, muscular strength exercising) associated with anabolic steroid use.</p> <p>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.</p>	May 27 10:30 AM - 12:00 PM	464	<p>Physical activity improves cognitive function and academic achievement, although many youth remain sedentary during school. Exercise desks may be advantageous to improving physical activity as it does not require any teacher education and does not jeopardize time spent on academic instruction.</p> <p>PURPOSE: The purpose of this study was to determine the effect of exercise desks on levels of physical activity and classroom performance in 4th and 7th grade students with neurodevelopmental disorders.</p> <p>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 composed of pedaling, a stand and spin, and accordion chairs. Students reading skills were assessed using two curriculum-based measurements: Maze Reading Comprehension and Oral Reading Fluency.</p> <p>RESULTS: Weight significantly correlated with time spent in sedentary ($r = .43$; $p < 0.001$), light ($r = .37$; $p < 0.001$) and moderate ($r = -.46$; $p < 0.001$) 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.</p> <p>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.</p>	May 27 10:30 AM - 12:00 PM
463	<p>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 associations among MT, aerobic fitness, and music during exercise.</p> <p>METHODS: Thirty-one recreationally-active individuals (22.13 ± 2.11 yrs, 25.15 ± 2.94 BMI, 42.89 ± 5.31 $\text{mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$; 65.5% male) were recruited for this study. Participants completed a MT questionnaire and performed a $\text{VO}_{2\text{max}}$ test on the treadmill. Participants then completed two counterbalanced, experimental trials consisting of exercise with: 1) no music; and 2) self-selected music from a personalized playlist. For each experimental trial, participants performed a time-to-exhaustion (TTE) run at 80% $\text{VO}_{2\text{max}}$, separated by at least 48 hours. Independent sample t-tests were used to examine differences between the two trials, while Pearson correlations were conducted to examine the associations among aerobic fitness, MT, and TTE for both music (TTE_M) and non-music (TTE_{NM}) conditions. Linear regression was used to investigate relationships between MT and change in exercise performance (ΔTTE) between music conditions.</p> <p>RESULTS: There were no significant differences between minutes for TTE_{NM} (12.23 ± 5.24) and TTE_M (14.18 ± 4.79). Moderate to strong correlations with $\text{VO}_{2\text{max}}$ were observed for TTE_M ($r = .39$ $p = 0.030$), TTE_{NM} ($r = .52$, $p = 0.003$), and MT ($r = .40$, $p = 0.024$). Linear regression revealed that a higher MT score was associated with a smaller change between the two performance trials ($F_{1,29} = 4.42$, $r = -.63$, $p = 0.040$), irrespective of order effect or aerobic fitness.</p> <p>CONCLUSIONS: Associations existed between aerobic fitness, MT, and exercise performance for both music and non-music trials. Participants with greater MT experienced less of a change between performance trials, suggesting that individuals with greater MT may demonstrate consistent patterns of performance, irrespective of aerobic fitness or the presence of external factors. Understanding the relationship between MT and music during exercise may allow exercise professionals to better tailor their training programs to each individual, increasing exercise performance and adherence.</p>	May 27 10:30 AM - 12:00 PM	464	<p>PURPOSE: The aim of this study was to examine compulsive exercise and associations with physical activity and psychosocial health among early adolescents.</p> <p>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), KIDSCREEN-27, Subjective Vitality Scale (SVS), and Compulsive Exercise Test (CET). High CET score was identified as total CET score ≥ 15.</p> <p>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 ($r = .12$, $p = 0.003$), and between total CET score and number of weight reduction attempts the past year ($r = .22$, $p = 0.02$). No correlation was found between total CET score and physical activity, or between total CET score and sedentary time. A regression analysis showed introjected regulation ($p < 0.001$), identified regulation ($p = 0.03$) and extrinsic motivation ($p = 0.04$), but not intrinsic motivation, amotivation, SVS, KIDSCREEN-27 domains, gender or physical activity level, as significant predictors of total CET score.</p> <p>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.</p>	May 27 10:30 AM - 12:00 PM

466	Board #282	May 27 10:30 AM - 12:00 PM
The Desire To Move And Rest: Assessing Reliability And Validity Of The CRAVE Scale		
Matthew Stults-Kolehmainen ¹ , Miguel Blacutt ² , Amanda Divin ³ , Susannah Williamson ⁴ , Todd A. Gilson ⁵ , John B. Bartholomew, FACSM ⁶ , Rajita Sinha ⁷ . ¹ <i>Yale - New Haven Hospital, New Haven, CT.</i> ² <i>Teachers College, Columbia University, New York, NY.</i> ³ <i>Northwestern State University, Natchitoches, LA.</i> ⁴ <i>Texas A & M University, College Station, TX.</i> ⁵ <i>Northern Illinois University, DeKalb, IL.</i> ⁶ <i>The University of Texas at Austin, Austin, TX.</i> ⁷ <i>Yale University Medical School, New Haven, CT.</i> (Sponsor: John B. Bartholomew, FACSM)		
Email: Matthew.Stults-kolehmainen@YNHH.ORG <i>(No relevant relationships reported)</i>		

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 Scores 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. 33.4 ± 2.8 , $p=0.016$) and lower than mid (33.1 ± 2.8 , $p=0.019$). Cronbach alpha coefficients for pre-, mid- and post-lecture (desire to Move: 0.90, 0.94, 0.93, respectively; Rest: 0.89, 0.94, 0.93). Inter-class correlations: Move=.85; Rest=.90.

The desire to move pre- and mid-lecture were similar at different times of the day. The post-class desire to move was significantly higher at 3PM compared to 9AM (44.0 ± 16.6 vs. 28.11 ± 12.2 , $p=0.019$). There were no differences in desire to rest based on time of day. Desire to move at baseline was significantly associated with energy ($r=0.38$, $p=0.018$) and 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.

467	Board #283	May 27 10:30 AM - 12:00 PM
Children's Motivation For Physical Activity		
Tyler J. Kybartas ¹ , Aaron P. Wood ² , Kelley Strohacker, FACSM ² , Rebecca A. Zakrajsek ² , Jedediah E. Blanton ² , Samantha F. Ehrlich ² , Dawn P. Coe, FACSM ² . ¹ <i>Illinois State University, Normal, IL.</i> ² <i>University of Tennessee, Knoxville, TN.</i>		
Email: tjkybar@ilstu.edu <i>(No relevant relationships reported)</i>		

The establishment of physical activity (PA) routines in childhood is critical to form life-long PA habits. Children are motivated for activities that they enjoy but research is scarce on motivational factors for PA in children younger than eight years old. **PURPOSE:** To explore why children enjoy or do not enjoy physical activities to gather their underlying motivation. Additionally, physical activity and perceived motor competency data were collected to describe the participants. **METHODS:** A mixed-methods study design was employed. Participants ($n=16$) were 2nd and 3rd grade students at two YMCA afterschool programs. Each child wore an accelerometer on the right hip for seven consecutive days and data were converted to min in PA intensities. They also completed Harter's perceived motor competency survey and took part in focus groups. There were two 2nd grade and two 3rd grade focus groups, which consisted of 3-5 participants each. Descriptive analyses were performed on PA and perceived motor competency data. Focus group data underwent thematic analysis using an inductive approach. **RESULTS:** PA data revealed that the majority of participants (57%) met PA recommendation with an average of 63.8 ± 25.4 minutes of moderate to vigorous PA per day. Additionally, the average perceived motor competency score was 3.0 ± 0.6 (out of 4). Information from the focus groups was used to create four over-arching themes which included 1) PA is sport, 2) social influence, 3) perceived competence, and 4) PA characteristics. Within the social influence theme, peers,

parents, siblings, and gender norms appear to make important contributions to this theme. The PA characteristics theme included roughness and danger, movement and action, teammates and competition (enjoyment only), and rules (unenjoyment only). It appears that the social influence, perceived competence, and PA characteristics had overlap on one another, suggesting perhaps all three have a reciprocal interaction that may relate to the enjoyment or unenjoyment of physical activities. **CONCLUSIONS:** Results suggest exposing children early to wide varieties of physical activities may help minimize activities they dislike and build their perceived competence and social bonds, which may be crucial to establishing and continuing PA behaviors.

468	Board #284	May 27 10:30 AM - 12:00 PM
Exploring The Influence Of Pregnancy And Physical Activity Involvement On Physical Activity Levels And Knowledge Exploring The Influence Of Pregnancy And Physical Activity Involvement On Physical Activity Levels And Knowledge		
Kellie A. Walters ¹ , Cindy L. Hartman ² , Kate Evans ³ . ¹ <i>California State University, Long Beach, Long Beach, CA.</i> ² <i>University of New Hampshire, Durham, NH.</i> ³ <i>University of Wisconsin-La Crosse, La Crosse, WI.</i>		
Email: kellie.walters@csulb.edu <i>(No relevant relationships reported)</i>		

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 for 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.

469	Board #285	May 27 10:30 AM - 12:00 PM
The Maternal Factor: Associations Between Maternal Health Characteristics And Child And Family Health Habits		
Bethany Williams ¹ , Colette Vartanian ¹ , Chelsea L. Kracht ² , Jonathan D. Baldwin ¹ , Laura Hubbs-Tait ³ , Emily H. Guseman ⁴ , Jennifer L. Graef ¹ , Susan B. Sisson, FACSM ¹ . ¹ <i>University of Oklahoma Health Sciences Center, Oklahoma City, OK.</i> ² <i>Pennington Biomedical Research Center, Baton Rouge, LA.</i> ³ <i>Oklahoma State University, Stillwater, OK.</i> ⁴ <i>Ohio University, Athens, OH.</i> (Sponsor: Susan B. Sisson, FACSM)		
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Childhood physical activity (PA) is important for adequate growth and development. Child PA is influenced by family health habits, such as encouragement and active involvement. Mothers are of central importance within the family unit, as their personal and supportive behaviors can alter the health-promoting home environment. To better understand the dynamics of family health behavior, maternal characteristics associated with child and family PA must be explored. **PURPOSE:** Determine associations between maternal health characteristics (anthropometrics and PA) with child and family health habits. **METHODS:** Mother-child dyads (children aged 5.0-7.9 years) were recruited. Mother and child height and weight were measured

objectively 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 1159.8 ± 262.8 CPM and mothers reported average family PA participation score of 6.2 ± 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?

Bradley J. Cardinal, FACSM, Dakota B. Dailey, Alexandra Szarabajko, N. Emmanuel Ughelu, Jake D. Wambaugh. *Oregon State University, Corvallis, OR.*

(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 modeling others, persuasion and arousal, building assets or avoiding risks, affecting the influence process, building efficacy or confidence, and developing positive expectancy) of the Psychological Capital Model (PCM). These are the conduits through which hope, efficacy, resiliency, and optimism are developed. **METHODS:** Ten "Mic'd up" videos were acquired vis-à-vis YouTube. The videos purposefully 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 coaches' statement 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.

- 471** Board #287 May 27 10:30 AM - 12:00 PM
Acute Effects Of Dumbbell Exercise On Oxygenated Hemodynamic Concentration Of Cerebral Activation: A Fnirs Study

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(No relevant relationships reported)

Purpose. To examine cerebral cortical activation in the reigns of the prefrontal cortex and parietal lobe during the performance of two types of dumbbell exercise.

Methods. A total of 22 young healthy male adults (mean age = 23.8 ± 2.05 years, height = 1.75 ± 0.06 m, weight = 71.4 ± 8.80 kg) participated in a crossover design study that involved two experimental exercise conditions: momentum dumbbell and conventional dumbbell. Participants' task performance included 10 10-second sets of single-arm dumbbell exercise, with a rest interval of 60 seconds between sets and a 5-minute washout period between conditions. Primary outcome was oxygenated hemoglobin (HbO_2) concentration in the prefrontal cortex and parietal lobe assessed with functional near-infrared spectroscopy. Secondary outcome measures were upper-limb muscle activation measured by surface electromyography. Outcome data were ascertained during exercise.

Results. A significant difference in HbO_2 was observed in the prefrontal and parietal regions with a high level of brain activation observed during the momentum dumbbell exercise relative to the conventional dumbbell exercise ($p < 0.05$). Compared to conventional dumbbell exercise, momentum dumbbell exercise also showed a higher level of muscle activation in the anterior deltoid and posterior deltoid of the upper arm and in the flexor carpi radialis and extensor carpi radialis longus of the forearm ($p < 0.05$). No between-condition differences were found, however, in biceps brachii and triceps brachii ($p > 0.05$).

Conclusion: A dynamic dumbbell exercise, compared with a conventional dumbbell exercise, resulted in higher hemodynamic responses and greater upper-limb muscle activation in young healthy adults. The new resistance-based training exercise may be suited as a stand-alone exercise modality aimed at promoting brain health.

Supported by the Shanghai City Committee of Science and Technology Key Project (17080503200) and National Natural Science Foundation of China (31701041).

- 472** Board #288 May 27 10:30 AM - 12:00 PM
Can You Dig It: The Acute Psychological Responses To Volleyball Participation

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(No relevant relationships reported)

Exercise is one of the most beneficial daily habits to increase overall health and wellness. However, failure to enjoy exercise programs has often been cited as a primary reason to cease/not engage in said programs. Among adults, participation in recreational sporting activities is often overlooked as a potentially more enjoyable mode of exercise. **PURPOSE:** Explore the acute effects of recreational sports on affective states. **METHODS:** Participants [$N = 24$, 18 males; age ($M \pm SD$): 29.0 ± 6.8 yrs; BMI ($M \pm SD$): 24.0 ± 4.1] completed three games of recreational volleyball over a one hour duration. Affective states (Activation-Deactivation Checklist: AD ACL) and state anxiety (SAI) were assessed before (pre), immediately (post0) and ten minutes (post10) after activity. Data was analyzed using SPSS 24.0.0, utilizing repeated measures analysis of differences for main outcome measures. **RESULTS:** Participants reported a significant increase in Energy ($M_{diff} \pm SE$): 4.4 ± 0.75 [Cohen's $d = 1.34$] and Tension ($M_{diff} \pm SE$): 2.3 ± 0.57 [Cohen's $d = 1.06$], while reporting a significant decrease in Tiredness ($M_{diff} \pm SE$): 3.0 ± 0.83 [Cohen's $d = 0.88$] and Calmness ($M_{diff} \pm SE$): 4.0 ± 0.62 [Cohen's $d = 1.49$] from pre to post0. However, affective states were not different at post10 relative to pre (all $p's \geq 0.5$). While SAI significantly decreased from post0 to post10 ($M_{diff} \pm SE$): 3.2 ± 0.74 [Cohen's $d = 0.90$], it was not different at post10 relative to pre ($p = 0.52$). **CONCLUSION:** While participants experienced significant increases in Energy and Tension, while showing decreases in Tiredness and Calmness consistent to previous literature immediately post exercise, none of these improved affective states were expressed at post10. Additionally, no significant changes in state anxiety were observed 10 minutes post exercise. It is possible that the psychological effects of sport related physical activity differ from more traditional cardiovascular exercise effects. Future work on the psychological responses to recreational activities is needed to further explore these phenomenon.

473	Board #289	May 27 10:30 AM - 12:00 PM
Relationship Between Sleep Parameters, Perceived Recovery And Aerobic Performance In Runners		
Marco T. de Mello, Aldo Coelho Silva, Luisa F. Nogueira, Andressa Silva, UFMG - Federal University of Minas Gerais, Belo Horizonte, Brazil.		
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Sleep is considered fundamental for the physical recovery process, being related to the compensation process due to the residual effect of training. In addition, sleep seems to be related to performance in cognitive activities. However, little is known about the relationship of sleep to performance and recovery in long-distance runners. **PURPOSE:** To verify the relationship between sleep parameters, perceived recovery and aerobic performance of runners. **METHODS:** Eight long-distance runners (age, 30.3 ± 5.5 years; maximum oxygen consumption, 59.4 ± 3.4 mL.kg.min $^{-1}$), classified as good sleepers (Pittsburgh Index Quality <5), had their sleep monitored for six days a priori from a race to exhaustion. Pulse actigraph was used for 15 days to verify sleep parameters (total sleep time, sleep efficiency, number of awakenings and sleep latency). Perceived recovery was assessed by the Total Recovery Quality Scale (TQR) prior to the running session. The run-to-exhaustion session was performed at the anaerobic threshold, determined by the ventilatory equivalent, and presented as the time limit until exhaustion (tLIM). **RESULTS:** Runners had a sleep efficiency of $87.4 \pm 9.6\%$, total sleep time of 350.4 ± 55.9 min (minutes), number of awakenings of 33.8 ± 25.5 min, sleep latency 13.8 ± 18.1 min on the night before the race and on the day of running 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 who running time to anaerobic threshold exhaustion and perceived recovery are associated with sleep parameters of the night before the race.

Supported by CEPE/UFMG, FAPEMIG, CAPES and CNPQ.

474	Board #290	May 27 10:30 AM - 12:00 PM
Is Karate Training Effective In Improving Social Skills And Executive Functions In Children With Autism?		
Cataldi Stefania, Greco Gianpiero, Bonavolontà Valerio, Fischetti Francesco. University of Bari Aldo Moro, Bari, Italy. Email: stefania_cataldi@virgilio.it (No relevant relationships reported)		

Medicine and Science in Sports and Exercise, Volume 51, Supplement 1 5S
Is Karate Training Effective In Improving Social Skills and Executive Functions in Children with Autism?

Stefania Cataldi, Gianpiero Greco, Valerio Bonavolontà, Francesco Fischetti University of Study of Bari "Aldo Moro", Bari, ITALY. Limited research exists exploring recreational activities (e.g. sport) as an integrative approach to therapy to bring benefits in social skills and executive functions. **PURPOSE:** This study examined the effects of 12-week traditional Shotokan Karate training on social-emotional skills and executive functioning of children (8-11 years) with diagnosed autism spectrum disorder. **METHODS:** Twenty-eight children were matched into pairs based on age, gender, and autism severity, and randomly allocated into an intervention ($n = 14$) or waitlist control group ($n = 14$). The intervention group performed Kata techniques training two times per week (45 min). The intervention included typically-developing children that helped facilitate the social skills, and activities targeted to train specific domains of executive functions, namely behavioral inhibition, working memory, and cognitive flexibility. At baseline and after 12 weeks, parents assessed social skills and executive functioning respectively through the Social Skills Improvement System Rating Scale and Behaviour Rating Inventory of Executive Function.

RESULTS: Findings suggest that intervention group showed significantly greater socio-emotional skills ($\Delta 8.9 \pm 3.1$, $p < 0.001$, $d = 2.85$) and lesser behavioral problems ($\Delta -8.0 \pm 3.1$, $p < 0.001$, $d = 2.64$) than the control group, and decreased the behavioral ($\Delta -3.6 \pm 2.7$, $p < 0.001$, $d = 1.36$), emotion ($\Delta -3.5 \pm 2.1$, $p < 0.001$, $d = 1.63$) and cognitive ($\Delta -2.3 \pm 1.5$, $p < 0.001$, $d = 1.54$) regulation indexes, and the Global Executive Functioning Composite ($\Delta -3.2 \pm 3.3$, $p = 0.003$, $d = 0.97$).

CONCLUSION: After 12 weeks, children with ASD showed a greater socio-emotional competence such as communication, cooperation and engagement, a better executive functioning ability such as cognitive flexibility, inhibitory control and working memory and a lower aggressiveness, sadness, anxiety and hyperactivity. Since ASD is a broad economic and societal problem that affects individual, family, and community levels.

475	Board #291	May 27 10:30 AM - 12:00 PM
Goal Orientation And Beliefs About Success In Age Group Swimmers		
Nathan Rhea, Courtney Jensen, J. Mark VanNess. University of the Pacific, Stockton, CA. (No relevant relationships reported)		

Determining a swimmer's goal orientation and what they believe makes them successful can help coaches create better workouts and outcome measures in young athletes. **PURPOSE:** Goal orientation (task vs ego) and success beliefs (effort, deception, ability and external factors) were examined in age group swimmers to determine if achievement theory differed by age. **METHODS:** Eighty (N=80), 11-18 year old USA Swimming club members, completed the Task and Ego Orientation in Sport Questionnaire (TEOSQ) and the Beliefs About the Causes of Sport Success Questionnaire (BACSSQ). Parent consent and child assent was obtained. Regression and multivariate analyses were used to examine differences between age groups. **RESULTS:** Athletes with Ego orientation had significant positive relationships with ability and deception as beliefs about the causes of sport success (Wilks' $\Lambda = 0.010$, $F(6, 69) = 1,195$, $p < 0.001$ and $p < 0.05$ for age categories, subsequent post hoc tests reached $p < 0.05$ for significance). Those with Task orientation had a positive relationship with higher effort and negative relationship with deception as a belief about the cause of sport success. Age comparisons showed 13-14 and 15-18 year old age groups had significantly higher ego orientation than the 11-12 age group, the 15-18 age group having a significantly lower task orientation than both the 11-12 and 13-14 age groups. The 13-14 age group attributed deception to success in swimming significantly more than the 11-12 age group. **CONCLUSION:** Older swimmers develop a higher ego orientation and lower task orientation due to more visible differences in ability and an increased focus on performance.

476	Board #292	May 27 10:30 AM - 12:00 PM
Ironic Process Theory In Softball Pitching: How Knowing Information About An Opponent's Strengths Affects Performance		
Ronald Otterstetter, FACSM ¹ , Mackenzie Conrad ¹ , Mallory Kobak ² , Brian Miller ¹ , Judith Juvancic-Heltzel ¹ . ¹ The University of Akron, Akron, OH. ² Hiram College, Hiram, OH. (No relevant relationships reported)		

INTRODUCTION: As athletic competition and college athletics continue to grow and flourish, there is an increased emphasis on game preparation. Collegiate softball pitchers are expected to handle an immense amount of pressure, perform with precision, and incur few errors. **PURPOSE:** Examine the Ironic Process Theory related to fast pitch softball pitching and to determine how knowing information about an opponent's strengths affects experienced pitcher's performance under pressure. **METHODS:** Experienced college softball pitchers ($n = 12$) were recruited as subjects. Each pitcher was randomly instructed through two 30 pitch phases (a high and low pressure phase) with two different conditions: black target only condition (BOTC) or black and red target condition (BRTC). Subjects were asked to aim and hit the black target and avoid the red target. The black target represented the weakness of the opponent and the red target represented the strength of the opponent. Performance pressure was measured before each phase using the Mental Readiness Form (MRF-3) (Krane, 1994). **RESULTS:** Pre-MRF-3 reached statistical significance across the between-subjects factor of pressure, $[t(22) = 3.102$, $p = 0.005$] with a mean difference of 4.75 (95% C.I. 1.57 to 7.92) indicating that the pressure situation induced an increase in perceived anxiety and stress. ANCOVA did not reach statistical significance on the main effects of black targets hit nor the interactions terms for black targets hit by MRF-3 and black targets hit by Pressure. This finding asserts that there was no difference in performance between BRTC and BOTC across pressure after adjusting for perceived anxiety. There was no statistically significant difference of red target hit between the high pressure and low pressure situations, $d = 0.25$ (95% C.I. -0.463 to 0.963), $t(22) = 0.723$, $p = 0.963$. **DISCUSSION:** Practically speaking, the pitchers in this study did perform more effectively in the high pressure situation. Although different from previous Ironic Theory research, it is important to note this increased ability for pitchers to hit a desired target while under pressure. Even if not statistically significant, this can help pitchers and coaches understand the link between pressure and performance more effectively, and add training components to improve in stress situations.

477	Board #293	May 27 10:30 AM - 12:00 PM
The Effect Of Random And Blocked Practice In Volleyball Attack Learning		
Nektarios A.M. Stavrou ¹ , Natalia Kompoliadi ² , Nikolaos Bergeles ² . ¹ National and Kapodistrian University of Athens, Faculty of Physical Education and Sport Science - Hellenic Sports Research Institute, Olympic Athletic Center of Athens "Spyros Louis", Athens, Greece. ² National and Kapodistrian University of Athens, Athens, Greece. Email: nstavrou@phed.uoa.gr (No relevant relationships reported)		

Several practice methods have been used by coaches in order to improve athletes' performance through the permanent changes in movement performance. Two of the widely used practice tasks are blocked and random schedule. In random schedule, the practice target is unpredictable for the athletes. On the other hand, in blocked practice, the athlete executes the same motor movement repeatedly before moving to the next skill. **PURPOSE:** The purpose of the present study was to examine the effect of contextual interference (random, blocked practice) on improving the volleyball attack (spike). **METHODS:** Thirty six (36) amateur volleyball players ranging in age from 18 to 25 years old volunteered to participate in the study. The participants were randomly assigned into three experimental conditions: (a) random practice, (b) blocked practice, and (c) control group. The intervention program lasted 6 weeks, and each participant underwent two 90 minute training sessions per week. During the training, each participant performed a total of 40 blows per training session. Three measures were applied: The first measure (pre-test) performed just before the commencement of the intervention program, one immediately after its end (post-test), and the third measure a week after the program completion (follow-up). **RESULTS:** The results indicated a significant improvement in the random schedule experimental group in the post-test compared to the pre-test ($p<.001$) as well as in the follow-up measure ($p<.01$). The blocked schedule group showed also an improvement in the post-test and follow-up measure compared to the pre-test ($p<.05$, $p<.05$). 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.

478	Board #294	May 27 10:30 AM - 12:00 PM
Effect Of Bodybuilding Calisthenics Training On Executive Ability In Old Women Adults		
Chunmei Cao ¹ , Hengnan Jiang ¹ , Keying Zhang ¹ , Yu Liu ² . ¹ Tsinghua University, Beijing, China. ² Peking University, Beijing, China. Email: caocm@tsinghua.edu.cn (No relevant relationships reported)		

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, $n = 75$) and 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 were used to evaluate the executive ability, which were measured before and after intervention. Two-way (group vs. time) repeated measures ANOVAs were performed for each of the outcome parameters. Tukey's HSD tests were employed for post-hoc comparisons. The alpha level was set at $p < 0.05$.

RESULTS: 1. There were statistically significant group by time interactions for TMT-A ($F_{(1,124)} = 6.90$, $p < .001$), TMT-B ($F_{(1,124)} = 6.64$, $p < .005$) and Tapping Test ($F_{(1,124)} = 3.99$, $p < .05$). 2. The main effect for time was significant for TMT-A ($F_{(1,129)} = 29.48$, $p < .001$), TMT-B ($F_{(1,125)} = 22.09$, $p < .001$) 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.

479	Board #295	May 27 10:30 AM - 12:00 PM
Grit And Ultramarathon Running		
Julie M. Cousins, Madeline J. Peterson, Andrew N. Christopher, Andrea P. Francis, Heather H. Betz, FACSM. Albion College, Albion, MI. (Sponsor: Heather Betz, FACSM) Email: jcousins@albion.edu (No relevant relationships reported)		

Ultramarathons consist of any race that is longer than 26.2 miles (42 km). Grit is the tendency to pursue long-term challenging goals with perseverance and passion. It has been assumed that ultramarathon runners have a high level of grit because of the challenges they must overcome to run such a long distance. **PURPOSE:** The purpose of this study was to investigate the association between ultramarathon running and grit-perseverance and grit-passion. **METHODS:** A total of 153 ultramarathon runners (age = 40.5 (9.0) years) participated in this study. The ultramarathon runners completed 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 $p < .05$. **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.

480	Board #296	May 27 10:30 AM - 12:00 PM
The Effect Of Advanced Imagery Training On NCAA Shot Putter Performance		
Conrad L. Woolsey ¹ , Tucker D. Woolsey ¹ , Scott Strohmeyer ² , Stephen Walker ¹ , Wendell Otto ¹ , Brandie C. Cheshier ³ , Cody Diehl ³ , Bert H. Jacobson ³ . ¹ University of Western States, Portland, OR. ² University of Central Missouri, Warrensburg, MO. ³ Oklahoma State University, Stillwater, OK. (No relevant relationships reported)		

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 personal cues. Imagery was conducted five days per week for three weeks. A pre- and posttest design was used to evaluate the efficacy of PETTLEP-based imagery. Data was recorded using advanced force plate technology, biomechanical sensors, and infrared camera equipment and performance variables recorded included peak force, release angle, height of release, and release velocity. **RESULTS:** While all dependent variables increased in value, results yielded no significant difference in pre- to posttest for PF (Pre: 969.50 ± 185.18 N; Post: 1030.16 ± 201.37 N, $p > 0.05$), RA (Pre: $33.42 \pm 4.62^\circ$; Post: $36.95 \pm 8.08^\circ$, $p > 0.05$), RH (Pre: 2.00 ± 0.11 m; Post: 36.95 ± 8.08 m, $p > 0.05$), and RV (Pre: 10.89 ± 0.97 m/s; Post: 11.29 ± 0.79 m/s, $p > 0.05$). However, a significant difference was found for DT (Pre: 12.49 ± 2.14 m; Post: 11.29 ± 1.67 m, $p < 0.05$). Additionally, release velocity significantly correlated with distance thrown in both the pre- and post-tests ($r = .962$ and $r = .834$ respectively). Findings from the pretest linear regression analysis support using the model for release angle, release height, release velocity, and peak force production as a predictor of distance thrown with a level of confidence ($F(4,5) = 26.29$, $p < 0.001$; R^2 of .918). **CONCLUSION:** While these findings are encouraging, the PETTLEP-based imagery training model employed in the present study needs to be evaluated further to determine its effectiveness for consistently enhancing athletic performance.

481	Board #297 Motivation, Personality, And Trait Self-handicapping In College Club Athletes David A. Tobar, Jordan Allen, Bonnie G. Berger. <i>Bowling Green State University, Bowling Green, OH.</i> Email: dtobar@bgsu.edu (No relevant relationships reported)	May 27 10:30 AM - 12:00 PM	483	Board #299 Mental Preparation In High Altitude Mountain Climbers Kelly Rae Rice-McNeil. <i>Eastern Oregon University, La Grande, OR.</i> Email: krice@eou.edu (No relevant relationships reported)	May 27 10:30 AM - 12:00 PM
	<p>According to Self-Determination Theory (Ryan & Deci, 2017), motivation lies on a continuum from least (amotivation) to most self-determined (intrinsic). Personality traits have been shown to be related motivation in sport (e.g., Brinkman et al., 2016). Trait self-handicapping may be related to less self-determined motivation as athletes who use these strategies often fear failure for an upcoming, evaluative event and wish to control how they are perceived by others (Berger & Tobar, 2019). Despite about two million college students participating in club sports, research on these variables in this population is almost non-existent. PURPOSE: To examine the relationship between Big Five personality traits, trait self-handicapping, and motivation in college club athletes. METHODS: Data were collected from rugby (12 females, 28 males) and volleyball (15 females, 12 males) club athletes at a D-I university in the Midwest. Participants completed the Big Five Inventory, Self-Handicapping Scale, and Sport Motivation Scale - II. Factorial ANOVA and MANOVA were used to examine gender and sport differences for self-handicapping (SH), personality, motivation [intrinsic (INT), integrated (ITG), identified (IDN), introjected (ITJ), external (EXT), and amotivation (AMT)], and relative autonomy index (RAI). Personality traits and SH were included in stepwise multiple regression analyses to predict each type of motivation and RAI. RESULTS: Personality, SH, motivation, and RAI did not differ by gender or sport ($p > .05$). Thus, data were collapsed across gender and sport. Regression analyses revealed that Extraversion was the only significant predictor of INT [$R = .32, p < .01$], ITG [$R = .36, p < .005$], and IDN [$R = .40, p < .001$]. Negative Emotionality predicted ITJ [$R = .29, p < .05$] and SH predicted EXT [$R = .26, p < .05$]. 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.</p>		<p>Elite athletes use mental strategies to enhance performance. High altitude mountain climbers also require rigorous training to meet physical, and dangerous, demands of climbing. However, little is known about the mental strategies used by this population. PURPOSE: The purpose was to pilot test a survey which asked the following: 1) what do mountaineers do to prepare for a climb, 2) what mental strategies are used to overcome obstacles, and 3) do these strategies affect chances of summit success? METHODS: Pre-surveys were distributed to clients before mountain climbs on two high altitude peaks in Washington State (Baker and Rainer). Post-surveys were distributed 7 days post-climb via an online form. All clients were on guided trips. RESULTS: Males = 39 (78%) and Females = 11 (22%) climbed either Mt Rainer = 33 (66%) or Mt Baker = 17 (34%). 92% of clients had a bachelor's degree or above and 60% identified as White, 24% Asian, 16% other. For 86% of the clients, this was their first attempt on that mountain. All clients (100%) physical trained an average of 4.82 months, 4.16 days/week and 81.8 min/day. 50% mentally trained for 3.26 months, 2.26 days/week and 22.5 min/day. Self-identified mental preparation ranged from researching gear (n=5), reading about climbing(n=5), visualization (n=3) and meditation (n=4). 23 clients completed post-survey, the summit success rate was 46.2% (n=12) reached the summit, 42.3% (n=11) did not. CONCLUSION: Understanding of mental preparation among mountain climbers appears limited. An intervention that can be delivered to high altitude mountain climbers to implement mental strategies may help increase summit success.</p>		
482	Board #298 Factors Associated With Perceived Safety Norms Within Children's Sports Environments Aliza K. Nedimyer ¹ , Avinash Chandran ¹ , Melissa C. Kay ² , Paula Gildner ¹ , K. Hunter Byrd ¹ , Johna K. Register-Mihalik ¹ , Zachary Y. Kerr ¹ . ¹ <i>University of North Carolina at Chapel Hill, Chapel Hill, NC.</i> ² <i>University of Southern Mississippi, Hattiesburg, MS.</i> (No relevant relationships reported)	May 27 10:30 AM - 12:00 PM	484	Board #300 Examination Of Quality Of Life And Activities Of Daily Living After Sport Participation Heather E. Key, Toni Torres-McGehee, Samantha R. Weber, Rachel Sharpe, Eva Monsma, Mike McCall. <i>University of South Carolina, Columbia, SC.</i> (No relevant relationships reported)	May 27 10:30 AM - 12:00 PM
	<p>Purpose: Middle school (MS) aged children participate in sports in multiple settings. Parents' perceptions of safety norms in these settings likely influence their decisions regarding children's sport participation. This study looked at factors associated with parents' perceived safety norms (ie. concussion risk) of their MS children's sport settings.</p> <p>Methods: Randomly-selected US parents (aged ≥ 18 years) of MS children (n=772) completed an online questionnaire capturing parent and child characteristics, and parent knowledge, attitudes, and norms regarding concussion and safety. The main outcome, perceived safety norms related to children's sports settings, originated from a pre-validated measure [11 7-point scale items (range: 11-77; higher scores=better norms regarding safety)]. Parent (age, gender, race/ethnicity, education, concussion history, concussion knowledge, concussion care-seeking attitudes) and child characteristics (concussion history, contact level of sports played) served as explanatory variables. Multivariable logistic regressions modelled odds of better safety norms; norms scores were categorized by the median split of the possible score range (i.e., 11-44, 45-77). Separate analyses assessed norms for parents with children in MS sports (n=617) and club/rec league sports (n=581).</p> <p>Results: Most respondents were female (60%), white/non-Hispanic (52%), and had at least a bachelor's degree (50%). Parents' mean age was 58 ± 9 years; 31% had a concussion history and 23% had a MS-aged child with a concussion history. Among parents with children in club/rec league sports, higher odds of better safety norms were associated with older age (5-year increase, OR=1.29; 95%CI=1.06-1.58), and higher concussion care-seeking attitudes (10% scale increase, OR=1.33; 95%CI=1.16-1.52). Among parents with children in MS sports, higher odds of better safety norms were associated with higher concussion-related knowledge (10% scale increase, OR=1.25; 95%CI=1.06-1.48) and higher concussion care-seeking attitudes (10% scale increase, OR=1.34; 95%CI=1.18-1.52).</p> <p>Conclusions: Parental factors associated with safety norms varied based on child specific sport settings. Parents should take setting into account when making decisions related to their children's sport participation.</p>		<p>Context: Athletes often develop positive self-esteem during sport participation but may have negative repercussions once an athlete retires. Preparation for retirement of sport is important in order to prevent negative mental health consequences and decreases in quality of life and activities of daily living.</p> <p>Purpose: To examine quality of life and activities of daily living in retired athletes. The secondary purpose will examine differences between gender, the type of sport played, and length of time in retirement.</p> <p>Methods: Cross-sectional study examined retired athletes (n=180; ages: 28.5 ± 10.4 years; males: n=72; females: n= 107). Each participant completed at minimum of 4 years of high school sports, or 2 years of collegiate athletics, or 2 years of professional sports. The survey included demographic questions related to activities of daily living (e.g., health status, activity level, basic mood levels, and the Quality of Life Index (QLI)). Basic descriptive, independent samples t-tests, and ANOVAs were used.</p> <p>Results: No significant differences were found between females and males' total score for sport type and QLI. A significant difference was found between Time in Retirement and QLI total scores ($p=.008$). A significant difference ($p \leq 0.01$) was found between gender and Time in Retirement in the amount of vigorous activities (e.g., running, strenuous exercise, etc.) and mood/nervousness ($p=0.006$) with females between 0-5 years of retirement displaying the highest concern. Majority of participants 84.4% (n=60) felt they were healthy for their age and 93.9% (n=69) felt their health does not prevent them from working and/or decreases their activities of daily living. Only 13.4% (n=24) reported feeling bad in the past 30 days.</p> <p>Conclusion: While it is suggested that retirement from sport may have negative repercussions on health and quality of life, the overall results indicated the opposite. Individuals reported their quality of life and health did not prevent them from completing activities of daily living. It is important to prepare athletes for retirement and encourage continuation of physical activity and maintenance of their health.</p>		

A-53 Free Communication/Poster - Immunology and Endocrinology Across the HealthspanWednesday, May 27, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall**485** 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**Eunhan Cho¹, Bailey Theall¹, James Stampley¹, Brett Davis¹, Heather Quiriarte¹, Frank Greenway², Neil Johannsen¹, Guillaume Spielmann¹, Brian A. Irving, FACSM¹. ¹Louisiana State University, Baton Rouge, LA. ²Pennington Biomedical Research Center, Baton Rouge, LA. (Sponsor: Brian Irving, FACSM)

Email: echo3@lsu.edu

(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 ($\text{VO}_2 \text{ peak}$) in adults over 65 years old are 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 ± 4 years) from an on-going exercise intervention (REALPA). At baseline participants performed a $\text{VO}_2 \text{ peak}$ 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 G 1 (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 $\text{VO}_2 \text{ peak}$ ranged from 12.2 to 29.9 mL/kg/min ($20.5 \pm 5.1 \text{ mL/kg/min}$) and spent 317.4 ± 56.9 minutes of LPA/day, 22.5 ± 14.3 minutes of Moderate-Vigorous intensity PA (MVPA)/day and accumulated $4,595 \pm 1,091$ steps/day. The number of pan memory T-cells (CD3+/KLRG1+) were inversely correlated with $\text{VO}_2 \text{ peak}$ ($r = -0.51$, $p = 0.045$), while the percentage of pan memory T-cells were negatively associated with volume of LPA ($r = -0.54$, $p = 0.033$), but not with MVPA ($p > 0.05$). Additionally, actigraphy analysis showed that a greater number of daily steps were associated with reduced numbers of memory CD4+ T-cells (KLRG1+/CD57-) ($r = -0.53$, $p = 0.035$). **Conclusions:** Our data support the benefits of high $\text{VO}_2 \text{ peak}$ 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 5R21AG058181-02.

486 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)

(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 of treadmill walking (65% VO_{peak}).

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 ; 8.2 ± 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 ± 789 steps/day, $p < 0.001$). Steps during the B weekend period were reduced compared to B ($p < 0.001$) and during WR following SR+EX (SR, $p < 0.01$; SREX,

$p < 0.001$). Subjects performed less light (LT) PA during SR+EX ($p = 0.001$). 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 (MVPA) was elevated 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+EX.

CONCLUSION Overweight adults maintained steps during SR, but reduced time spent performing MVPA. When subjects performed EX daily (SREX), SED was replaced with MVPA with no changes in LTPA observed. Subjects increased SED and decreased LTPA and MVPA during WR compared to B weekend, likely due to the reduced step counts. Modest SR did not induce IR in overweight adults, but despite reduced PA during WR, IR was improved compared to B.

487 Board #303 May 27 9:30 AM - 11:00 AM**Acute Resistance Exercise Fails To Improve Influenza Vaccine Response In Older Adults**

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(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 naive older adults (20 women, 73.9 ± 5.6 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 (Seqirus 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 ($F(1,28,12) = 5.85$, $p = 0.022$). There was a trend for group differences in fold-increase in antibodies against B/Colorado at 6 weeks ($H(2) = 4.512$, $p = 0.105$) 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.

488 Board #304 May 27 9:30 AM - 11:00 AM**EFFECTS OF AEROBIC AND RESISTANCE EXERCISE ON BIOMARKERS OF B-CELL ACTIVATION IN TYPE 2 DIABETES**Guillaume Spielmann¹, John Campbell², Manjot Singh¹, Timothy Church³, Brian A. Irving, FACSM¹, Neil Johannsen¹. ¹Louisiana State University, Baton Rouge, LA. ²University of Bath, Bath, United Kingdom. ³Pennington Biomedical Research Center, Baton Rouge, LA. (Sponsor: Brian Irving, FACSM)

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Reduced physical activity and associated chronic low-grade inflammation have long been recognized as risk factors for the development of type 2 diabetes (T2D). Various types of exercise interventions are designed to improve the management of T2D; however, the impact of different modes of exercise training on immune activation in patients with T2D remains unclear. **Purpose:** This study aimed to determine the impact of 9 months of exercise training on Free Light Chains (FLC), a near real-time blood indicator of B-cell activation, in people with T2D. **Methods:** Retrospective analysis was performed on 258 archived plasma samples collected during the HART-D study (NCT00458133) from sedentary individuals with T2D after nine-months of resistance (RT), aerobic (AT), combined exercise (ATRT), or no-exercise control (CON). Aerobic fitness (VO_{peak}) was measured before and after the intervention using a graded treadmill test, and muscle quality was determined by dividing peak torque during concentric isokinetic knee flexion by lean mass using DXA scanner. Samples were

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, VO₂peak and muscle quality were both negatively correlated with total FLC ($r^2=0.118$, beta=-0.312; $p<0.001$ and $r^2=0.100$, 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 VO₂peak 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 ($r^2=0.058$, 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.

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

490 Board #306 May 27 9:30 AM - 11:00 AM
MONOCYTE FUNCTION FOLLOWING ACUTE EXERCISE IN BREAST CANCER SURVIVORS BEFORE AND AFTER EXERCISE TRAINING

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Breast cancer therapy impairs immune function that may be attenuated with exercise, though the specific changes that occur remain unclear. **PURPOSE:** 1) To examine monocyte function in breast cancer survivors (BCS) following acute exercise and 2) to determine if this response changes with exercise training. **METHODS:** 9 BCS [Age: 58±8, BMI: 27.9±6.7] completed a cardiopulmonary exercise test (CPET). In 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 phagocytosis and oxidative burst were assessed following *E.coli* exposure. Toll-like receptor 2 (TLR2) and 4 (TLR4) 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. **RESULTS:** Phagocytosis increased 1h after acute exercise before (rest: 3396±941 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 post: 5027±2039, $p=0.078$). Oxidative burst was unchanged with acute exercise but improved following training (pre: 4264±1061 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 rest: 355±115 0h: 339±98 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).

491 Board #307 May 27 9:30 AM - 11:00 AM
Association Between Circulating FGF21 Levels And Physical Activity In Abdominal Obese Adults
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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 ELISA methods. Daily physical activity levels were objectively assessed using a uniaxial accelerometer and categorized into light-intensity physical activity (LPA) and moderate- to vigorous-intensity physical activity (MVPA).

RESULTS: Abdominal obese adults had a higher median value of serum FGF21 levels when compared with non-obese adults (102 pg/mL vs. 139 pg/mL, $P = 0.006$). Serum FGF21 levels were correlated negatively with the time spent in LPA ($r_s = -0.326$, $P = 0.025$) and MVPA ($r_s = -0.349$, $P = 0.016$) 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 between 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.

492 Board #308 May 27 9:30 AM - 11:00 AM
Diabetes Risk Variants Associate With Impaired Insulin Sensitivity In Healthy Adults Following Bed Rest
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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 nondiabetic adults (65.9 ± 7.9 years, BMI 27.1 ± 3.0 , 82.2 ± 6.4 mg/dL fasting blood glucose) completed bed rest studies at the University of Texas Medical Branch. The protocol consisted of a 3 day run-in period, 7 days of bed rest and 7 days of rehabilitation. OGTT (75g) were administered before and after bed rest protocol and following rehabilitation. Venous blood was collected at baseline, 0, 30, 60, 90, and 120 minutes, and the Matsuda Insulin Sensitivity Index (Mat-ISI), HOMA-IR, Insulinogenic Index (II), and the Disposition Index (DI) were calculated. DNA from whole blood was used to genotype for MTNR1B (rs10830963), NOTCH2 (rs10923931), RASGRP1 (rs7403531), PROX1 (rs2075423), HHX (rs1111875), IGF2BP2 (rs402960), CDKAL1 (rs7754840), SLC30A8 (rs13266634), ZFAND6 (rs11634397), and TCF7L2 (rs7903146) risk variants using TaqMan Assays. Results were collated into an unweighted risk score based on the total number of risk alleles (possible range from 0-20). 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 inversely associated with the Mat-ISI and the DI only immediately after the completion of the bed rest period ($p=0.035$ and $p=0.017$, respectively), but not at baseline or after rehabilitation. Post-bed rest Mat-ISI ranged from 18.1 ± 11.6 for those in the lowest risk group vs. 6.8 ± 0.26 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 disuse-related loss of insulin sensitivity. The work was supported by the Claude D. Pepper Older Americans Independence Center (P30 AG024832).

- 493** Board #309 May 27 9:30 AM - 11:00 AM
Metabolic Effects Of High-intensity Interval Training With Probiotics Supplementation In Obese Women
 Yi-Chen Chen¹, Ting-Yao Wang², Chien-Wen Hou¹. ¹Institute of Sports Sciences, Taipei city, Taiwan. ²Holistic Education Center, Hualien city, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)
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(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 before breakfast and participated in a self-monitored HIIT training (treadmill running 7 x 2 minutes at $85\text{-}90\%$ $\dot{V}_{O_{max}}$ with 1-minute resting interval) for 3 sessions per week for 8 weeks. Cardiopulmonary fitness - $\dot{V}_{O_{max}}$ and time to exhaustion, body composition - body weight and body fat %, waist and hip circumferences, and blood sugar and lipid profile - fasting blood glucose (FBG), triglyceride (TG), and high-density lipoprotein (HDL) were measured at baseline and after the exercise intervention. Data was analyzed using paired t-test and ANCOVA. RESULTS: Time to exhaustion significantly increased in TWK10 (+11.4%, $p = .008$) and PLA (+8.8%, $p = .004$). 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 (+4.5%, $p = .027$) but no significance was found in TWK10 group and between both groups. No significant time and group effects were found in $\dot{V}_{O_{max}}$, body weight, body fat %, TG, and HDL. CONCLUSION: Probiotics supplement in combination with HIIT may only control body circumferences and stabilize FBG over time, but does not have additive benefits in overall cardiopulmonary fitness and metabolic biomarkers.

A-54 Free Communication/Poster - Diabetes/ 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. Jagers, FACSM, Timothy McKay, Kupper Wintergerst. University of Louisville, Louisville, KY. (Sponsor: Jason Jagers, FACSM)
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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 or more 3.48 ± 1.95 days per week with only 7.9% ($n = 12$) meeting the recommendation of daily PA, yet almost two-thirds played sports within the past year ($n = 98$, 64.1%). A multiple linear regression model indicated that although HbA1c

decreased by .175 for each day a child engaged in PA and decreased .121 for every sport team a child played only the number of days active per week was a significant predictor of better 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 socioecological 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 Diabetics
 Jacob L. Barber¹, Neil M. Johannsen², William E. Kraus, FACSM³, Timothy S. Church⁴, Mark A. Sarzynski, FACSM¹. ¹University of South Carolina, Columbia, SC. ²Louisiana State University, Baton Rouge, LA. ³Duke University School of Medicine, Durham, NC. ⁴Pennington Biomedical Research Center, Baton Rouge, LA. (Sponsor: Mark Sarzynski, FACSM)
(No relevant relationships reported)

Purpose: Type 2 diabetes (T2D) is associated with dysfunctional lipid metabolism in addition to impaired glucose metabolism. Exercise is widely prescribed in the treatment of T2D; however, the effects of exercise on 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, $n=62$), resistance training (RT, $n=55$), or combination of aerobic and resistance training (AT/RT, $n=64$). NMR spectroscopy was used to quantify lipoprotein size, total and subclass concentrations of triglyceride rich lipoproteins, low-density lipoproteins, and high-density lipoproteins (TRL-P, LDL-P, and HDL-P respectively). Paired t-tests were used to assess the effects of exercise within each intervention, and general linear models (GLMs) adjusting for group, sex, race, age, baseline BMI, and baseline trait value were used to compare changes in lipoprotein subfractions in exercise groups to changes in control. Results: AT resulted in nominal ($p < 0.05$) changes in small HDL-P (H2 (7.8nm): $-0.69 \mu\text{mol/L}$, $p = 0.032$, H1 (7.4nm): $0.44 \mu\text{mol/L}$, $p = 0.03$), and RT increased medium LDL-P (43.89 nmol/L, $p = 0.002$), while AT/RT failed to produce changes in any lipoprotein subclass. Adjusted GLMs revealed the change in H2 HDL-P was less in AT compared 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 subfractions 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

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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 (MICT) protocols. METHODS: Forty-four elderly people diagnosed with T2DM for less than 5 years ($BMI = 30.57 \pm 2.56\text{kg/m}^2$, 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 ($vVO_2\text{max}$). Subsequently, they were allocated to three different groups and used for eight weeks of physical exercise, which were: MICT (14' at 70% of $vVO_2\text{max}$), G2: (5' - 2' at 100% of $vVO_2\text{max}$ with 2' of passive rest) and G30:30 (20' - 30" at 100% of $vVO_2\text{max}$ and passive rest). To capture HR, a heart rate monitor (Polar, v800, Finland)

was used. HRV data were analyzed using Kubios HRV software, and exponential data were analyzed using CardioKin software. To compare the protocols, the two-way ANOVA test with repeated measures, $p = 5\%$ was used. **RESULTS:** group x time interaction was observed in the SDNN [$F(2,82) = 3,462$; $p = 0.036$]. After performing multiple comparisons on SDNN variable, as a function of time, only the HIIT-30:30 group showed a significant difference ($p = 0.025$), the rMSSD variable showed no difference in any evaluation. In the off parameters, group effect was found in the TAUoff variables [$F(2,82) = 4,710$; $p = 0.012$] time effect for AMPoff was found [$F(1,82) = 4,881$; $p = 0.030$]. It was also observed group x time interaction in TAUoff [$F(2,82) = 3,146$; $p = 0.048$]. In the variables in which group x time interaction was observed post hoc to obtain multiple comparisons, the MICT group presented higher TAUoff values when compared to the groups HIIT-30:30 and HIIT-2:2 ($p = 0.001$ and 0.013 , respectively) representing a demonstrated post-exercise sympathetic hyperactivity. **CONCLUSION:** Of all evaluated protocols, the 30:30 protocol was the one that presented the best HR response, and thus, the application of this protocol is effective in improving autonomic control, without greater risk for diabetics.

497 Board #313 May 27 10:30 AM - 12:00 PM

Cardiopulmonary Differences Between Normal And Overweight Diabetics

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(No relevant relationships reported)

Diabetes Mellitus (DM) is one of the most common lifestyle-associated diseases worldwide. DM is often correlated to sedentary lifestyle, poor nutritional behaviors and high body fat. Therefore sedentary and overweight people are at high risk of having DM. However, there are also normal weight diabetics in which these factors may be less strongly correlated. **PURPOSE:** To comprehensively describe differences between normal and overweight patients with DM using cardiopulmonary exercise testing. **METHODS:** As part of two separate exercise trials being run on normoweight (STRONG-D) and overweight (IMPACT) diabetics, patients performed individualised ramp CPET. Results of CPET were compared between the groups using statistics for multiple between group comparisons. **RESULTS:** Besides known demographic and anthropometric differences, the normoweight group also reached significantly ($p<0.01$) higher workload (17%), higher peak ventilation (11%) and oxygen uptake (12%), higher heart rate recovery (6%), and had lower resting heart rate (11%) and ventilatory efficiency (21%). **CONCLUSIONS:** DM is in itself a risk factor for further cardiovascular disease, but the DM risk profile may be more sensitively identified through examination of exercise performance.

498 Board #314 May 27 10:30 AM - 12:00 PM

Influence Of Fasting Blood Glucose On Cardiopulmonary Responses To Maximal Exercise

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(No relevant relationships reported)

Cardiopulmonary exercise testing (CPET) is used in the diagnosis and prognosis of several chronic diseases. However, the impact of impaired fasting glucose regulation on CPET responses is unknown. **PURPOSE:** To examine the influence of fasting blood glucose status on CPET responses to maximal exercise. **METHODS:** Apparently healthy adults ($n=3863$) from the Ball State Adult Fitness Longitudinal Lifestyle Study (BALL ST) were examined. Participants were categorized by fasting blood glucose status according to American Diabetes Association guidelines as normal (NORMAL, $n=2738$, 50% male, plasma glucose $88\pm 9 \text{ mg}\cdot\text{dl}^{-1}$), prediabetes (PRE, $n=938$, 66% male, plasma glucose $107\pm 9 \text{ mg}\cdot\text{dl}^{-1}$) or diabetes mellitus (DM, $n=187$, 60% male, plasma glucose $152\pm 51 \text{ mg}\cdot\text{dl}^{-1}$). All participants performed a maximal CPET for the determination of cardiorespiratory fitness (CRF), ventilatory threshold (VT), ventilatory efficiency slope (V_{Eslope}), oxygen uptake efficiency slope (OUES), oxygen pulse ($\dot{O}_2\text{pulse}$), exercise ventilatory power (EVP), and exercise circulatory power (ECP). Analysis of variance (ANOVA) was used to compare group means. **RESULTS:** Age- and sex-adjusted CRF (expressed as percentiles based on the Fitness Registry and Importance of Exercise National Database (FRIEND)) was inversely related to fasting blood glucose status (NORMAL>PRE>DM; 47 ± 28 , 41 ± 28 , 26 ± 24 percentile, $p<0.05$ for all) as was VT (NORMAL>PRE>DM; 19.5 ± 8.0 , 17.9 ± 6.8 , $15.1\pm 5.2 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$, $p<0.05$ for all). EVP was lower ($p<0.05$) for NORMAL ($6.6\pm 1.7 \text{ mmHg}$) compared to PRE ($7.1\pm 1.8 \text{ mmHg}$) and DM ($7.2\pm 2.8 \text{ mmHg}$). ECP was lower ($p<0.05$) for DM ($4575\pm 1611 \text{ mmHg}\cdot\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) compared to NORMAL ($5498\pm 1986 \text{ mmHg}\cdot\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) and PRE ($5410\pm 1790 \text{ mmHg}\cdot\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$). $\dot{O}_2\text{pulse}$ was higher ($p<0.05$) in PRE ($15.4\pm 4.5 \text{ ml}\cdot\text{beat}^{-1}$) compared to NORMAL

($14.5\pm 5.3 \text{ ml}\cdot\text{beat}^{-1}$) and DM ($13.9\pm 4.0 \text{ ml}\cdot\text{beat}^{-1}$). No differences between groups existed for V_{Eslope} or OUES. **CONCLUSION:** These data demonstrate that impaired fasting glucose regulation is associated with altered CPET responses indicating that CPET may be an additional diagnostic tool in the diagnosis of diabetes.

499

Board #315

May 27 10:30 AM - 12:00 PM

The Effects Of Resveratrol And Exercise Training On Functional Fitness In Elderly With T2dm

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(No relevant relationships reported)

Although resveratrol has potential to be an ‘exercise pill’, studies that have observed the effects of resveratrol after it was consumed by diabetics, to whom exercise was very important, were limited. In particular, studies that both observed and compared the effects of resveratrol intake and aerobic exercise done at the same time by T2DM elderly women, who tend to lack treatment and care the most, were needed. Thus, in this study, the body composition, aerobic exercise ability and functional fitness effects in T2DM elderly women was observed throughout 8 weeks of treatment. **PURPOSE:** The purpose of this study was to investigate the effects 8 weeks of aerobic training and resveratrol supplementation on body composition, aerobic exercise capacity, and functional fitness in T2DM elderly women. **METHODS:** Fifty T2DM elderly women (70.5 ± 4.4) were randomly assigned to either a combined aerobic training and resveratrol supplementation group (EX+R: $n=12$), an aerobic training only group (EX: $n=12$), a resveratrol supplementation only group (R: $n=13$), or a control group (CON: $n=13$). The subjects in EX exercised three sessions per week, the subjects in R took in resveratrol for $500 \text{ mg}\cdot\text{d}^{-1}$ for 8 weeks, 40 minutes per session for 8 weeks, and the subjects in EX+R participated in both treatment. **RESULTS:** Body composition did not change significantly in all groups. However, aerobic exercise capacity ($\dot{V}\text{O}_{2\text{max}}$) increased significantly in EX+R ($38\pm 2.9 \text{ vs. } 42.8\pm 2.5 \text{ ml/kg/min}$, $P<.001$) and R ($33.9\pm 7.5 \text{ vs. } 37.3\pm 7.9 \text{ ml/kg/min}$, $P<.05$). Functional fitness Chair sit-to stand was increased significantly in EX+R ($19.1\pm 4.9 \text{ vs. } 21\pm 4.1 \text{ reps}$), EX ($19.8\pm 3.3 \text{ vs. } 22.5\pm 4.3 \text{ reps}$), and R ($20.6\pm 4.4 \text{ vs. } 22.3\pm 3.6 \text{ reps}$). Foot tapping in a sitting down was increased significantly in EX+R ($26.6\pm 3.8 \text{ vs. } 30\pm 3.6 \text{ reps}$, $P<.05$) and EX ($26\pm 5.5 \text{ vs. } 31.2\pm 4.2 \text{ reps}$, $P<.01$). Also, pegboard increased significantly in EX+R ($38.8\pm 4.0 \text{ vs. } 41.5\pm 3.8 \text{ reps}$, $P<.05$), EX ($39\pm 4.5 \text{ vs. } 41\pm 4.4 \text{ reps}$, $P<.05$) and R ($38.3\pm 2.4 \text{ vs. } 41\pm 2.9 \text{ reps}$, $P<.01$), whereas the other functional fitness-related variables showed no significant changes in all groups. **CONCLUSIONS:** It was concluded that the 8 weeks of resveratrol supplementation and aerobic training combined had positive effects on aerobic exercise capacity and functional fitness of T2DM elderly women.

500

Board #316

May 27 10:30 AM - 12:00 PM

No Difference In Heart Rate Recovery During Graded Treadmill Testing In Patients With And Without Nonalcoholic Fatty Liver Disease (NAFLD)

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(No relevant relationships reported)

Cardiac Mortality is the most common cause of death for nonalcoholic fatty liver disease (NAFLD), which is linked to physical inactivity and obesity. **PURPOSE:** To determine whether individuals with NAFLD show heart rate recovery impairment (HR_{IR} is ≤ 12 beats per minute at 1 minute post-exercise, an independent predictor of mortality) compared to non-NAFLD participants following graded treadmill testing (GTT) to volitional exhaustion.

METHODS: Non-pharmacological clinical research participants with and without NAFLD were included. All performed symptom-limited, Modified Bruce GTT. Gas exchange captured cardiorespiratory variables and impedance cardiometry assessed heart rate, stroke volume, and cardiac output (CO) continuously during rest, testing, and recovery. Participants completed nutrition, activity, and fatigue questionnaires. Linear regression assessed effects of covariates on HR_{IR}.

RESULTS: 86 participants (48.8% Male, 62.8% Caucasian, 65.8% NAFLD/NASH, Age 48 ± 13.6 years) were included for analysis. T-test comparisons showed individuals with NAFLD to be older (52 vs 41.4 years, $p=.001$), have higher body mass index (31.2 vs 28.4 kg/m^2 , $p=.007$), and increased body fat percentage, (34.1% vs 28.6% , $p=.006$) but showed no differences for resting pulse, blood pressure, gender, or ethnicity. Per GTT, individuals with NAFLD had reduced oxygen consumption at anaerobic threshold (AT) (12.3 vs 15.6 mL/kg/min) and peak exertion (23.1 vs 31.2 mL/kg/min , $p<.001$) compared to non-NAFLD. The NAFLD cohort also reported reduced maximal and average activity scores compared to the non-NAFLD group (MAS 89.8 vs 81.4 , $p=.001$; AAS 88.1 vs 77.6 , $p<.001$). No group differences were

found for iHRR presence or continuous HRR measure. Stepwise linear regression showed peak CO ($B=0.317$, $p=.041$) and MAS ($B=.348$, $p=.025$) to be significant predictors of HRR for all participants ($R^2 =.261$).

CONCLUSIONS: No HRR post exercise differences were found between NAFLD and non-NAFLD individuals. Increased CO and self-reported exercise capacity may indicate lower probability of impaired HRR. AAS and MAS were reduced in the NAFLD group, which may reflect reduced aerobic capacity at peak performance and AT. NAFLD individuals may benefit from exercise participation encouragement to improve tolerance of physical activity.

501 Board #317 May 27 10:30 AM - 12:00 PM
A Simple Smartphone-based Physical Activity Level Did Not Predict Obesity Prevalence In Type 2 Diabetes Patients In Korea

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(No relevant relationships reported)

PURPOSE: Obesity management in patients with type 2 diabetes (T2DM) is very important for improving insulin resistance. One of the factors affecting obesity management is physical activity level (PAL). The purpose of this study was to investigate the relationship between obesity and the daily physical activity level monitored by smart-phones in T2DM patients.

METHODS: A total of 325 patients with T2DM who have enrolled a diabetes self-management App (iCareD, Medical Excellence Inc., Korea) linked to an electronic medical record (EMR) at least for 30 days was enlisted. The daily walking steps were monitored by a 3-axis accelerometer embedded in the smartphone. And 268 patients who walked over an average of 1,000 step/day in 30 days (163 men; 58.1 ± 11.8 yrs, 170.9 ± 5.8 cm, 73.7 ± 11.4 kg, and 25.2 ± 3.5 kg/m², 105 women; 55.3 ± 14.6 yrs, 158.1 ± 5.2 cm, 61.0 ± 11.7 kg, and 24.3 ± 4.0 kg/m²) were selected for the analyses of PAL. The medical record (height, weight, and body mass index: BMI) of those selected subjects were retrieved from the hospital. PAL was divided into quartile, and the obesity prevalence was compared by groups. Statistical software SAS version 9.4 were used and statistical significance was set at $p<0.05$.

RESULTS: The average daily PAL for 30 days was $5,209 \pm 3,276$ step/day (n=268). Those who walked >7,500 step/day were 20.8% (n=56). The quartile was divided by 67 patients at $\leq 2,452$, between $>2,452$ and $\leq 4,655$, between $>4,655$ and $\leq 7,009$, and $>7,009$ step/day, for the 1st, 2nd, 3rd, and 4th quartile, respectively. The total obesity prevalence with BMI ≥ 25 kg/m² was 41.7% (n=112). The group obesity prevalence was 47.7% (n=32), 44.7% (n=30), 40.2% (n=27), and 34.3% (n=23), in 1st, 2nd, 3rd, and 4th quartile, respectively ($p=0.459$).

CONCLUSIONS: This study revealed a quantification of PAL monitored by smartphones in Korean T2DM patients. The majority of the subjects did not meet the recommended activity level guided by the American Diabetes Association (7,500~9,999 step/day). The low level of PAL may be due by data collection modality such as smartphones. Further studies are required. (study funded by NRF-2014M3A9D7070333).

502 Board #318 May 27 10:30 AM - 12:00 PM
Acute Vs. Chronic Responses To Exercise Training In Type-2 Vs. Pre-diabetic Adults.

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(No relevant relationships reported)

Exercise is recommended for improving glycemic control yet it remains unclear whether exercise training produces similar acute and chronic adaptations in T2DM vs. pre-diabetic individuals given their varying states of insulin resistance. **PURPOSE:** To compare acute and chronic exercise training adaptations in response to the same exercise training program in T2DM vs. pre-diabetic individuals. **METHODS:** 18 male (n=8) and female (n=10), previously inactive (no planned physical activity), adults with T2DM (n=10) or pre-diabetes (n=8) completed the same exercise training program (3 days/wk, 8 wks). Before and exactly 72-hr after participants' last exercise session, chronic adaptations in body fat percentage ([BF%] assessed via dual x-ray absorptiometry), fitness determined by a 6-minute walk test, resting systolic (SBP) and diastolic (DBP) blood pressure, fasting blood glucose (BG), and self-efficacy using the Self-Efficacy for Exercise Scale (SEE) were measured. Participants' SBP, DBP, and BG were also monitored immediately before and 5-min after each exercise session to determine acute responses to exercise. **RESULTS:** A significant improvement in 6MWT was observed for T2DM (1544 ± 82 vs. 1752 ± 80 ft., $p<0.01$) and pre-diabetic

(1414 ± 97 vs. 1624 ± 115 ft., $p<0.01$) participants. No significant chronic or acute changes were observed in SBP for either group. A significant improvement in resting DBP was observed in T2DM (80 ± 2 vs. 75 ± 3 mmHg, $p=0.03$) but not pre-diabetic (75 ± 2 vs. 79 ± 3 mmHg, $p=0.13$) participants yet no acute changes were observed in DBP for either group. No significant changes were observed in fasting BG in either group. Acutely exercise resulted in significantly lower BG in diabetic (172 ± 12 vs. 145 ± 11 mg/dL, $p<0.01$) and pre-diabetic (104 ± 4 vs. 95 ± 3 mg/dL, $p<0.01$) participants. A significant improvement in SEE was observed in diabetic (34.3 ± 9.0 vs. 65.0 ± 9.0 , $p=0.029$), but not pre-diabetic (38.8 ± 12.8 vs. 60.0 ± 12.8 , $p=0.24$) participants.

CONCLUSION: Despite varying states of insulin resistance, exercise training resulted in similar improvements in fitness and acute improvements in blood glucose in both diabetic and pre-diabetic adults. However, unlike pre-diabetics, diabetic participants experienced additional benefits in resting diastolic blood pressure and exercise self-efficacy.

503 Board #319 May 27 10:30 AM - 12:00 PM
Accuracy Of Continuous Glucose Monitoring During Exercise In Type I Diabetes Patients

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Subcutaneous continuous glucose monitor devices provide a more detailed description of glycemic control. This may be particularly useful as a tool to detect hypo- or hyperglycemia during exercise. Performance of continuous glucose monitor devices, however, is likely to be lower when glucose levels are changing rapidly, such as occurs during exercise. **PURPOSE:** To determine the accuracy of a subcutaneous continuous glucose monitor during exercise in Type I Diabetes patients. **METHODS:** Paired subcutaneous continuous glucose monitor (Freestyle Libre, Abbott Diabetes Care, Witney, UK) and capillary glucose values were collected, from 38 adults (20 women and 18 men; mean \pm SD, 45 ± 14 years) with Type I Diabetes, at rest, low- (40%HRR), moderate- (70%HRR), and high-exercise intensity ($>85\%$ HRR). Mean Absolute Relative Differences (MARD) was used to determine accuracy. **RESULTS:** The glucose values (mg/dL) for subcutaneous continuous glucose monitor and capillary glucose monitor did significantly differ at low- (mean \pm SD; 164 ± 70 vs 144 ± 54) and moderate-exercise intensity (148 ± 61 vs 131 ± 50) ($P < 0.05$), but not at rest (177 ± 72 vs 170 ± 59) and high-exercise intensity (142 ± 53 vs 144 ± 45) ($P > 0.05$). MARD at rest was 4%, while the individuals MARDs were 14%, 13%, and 2% for low-, moderate-, and high-exercise intensity, respectively. **CONCLUSIONS:** Continuous glucose monitoring was not sufficiently accurate to describe glucose levels at low-to-moderate exercise intensities in Type I Diabetes patients and require confirmatory capillary glucose measurements.

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

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(No relevant relationships reported)

A major obstacle in exercise-based rehabilitation is exercise compliance. Monetary incentives are associated with greater exercise compliance and improvements in health, yet an ideal monetary system has yet to be identified. **PURPOSE:** To examine exercise compliance and health outcome measures associated with fixed- vs. incremental-loss monetary systems during an exercise training in a clinical population. **METHODS:** 17 male (n=7) and female (n=10), previously inactive (no planned physical activity), hyperglycemic (T2DM, n=9; pre-diabetes, n=8), adults (53 ± 2 yrs.) 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 for each session missed per week: \$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- vs. incremental-loss group ($90 \pm 4\%$ vs. $92 \pm 3\%$, $p=0.63$). No significant differences were observed between groups or in

response to exercise training for BF%. Similar improvements were observed in the 6MWT for the fixed-loss (1534±99 vs. 1799±99 ft, $p<0.001$) and incremental-loss (1455±93 vs. 1585±93 ft, $p=0.04$) groups. Similar reductions were also observed in average acute blood glucose response from pre to post-exercise in the fixed- (131±18 vs. 114±11 mg/dL, $p=0.03$) and incremental-loss (152±23 vs. 132±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 system, modest monetary incentives appear to promote high exercise compliance that was associated with meaningful health benefits including improved fitness and blood glucose control for hyperglycemia individuals.

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, $\text{HbA1c } 36.09 \pm 4.18$, $\text{HbA1c } 7.05 \pm 0.85\%$) 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 \times group interactions for irisin ($p<0.001$), C-peptide ($p=0.002$), 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 irisin level had significantly increased. In addition, HbA1c and Glucose were significantly decreased to improve glycemic control, and C-peptide, CPI and HOMA- β levels were significantly increased. Fasting glucose ($r=-0.424$), HbA1c ($r=-0.351$), SBP ($r=-0.397$) and percentage of body fat ($r=-0.423$) changes level showed a negative whereas HOMA- β ($r=0.411$) and aerobic endurance ($r=0.355$) changes level had a positive correlation with irisin 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 irisin 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 effects of acute continuous 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.

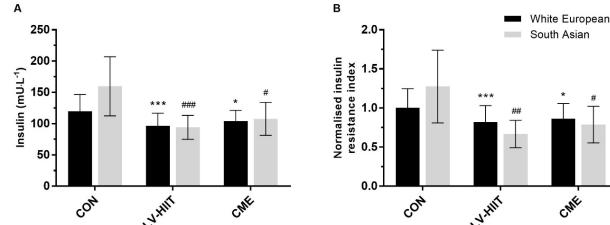
METHODS: 23 participants (WE / SA [M/F]: 13[6/7] / 10[7/3]; median (IQR): age 67 (60–68) years, BMI 30.0 (28.4–32.8) kg/m², waist circumference 100.8 (97.6–109.1) cm, HbA1c 5.9 (5.8–6.1) %) completed three 6 h trials (control [CON], CME, LV-HIIT; randomized order). Participants rested throughout, except for 35 min of CME and 25 min of LV-HIIT (closely matched for external work produced) during corresponding trials. Both CME and LV-HIIT ended at 2 h. Standardized meals were consumed at 0 and 3 h. Plasma glucose and insulin were measured at 0, 0.5, 1, 2, 3, 3.5, 4, 5 and 6 h. Data were analysed as post-exercise time-averaged area under the curve (AUC_{post}), using generalized estimating equations, adjusted for pre-exercise AUC

(also time-averaged), sex and age. Main effects of trial and ethnicity were assessed, with an interaction term fitted to explore if ethnicity modulated responses. Insulin resistance index (IRI) was calculated as tAUC_{glu} \times tAUC_{ins}.

RESULTS: Glucose was unaffected (all $p \geq 0.28$), but insulin AUC_{post} was reduced in both exercise trials compared to CON (main effect $p < 0.001$; Figure 1A). Furthermore, this effect was modulated by ethnicity ($p = 0.03$), with a greater effect seen in SAs. Notably, insulin AUC_{post} was similar in both ethnicities during exercise trials, despite being higher in SAs during CON (Figure 1A). Results were similar for IRI (Figure 1B).

CONCLUSION: Despite ~30% higher post-prandial insulin responses during prolonged sitting, SAs may benefit more from acute exercise than WEs. Acknowledging that this was an acute-crossover study, these findings warrant further investigation with longer-term exercise training interventions, given the higher cardiometabolic disease risk observed in SAs.

Figure 1 – Post-exercise responses of (A) insulin and (B) insulin resistance index during each trial in each ethnicity group.



Data presented as mean (95% confidence interval); **/## indicate significant differences from the CON trial within ethnicity group (* $p < 0.05$, **/ $p < 0.01$, ***/## $p = 0.001$). Data for insulin resistance index presented normalised to the mean value during the CON trial in the white European group, for ease of interpretation. CME: continuous moderate-intensity aerobic exercise trial; CON: control trial; LV-HIIT: low-volume high-intensity interval training.

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 \times 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), between intervention and control treatments after adjustment for covariates (e.g., age, sex, and race).

Results: There were significant mean differences 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 (iAUC 3.98 mmol·h/L vs 6.92 mmol·h/L, $p = 0.006$, effect size [ES] = 1.72) and the motor-assisted cycling (iAUC, 3.98 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.

508 Board #324 May 27 10:30 AM - 12:00 PM

Value And Challenges Of Investigating Real-world Effectiveness Of Exercise Physiology Services For Type-2 Diabetes

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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 in tightly controlled research trials. **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 $7 \pm 1\%$, 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.

509 Board #325 May 27 10:30 AM - 12:00 PM

Glycemic Effects Of Exercise In Sri Lankans Adults With Type 2 Diabetes Mellitus

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The prevalence of type 2 Diabetes Mellitus (T2DM) is rising in South Asia. Although exercise training is recommended for its management, the effects of exercise training on glycemic control in Sri Lankans with T2DM has not been studied. **PURPOSE:** To examine the effects of aerobic training (AT) and resistance training (RT) on glycemic control in Sri Lankan adults with T2DM. **METHODS:** 86 Sedentary Sri Lankans (50.1 ± 8.7 years, 53% women) diagnosed with T2DM within last 6 years were randomized into AT (n=28), RT (n=28) or control (CN, n=30). Supervised exercise training was performed for 75 minutes per session, 2 days/week for 12 weeks. RT targeted 7 (i.e., 3 upper body, 3 lower body, 1 core) exercises. AT included brisk walking, stepping and stationary cycling at an intensity of 60-75% heart rate max. Fasting blood glucose (FBG), HbA1c, and fasting insulin (FI) were measured at baseline and post intervention. **RESULTS:** Baseline mean BMI, HbA1c, FBG and FI were $26.4 \text{ kg/m}^2 \pm 4.0$, $8.2 \pm 1.7\%$, $146.9 \pm 54.1 \text{ mg/dl}$ and $13.3 \pm 8.5 \text{ micIU/ml}$, respectively. Subject characteristics were similar among groups, except the CN group had higher mean HbA1c level ($8.9 \pm 1.7\%$). Absolute mean change in HbA1c was not

significant across groups; RT 0.6% (95% CI; 1.16% to -0.01%, p=0.8), AT 0.74% (95% CI; 1.25% to -0.24%, p=0.5) or CN 0.52% (95% CI, 1.1% to 0.03%, p=0.8). Absolute mean change in FBG significantly improved in RT (-3.8 mg/dl [95% CI, 4.9 to -12.6 mg/dl; p=0.02]) and CN (25.6 mg/dl [95% CI; 48.5 to 3.0 mg/dl, p=0.04]), but not AT (20.1 mg/dl [95% CI, 39.6 to 0.6 mg/dl, p=0.5]). Absolute mean change in FI did not significantly increase in RT (0.2 micIU/ml [95% CI, 2.9 to -2.4 micIU/ml, p=0.1]) or AT (0.2 micIU/ml [95% CI; 2.9 to -2.5 micIU/ml, p=0.1]) but did in the CN group (3.0 micIU/ml [95% CI, 0.8 to -8.3 micIU/ml, p=0.00]). **CONCLUSION:** To our knowledge this is the first randomized controlled trial to study the effects of AT and RT on glycemic control in Sri Lankan diabetics. Intervention showed mixed effects in improvement in chronic glycemic control (HbA1c) and in short term glycemic control (FBG). FI did not increase in intervention groups which demonstrated reduced disease progression. Future studies with larger sample sizes are need for definitive conclusions.

510 Board #326 May 27 10:30 AM - 12:00 PM

Improvement In Insulin Sensitivity With Four Weeks Of Neuromuscular Electrical Stimulation In Overweight/obese Sedentary Adults

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(No relevant relationships reported)

Most U.S. adults (80%) do not meet minimum exercise recommendations by ACSM (CDC, 2015). Using an *in vitro* primary cell culture model, we and others have shown that muscle contraction induced by electrical stimulation results in increased glucose transporter 4 (GLUT4) protein, glucose uptake and mitochondrial content. Neuromuscular electrical stimulation (NMES) is a novel alternate strategy to induce muscle contraction, using electrical impulses. However, effectiveness of NMES induced muscle contraction to improve insulin sensitivity and energy expenditure is not clear.

PURPOSE: To investigate the effects of four weeks of NMES on insulin sensitivity in a sedentary overweight/obese population.

METHODS: Sedentary overweight/obese participants (n=8; age: 37.0 ± 3.6 years; BMI = $30.9 \pm 1.1 \text{ kg/m}^2$) were randomized into either a control or NMES group. All participants received bilateral quadriceps stimulation (12 sessions, 30 minutes/session, 3 times/week) either using low intensity sensory level (control) or at high intensity neuromuscular level (NMES) for four weeks (50Hz and 300μs pulse width). Insulin sensitivity was assessed by three-hour oral glucose tolerance test (OGTT) at baseline and after four weeks of NMES intervention.

RESULTS: Control and NMES group had comparable fasting blood glucose (Control 106.1 ± 3.1 ; NMES $107.9 \pm 3.9 \text{ mg/dL}$; p=0.74) and glucose tolerance (Control 430.73 ± 20.23 ; NMES $469.97 \pm 28.03 \text{ AU}$; p=0.30) at baseline. Four weeks of NMES resulted in significant improvement in insulin sensitivity measured by OGTT, whereas no change was observed in control group (Control 430.73 ± 20.23 to $418.36 \pm 15.13 \text{ AU}$; p=0.62; NMES 469.97 ± 28.03 to $423.97 \pm 31.53 \text{ AU}$; p=0.04). Additionally, blood glucose level measured after 2 hours of glucose drink consumption tended to be lower after 4 weeks of NMES treatment (154.38 ± 8.71 to $140.25 \pm 9.46 \text{ mg/dL}$, p=0.052) whereas no change was observed in control group (151.75 ± 6.14 to $139.75 \pm 9.03 \text{ mg/dL}$, p=0.33).

CONCLUSION: NMES is a novel and effective strategy to improve insulin sensitivity in an at-risk overweight/obese sedentary population.

511 Board #327 May 27 10:30 AM - 12:00 PM

Exercise Prescription Is An Effective Action To Achieve 3B Targets In T2DM

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PURPOSE: To explore the effects of exercise prescription on the effect of achieve blood glucose, blood pressure and blood lipid(3B) targets of T2D patients.

METHODS: T2D patients aged from 18 years to 75 years were assigned to the exercise prescription group (ExRx), 10000-steps group (Steps), or education group (Edu). CPT, anthropometric and blood test was assessed at baseline and after 12 weeks intervention in all participants. Participants were asked to achieve moderate exercise (50%-60% VO_{2max}, self-monitored heart rate) for a minimum of 30min/d, 5d/week for ExRx group, or achieve 10,000 steps a day as pedometer monitored, at least 5d/week for Steps group, or receive exercise education every 4 weeks but not make exercise records for Edu group. Follow-up was performed every four weeks. The primary outcome was the improvement of fitness and glucose control of T2D; secondary outcomes were the achievements of 3B targets of T2D.

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 VO_{2max} were significantly increased by 2.49±5.92METs in ExRx group compared with Steps group(0.53±1.23 METs) and Edu group (-0.54±4.82 METs)(P<0.001); FPG decreased 0.39±1.79mmol/L(P<0.001), no intergroup difference; HbA1c were significantly decreased 0.37±0.92% in ExRx group compared with Steps group(0.12±1.05%) and Edu group (-0.05±1.09%)(P<0.05). After intervention for 12 weeks, the proportion of patients who achieved 3B targets increased from 10.5% to 17.0%, while VO_{2max} increased 0.74±3.34METs for all participants. Participants who achieves the three targets got an improvement of 1.03±3.60METs in VO_{2max} 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 targets got an improvement of 1METs in VO_{2max} 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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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) and Fitbit consecutively for a period of two weeks or more were included in the data analysis. Glucose variability was determined using 2-weeks of CGM data and PA intensity time was retrieved through 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 ($\beta = -0.12$, $p = 0.03$). **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

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 Schlagheckl¹, Niklas Joisten¹, Annette Rademacher¹, Sebastian Proschinger¹, Max Oberste¹, Alexander Schenk¹, Jan Kool², Wilhelm Bloch¹, Jens Banski², Philipp Zimmer¹. ¹German Sport University Cologne, Cologne, Germany. ²Kliniken- Valens, Valens, Switzerland.

(No relevant relationships reported)

Sport and Exercise have been described to promote positive effects on psychosocial symptoms of multiple sclerosis (MS) such as fatigue, depression and anxiety. However, detailed recommendations for intervention programs in the rehabilitation of MS have not been proposed yet.

PURPOSE: The present study aims to compare the influence of high intensity interval (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 (5×1.5 minutes at 95–100% of participants' maximal heart rate (HR_{max})) or moderate continuous aerobic exercise (MC) (24 minutes continuous cycling at 65% of HR_{max}) on a bicycle ergometer. Before (t0) and after (t1) the training period, fatigue, depression and anxiety were assessed using the multidimensional fatigue scale for motor and cognitive functions (FMSMC) and the Hospital and anxiety scale (HADS). Effects of within (t0 vs. t1) - and between (HIIT vs. MC, relapsing remitting type vs. secondary progressive type) - subjects have been analyzed by baseline-adjusted analysis of variance (ANCOVA).

RESULTS: At the time of allocation, 68 patients were identified to have mild fatigue (sum score ≥ 43) and were included in the analysis of FMSMC. ANCOVA revealed significant time effects for the FSCM sum score ($F(1)=7.188$, $p=.009$). While people with relapsing remitting type of MS improved in both HIIT ($p\leq .001$) 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 FMSMC outcomes. Regarding HADS, 38 patients with mild depression or anxiety (HADS-TS ≥ 8) at the time of allocation were analyzed. No significant time, group and interaction effect for any outcome was observed.

CONCLUSION: There are no differences in the impact of HIIT vs. MC on fatigue, depression and anxiety in people with MS. However, people with relapsing remitting MS tend to react more sensible for positive effects of aerobic exercise in general regarding fatigue than people with secondary progressive MS. Nonetheless, results need to be taken with caution, since no main effect for group and MS type was detected.

514 Board #330 May 27 9:30 AM - 11:00 AM

High-intensity Interval Training In Inflammatory Rheumatic Disease Patients: Treatment By Man Or Machine?

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Reported Relationships: H. Haglo: Other (please describe); My employer (Myworkout AS) is the developer of the application used in this study.

High-intensity interval training (HIIT) is documented to counteract the reduced maximal oxygen uptake ($\dot{V}O_{2max}$) and poor cardiovascular health associated with inflammatory rheumatic disease (IRS). However, supervised HIIT is resource demanding.

PURPOSE: This study sought to investigate if guidance by a smartphone application (APP: Myworkout GO) could yield similar HIIT-induced effects as supervision by healthcare professionals. **METHODS:** Thirty-four adults (27 females, 50±11 yrs; 7 males, 52±10 yrs), diagnosed with rheumatoid arthritis, spondyloarthritis or systemic lupus erythematosus were randomized to a supervised group (SG) or an APP group (AG). Both groups performed 4x4 minute intervals with an intensity corresponding to 85–95% of HR_{max} twice a week for 10 weeks. Treadmill $\dot{V}O_{2max}$ and health-related quality-of-life (HRQoL), measured using SF-36, was assessed before and after the exercise period. **RESULTS:** $\dot{V}O_{2max}$ increased ($p<0.001$) in both groups, revealing

3.6 ± 1.4 (SG) and 3.7 ± 1.5 mL·kg $^{-1}$ ·min $^{-1}$ (AG) improvements, with no between-group differences apparent. Improvements in the following HRQoL dimensions; bodily pain, vitality, social functioning and emotional wellbeing were observed for both groups (all $p < 0.001$ – 0.05). Again, with no between-group differences detected. **CONCLUSION:** HIIT increased $\dot{V}O_{2\text{max}}$ 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.

515	Board #331	May 27 9:30 AM - 11:00 AM
High-intensity Interval Training Reduces Symptom-And Disability-associated Inflammation Marker In Persons With Multiple Sclerosis		
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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 cardiorespiratory fitness (chronic only) in PwMS.

Methods: An interim analysis of a randomized controlled trial comparing 3-weeks of HIIT vs. MCT during inpatient rehabilitation was conducted. 60 PwMS (mean age 49.7 yrs, EDSS 3–6) with relapsing remitting ($n=38$) and secondary progressive ($n=22$) subtype were included. The HIIT group performed 5×1.5 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 3×/week. An incremental exercise test with spiroometry was conducted before and after the intervention. To assess chronic effects on NLR, blood samples were collected before (T_0) the first exercise session and after the intervention period (T_3) during resting conditions. To assess acute effects on NLR, samples were also collected immediately (T_1) and 3 hours (h) (T_2) after the first exercise session. NLR was calculated from blood panels. Baseline-adjusted ANCOVAs with Bonferroni post-hoc test were performed.

Results: Relative $\dot{V}O_{2\text{peak}}$ increased in HIIT (mean difference (MD)= 2.47 mL kg $^{-1}$ min $^{-1}$, $p < .001$) and MCT (MD= 1.5 mL kg $^{-1}$ min $^{-1}$, $p = .004$), but no group differences were found. The increase in relative peak power was larger in HIIT than in MCT (MD= $.17$ watts kg $^{-1}$, $p = .031$). NLR decreased after the intervention period (T_3) within HIIT only (MD= $-.27$, $p = .01$). NLR was greater in HIIT 3 h after the first exercise session (T_2) compared to MCT (MD= 1.6 , $p = .05$).

Conclusion: Despite the short intervention period, cardiorespiratory fitness improved in both exercise modalities, whereas HIIT may induce greater enhancements. Only HIIT chronically reduced the NLR, thereby potentially contributing to symptom alleviation in PwMS. This chronic response might be due to repetitive inflammatory states after each HIIT session as reflected by the acute effects.

516	Board #332	May 27 9:30 AM - 11:00 AM
High-intensity Interval Training In Older Adults: A Scoping Review		
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High-intensity interval training (HIIT) is an increasingly popular form of aerobic exercise which includes bouts of high-intensity exercise interspersed with periods of rest. The health benefits and risks as well as the optimal design of HIIT are still unclear. Further, most of the research on the effects and benefits of HIIT has been done in young and middle-aged adults and as such, the tolerability and effects in senior populations is less well-known. **PURPOSE:** To characterize HIIT research that has been done in older adults including protocols, feasibility and safety as well as to identify gaps in the current knowledge. **METHODS:** Five databases were searched with variations of the search terms, "high-intensity interval training, high-intensity exercise" and "elderly, older adults." These searches identified 3377 potential studies which were reviewed for inclusion. Studies were included if they were randomized controlled trials published

in English in or after 2009, if the mean age of a treatment group was 65 years or older, and if the exercise protocols being tested were exclusively high-intensity or high-intensity interval training. **RESULTS:** Of 3377 papers identified in the initial search, 86 met the inclusion criteria. The HIT protocols used varied widely and ranged from a single session of HIT to a year-long program. These studies included both healthy and clinical populations. The greatest number of studies examined HIT in healthy subjects, followed by subjects with cardiac or vascular disease (heart failure, coronary artery disease, hypertension), metabolic dysfunction (Type-2 Diabetes Mellitus, obesity), and chronic obstructive pulmonary disease. Sample sizes ranged from 5 to 618 with 90% of studies including less than 70 subjects. The most common primary outcomes identified in the studies included changes in cardiorespiratory fitness as well as feasibility and safety of the protocols in the target populations. **CONCLUSIONS:** With a few exceptions, most studies had small sample sizes and many included non-clinical populations. Larger studies are needed to further evaluate the clinical effects of HIT in older adults. Additionally, there is much variety in the modes of exercise as well as the HIT protocols being used. Despite this, HIT was generally reported to be well-tolerated and safe in older populations.

517	Board #333	May 27 9:30 AM - 11:00 AM
Use It Or Lose It: What Happens To Bone When High-Intensity Exercise Ceases Or Continues?		
Belinda R. Beck, FACSM ¹ , Steven L. Watson ¹ , Benjamin K. Weeks ¹ , Lisa J. Weis ² , Kirt Myers ¹ . ¹ <i>Griffith University, Gold Coast campus, Australia.</i> ² <i>The Bone Clinic, Brisbane, Australia.</i> Email: b.beck@griffith.edu.au		
<i>Reported Relationships: B.R. Beck: Ownership/interest/stock; Owner & Director, The Bone Clinic, Australia.</i>		

The LIFTMOR trial was the first to show a high-intensity resistance and impact training program (HiRIT) was safe and efficacious for improving bone and physical function in postmenopausal women with low to very low bone mass. While results were promising, the long-term efficacy and safety of HiRIT outside an RCT setting was unknown. **PURPOSE:** The primary aim of the current study was to evaluate the effects of continuing or ceasing HiRIT on bone mineral density (BMD) and physical function of LIFTMOR trial participants. **METHODS:** We report a retrospective observational study of LIFTMOR trial participants. Three years after completion of the LIFTMOR trial, participants in the HiRIT arm of the trial underwent a single testing session. Participants were allocated to one of two groups according to either ongoing HiRIT participation (compliance $>25\%$; HiRIT-HiRIT), or cessation of HiRIT (HiRIT-CON) after LIFTMOR. The LIFTMOR testing protocol was employed, including; BMD at the lumbar spine (LS) and femoral neck (FN), back extensor strength (BES), lower extremity strength (LES), functional reach test (FRT), timed up-and-go test (TUG), five times sit-to-stand (FTSTS) and maximal vertical jump (VJ). Data were analysed using repeated measures ANCOVA comparing final LIFTMOR outcomes to 3 year outcomes. **RESULTS:** Twenty-three women (HiRIT-HiRIT, $n = 7$; 64 ± 4 yr, 159.4 ± 6.5 cm, 67.0 ± 7.2 kg and HiRIT-CON, $n = 16$; 65 ± 4 yr, 161.8 ± 5.9 cm, 61.9 ± 9.5 kg) participated in follow-up testing 3.2 ± 0.6 yrs post-LIFTMOR. There were no characteristic differences between the follow up sample and the LIFTMOR sample at baseline. Significant ongoing gains in BMD were apparent in HiRIT-HiRIT compared with HiRIT-CON at the LS ($8.63 \pm 5.29\%$ vs $2.18 \pm 5.65\%$, $p = 0.042$) and FN ($3.67 \pm 4.45\%$ vs $2.85 \pm 5.79\%$, $p = 0.014$), while the HiRIT-CON group maintained BMD benefits from the LIFTMOR intervention. Between-group differences in functional outcomes favoured HiRIT-HiRIT but did not reach significance. No injuries were reported. **CONCLUSION:** Postmenopausal women with low bone mass continuing HiRIT over a 4 year period continued to improve bone mass, while those ceasing HiRIT maintained the gains achieved from 8 months of HiRIT 3 years previously. HiRIT exercise appears to be a highly effective therapy to reduce risk of osteoporotic fracture by improving bone mass.

518	Board #334	May 27 9:30 AM - 11:00 AM
Effect Of Continuous Versus High-intensity Interval Training In The Management Of Adolescent Overweight		
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<i>(No relevant relationships reported)</i>		

Physical activity (PA) is a widespread strategy for weight management. Yet, the majority of the adolescents with overweight present low levels of PA. PA type and structure may influence not only energy expenditure, but also PA adherence. **PURPOSE:** To analyze: a) the effectiveness of two distinct exercise protocols (continuous- CT versus high intensity interval training- HIIT) on BMI z-score (main outcome) and other anthropometric/clinical outcomes in adolescents with overweight; b) the participants' compliance with both exercise protocols. **METHODS:** Anthropometric and clinical data from 60 adolescents (Control, $n=20$; CT, $n=21$; HIIT, $n=19$) with overweight ($BMI \geq p85$ - WHO reference) recruited for the non-

randomized controlled trial PAC-MAnO (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 analyze differences between groups. **RESULTS:** HIIT was the only group showing a significant decrease in BMI z-score (-0.19 ± 0.23 , $p=.002$) and Waist/Hight Ratio (WHR) (-0.02 ± 0.03 , $p=.018$); and an increase in Fat-and-bone free-mass ($0.8 \pm 1.1\%$, $p=.041$) and $\text{VO}_2 \text{ max}$ (148.2 ± 122.0 ml/min, $p=.001$) compared to baseline. Compared with Control and CT groups, HIIT group showed a higher decrease in BMI z-score ($d=1.16$, $p=.004$; $d=0.72$, $p=.029$) and WHR ($d=1.18$, $p=.013$; $d=0.77$, $p=.019$); and a higher increase in $\text{VO}_2 \text{ max}$ ($d=1.47$, $p=.026$; $d=1.07$, $p=.011$), MPA ($d=2.10$, $p<.001$; $d=0.66$, $p=.044$), MVPA ($d=2.15$, $p<.001$; $d=0.70$, $p=.031$). Time in MVPA during exercise sessions was also higher in the HIIT group compared to CT ($d=1.46$, $p=.004$). Attendance of the exercise sessions was significantly higher among the HIIT participants (57.9 vs 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 Bansl², Annette Rademacher¹, Niklas Joisten¹, Alexander Schenk¹, Max Oberste¹, Jan Kool², Wilhelm Bloch¹, Philipp Zimmer¹. ¹*German Sport University Cologne, Cologne, Germany.* ²*Kliniken Valens, Valens, Switzerland.*
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(No relevant relationships reported)

Persons with multiple sclerosis (pwMS) report lower health-related quality of life (HRQoL) as compared to general and other chronic disease populations. High-intensity interval training (HIIT) has been shown to improve certain physical and cognitive measures more effectively than moderate training in pwMS. **PURPOSE:** To determine the influence of HIIT vs. moderate training over three weeks on HRQoL and motor/processing performance of activities of daily living (ADL) in pwMS with light-to-moderate disability status. **METHODS:** The intervention group (INT; n=36) cycled at 95–100% of HR_{max} during 5×1.5-min high-intensity intervals, whereas the control group (CON; n=36) cycled for 24 minutes at 65% of HR_{max} . Performance of ADL was quantified by the Assessment of Motor and Processing Skills. Physical and mental HRQoL were assessed using the Patient-Reported Outcome Measurement Information System short form Global-10. Between-subject and within-subject effects (baseline vs. post intervention) were analyzed by ANCOVA (Bonferroni corrected). Baseline measures were used as covariates.

RESULTS: Results are presented as MEAN baseline ± MEAN change at post. No significant group interaction for either outcome measure was observed. Physical HRQoL improved significantly in both groups (INT: 12.662 ± 1.256 [SE=.290], $p<.0001$; CON: 12.662 ± 0.773 [SE=.290], $p=.01$), whereas mental HRQoL only improved in CON (13.647 ± 1.247 [SE=.336], $p<.001$). Significant improvements in motor (INT: 1.437 ± 0.203 [SE=.075], $p=.009$; CON: $1.437 \pm .210$ [SE=.081], $p=.012$) and processing (INT: 1.111 ± 0.110 [SE=.053], $p=.042$; CON: 1.111 ± 0.145 [SE=.057], $p=.014$) performance of ADL have been observed in both groups.

CONCLUSIONS: Compared to moderate training, HIIT over three weeks does not show superior effects on HRQoL and ADL measures. However, both HIIT and moderate training seem to have profound clinical impact by improving overall HRQoL and performance of ADL in pwMS. Trial registration NCT03652519

- 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
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PURPOSE: To evaluate acute hemodynamic and autonomic responses to high-intensity interval (HIIT) vs moderate-intensity continuous (MICE) exercise in heated water-based in older hypertensive individuals. **METHODS:** 15 sedentary older hypertensives were randomized in 2:2:1 to HIIT, MICE or without exercise (CON)

sessions. Systolic/diastolic blood pressure (SBP/DBP), pulse wave velocity (PWV), endothelial function (EF) and variability of heart rate (HRV) were assessed before (pre), immediately after (post) and 45 min after intervention (rec). HIIT was consisted of warm-up (4 min), 21 min of 1 min of high-intensity alternating with 2 min of walking at moderate-intensity. MICE was performed by 4 min warm-up followed by 26 min of walking at moderate-intensity. Sessions were controlled using Rating Perceived of Exertion Scale (RPE). Two-way ANOVA (repeated measures) was used to indicate interventions differences and Bonferroni post hoc was used to identify significant differences ($p<0.05$). **RESULTS:** No significant differences were found for PWV and EF. HRV showed an increase in the μ_{HF} (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 HF_{HF} (PRE: 413 ± 874 ms² vs POST: 272 ± 716 ms²; $p < 0.001$), during REC only the HIIT group was able to increase the HF_{HF} index (POST: 272 ± 716 ms² vs REC: 530 ± 1336 ms²; $p < 0.001$). The changes in HF_{HF} during REC was followed by a decreased of LF_{HF} (low frequency band) index after HIIT (POST: 49 ± 24 n.u. vs REC: 33 ± 18 n.u.; $p = 0.013$). None difference was found in pre SBP/DBP ($p>0.05$). Although in post moment SBP was different between CON (153 ± 4) vs MICE (141 ± 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 PRE (122 ± 4) in REC moment (123 ± 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.

- 521** Board #337 May 27 9:30 AM - 11:00 AM
Effects Of High Intensity Resistance Training Protocols On Cardiovascular Parameters In Hypertensive Women
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Establishing an ideal resistance training (RT) protocol for hypertensive individuals has been a challenging task, given the many variables that should be considered in these protocols. In general, the protocols established for hypertensive individuals involve the use of lower loads and a higher number of repetitions. However, recent evidence has shown that this approach might generate negative effects on cardiovascular parameters, especially in the short term, which may indicate a potential risk to participants. In contrast, the use of higher loads but with a reduced number of repetitions does not seem to cause such overload to the cardiovascular system and have been shown to promote comparable gains in variables such as strength, body composition, balance and quality of life. **PURPOSE:** Analyze the effects of different resistance training protocols with lower and higher loads on cardiovascular parameters in hypertensive women. **METHODS:** A randomized crossover design clinical trial was conducted with 20 postmenopausal hypertensive women who underwent a control session and two RT protocols involving 6 and 15 repetition maximum (RM). The cardiovascular variables were collected pre, immediately post, 1 h post, and 24 h post each protocol. Repeated-measures ANOVA was used. **RESULTS:** The HR indices were higher in 15RM protocol immediately and 1 hour after the exercise (86.55 ± 12.81 ; 75.96 ± 11.51) when compared with control (67.14 ± 7.38 ; 66.01 ± 8.88) and 6RM (78.56 ± 9.73 ; 71.29 ± 9.40) sessions ($p < 0.05$). The rate-pressure product indices that represent the myocardial workload also were higher in 15RM protocol immediately (12089.59 ± 3022.77) and persisted in 1 hour after (9947.44 ± 2184.58) the exercise when compared with control (8830.83 ± 1394.09 ; 8800.71 ± 1498.79) and 6RM (11002.58 ± 1986.82 ; 9226.33 ± 1604.68) sessions ($p < 0.05$). **CONCLUSIONS:** Performing high intensity RT with lower loads and a higher number of repetitions seems to promote higher heart rate and rate-pressure product, which may be related to an increased cardiovascular stress. Although the 6RM protocol also raises these parameters immediately after, these changes were not evident within 1 hour and may serve as an indication that the use of high loads may be safe to the cardiovascular system in hypertensive individuals.

522	Board #338 Resistance Training And High-intensity Interval Training Improve Cardiometabolic Health In Older Adults: A Meta-analysis	May 27 9:30 AM - 11:00 AM
	Kelly A. McLeod, Jeanette M. Thom, Matthew D. Jones, Belinda J. Parmenter. <i>UNSW Sydney, Kensington, Australia.</i> Email: k.mcleod@unsw.edu.au (No relevant relationships reported)	
	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% male with a mean age of 67.7 ± 1.8 years. Training ranged from 2-4 times per week for 22 ± 16 weeks. Compared to usual care, exercise significantly improved body mass index (BMI) (MD -0.36 [-0.50, -0.22], p<0.0001), body fat % (BF%) (SMD -0.60 [-1.13, -0.06], p=0.03), peak aerobic capacity (SMD 0.40 [0.13, 0.68], p=0.004), triglycerides (SMD -0.22 [-0.45, 0.00] 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 body mass (SMD 0.96 [0.05, 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.	

523	Board #339 Postmenopausal Women With Low Bone Mass Enjoy Bone-targeted, High-intensity Resistance Training: LIFTMOR Trial Observations	May 27 9:30 AM - 11:00 AM
	Benjamin K. Weeks ¹ , Belinda R. Beck, FACSM ¹ , Conor Lambert ¹ , Lisa J. Weis ² , Amy T. Harding ¹ , Sean A. Horan ¹ , Steven L. Watson ¹ . ¹ <i>Griffith University, Gold Coast, Queensland, Australia.</i> ² <i>The Bone Clinic, Brisbane, Queensland, Australia.</i> (Sponsor: Belinda R Beck, FACSM) Email: B.Weeks@griffith.edu.au (No relevant relationships reported)	

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, a comprehensive evaluation of participant perception of HiRIT was required to inform implementation in the 'real world'. Therefore, the aim of the current work was to examine physical activity enjoyment, quality of life (QOL), and participant perception of the HiRIT program undertaken in the LIFTMOR trial. **METHODS:** Postmenopausal women with low bone mass were randomized to either 8 months of 30-minute, twice-weekly supervised HiRIT (n=49) or unsupervised, low-intensity, home-based exercise (CON; n=52). At baseline and follow-up, all participants completed physical activity enjoyment (PACES-8) and QOL (WHOQOL-BREF) questionnaires (Kruskal-Wallis and Friedman's test). At follow-up, 17 HiRIT and 15 CON participants completed an exit survey relating to their experiences, scored using a 5-point Likert scale. Of those, 14 participants from the HiRIT program underwent semi-structured interviews to facilitate qualitative analysis (Leximancer v4.50) of their experiences undertaking the HiRIT program. **RESULTS:** Participants who undertook the HiRIT program reported improvements in PACES-8 (3.3 ± 1.0 vs -1.6 ± 0.9 , p<0.001), and on the exit survey, HiRIT were happier with their group allocation (4.8 ± 0.6 vs 4.0 ± 1.2 , p=0.03), more enthusiastic about undertaking training sessions (4.4 ± 0.5 vs 3.7 ± 1.1 , p=0.03) and more likely to participate in the LIFTMOR trial again given the chance (3.8 ± 0.9 vs 2.9 ± 1.3 , p=0.028), than CON (p<0.05). Qualitative analysis revealed current bone health status as the most common motivator for enrolling in the LIFTMOR trial, time was an important barrier to previous physical activity participation and supervised group exercise sessions were perceived as positive. All HiRIT participants would recommend the program to a friend. No differences in QOL were observed (p>0.05).
CONCLUSIONS: 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.

524	Board #340 Eccentric Training To Improve/maintain Motor And Speech Function For Persons With Parkinson's Disease	May 27 9:30 AM - 11:00 AM
	Jeff Bauer, Irena Vincent, Philip Buckenmeyer, Larissa True, Alexander Generali, Olivia Trumino. <i>SUNY Cortland, Cortland, NY.</i> Email: jeff.bauer@cortland.edu (No relevant relationships reported)	

PURPOSE: Parkinson's disease (PD) is a progressive motor disease that is typically characterized by gait, balance, and speech difficulties. This study evaluated the effectiveness of lower body eccentric training on adults with PD. It was hypothesized that completing a 24-session training protocol would maintain or improve balance, gait, and speech variables. **METHODS:** 6 male and 5 female PD volunteers (PDV) (61-78 yrs, $\bar{x}=70$ yrs) completed the exercise program. All were clinically diagnosed with PD (.5 - 14 yrs since diagnosis, $\bar{x}=4$ yrs) and able to walk/stand without assistance. The PDVs attended 24 biweekly training sessions, which consisted of three 45-second bouts of high-intensity lower body eccentric exercise with a 2-minute rest period between bouts. An exercise machine provided an eccentric quadriceps workout as PDVs stood with both feet on a solid platform that moved along an elliptical path. Pre- and post-exercise SWAY (30-second eyes-closed balance test) and SAW (self-paced 7-meter straight walk, turn around, and return) tasks were completed to record measures of balance and gait. Speech data were recorded at the beginning, in the middle, and at the end of the exercise program. **RESULTS:** SWAY test - Paired samples t-tests showed no significant pre/post (Session 1 to Session 24) differences for the total center of gravity path, coronal, or sagittal path length. SAW test - Paired samples t-tests showed significant pre/post (Session 1 to Session 24) improvement for Right leg cadence (RLC) (p = .040), Left leg cadence (LLC) (p = 0.43) and Right toe angle (RTA) (p = .035). No significant change was observed for Left toe-off angle, Right and Left leg double support time, or Right and Left leg elevation at midswing. Most PDVs produced similar respiratory, speech rate, intonation, and loudness values throughout the study, with a few producing slightly improved values. Sound production precision either remained unchanged or slightly deteriorated towards the end of the protocol. **CONCLUSIONS:** No balance or gait parameters evaluated over the duration of the study indicated a decrease in function in the 11 PDVs. RLC, LLC and RTA did show improvement. Most speech variables remained unchanged. Lower body eccentric training should be considered to maintain gait and balance functions for ambulatory adults with PD.

525	Board #341 Parkinson's Disease Treatments: Treating Symptoms Through Group Power Movements Or Passive Forced Cycling	May 27 9:30 AM - 11:00 AM
	Allison Nickel, Miranda Hanson, Ella Borgerding, Max Stockwell, Lauren Johnson, Emalee Smith, Shaina Bodenhofer, Samuel Miller, Joshua Olson, Joshua Waits, Justin Geiger. <i>Winona State University, Winona, MN.</i> (No relevant relationships reported)	

Introduction: Parkinson's Disease (PD) is a neurodegenerative disease that affects motor and non-motor function due to a loss of dopamine. There are exercise interventions that have been shown to improve PD symptoms, such as passive forced cycling and group fitness classes. Passive forced cycling is a useful, non-invasive treatment for PD, and has been shown to produce similar effects to common PD medications including improvement in motor function, gait, and quality of life. The Group Fitness-Only (GFO) class is based on large body movements in order to slow the progression of PD symptoms. The purpose of this study was to determine if Forced Cycling paired with a group fitness class or the group fitness class alone was better in the symptomatic treatment of PD. **Methods:** A total of ten participants diagnosed with stage two or three PD were recruited through a local support group and a medical facility. Each participant was randomly assigned to either GFO or group fitness class paired with Forced Cycling (PFC) exercise groups. Regardless of the group, the participants were asked to attend four 60-minute exercise sessions per week for four weeks. Pre and post data were collected using the MiniBESTest and PROMIS-29 survey. **Results:** The GFO group improved their Timed Up and Go test (Pretest: 6.51 ± 0.80 , Posttest: 5.87 ± 1.03 , p = 0.041). The time taken to perform the TUG also improved more for the GFO group when compared to the PFC group's posttest data (Pretest: 5.87 ± 1.03 , Posttest: 8.59 ± 1.74 , p = 0.032). Dynamic gait sub-score improved posttest in the PFC group compared to the GFO group (Pretest: 7.8 ± 0.8 , Posttest: 9.0 ± 0.0 , p = 0.033). Other variables showed improvement but were not statistically significant. **Conclusion:** This pilot study suggests that strength-based group fitness classes are a part of an effective intervention for managing PD symptoms and could

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. <i>Winona State University, Winona, MN.</i>		
(No relevant relationships reported)		

PURPOSE: : Parkinson's Disease (PD) is a neurodegenerative disease that affects motor and non-motor function due to a loss of dopamine. Exercise has been shown to help physical and mental symptoms of PD. Over-speed cycling (OSC) involves cycling at a speed faster than the participant can actively produce. Group fitness classes (GF) for patients with Parkinson's Disease focus on dynamic movements to enhance activities of daily living. Both OSC and GF have been shown to improve PD symptoms, however, previous studies have not examined the effects of these modalities on mental health.

METHODS: Participants (n=8, mean age 73±3) diagnosed with level 2-3 PD were randomly assigned into two groups: 1) GF or 2) GF classes combined with OSC (GFC). GF was completed four times per week for one hour, for four weeks. In GFC, both the GF class and OSC was completed for one hour, two times per week for four weeks. The OSC protocol included a five minute-manual warm up 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. After the speed was determined, participants performed the forced cycling for 55 minutes, and completed the session with a five-minute cool down. A previously validated survey was administered pre and post exercise intervention to determine scores for physical function, mental health, fatigue, sleep, ability to participate in social roles and activities, and pain.

RESULTS: All variables of the survey were recorded observing only one statistically significant change within physical function. There was a significant difference between GF and GFC when participants were asked, after the 4-week protocol, about their ability to go up and down stairs at a normal pace (5.0 ± 0.0 vs. 4.2 ± 0.5 , $p=0.024$). All other variables included in the survey did not yield any significant changes during the 4-week exercise protocol.

CONCLUSIONS: The results of this pilot study suggest that mental health measures show no significant improvements or 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		
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Email: amerigo.rossi@liu.edu (No relevant relationships reported)		

Parkinson's disease (PD) is the second-most common neurodegenerative disorder in the United States. Physical activity has been shown to improve physical function in people with PD, however the correlation between many common measures of physical function is still unclear.

PURPOSE: To evaluate the correlation between various measures of physical function among people with PD who exercised regularly.

METHODS: Eighty-three individuals with PD (67 ± 6 years old; 8 ± 6 years since diagnosis; 54% women) were tested at baseline, and every 3 months to 1 year thereafter while participating in a twice-weekly group exercise program. Participants continued in the program for up to 10 years and completed a total of 605 examinations (range: 1-29/participant) during which they were assessed for gait velocity, six-minute walk test, timed up-and-go, single leg balance, Berg Balance Scale, grip strength, 30-second chair stand, and the Motor section of the Unified Parkinson's Disease Rating Scale (UPDRS). A correlation matrix across all 8 variables was calculated using Pearson correlation coefficients with a Bonferroni-adjusted alpha level of 0.002. Correlation strength was defined as strong (abs $r > 0.7$), moderate ($0.7 \geq \text{abs } r > 0.5$), and weak (abs $r < 0.5$).

RESULTS: Mean (\pm SD) six-minute walk test was 340 ± 188 meters, timed up-and-go was 11.0 ± 4.4 seconds, and gait velocity was 115 ± 24 cm•sec $^{-1}$. All correlations were significant ($p < 0.002$). Gait velocity had a strong correlation with the timed up-and-go ($r = -0.72$), as well as moderate correlations with the six-minute walk test ($r = 0.52$), Berg Balance Scale ($r = 0.52$), and 30-second chair stand ($r = 0.55$). The timed up-and-

go had moderate correlations with 30-second chair stand ($r = -0.61$), and Berg Balance Scale ($r = -0.61$). The Berg Balance Scale also had a moderate correlation with the single leg balance test ($r = 0.54$) and UPDRS ($r = -0.60$).

CONCLUSION: Gait velocity, timed up-and-go, and the Berg Balance Scale were all correlated with at least three other variables, indicating the greatest breadth of association. Grip strength was the only variable with no moderate or strong correlations. Further research should be conducted to determine whether these correlations change for people with Parkinson's disease following exercise training.

528	Board #344	May 27 9:30 AM - 11:00 AM
Effects Of 24-week Wuqinxix Intervention On Posture Control Ability Of Patients With Parkinson's Disease		
Tian Wang, Guiping Xiao, Kuncheng Jie, Zhenlan Li, Yan Jiang, Zhen Wang, Jie Zhuang. <i>Shanghai University of Sport, Shanghai, China.</i>		

(No relevant relationships reported)

PURPOSE: This study was to determine the effects of 24-week's Wuqinxix 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 Wuqinxix 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 Wuqinxix 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 Wuqinxix group showed a significant increase in forward maximum excursion and endpoint excursion.(Table 1)
CONCLUSIONS: After 24 weeks of exercise intervention, the posture control ability of patients with Parkinson's disease in the Wuqinxix group was significantly improved and it has already been appeared after the 12th week.

posture control range changes before and after 24-week intervention					
			Forward		
			MXE	EDE	DCL
Time factor	Wuqinxix(N=23)	Baseline	71.08±19.91	53.21±19.36	80.21±14.21
		12 weeks	71.08±19.91	62.83±18.97	84.46±9.06
		24 weeks	79.66±18.17	60.08±20.27	82.96±8.71
		F	8.254	5.985	2.315
		p	0.001**	0.005**	0.110
	Stretch group	Baseline	75.00±17.72	60.38±17.54	83.88±8.44
		12 weeks	80.00±11.92	65.33±15.08	86.00±7.50
		24 weeks	79.63±17.50	62.17±19.08	85.33±6.68
		F	1.201	0.803	0.285
		p	0.310	0.446	0.754
Group factor		F	1.346	1.360	2.749
		p	0.252	0.249	0.104

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		

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PURPOSE: This study was to compare the effects of 12-week's Wuqinxix exercise versus stretching on hand function (including hand dexterity and hand-eye coordination) in patients with idiopathic Parkinson's disease (PD).

METHODS: This study used a randomized, controlled trial design, where 46 patients (23 women) with stage 1 through 3 Parkinson's on the Hoehn and Yahr staging scale were randomly and evenly assigned into a Wuqinxixi exercise group or a stretching group. All participants practiced either 60-minute Wuqinxixi or stretching exercise sessions twice a week for 12 weeks. The Purdue Pegboard test (PPT) 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 ANOVAs using SPSS 24.0 were conducted to determine the differences in hand function between the Wuqinxixi and stretching groups before and after the intervention. Statistical significance level was set at $p < 0.05$.

RESULTS: After the 12-week's exercise intervention, the post-intervention PPT score performed by both hands was greater ($P = 0.003$) in the Wuqinxixi group than the stretching group; whereas the post-intervention SPT scores were significantly increased ($P < 0.01$) for both groups through the intervention, with no group difference being observed ($P = 0.734$). (Table 1)

CONCLUSIONS: The Wuqinxixi 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

Items	Wuqinxixi (N = 23)		Stretching Group (N=23)		P values from ANOVAs		P value from the test for Δ difference	
Scores Perfor- mance	Baseline	12- week	Δ (change)	Baseline	12- week	Δ (change)	Group factor	Time factor
PPT-D	12.26 ± 2.28	12.87 ± 2.53	0.61 $\pm 1.34^*$	12.22 ± 3.72	11.83 ± 3.74	-0.39 ± 1.62	0.408	0.868
PPT-ND	10.74 ± 2.09	11.52 ± 2.25	0.78 ± 1.86	11.74 ± 3.12	11.83 ± 2.75	0.87 ± 1.20	0.229	0.421
PPT-B	17.22 ± 3.85	19.04 ± 4.22	1.83 $\pm 3.13^*$	18.35 ± 6.40	17.30 ± 4.92	-1.04 ± 3.86	0.769	0.705
PPT-A	20.74 ± 6.57	22.78 ± 7.20	2.04 $\pm 3.44^{**}$	21.09 ± 6.73	21.35 ± 5.77	0.26 ± 4.33	0.693	0.404
SPT	8.75 ± 2.50	7.42 ± 1.70	-1.32 $\pm 0.38^{**}$	8.71 ± 2.00	7.82 ± 1.78	-0.89 $\pm 0.16^{**}$	0.657	0.007

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

530 Board #346 May 27 9:30 AM - 11:00 AM Changes In Muscle Power After Usual Care Or Early Structured Exercise Intervention In Acutely Hospitalized Older Adults: A Secondary Analysis Of A Randomized Controlled Trial.

Mikel Izquierdo¹, Mikel L. Sáez de Asteasu¹, Nicolás Martínez-Velilla², Fabricio Zambom-Ferraresi¹, Robinson Ramírez-Vélez¹, Antonio García-Hermoso³, Eduardo L. Cadore⁴, Álvaro Casas-Herrero², Arkaitz Galbete³. ¹Public University of Navarra, Pamplona, Spain. ²Complejo Hospitalario de Navarra (CHN)-Universidad Pública de Navarra, Pamplona, Spain. ³Navarrabiomed-Biomedical Research Centre, IDISNA-Navarra's Health Research Institute, Pamplona, Spain. ⁴Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil.

(No relevant relationships reported)

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 of a single-blind randomized clinical trial in an acute care for elderly (ACE) unit in a tertiary public hospital in Navarre (Spain). 370 hospitalized patients (aged ≥ 75 years) were randomly allocated to an exercise intervention ($n=185$) or a usual care ($n=185$) group. The intervention consisted of a multicomponent exercise-training program performed during 5-7 consecutive days (2 sessions/day). The usual care group received habitual hospital care, which included physical rehabilitation when needed. The main endpoints were change in maximal dynamic strength (i.e., leg-press, chest-press, and knee extension exercises) and maximal isometric knee extensors and hip flexors strength from baseline to discharge. Changes in muscle power output at submaximal and maximal loads were also measured after the intervention period. **RESULTS:** The physical exercise program provided significant benefits over usual care. At discharge, the exercise group showed a mean increase of 19.6 kg (95% confidence interval [CI], 16.0, 23.2; $p < 0.001$) on the one-repetition maximum (1RM) in the leg-press exercise, 5.7 kg (95%CI, 4.7, 6.8; $p < 0.001$) on the 1RM in the chest-press exercise, and 9.4 kg (95%CI, 7.3, 11.5; $p < 0.001$) on the 1RM in the knee extension exercise over usual-care group. There were improvements in the intervention

group also in the isometric maximal knee extension strength (14.8 Newtons (N); 95%CI, 11.2, 18.5 vs. -7.8 N; 95%CI, -11.0, -3.5 in the control group; $p < 0.001$) and the hip flexion strength (13.6 N; 95%CI, 10.7, 16.5 vs. -7.2 N; 95%CI, -10.1, -4.3; $p < 0.001$). Significant benefits were also observed in the exercise group for the muscle power output at submaximal loads (i.e., 30%1RM, 45%1RM, 60%1RM, and 75%1RM; all $p < 0.001$) over usual care group.

CONCLUSIONS: An individualized, multicomponent exercise-training program, with special emphasis on muscle power training, proved to be an effective therapy for improving muscle power output of lower limbs at submaximal loads and maximal muscle strength in very old patients during acute hospitalization.

531 Board #347 May 27 9:30 AM - 11:00 AM The Effects Of Power Training Frequency On Functional Performance In Healthy, Older, Untrained Women.

Konstantina Katsoulis, Catherine E. Amara. *University of Toronto, Toronto, ON, Canada.*
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(No relevant relationships reported)

Power training (PT) in older adults can improve muscle power and functional performance. The majority of studies have utilized higher intensities for training ($\geq 60\%$ of maximum strength) and have included combined results for older men and women. Less is known about the effects of low-intensity PT on muscle performance and function in older, healthy women. In addition, the dose-response of PT on power and function with 1, 2, or 3 days/week in older adults has not been determined.

PURPOSE: The purpose of this study was to investigate the impact of different weekly frequencies of low-intensity PT on muscle strength, power, and function in healthy, older, untrained women. **METHODS:** Older women ($n = 54$) were randomized to PT 1 ($n = 14$), 2 ($n = 17$), or 3 ($n = 17$) days/week or wait-control, C ($n = 15$). Participants undertook 12 weeks of PT using lower-body resistance training machines at an intensity of 40% of the 1-repetition maximum (1RM), and performed the concentric phase of the exercises 'as fast as possible'. The primary outcome was functional performance (Short Physical Performance Battery, stair climb, 30 second chair stands, and 400-meter walk) and secondary outcomes were strength (leg-press 1RM) and power (knee-extension power at 40% of maximal isometric strength). **RESULTS:** Within-group analyses (pre-post time points) indicated that strength improved in all PT groups ($p < 0.05$) with a 23.7%, 23.3%, 34.8%, and 9.8% increase from baseline for PT1, PT2, PT3 and C, respectively. Pre-post power improved significantly in PT2 and PT3 ($p < 0.05$) by 9.6% and 12.2%, respectively. For pre-post function, all PT groups improved in 3 of 4 functional tests ($p < 0.05$) with improvements ranging from 4.0 - 21.7% and with no differences observed between groups. Although the control group showed small but significant improvement in some aspects of function over the course of the study, effect sizes for all PT groups suggest small to large improvements above that observed in the controls. The large intra-individual variability in the data might have limited statistical power to detect differences between the groups. **CONCLUSIONS:** PT of 2 days/week or more is recommended for improving muscle power, however, 1 session weekly might be sufficient for improving functional performance.

532 Board #348 May 27 9:30 AM - 11:00 AM Effectiveness Of Aquatic Exercise On Dynamic Balance In Older Adults: A Systematic Review And Meta-analysis

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(No relevant relationships reported)

Balance and mobility impairments are the leading causes of falls in older adults. Aquatic-based exercises have been broadly practiced as an alternative to land-based exercises due to several beneficial effects. However, there has been no systematic review with meta-analysis regarding the effects of aquatic exercises on dynamic balance in older adults.

PURPOSE: To compare the effectiveness of aquatic exercises (AE) to land exercises (LE) on dynamic balance in older adults. **METHODS:** Electronic databases (PubMed, MEDLINE, CINAHL, SPORTDiscus, psycINFO), from inception to March 2019, were searched. Studies met the following eligibility criteria: Randomized controlled trials, English language, older adults aged 65 years or older, a minimum of one AE group and one LE group, at least one assessment for dynamic balance. For the meta-analysis, the effect sizes of dynamic balance outcomes were calculated using a weighted mean difference (WMD) or a standardized mean difference (SMD) and a 95% confidence interval (CI). **RESULTS:** A total of 9 trials met the inclusion criteria, and 7 studies including 328 participants (age = 69.6 ± 6.4 yr) were eligible for the meta-analysis. Exercise intervention duration and frequency varied from 4 to 20 weeks, from 2 to 5 sessions per week, from 45 to 60 min per session. The tests most used in the studies were Berg Balance Scale (BBS), Tinetti scale, gait assessment, Functional Reach Test (FRT), Timed Up and Go test (TUG), and Five Times Sit-

to-Stand test (FTSTS). The meta-analysis showed that older adults in AE groups demonstrated comparably enhanced dynamic balance compared with those in LE groups (SMD = 0.38; 95% CI, 0.16–0.60). Subgroup analysis showed that there were no differences in BBS (WMD = 1.66; 95% CI, -0.27–3.59; P = .09), FRT (WMD = 2.40; 95% CI, -3.38–8.18; P = .42), TUG (WMD = 0.98; 95% CI, -0.08–2.04; P = .07), and FTSTS (WMD = 2.05; 95% CI, -0.59–4.70; P = .13) between AE and LE groups. **CONCLUSION:** AE may have comparable effects on dynamic balance abilities in older adults aged 65 years 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.

533	Board #349	May 27 9:30 AM - 11:00 AM
Weekly Sedentary And Standing Time As Predictors Of Body Composition In Older Adults		
Alexis Ortiz, FACSM ¹ , Martha Acosta ² , Lisa Le ² , Kalie Pietsch ² , Juan Robledo ² . ¹ <i>University of The Incarnate Word, San Antonio, TX.</i> ² <i>University of Texas Health, San Antonio, TX.</i>		
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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 levels from five days of accelerometer data of 315 subjects (mean age: 63.47 ± 5.90 years, mean BMI: $27.91 \pm 4.54 \text{ kg} \cdot \text{m}^{-2}$ male: 155; female: 160) were retrieved 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 ($<18.5\text{--}24.9 \text{ kg} \cdot \text{m}^{-2}$), overweight ($25\text{--}29.9 \text{ kg} \cdot \text{m}^{-2}$) and obese ($>30 \text{ kg} \cdot \text{m}^{-2}$). Average time spent (secs) in standing, sitting, 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) between the three groups were performed for weekly steps and time spent standing, sitting, and lying down. An alpha level of .05 was considered statistically significant. A linear regression analysis was performed to explore the association between these variables and body composition for the entire sample. **RESULTS:** ANOVA analysis revealed statistically significant differences for time spent standing and sitting between the normal weight (standing: $26,941 \pm 8,163$ secs; sitting: $29,954 \pm 9,197$ secs) group and the overweight (standing: $22,840 \pm 7,892$ secs; sitting: $33,632 \pm 10,630$ secs) and obese (standing: $20,836 \pm 7,318$ secs; sitting: $34,467 \pm 10,335$ secs) groups. The regression analysis showed a statistically significant association ($r=.31$, $r^2=.094$; $p < .001$) among steps, standing, sitting, and lying with the greatest contributors to the model being standing time ($p=.008$) and sitting (.042). The greater time standing indicated lower BMI, while greater time sitting contributed to greater BMI. **CONCLUSIONS:** In older adults, greater time spent standing and lower time spent sitting appears to be the 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.

534	Board #350	May 27 9:30 AM - 11:00 AM
The Effect Of Five-years Of Exercise On High-density Lipoprotein Cholesterol In Older Adults		
Ida Berglund ¹ , Elisabeth Vesterbekkmo ² , Stian Lydersen ³ , Ulrik Wisloff ¹ , Stensvold Dorthe ¹ . ¹ <i>K.G. Jebsen Center of Exercise in medicine at the Faculty of Medicine and Health Sciences, Norwegian University of Science and Technology, Trondheim, Norway.</i> ² <i>Department of Cardiology, St. Olavs Hospital, Trondheim University Hospital, Trondheim, Norway.</i> ³ <i>Regional Center for Child and Youth Mental Health and Child Welfare, Norwegian University of Science and Technology (NTNU), Trondheim, Norway.</i>		
Email: ida.j.berglund@ntnu.no (No relevant relationships reported)		

Purpose. Dyslipidemia, is one of the major risk factors for cardiovascular disease (CVD), the leading cause of death in older adults. Aging is associated with an unfavorable change in the lipid-profile. High levels of LDL can be reduced by cholesterol lowering medications, while pharmacological treatment have not proven to be as efficient in 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 compare 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 4×4 min intervals at ~90% of peak heart rate) or

moderate-intensity training (MICT) (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 MICT (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.

535	Board #351	May 27 9:30 AM - 11:00 AM
Is The Physical Activity Vital Sign Associated With Fall Risk In Older Adults?		
Colleen Griffin Hergott, Nathan Massey, Debra A. Beazley, Lori A. Bolgla. <i>Augusta University, Augusta, GA.</i>		
(No relevant relationships reported)		

PURPOSE: ACSM Exercise Is Medicine (EIM) initiative recommends the use of Physical Activity Vital Signs (PAVS) 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= 81.2 ± 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 risk. 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 ($r = .23$; $p = .06$), 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.

A-56 Free Communication/Poster - Strength and Muscle Research in Exercise Oncology

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

536	Board #352	May 27 10:30 AM - 12:00 PM
Correlation Between Age, Sarcopenia, And Length Of Stay In Preoperative Cancer Patients		
Fabrício A. Voltarelli ¹ , Roberto Carlos Vieira-Junior, RCVJ ¹ , Aílton S. Machado, ASMI ¹ , Felipe S. Boa Sorte, FSBS ¹ , Andreia C. Alves, ACA ¹ , Sérgio I. Guasque Faria, SIGF ² , Geovane J. Tolazzi, GJT ¹ , Haracelli A. Leite da Costa, HALC ¹ . ¹ <i>Federal University of Mato Grosso, Cuiabá - MT, Brazil.</i> ² <i>University of Cuiabá, Cuiabá - MT, Brazil.</i> ³ <i>Mato Grosso Cancer Hospital, Cuiabá - MT, Brazil.</i>		
Email: voltarellifa@gmail.com (No relevant relationships reported)		

PURPOSE: Data from the National Cancer Institute indicate that in Brazil (2018–2019) there should be 1.2 million new cases of cancer, and by 2025 the estimate is a 50% increase in its incidence. In this sense, researches indicate that cancer is associated with metabolic alterations, causing significant changes in body composition, which may promote muscle mass loss and, consequently, sarcopenia. The present study aimed to evaluate the correlation between age, sarcopenia, and length of stay (LS) in preoperative cancer patients (CP).

METHODS: Ninety-six CP of both sexes (53.1 ± 14.1 years old), admitted to the Mato Grosso Cancer Hospital (HCan-MT), Cuiabá, Mato Grosso, Brazil, were enrolled and performed the following evaluations: total body mass (TBM), height, BMI, and calf circumference (CC); answered a sarcopenia questionnaire (SARC-F); LS information was collected from the hospital database. The CP were divided into 2 groups according to the cutoff point of the CC measurement (indicative of sarcopenia;

men: <34 cm; women: <33 cm): non-sarcopenic (NS; 68 - 70.8%); probable sarcopenic (PS; 28 - 29.2%). Data are presented as mean \pm standard deviation and, for comparison between means, the Mann-Whitney test was applied. To verify the correlation between the variables, the Spearman correlation test was used. For all analyses, the p-value was set at 0.05. The analysis was performed using the IBM SPSS version 22.0 program (Ethics Committee Protocol Number: 87449918.5.0000.8124).

RESULTS: NS TBM (kg) (75.0 ± 16.7) was significantly higher (p <0.001) if compared to PS (58.6 ± 9.1). The same occurred in relation to BMI (Kg. [m²] -1) (NS: 28.3 ± 5.6 ; PS: 22.6 ± 2.8 ; p <0.001). Regarding LS (days), there were no significant differences between groups (NS: 3.5 ± 3.5 ; PS: 5.2 ± 5.6 ; p = 0.386). There was a positive correlation (p = 0.05) (correlation coefficient: p = 0.200) between the LS and the score obtained in the SARC-F questionnaire. In addition, there was a significant positive correlation (p<0.001) between the ranks of the LS and age (correlation coefficient: p = 0.388).

CONCLUSIONS: Take together, the results denote that sarcopenic CP, especially the elderly, presented a longer length of stay in the postoperative period.

537	Board #353 Examination Of The Time Course Effect Of Creatine Supplementation On Acute Doxorubicin-induced Skeletal Muscle Dysfunction	May 27 10:30 AM - 12:00 PM
	Brandon C. Jones, Raquel B. Busekrus, Salaheddin Sharif, David S. Hydock. <i>University of Northern Colorado, Greeley, CO.</i> Email: brandon.jones@unco.edu (No relevant relationships reported)	

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 *ex vivo* fatigue protocol were measured. **RESULTS:** No between group differences in grip force were observed 1 day post injection, but at 3 days, a between group difference in grip force was observed (p=0.03) with Dox and Cr1+Dox having lower grip forces than Con (-9.8% and -10.5%, respectively, p<0.05), but this difference was not observed in Cr2+Dox. A between group difference in grip force was also observed at the 5 day time point (p<0.0001) 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 day 3, EDLs from Dox generated less force than Con at the 10 s through 40 s and the 70 s through 100 s time points (p<0.05), but these differences were not observed in Cr1+Dox and 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 provided 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 Phase Angle Adaptation To Exercise Training In Cancer Patients Undergoing Treatment	May 27 10:30 AM - 12:00 PM
	Nicholas Harman, Nathaniel Croteau, Reid Hayward. <i>University of Northern Colorado, University of Northern Colorado Cancer Rehabilitation Institute, Greeley, CO.</i> (No relevant relationships reported)	

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 rehabilitative benefits (e.g., cellular health, membrane integrity, disease risk) that exercise may have in this population.

539	Board #355 Muscle Cross-sectional Area Improves With Home-based Training During Metastatic Castration-resistant Prostate Cancer	May 27 10:30 AM - 12:00 PM
	Michael R. Harrison ¹ , Mohammod Alzer ² , Hayden K. Giuliani ² , Jack Carver ² , Alex R. Lucas ³ , David B. Bartlett ¹ , Matthew I. Milowsky ² , Young Whang ² , Rhonda L. Bitting ³ , Claudio L. Battaglini, FACSM ² , Lee Stoner, FACSM ² , Anthony C. Hackney ² , Eric D. Ryan ² , Erik D. Hanson ² . ¹ Duke Cancer Institute, Durham, NC. ² University of North Carolina, Chapel Hill, NC. ³ Wake Forest University, Winston-Salem, NC. (Sponsor: Claudio Battaglini, FACSM) Email: michael.harrison@duke.edu	

Reported Relationships: M.R. Harrison: Consulting Fee; Bayer, Janssen. Industry contracted research; Pfizer.

PURPOSE: Exercise training improves regional body composition in localized prostate cancer, but it is unknown if training has similar effects in advanced disease. Goals of this analysis were to determine changes in leg muscle cross-sectional area (CSA) and quality (MQ) values following home-based exercise training during metastatic castration-resistant prostate cancer (mCRPC) and to compare CSA values to healthy controls (CON).

METHODS: Sedentary mCRPC patients undergoing androgen deprivation therapy (ADT) including next generation androgen receptor signaling inhibitors (n = 17, age = $71y \pm 8$, BMI = $32.0 \text{ kg/m}^2 \pm 6.5$) underwent CSA and MQ analyses using B-mode ultrasound for the vastus lateralis (VL) muscle before and after a 12-week home-based exercise protocol. Age- and BMI-matched CON (n = 17, age = $69y \pm 2$, BMI = $32.8 \text{ kg/m}^2 \pm 6.5$) completed baseline scans only.

RESULTS: At baseline, VL CSA was lower in mCRPC ($9.12 \text{ cm}^2 \pm 3.15$) relative to CON ($36.55 \text{ cm}^2 \pm 7.04$, p <0.001, d=4.95). For mCRPC patients, the 12-week intervention did not change VL MQ, but increased CSA by 15.2% following the intervention (pre: $8.28 \text{ cm}^2 \pm 2.85$, post: 9.54 ± 3.56 , p <0.001, d= 0.39) with no change in MQ.

CONCLUSIONS: Patients undergoing ADT for advanced prostate cancer exhibit lower muscle size compared to CON; however preliminary results suggest that home-based exercise training induces a moderate degree of regional muscle hypertrophy. The finding of regional hypertrophy is consistent with work conducted in patients with localized disease on ADT and may be an important outcome to monitor if increases in muscle CSA translate into improvements in physical function and quality of life. Supported by Physical Activity and Cancer Survivorship Pilot Funding.

540	Board #356 Effect Of Exercise Training During Anthracycline Chemotherapy For Breast Cancer On Skeletal Muscle Composition, Strength And Physical Function.	May 27 10:30 AM - 12:00 PM
	Stephen J. Foulkes ¹ , Grace Ramsden ¹ , Yoland Antill ² , Sherene Loi ³ , Mark J. Haykowsky ⁴ , Robin M. Daly ¹ , Steve F. Fraser ¹ , Erin J. Howden ⁵ , Andre La Gerche ⁵ . ¹ Deakin University, Geelong, Australia. ² Cabrini Hospital, Melbourne, Australia. ³ Peter MacCallum Cancer Centre, Melbourne, Australia. ⁴ University of Texas Arlington, Arlington, TX. ⁵ Baker Heart and Diabetes Institute, Melbourne, Australia. Email: steve.foulkes@baker.edu.au (No relevant relationships reported)	

Adverse cardiovascular effects associated with anthracycline chemotherapy (AC) are well established, but the impact on skeletal muscle, and the ability of exercise to attenuate these effects has been poorly characterized. **PURPOSE:** To investigate the effects of structured exercise training during AC on skeletal muscle composition, strength and functional performance in women with early-stage breast cancer (BCa).

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 MRI), 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 Δ or mean Δ (95% CI). **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 +1.4% (-11.9, 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 [+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.

- 541** Board #357 May 27 10:30 AM - 12:00 PM
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 vitamins 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 ± 10.57 kg; 1.61 ± 0.07 m) or Placebo (PG; n = 13; 48.23 ± 8.34 years; 70.45 ± 9.92 kg; 1.58 ± 0.05 m). Both groups participated in a 10-week ST protocol with six different exercises, twice a week. AG supplemented vitamins C (500mg/day) and E (400UI/day), and PG with polydextrose (1g/day). At the beginning and at the end of training 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 $60^\circ/\text{s}^1$. Work capacity (WC) was measured by the amount of work performed in one set of 30 maximal isokinetic knee extensions at $120^\circ/\text{s}^1$. 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 (1805.25 ± 355.25 to 2210.34 ± 344.24 J; p < 0.001) and PG (1945.65 ± 294.87 to 2187.85 ± 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 ± 5.96 mm; 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 when compared to placebo in breast cancer survivors.

- 542** Board #358 May 27 10:30 AM - 12:00 PM
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 improvements in clinically relevant 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 (M age = 65 years) on ADT were randomly assigned to the EX+D (n = 16) or SC (n = 16) interventions. Measures of 1RM chest and leg extension strength were obtained at baseline and 3-month follow-up assessments. **RESULTS:** Results from a linear regression analysis revealed that frequency of self-monitoring was not significantly associated with increased 1RM chest strength ($b = 0.52$; SE_b = 0.551; $r^2 = .083$; p = 0.364) or 1RM leg extension strength ($b = 0.234$; SE_b = 0.716; $r^2 = .083$; 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-power lifestyle intervention trials is warranted.

- 543** Board #359 May 27 10:30 AM - 12:00 PM
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 8 to 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/BM). A repeated measurement ANOVA with the Bonferroni post hoc tests was used to examine differences between muscle strength changes.

RESULTS: After eight weeks of RT, 12 women reported RPE < 7 (6.12 ± 0.56) and 14 women reported RPE ≥ 7 (7.78 ± 0.49). There was no difference found at baseline ($p = 0.23$): 10-RM normalized was 0.27 ± 0.06 and 0.24 ± 0.05 , for RPE < 7 and RPE ≥ 7 , respectively. BCS who reported lower or higher RPE improved their 10-RM by $\Delta 19 \pm 12$ % and $\Delta 23\% \pm 14\%$ ($p < 0.0001$), 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 similar gains. Suggesting that RPE is not the main factor for improving muscle strength in this population. Further studies analyzing the differences between upper and lower RPE in upper muscle strength are needed.

544 Board #360 May 27 10:30 AM - 12:00 PM

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 $\geq D$) 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 \pm 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 $\geq 80\%$ of the planned training sessions. During home-based training, 64% of patients in INT performed $\geq 80\%$ of the planned training sessions. Plank position holding time (strength) increased by 24 \pm 28 s in INT and dropped by 2 \pm 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.