

**A-17 Thematic Poster - Acute Exercise**

Wednesday, May 29, 2019, 9:30 AM - 11:30 AM  
Room: CC-102A

**60 Chair:** Juan Murias. *University of Calgary, AB, Canada.*

*(No relevant relationships reported)*

**61 Board #1** May 29 9:30 AM - 11:30 AM

**Upper- and Lower-body Resistance Exercise With and Without Blood Flow Restriction on Autonomic Modulation**

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*(No relevant relationships reported)*

While data have demonstrated that resistance exercise without blood flow restriction (BFR) decreases vagal tone up to 30 minutes, the effects of upper- versus lower-body resistance exercise with BFR on autonomic modulation are unknown. **PURPOSE:** To evaluate autonomic modulation in response to upper- and lower-body resistance exercise with BFR. **METHODS:** Autonomic modulation was assessed in twenty resistance-trained individuals at rest, 30 (R30), and 60 (R60) minutes after either upper- or lower-body resistance exercise with or without BFR. The upper- and lower-body resistance exercise consisted of the lat pulldown and chest press, and knee extension and knee flexion, respectively. The BFR (40% of arterial occlusion pressure) and without BFR conditions consisted of 4 sets of 30, 15, 15, and 15 repetitions at 30% 1-repetition maximum (1RM), and 4 sets of 8 repetitions at 70% 1RM, respectively. Autonomic modulation was expressed as natural logarithm (Ln), and included total power (LnTP), high frequency power (LnHF), and sympathovagal balance (LnLF/LnHF ratio). An ANOVA was used to evaluate groups (upper- or lower-body) across conditions (BFR or without BFR) across time (Rest, R30, and R60) on autonomic modulation. **RESULTS:** There were no significant 3-way interactions for any variables. There were no changes for LnTP. There were significant main effects of time for LnHF (Upper-body with BFR (UBFR): Rest: 7.3±1.6ms<sup>2</sup>, R30: 6.3±1.6ms<sup>2</sup>, R60: 6.7±1.5ms<sup>2</sup>; Upper-body without BFR (UW): Rest: 7.1±1.4ms<sup>2</sup>, R30: 6.1±1.5ms<sup>2</sup>, R60: 6.5±1.3ms<sup>2</sup>; Lower-body with BFR (LBFR): Rest: 6.9±1.3ms<sup>2</sup>, R30: 6.2±1.6ms<sup>2</sup>, R60: 7.1±1.4ms<sup>2</sup>; Lower-body without BFR (LW): Rest: 7.3±1.5ms<sup>2</sup>, R30: 6.3±1.8ms<sup>2</sup>, R60: 7.1±1.4ms<sup>2</sup>) and the LnLF/LnHF ratio (UBFR: Rest: 3.9±0.9ms<sup>2</sup>, R30: 5.1±10.9ms<sup>2</sup>, R60: 4.8±1.0ms<sup>2</sup>; UW: Rest: 3.7±1.0ms<sup>2</sup>, R30: 4.9±0.8ms<sup>2</sup>, R60: 4.8±0.7ms<sup>2</sup>; LBFR: Rest: 4.0±1.0ms<sup>2</sup>, R30: 4.8±1.1ms<sup>2</sup>, R60: 4.5±1.0ms<sup>2</sup>; LW: Rest: 3.9±1.0ms<sup>2</sup>, R30: 5.0±0.9ms<sup>2</sup>, R60: 4.65±0.84ms<sup>2</sup>) such that LnHF and LnLF/HF ratio were significantly reduced, and augmented, after upper- and lower-body resistance exercise with and without BFR. **CONCLUSIONS:** These data suggest that either upper- or lower-body resistance exercise with or without BFR significantly alters autonomic modulation up to 60 minutes after an acute bout of resistance exercise.

**62 Board #2** May 29 9:30 AM - 11:30 AM

**Cardiovascular Disease Risk Influences Cerebrovascular Regulation in Older Adults**

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*(No relevant relationships reported)*

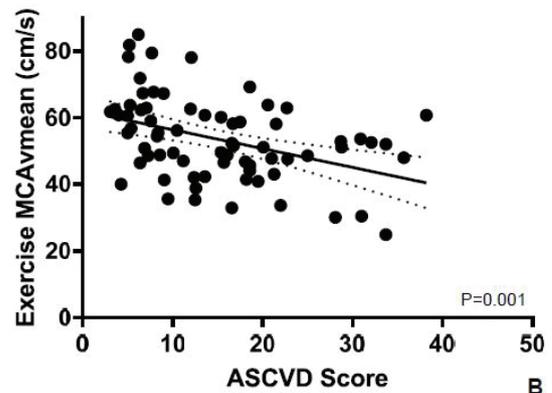
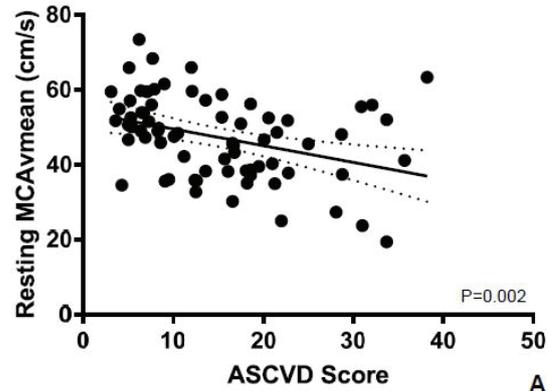
**Purpose:** The aim of this study was to evaluate the influence of CVD on cerebrovascular regulation at rest and during exercise. A secondary aim was to explore the relationship between cerebrovascular regulation and 1) the presence of white matter lesions and 2) cognitive function.

**Methods:** We recruited individuals who were cognitively normal older adults. CVD risk was assessed by the Pooled Cohort atherosclerotic cardiovascular disease (ASCVD) risk score. Transcranial Doppler ultrasound measured middle cerebral artery at rest and during a bout of moderate intensity exercise. We quantified white matter lesions from MRI and cognitive function outcomes included executive function, language, processing speed, and attention.

**Summary of Results:** Seventy-two participants 70.1 ± 4.7 years of age completed the study protocol. ASCVD risk score was significantly associated with both resting and exercise

cerebral blood flow velocity (p<0.01). Cerebrovascular regulation parameters were not associated with white matter lesions (p>0.468). We observed a significant association between cerebrovascular regulation parameters and language processing (p=0.010) but not other cognitive domains.

**Conclusion:** In cognitively normal older adults, higher ASCVD risk score was associated with blunted cerebrovascular regulation and with lower language processing performance. These results highlight the need for CVD risk management to maintain optimal brain health.



**63 Board #3** May 29 9:30 AM - 11:30 AM

**Looking Beyond A-vo<sub>2</sub> Difference: Peripheral Adaptations And Vo<sub>2</sub>Max In Trained And Untrained Adults**

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*(No relevant relationships reported)*

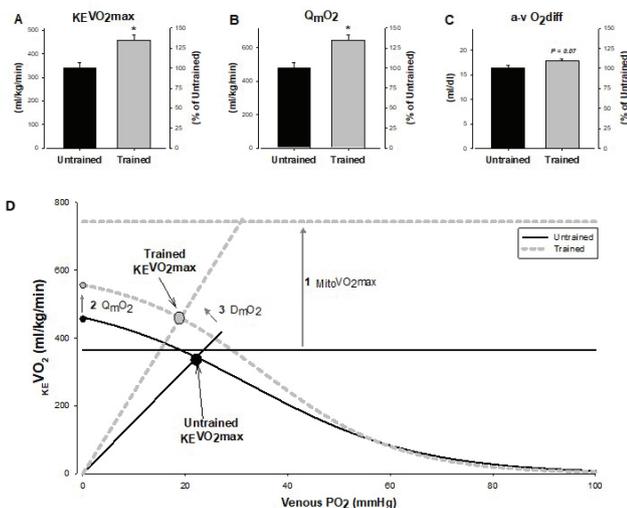
**PURPOSE:** Observing little-to-no increase in arterial-venous oxygen difference (a-vo<sub>2</sub>diff) following endurance training, some previous investigations have attributed little importance to factors peripheral to the heart, such as maximal mitochondrial oxygen consumption (V<sub>mito</sub>VO<sub>2</sub>max) and convective (Q<sub>m</sub>O<sub>2</sub>) and diffusive (D<sub>m</sub>O<sub>2</sub>) muscle oxygen delivery in the training-induced increase in VO<sub>2</sub>max. As lack of change in a-vo<sub>2</sub>diff does not necessarily indicate a lack of change in peripheral function, the purpose of this study was to determine the combined influences of adaptations peripheral to the heart in the endurance-training-associated increase in VO<sub>2</sub>max.

**METHODS:** Arterial-venous blood draws and Doppler ultrasound during maximal single leg knee extension (KE) exercise were used to quantify Q<sub>m</sub>O<sub>2</sub>, D<sub>m</sub>O<sub>2</sub>, a-vo<sub>2</sub>diff and KE VO<sub>2</sub>max when free of upstream limitations from the heart in 10 untrained and 10 trained young males. Mitochondrial respiration of muscle biopsied from the vastus lateralis was used to quantify V<sub>mito</sub>VO<sub>2</sub>max when free from upstream oxygen supply limitations.

**RESULTS:** In agreement with previous investigations, Q<sub>m</sub>O<sub>2</sub> and KE VO<sub>2</sub>max were 20-35% greater in the trained (P<0.05), while a-vo<sub>2</sub>diff was not markedly different (P>0.05, See Figures A-C). Nevertheless, training was associated with a 50-100%

increases in  $D_m O_2$  and  $MitO_2 VO_{2max}$ , ( $P < 0.05$ ). When plotted as a Wagner diagram (Figure D), it becomes clear that the greater  $KE VO_{2max}$  in the trained is the result of 3 synergistic adaptations (1. increased  $MitO_2 VO_{2max}$ , 2. increased  $Q_m O_2$  and 3. enhanced  $D_m O_2$ ), which, together, raise  $VO_{2max}$  more than each adaptation would alone.

**CONCLUSIONS:** Despite minimal changes in  $a-vO_2diff$ , the training-associated increase in  $KE VO_{2max}$  is dependent upon specific peripheral factors within the muscle exhibiting a greater capacity, including mitochondrial respiratory capacity, as well as convective and diffusive muscle oxygen delivery.



64 Board #4 May 29 9:30 AM - 11:30 AM

**Autonomic Modulation After High-Intensity Heavy Rope Exercise in Resistance-trained Individuals**

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(No relevant relationships reported)

The changes in autonomic modulation after high-intensity heavy rope exercise (HI-HRE) are unknown. **PURPOSE:** To examine the effects of HI-HRE on autonomic modulation in resistance-trained (RT) individuals. **METHODS:** Twenty-two young, RT individuals (mean±SD: age 23±3yrs; height 1.7±0.1m; weight: 74.3±14.9kg) had their heart rate (HR), mean arterial pressure (MAP), and measures of autonomic modulation collected at rest, and 15 (Rec1), 30 (Rec2) and 60 (Rec3) minutes following HI-HRE. Heart rate variability measurements included the root mean square of successive differences between normal heartbeats (RMSSD) in the time domain, high-frequency power (lnHF) and the ratio of low-frequency to high-frequency power (lnLF/lnHF ratio) in the frequency domain. RMSSD and lnHF are indicative of vagal modulation while the lnLF/lnHF ratio is a measure of sympathovagal balance. The HI-HRE consisted of six, 15-second exercise bouts, using a double wave pattern, separated by 30-seconds of passive recovery; the pace of the exercise was set at 180bpm. A one-way repeated measures analysis of variance was used to analyze the effects of HI-HRE across time (rest, Rec1, Rec2, and Rec3). Significant main effects were analyzed using pairwise comparisons with a Bonferroni correction. **RESULTS:** There was a significant main effect of time ( $p \leq 0.001$ ) for HR (rest: 63±10bpm; Rec1: 84±10bpm; Rec2: 76±9bpm; Rec3: 70±8bpm), such that it was augmented during all recoveries compared to rest. There was a significant main effect of time ( $p = 0.04$ ) for MAP (rest: 82.3±4.5mmHg; Rec1: 81.2±4.9mmHg; Rec2: 83.1±114.5mmHg; Rec3: 70±7mmHg), such that it was attenuated during all recoveries compared to rest. There were significant main effects of time ( $p \leq 0.001$ ) for the RMSSD (rest: 4.2±0.69ms; Rec1: 2.8±0.6ms; Rec2: 3.1±0.63ms; Rec3: 3.6±0.5ms) and the lnHF (rest: 7.4±1ms<sup>2</sup>; Rec1: 4.7±1.2ms<sup>2</sup>; Rec2: 5.5±1.1ms<sup>2</sup>; Rec3: 6.3±0.91ms<sup>2</sup>), such that they were decreased during all recoveries compared to rest. There was a significant ( $p \leq 0.001$ ) main effect of time for the lnLF/lnHF ratio (rest: 0.9±0.1; Rec1: 1.2±0.2; Rec2: 1.1±0.2; Rec3: 1±0.1), such that it was augmented during all recoveries compared to rest. **CONCLUSION:** These data demonstrate that high-intensity heavy rope exerciseresults in significant decreases in vagal modulation for at least 60 minutes.

65 Board #5 May 29 9:30 AM - 11:30 AM

**Effects Of Matched Intermittent Versus Continuous Exercises On The Changes Of Cardiac Biomarkers**

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(No relevant relationships reported)

**PURPOSE:** Endurance runners training with high-intensity intermittent exercise might experience damage to cardiac muscle. We have therefore compared the changes of cardiac biomarkers after workload-matched intermittent and continuous exercise in such runners.

**METHODS:** Twelve endurance runners (11 males, 1 female; age, 23.5±5.5 y;  $VO_{2max}$  62.4±5.4 ml.kg<sup>-1</sup>.min<sup>-1</sup>; velocity of  $VO_{2max}$  [ $vVO_{2max}$ ], 17.1±1.4 km.h<sup>-1</sup>; training volume, 44 ± 25 km.wk<sup>-1</sup>) completed intermittent and continuous exercise trials in random order. Intermittent exercise consisted of hard running at 90%  $vVO_{2max}$  for 2 min followed by easy running at 50%  $vVO_{2max}$  for 2 min, repeated for 92 min in total. The continuous run was performed at 70%  $vVO_{2max}$  for 92 min. Blood samples were drawn before exercise and at 0, 2, 4, 24 and 48 h after the completion of exercise for assay of various cardiac biomarkers. Changes in concentration of each biomarker were averaged over 0-24 h for comparison of intermittent with continuous exercise after adjustment for baseline concentration and exercise intensity expressed as percent of heart-rate reserve (%HRR).

**RESULTS:** There were trivial differences between the changes in concentration adjusted to the mean intensity of 78%HRR for all biomarkers investigated, but at 85%HRR high-sensitivity cardiac troponin-I and high-sensitivity cardiac troponin-T were moderately higher following intermittent exercise (factor mean change  $\times/\pm$ 90% confidence limits: 3.4  $\times/\pm$ 1.9 and 2.1  $\times/\pm$ 1.8 respectively). Changes in other cardiac biomarkers at 85%HRR were trivial.

**CONCLUSIONS:** Prolonged intermittent exercise is potentially more damaging to heart muscle than continuous exercise of the same average running speed at higher average heart rates.

66 Board #6 May 29 9:30 AM - 11:30 AM

**Exercise Tolerance: New Insights From Single-leg Cycling Exercise**

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(No relevant relationships reported)

The biological factors determining the maximal exercise capacity are typically assessed during whole-body exercise (e.g. double-leg cycling), implicitly assuming that limbs contribute homogeneously to exercise tolerance. However, given the presence of limb dominance, it is possible that the dominant leg may achieve greater peak  $O_2$  uptake ( $\dot{V}O_{2peak}$ ) and be able to sustain greater power outputs during prolonged dynamic exercise compared to the non-dominant leg.

**PURPOSE:** To investigate peak power output (PPO),  $\dot{V}O_{2peak}$ , and maximal lactate steady-state (MLSS) during double-leg as well as during dominant and non-dominant and counter-weighted single-leg cycling exercise performed with the dominant and non-dominant legs. **METHODS:** Twelve men (30 ± 5 yrs) during 12 to 14 lab visits performed: (i) a ramp-incremental test to determine PPO,  $\dot{V}O_{2peak}$ , and maximal  $O_2$  extraction; and (ii) 30-min constant-load tests to determine MLSS. These tests were performed using both legs (DBL), the dominant leg only (SLd), and the non-dominant leg only (SLnd). Gas exchange variables were measured with a metabolic cart; local de-oxygenation ([HHb]) of the vastus lateralis (VL) was measured using a frequency-domain NIRS; capillary blood samples were analysed for lactate concentration ([Lac]). **RESULTS:** PPO for DBL, SLd, and SLnd was different in each condition: 329 ± 38, 181 ± 30, 168 ± 27 W, respectively ( $p < 0.05$ ).  $\dot{V}O_{2peak}$  for DBL, SLd, and SLnd was different in each condition: 3.43 ± 0.34, 2.92 ± 0.42, 2.74 ± 0.38 L·min<sup>-1</sup>, respectively ( $p < 0.05$ ). The [HHb] amplitude of the VL was greater in the dominant compared to the non-dominant leg during both DBL (18.6 ± 8.5 vs 15.4 ± 9.5 mMol) and SL (15.4 ± 9.5 vs 11.6 ± 7.7 mMol) ramp-exercise ( $p < 0.05$ ). These amplitudes were highly correlated with the  $\dot{V}O_{2peak}$  values observed during DBL dominant and non-dominant ( $r = 0.86$  and  $r = 0.91$ , respectively), SLd ( $r = 0.79$ ), and SLnd ( $r = 0.71$ ) RI tests ( $p < 0.05$ ). The PO at MLSS for DBL, SLd, and SLnd was different in each condition: 183 ± 32, 119 ± 25, and 111 ± 24 W, respectively ( $p < 0.05$ ). The  $\dot{V}O_{2}$ , [Lac], and RPE values during SLnd and SLd were similar ( $p > 0.05$ ) despite this lower PO. **CONCLUSIONS:** These data indicate a heterogeneous exercise capacity of the exercising limbs that should be considered when evaluating exercise tolerance during double-leg exercise.

67 Board #7 May 29 9:30 AM - 11:30 AM

**Despite Menstrual Phase Differences in Respiration, Blood Lactate, and Muscle Deoxygenation, Exercise Performance is Unchanged**Jordyn Smith, Glen R. Belfry. *Western University, London, ON, Canada.*

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(No relevant relationships reported)

**PURPOSE:** Fluctuations of ovarian hormones over the menstrual cycle result in changes in cardiorespiratory and metabolic responses that may affect exercise performance. The purpose of this study is to evaluate respiration, muscle deoxygenation ( $\Delta\%[\text{HHb}]$ ) and arterialised blood lactate  $[\text{La}^-]$  throughout incremental (RAMP) and constant load exercise performance (EP) during follicular (FOL) and luteal (LUT) phases.

**METHODS:** Ten eumenorrheic females (22 yrs  $\pm$  1.4; 167  $\pm$  7 cm; 64  $\pm$  8 kg) completed RAMP (20 W/min) and EP (@ 101%  $\text{VO}_{2\text{max}}$ ) to limit of tolerance during both FOL and LUT phases. Breath-by-breath measures of gas exchange and vastus lateralis muscle deoxygenation were recorded throughout.

**RESULTS: RAMP:** FOL and LUT maximal oxygen uptake ( $\text{VO}_{2\text{max}}$ ) (FOL: 2.36  $\pm$  0.4  $\text{L}\cdot\text{min}^{-1}$ ; LUT: 2.36  $\pm$  0.4  $\text{L}\cdot\text{min}^{-1}$ ), ventilation ( $V_E$ ) (FOL: 53.2  $\pm$  25  $\text{L}\cdot\text{min}^{-1}$ ; LUT: 55.1  $\pm$  25  $\text{L}\cdot\text{min}^{-1}$ ), and  $\Delta\%[\text{HHb}]$  (FOL: 60  $\pm$  3%; LUT: 57  $\pm$  3%) were unchanged ( $p > 0.05$ ).

However,  $\Delta\%[\text{HHb}]/\Delta\text{VO}_2$  was 65% lower in LUT compared to FOL below lactate threshold (GET) ( $p < 0.05$ ).  $P_{\text{ET}}\text{CO}_2$  values were lower in LUT compared to FOL (FOL: 37  $\pm$  2 mmHg; LUT: 36  $\pm$  3 mmHg) ( $p < 0.01$ ), whereas  $P_{\text{ET}}\text{O}_2$  values remained unchanged (FOL: 105  $\pm$  6 mmHg; LUT: 107  $\pm$  6 mmHg) ( $p > 0.05$ ).  $EP: V_E$  (FOL: 83  $\pm$  19  $\text{L}\cdot\text{min}^{-1}$ ; LUT: 89  $\pm$  17  $\text{L}\cdot\text{min}^{-1}$ ) and  $P_{\text{ET}}\text{O}_2$  (FOL: 115  $\pm$  4 mmHg; LUT: 118  $\pm$  4 mmHg) were greater in LUT compared to FOL ( $p < 0.05$ ), without changes in breathing frequency (FOL: 32  $\pm$  4  $\text{L}\cdot\text{min}^{-1}$ ; LUT: 35  $\pm$  5  $\text{L}\cdot\text{min}^{-1}$ ) ( $p > 0.05$ ). No differences in  $\%[\text{HHb}]$  were observed between LUT and FOL (FOL: 83  $\pm$  21%; LUT: 85  $\pm$  21%); however,  $\Delta\%[\text{HHb}]/\Delta\text{VO}_2$  was 18% lower during the kinetic phase of the EP in LUT compared to FOL ( $p < 0.05$ ). Post-EP  $[\text{La}^-]$  were lower in LUT compared to FOL (FOL: 12.9  $\pm$  2.5  $\text{mmol}\cdot\text{L}^{-1}$ ; LUT: 11.7  $\pm$  1.7  $\text{mmol}\cdot\text{L}^{-1}$ ) ( $p < 0.05$ ). No performance differences were

observed between FOL and LUT for RAMP peak power (FOL: 218  $\pm$  35 W; LUT: 221  $\pm$  29 W) or EP endurance (FOL: 99  $\pm$  20 s; LUT: 96  $\pm$  15 s) ( $p > 0.05$ ).

**CONCLUSION:** During RAMP exercise, there was a greater reliance on muscle deoxygenation at sub-GET work rates in FOL compared to LUT. During EP, the LUT phase showed higher  $V_E$ , lower Post-EP  $[\text{La}^-]$ , and lower muscle deoxygenation during the kinetic portion of the step exercise, suggesting increased ventilatory buffering compared to FOL. Despite the different physiological responses between menstrual phases, short duration exercise performance is preserved.

68 Board #8 May 29 9:30 AM - 11:30 AM

**Effect Of Ultra-endurance Exercise On Alveolar-Capillary Recruitment And Lung Diffusion**Glenn Stewart<sup>1</sup>, Caitlin Jorgenson<sup>1</sup>, Courtney Wheatley<sup>1</sup>, Paul Robach<sup>2</sup>, Alice Gavet<sup>2</sup>, Briana Ziegler<sup>1</sup>, Jesse Schwartz<sup>1</sup>, Bryan Taylor<sup>3</sup>, Loïc Chabridon<sup>2</sup>, Pierre Bouzat<sup>4</sup>, Bruce Johnson<sup>1</sup>. <sup>1</sup>Mayo Clinic, Rochester, MN. <sup>2</sup>Ecole Nationale de Sports de Montagne, Chamonix, France. <sup>3</sup>University of Leeds, Leeds, United Kingdom. <sup>4</sup>Grenoble University Hospital, Grenoble, France.

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(No relevant relationships reported)

**Purpose**—Prolonged vigorous exercise increases cardiac output and pulmonary arterial and capillary pressures to levels that may exceed a tolerable right ventricular and alveolar-capillary load. Accordingly, this study examined the effect of an ultramarathon on resting and exertional measures of alveolar-capillary recruitment & lung diffusion. **Methods**—Cardiac and lung function were examined at rest & during 3 stages of low-intensity exercise in 44 runners (Age: 41  $\pm$  9 yr BMI: 23  $\pm$  2  $\text{kg}/\text{m}^2$ ) before, and 1-4-h and 24-h after the Hong Kong 100 and Ultra Trail Mont Blanc ultramarathons. Cardiac biomarkers (cTnI, BNP) were assessed from whole blood (I-stat), while stroke volume (SV) & cardiac output (Q) were quantified via echocardiography. Lung diffusing capacity for carbon monoxide and nitric oxide (DLco & DLno) and its components, alveolar membrane conductance (Dm) and capillary blood volume (Vc), were determined via a single-breath DLco/DLno method.

**Results**—Participants finished the ultramarathons in 22  $\pm$  11 h with an average heart rate of 130  $\pm$  14 bpm. Cardiac biomarkers increased after the race (cTnI: 0.03  $\pm$  0.01 vs 0.09  $\pm$  0.02 ng/ml; BNP: 18  $\pm$  2 vs 129  $\pm$  14 pg/ml,  $p$ 's  $< 0.01$ ). Stroke volume decreased post-race at rest (86  $\pm$  2 vs 74  $\pm$  2 ml,  $p < 0.01$ ) & during exercise (Stage3: 99  $\pm$  2 vs 92  $\pm$  3 ml,  $p < 0.01$ ), while cardiac output was similar pre and post-race (Rest: 4.6  $\pm$  0.1 vs 4.9  $\pm$  0.2,  $p = 0.20$ ; Stage3: 8.7  $\pm$  0.3 vs 8.8  $\pm$  0.3,  $p = 0.61$ ). Resting DLco, DLno & Vc decreased post-race, while Dm was unchanged. On the contrary, DLco, DLno and Dm were reduced during low intensity exercise post-race, while Vc normalized to pre-race values. When corrected for Q, DLco was lower at rest (DLco/Q: 7.1  $\pm$  0.2

vs 5.7  $\pm$  0.2,  $p < 0.01$ ), but normalized to pre-race values during exertion (stage3 DLco/Q: 4.0  $\pm$  0.1 vs 3.8  $\pm$  0.2,  $p = 0.31$ ). All values returned to baseline after 24-h of recovery. **Conclusions**—The data suggests a transient decrease in lung diffusion at rest following ultra-endurance exercise is related to a reduced capillary blood volume and potential pulmonary de-recruitment; however, pulmonary capillary recruitment during low-intensity exercise remains mostly preserved. On the contrary, alveolar membrane conductance was preserved at rest but reduced during light exercise and may contribute to the exertional decrease in lung diffusion after an ultramarathon.

**A-18 Thematic Poster - Exercise and Cancer**

Wednesday, May 29, 2019, 9:30 AM - 11:30 AM

Room: CC-101A

69 Chair: Claudio Battaglini, FACSM. *University of North Carolina at Chapel Hill, Chapel Hill, NC.*

(No relevant relationships reported)

70 Board #1 May 29 9:30 AM - 11:30 AM

**Effects Of A 16-week Aerobic And Resistance Exercise Intervention On Leptin/adiponectin Ratio In Overweight And Obese Breast Cancer Survivors**Kaylie Zapanta, Kyuwan Lee, Nathalie Sami, Christina M. Dieli-Conwright, FACSM. *University of Southern California, Los Angeles, CA.*

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(No relevant relationships reported)

**INTRODUCTION:** Overweight and obese breast cancer survivors (BCS) are at greater risk of developing type II diabetes (T2D) than non-cancer populations due, in part, from adipose tissue-induced modulations to the adipokines, leptin and adiponectin. Leptin upregulates inflammatory cytokines associated with insulin resistance (IR) while adiponectin inhibits inflammation and regulates glucose uptake. The Leptin/Adiponectin Ratio (LAR) has been used as an indicator for the diagnosis of T2D, due to its ability to measure both inflammatory and glucose abnormalities. In overweight and obese BCS, an elevated LAR induces IR, which contributes to the development of T2D. Exercise may be an effective strategy to reduce the LAR to target the risk of T2D in BCS. **OBJECTIVES:** The purpose of this study was to determine whether a 16-week aerobic and resistance exercise intervention reduces the LAR in overweight and obese BCS. **METHODS:** Sedentary, overweight/obese (BMI  $\geq$  25  $\text{kg}/\text{m}^2$ ) BCS (Stage I-III) were randomized to the Exercise (EX; n=50) or Control (CON; n=50) groups. The EX group underwent supervised moderate-vigorous intensity aerobic and resistance exercise sessions 3 times per week for 16 weeks. Leptin and adiponectin were measured from fasting blood samples using enzyme-linked immunoabsorbant assays. Paired t-tests and mixed-model repeated measures ANOVA were used to examine the within and between group differences in mean changes in LAR. **RESULTS:** On average, women were 53.5  $\pm$  10.4 years old, postmenopausal (60%), Hispanic (55%) with a BMI 33.5  $\pm$  5.5  $\text{kg}/\text{m}^2$ . Post-intervention, leptin was significantly reduced (-8.0 ng/mL  $\pm$  0.3) in the EX group compared to CON group (+4.8 ng/mL  $\pm$  0.5;  $p = 0.001$ ). Adiponectin was significantly increased (+7.5  $\mu\text{g}/\text{dL} \pm 1.0$ ) in EX group compared to CON group (-1 ng/mL  $\pm$  0.3;  $p = 0.001$ ). Post-intervention, LAR was significantly reduced (-1.23  $\pm$  0.21) in the EX group compared to CON (0.66  $\pm$  0.11;  $p < 0.01$ ). There was a significant increase in LAR in the CON group ( $P < 0.01$ ). **CONCLUSION:** A 16-week aerobic and resistance exercise intervention is an effective approach to reduce the LAR in overweight and obese BCS. This finding supports the utilization of exercise to reduce the risk of T2D following the completion of cancer treatment in overweight and obese BCS.

- 71** Board #2 May 29 9:30 AM - 11:30 AM  
**Effect of Exercise During Versus After Chemotherapy for Breast Cancer on Fatigue and Quality of Life**  
 Kelcey A. Bland<sup>1</sup>, Amy A. Kirkham<sup>2</sup>, Joshua M. Bovard<sup>3</sup>, Donald C. McKenzie<sup>3</sup>, Margot K. Davis<sup>3</sup>, Tamara Shenkier<sup>4</sup>, Karen A. Gelmon<sup>4</sup>, David Zucker<sup>5</sup>, Kristin L. Campbell<sup>1</sup>.  
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 (No relevant relationships reported)

Chemotherapy for breast cancer may result in fatigue and reduced quality of life (QOL). While exercise can attenuate adverse chemotherapy effects, improvements relative to baseline may be more likely with exercise performed post-treatment. **PURPOSE:** To compare the effect of exercise during versus after taxane chemotherapy for breast cancer on fatigue and QOL. **METHODS:** Women were randomized to supervised aerobic and resistance exercise 3x/wk for 8-12 wk starting pre-chemotherapy (Immediate Exercise=IE) or 2-3 wk post-chemotherapy (Delayed Exercise=DE). Fatigue and overall QOL/functional subscales were evaluated using the Piper Fatigue Scale (0=none, 10=severe) and European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (scored: 0-100), respectively, at: 1) baseline; 2) 2-3 wk post-chemotherapy (post-chemo); and 3) 10-15 wk post-chemotherapy (follow-up). **RESULTS:** Overall, n=27 women enrolled and n=26 (IE n=12, DE n=14) completed the intervention (attended >1 session). Attendance was 79±23% for IE and 81±20% for DE. Fatigue did not differ between groups across time, so change within groups was assessed individually. Fatigue increased in DE from baseline to post-chemo (mean diff: +1.7±0.47, p=0.01) and did not decrease with exercise between post-chemo and follow-up (mean diff: -1.1±0.65, p=0.13). Fatigue did not change over time in IE. Overall QOL differed between groups over time (p<0.01), where it was higher in IE versus DE post-chemo (mean diff: +6.2±3.0, p<0.05). No other group differences were found for QOL/functional subscales. The overall deterioration in QOL in DE during chemotherapy was a result of reductions in physical function (mean diff: -16.4±5.6, p<0.01), role function (mean diff: -20.0±6.3, p<0.05), cognitive function (mean diff: -16.0±5.8, p=0.01) and social function (mean diff: -17.4±7.4, p=0.04). Relative to post-chemo, the DE intervention significantly improved QOL by follow-up (mean diff: +20.2±5.4, p<0.01), such that DE and IE QOL did not differ at follow-up (mean diff: 4.6±3.7, p=0.22). **CONCLUSIONS:** Exercise during taxane chemotherapy may mitigate treatment-related fatigue and reductions in QOL in women with breast cancer. While exercise after chemotherapy increased overall QOL, fatigue experienced during chemotherapy persisted.

- 72** Board #3 May 29 9:30 AM - 11:30 AM  
**Heavy-load Resistance Exercise In Women At Risk Of Breast Cancer-related Lymphedema During Chemotherapy: Randomized Trial**  
 Kira B.N. Bloomquist<sup>1</sup>, Lis Adamsen<sup>1</sup>, Sandra C. Hayes<sup>2</sup>, Christian Lillelund<sup>1</sup>, Christina Andersen<sup>1</sup>, Karl Bang Christensen<sup>3</sup>, Peter Oturai<sup>1</sup>, Bent Ejlersen<sup>1</sup>, Malgorzata K. Tuxen<sup>4</sup>, Tom Møller<sup>1</sup>. <sup>1</sup>Copenhagen University Hospital, Rigshospitalet, Copenhagen, Denmark. <sup>2</sup>Queensland University of Technology, Brisbane, Australia. <sup>3</sup>The University of Copenhagen, Copenhagen, Denmark. <sup>4</sup>Copenhagen University Hospital, Herlev-Gentofte Hospital, Herlev, Denmark.  
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It is unclear whether women at risk of breast cancer-related lymphoedema can safely participate in heavy-load resistance exercise.

#### PURPOSE

To evaluate the effect of heavy-load resistance exercise on lymphedema outcomes in pre-diagnosis physically inactive women at risk of breast cancer-related lymphedema during adjuvant chemotherapy.

#### METHODS

Physically inactive women receiving anthracycline and taxane-based chemotherapy for breast cancer (n=153) were randomized to a HIGH (supervised multimodal exercise including heavy-load resistance exercise: 85-90% 1 repetition maximum [RM], three sets of 5-8 repetitions) versus LOW (walking supported by pedometer and one-on-one consultations) 12-week exercise intervention.

Outcomes (assessed at baseline, 12- and 39-weeks follow-up) included lymphedema status [extracellular fluid [L-Dex, bioimpedance spectroscopy] and inter-arm volume % difference [dual energy X-ray absorptiometry], lymphedema symptoms [numeric rating scale 0-10]], upper-extremity strength (1 RM), and quality of life domains (EORTC breast cancer specific questionnaire). Linear mixed models were used

to evaluate equivalence between groups for lymphedema outcomes (equivalence margins for L-Dex, % difference and symptoms scale: ±5, ±3% and ±1, respectively). Superiority analysis was conducted for muscle strength and quality of life domains.

**RESULTS**  
 Post-intervention equivalence between groups was found for extracellular fluid (0.4; 90% CI -2.5 to 3.2) and symptoms of heaviness (-0.2; -0.6 to 0.2), tightness (-0.1; -0.8 to 0.6) and swelling (0.2; -0.4 to 0.8). Non-equivalence was found for inter-arm volume % difference (-3.5%; -17.3 to 10.3) and pain (-0.7; -1.3 to 0), favoring the HIGH group. Strength gains were superior in the HIGH versus LOW group (3 kg; 1 to 5, p<0.05). Further, clinically relevant reductions in breast (-11; -15 to -7) and arm (-6; -10 to -1) symptoms were found in the HIGH group.

**CONCLUSION**  
 Findings suggest that pre-diagnosis physically inactive women can benefit from supervised heavy-load resistance exercise during adjuvant chemotherapy for breast cancer without increasing lymphedema risk.  
 Supported by funding from the Danish Cancer Society, the Novo Nordic Foundation and Trygfonden (7-12-0401)

- 73** Board #4 May 29 9:30 AM - 11:30 AM  
**A Randomised Clinical Trial Of 'Prehabilitation' High Intensity Interval Training (HIIT) Before Urological Cancer Surgery**  
 James EM Blackwell, Matthew S. Brook, Brett Doleman, Alistair Morton, John P. Williams, Jonathan N. Lund, Bethan E. Phillips. *University of Nottingham, Nottingham, United Kingdom.* (Sponsor: Professor Craig Sale, FACSM)  
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**PURPOSE:** Operations for urological malignancy are increasing in number and complexity due to the advancing age of patients with multiple comorbidities. Low pre-operative cardiorespiratory fitness (CRF) and muscle mass, are both associated with increased peri-operative morbidity and mortality, as well as poorer post-operative outcomes and delayed return normal activities. High intensity interval training (HIIT) may represent an efficacious training modality to rapidly improve CRF and body composition in the short clinically-dictated time-frame between diagnosis and surgery. **METHODS:** Forty patients (mean: 71 years, 98% male) were recruited at diagnosis of urological cancer. Patients providing written informed consent were to randomisation to either HIIT prehabilitation ((HIIT): 12 sessions of 5 x 1-min exertions, 3 sessions/week) or usual care (CON). Patients underwent cardiopulmonary exercise testing (CPET), dual-energy X-ray absorptiometry (DXA) scans and muscle architecture assessments using B-mode ultrasonography before and after a 28-day intervention period. *Vastus lateralis* (VL) muscle biopsies were also taken at both time-points. Statistical analysis, using ANCOVA, compared the effects of HIIT versus CON. **RESULTS:** HIIT elicited a clinically significant improvement in CPET-derived measures of anaerobic threshold (2.16 ml/kg/min (95% CI: 0.24 to 4.08),  $VO_{2PEAK}$  (2.26 ml/kg/min (95% CI: 1.25 to 3.26) and wattage at failure (12.86 W (95% CI: 5.52 to 20.19) vs. CON. Resting blood pressure (BP) decreased (vs. CON) with HIIT (systolic: -8.2 mmHg (95% CI -16.1 to -0.3), diastolic: -6.5 mmHg (95% CI -12 to -0.4)). There were no differences in whole-body composition changes between the groups, despite HIIT eliciting preferential gains in VL muscle thickness 0.22 mm (95% CI 0.02 to 0.41) and pennation angle 2.49 degrees (95% CI 0.42 to 4.55). HIIT was well-tolerated and safely delivered within this cohort. **CONCLUSIONS:** CRF, BP and muscle architecture parameters can be significantly improved with 4 weeks low-volume HIIT in urological cancer patients awaiting surgery. Mass-spectrometry analysis of muscle biopsies from this patient cohort will help elucidate the relative contribution of changes in mitochondrial and/or myofibrillar muscle protein metabolism in achieving these gains.

- 74** Board #5 May 29 9:30 AM - 11:30 AM  
**High Adherence To Home-Based Exercise Improves Muscle Strength And Cardiorespiratory Fitness With Advanced Prostate Cancer**  
 Erik D. Hanson<sup>1</sup>, Jackson L. Carver<sup>1</sup>, Alexander Lucas<sup>2</sup>, Michael Bass<sup>1</sup>, Mohammod Alzer<sup>1</sup>, Young Whang<sup>1</sup>, Michael Harrison<sup>3</sup>, Matthew I. Milowsky<sup>1</sup>, Rhonda L. Bitting<sup>2</sup>, Claudio L. Battaglini, FACSM<sup>1</sup>. <sup>1</sup>University of North Carolina at Chapel Hill, Chapel Hill, NC. <sup>2</sup>Wake Forest University, Winston-Salem, NC. <sup>3</sup>Duke University, Durham, NC. (Sponsor: Claudio Battaglini, FACSM)  
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Exercise is a potential mechanism for mitigating some side effects caused by androgen deprivation therapy (ADT) for metastatic castration-resistant prostate cancer (mCRPC)

and home-based interventions may help eliminate barriers to physical activity.

**PURPOSE:** To assess feasibility, adherence, and physiological changes following a home-based exercise intervention in men with mCRPC receiving ADT and androgen receptor targeting agents. **METHODS:** Men with mCRPC (age=71y ± 10, BMI=29.64 kg/m<sup>2</sup> ± 3.4) completed body composition (DXA), muscular strength, physical function, and cardiopulmonary exercise testing (CPET) before and after a 12-week home-based exercise intervention (with weekly phone contact) using resistance band and wearable technology for tracking walking. Patient reported outcomes were used for the assessment of fatigue (FACIT-Fatigue), quality of life (FACT-P) and depression (Hospital Anxiety and Depression Scale). Feasibility (target: 67%) was determined as the % of patients who completed the intervention. Adherence (target: 75%) to the overall program and specific activities was determined as the number completed relative to prescribed. Physiological changes were assessed using paired samples t-tests and adherence rates with a single sample t-test. **RESULTS:** Fourteen men completed baseline testing and eight completed the intervention (57%), which was lower than the target value. Adherence was reached but did not statistically exceed the target value of 75% for overall (82.7% ± 9.5; p=0.076), walking (80.7% ± 14.2; p=0.326), or resistance training (85.3% ± 12.5; p=0.072). Core focused exercises had significantly lower adherence (58% ± 35.7; p<0.001). Training significantly increased leg press maximal strength (10.7% ± 6.7, p=0.023) and peak oxygen consumption (9.7% ± 22.4%, p=0.013). No significant difference occurred in any other variable tested. **CONCLUSIONS:** Feasibility estimates were lower than expected but the high adherence promoted improvements in strength and cardiorespiratory function during mCRPC treatment but did not translate into functional improvements. These preliminary findings suggest home-based interventions are promising, but limited supervision or advanced disease may limit completion of training protocol.

75 Board #6 May 29 9:30 AM - 11:30 AM

### Pre-surgical Exercise In Men With Prostate Cancer Undergoing Prostatectomy.

Favil Singh<sup>1</sup>, Robert U. Newton<sup>1</sup>, Dennis R. Taaffe, FACSM<sup>1</sup>, Jeffery Thavaseelan<sup>2</sup>, Matthew Brown<sup>2</sup>, Elayne Ooi<sup>3</sup>, Kazunori Nosaka<sup>1</sup>, Daniel A. Galvao, FACSM<sup>1</sup>. <sup>1</sup>Edith Cowan University, Perth, Australia. <sup>2</sup>Perth Urology Clinic, Perth, Australia. <sup>3</sup>Swan Urology, Perth, Australia. (Sponsor: Daniel Galvao, FACSM) Email: f.singh@ecu.edu.au  
(No relevant relationships reported)

Traditionally, exercise interventions to improve recovery in prostate cancer patients following prostatectomy were limited to the post-surgical period with exercise protocols focusing on the pelvic floor muscles. However, emerging evidence indicates that a more opportune time to intervene to reduce the adverse effects of surgery and length of hospitalisation is the pre-operative period. **PURPOSE:** To evaluate the efficacy of exercise undertaken before surgery to enhance pre-surgical physical function and body composition, and improve recovery from surgery. **METHODS:** Twenty-two men with localised prostate cancer aged 50-73 years scheduled for surgery were randomised to exercise (EX = 12) or usual care (UC = 10). EX underwent a supervised 6-week progressive resistance and aerobic exercise program 3 times per week prior to surgery. Outcome measures included muscle strength and endurance, physical performance by a battery of tests, body composition by dual x-ray absorptiometry, and urinary incontinence. Measures were undertaken at baseline, pre-surgery, and 6 weeks post-surgery, with incontinence assessed following catheter removal and 6 weeks post-surgery. Data were checked for normality and analysed using two-way repeated-measures ANOVA. **RESULTS:** There were no differences between groups at baseline. Following exercise, there was a significant interaction (p < 0.05) for chest press, leg press and leg extension strength with strength increasing in EX prior to surgery and returning to pre-training values post-surgery. There was a significant time effect (p < 0.05) for 6 m fast walk, 6 m backwards walk, and 400 m walk with performance generally improving over the study period. Following surgery, lean mass was reduced (time, p < 0.001) by ~1.9 kg and ~1.4 kg in EX and UC, respectively. Urinary incontinence was significantly reduced at 6 weeks post-surgery in EX and UC (time, p < 0.001). There was no difference in length of hospital stay (3±1 days for EX and UC) and there were no exercise-related adverse effects. **CONCLUSIONS:** A pre-surgical exercise program improves components of physical function prior to surgery which may enhance the patient's fitness for surgery. Given the loss of lean mass following surgery, a longer period of anabolic exercise prior to surgery may prove useful in buffering post-surgical loss.

76 Board #7 May 29 9:30 AM - 11:30 AM

### Responders Versus Non-responders To Resistance-based Multimodal Exercise In Men With Prostate Cancer Undertaking ADT

Dennis R. Taaffe, FACSM<sup>1</sup>, Robert U. Newton<sup>1</sup>, Nigel Spry<sup>1</sup>, David Joseph<sup>2</sup>, Daniel A. Galvão, FACSM<sup>1</sup>. <sup>1</sup>Edith Cowan University, Perth, Australia. <sup>2</sup>Genesis Cancer Care, Perth, Australia.  
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In the management of prostate cancer androgen deprivation therapy (ADT) is effective in delaying disease progression and enhancing survival, although it is associated with an array of adverse effects including reduced muscle mass, strength and physical function, and an increase in body fat. Exercise is one strategy to counter these musculoskeletal treatment-related toxicities resulting from ADT. However, to recommend and prescribe exercise, clinicians need to know the likelihood of a positive response. **PURPOSE:** To assess the prevalence of exercise responsiveness in men with prostate cancer undergoing ADT on body composition, muscle strength, and physical function. **METHODS:** Prospective analyses were undertaken in 152 men (43-90 years) with prostate cancer on ADT undertaking resistance exercise combined with aerobic and/or impact training for 3-6 months. Whole body lean mass (LM) and fat mass (FM), trunk fat mass, and appendicular skeletal muscle (ASM) were assessed by dual x-ray absorptiometry, upper and lower body muscle strength by 1-RM, and physical function by a battery of tests (6-m usual, fast, and backwards walk, 400-m walk, repeated chair rise, stair climb). **RESULTS:** There were significant improvements (P<0.01) in LM (0.4±1.4 kg, range -2.8 to +4.1 kg) and ASM (0.2±0.8, range -1.9 to +1.9 kg), and all measures of muscle strength (chest press: 2.9±5.8 kg, range -12.5 to +37.5 kg; leg press: 29.2±27.6 kg, range -50.0 to +140.0 kg) and physical function (from -0.1±0.5 s, range +1.3 to -2.1 s for the 6-m usual walk, to -8.6±15.2 s, range +25.2 to -69.7 s for the 400-m walk). In addition, FM (0.6±1.8 kg, range -3.6 to +7.3 kg) increased (P<0.01). Twenty one men did not have a favourable response in at least one body composition component, 10 did not improve muscle strength, and 2 men did not improve physical function. However, all patients responded in at least one of the areas and 120 (79%) favourably responded in all three areas. For all 12 outcome measures, improvement was observed in 8±2 (range 2 to 12) measures. **CONCLUSION:** There were no non-responders to resistance-based multimodal exercise in men with prostate cancer undergoing ADT, and this form of exercise can be confidently prescribed to derive beneficial effects during active treatment.

### A-19 Thematic Poster - UCL Injuries in Overhead Athletes

Wednesday, May 29, 2019, 9:30 AM - 11:30 AM  
Room: CC-102B

77 Chair: Jason L. Zaremski, FACSM. University of Florida, Gainesville, FL.

(No relevant relationships reported)

### 78 Board #1 May 29 9:30 AM - 11:30 AM Is Shoulder Joint Rom Or Ucl Thickness A Predictor Of Medial Elbow Joint Space?

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(No relevant relationships reported)

UCL injuries among baseball athletes are an extremely common pathology. It is well documented that baseball athletes typically exhibit an increase in shoulder external rotation range of motion (ERRM) and a decrease in internal rotation range of motion (IRRM) while maintaining total rotational range of motion (TROM). Loss of TROM and ERRM may be associated with increased risk for UCL injury. Ultrasound imaging allows clinicians to evaluate UCL thickness and medial joint space (MJS) opening non-invasively. **PURPOSE:** To examine if shoulder joint motion (ERRM, IRRM, TROM), or the thickness of the UCL at the mid substance and apex of trochlea predicts medial elbow joint space (MJS) in asymptomatic collegiate baseball pitchers. **METHODS:** Twenty-nine NCAA Division I pitchers participated in this follow-up study. Ultrasound images were obtained of the MJS and UCL on the participant's

throwing arm using a GE LOGIQ e ultrasound unit. Participants were placed supine with a wedge placed underneath their pitching hand to maintain elbow position at 30 degrees. A 3 kg valgus force, as measured by a hand-held dynamometer, was applied 20 cm distal to the medial epicondyle. Ligament thickness measurements were performed at the mid-substance of UCL and at the apex of the trochlea. Imaging measurements to evaluate MJS opening were performed from the apex of the trochlea to the apex of the ulna. Standard goniometric procedures were performed with the athlete in a supine position to obtain ERRM, IRRM, and TROM values. Three stepwise linear multiple regression analyses were performed to determine if shoulder ROM or UCL thickness measures of the mid-substance and apex of the trochlea could predict MJS. **RESULTS:** Shoulder joint range of motion were not able to significantly predict MJS [ $R^2 = .05$ ,  $F(2,25) = 0.58$ ,  $p = 0.56$ ]. UCL thickness at the mid-substance [ $R^2 = .04$ ,  $F(1,25) = 0.10$ ,  $p = 0.76$ ], and at apex of the trochlea [ $R^2 = .00$ ,  $F(1,25) = 0.03$ ,  $p = 0.95$ ] were not able to significantly predict MJS. **CONCLUSIONS:** Results further supported prior research that shoulder ROM did not predict MJS, and new to this study, UCL thickness measured at two points were unable to predict MJS in asymptomatic baseball pitchers. Further research is recommended to perform multiple imaging sessions throughout the competitive season to further determine predictors of UCL injuries.

**79** Board #2 May 29 9:30 AM - 11:30 AM  
**Do Outcomes or Subsequent Injuries Differ Following Ulnar Collateral Ligament Reconstruction Using Palmaris vs. Hamstring Autograft?**

Joshua Dines<sup>1</sup>, Brandon Erickson<sup>2</sup>, Peter Chalmers<sup>3</sup>, John D'Angelo<sup>4</sup>, Kevin Ma<sup>4</sup>, Anthony Romeo<sup>2</sup>. <sup>1</sup>HSS, New York, NY. <sup>2</sup>Rothman Orthopaedic Institute, Tarrytown, NY. <sup>3</sup>University of Utah, Salt Lake City, UT. <sup>4</sup>MLB, New York, NY.  
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 (No relevant relationships reported)

**Purpose:** Ulnar collateral ligament reconstruction (UCLR) is a successful procedure in professional baseball players. It is unclear if results differ based on graft choice. The purpose was to determine the performance and return to sport (RTS) rate in professional baseball players following UCLR and compare performance and RTS rate, as well as injury rates, between players who underwent UCLR with hamstring vs. palmaris autograft. The authors hypothesize that there is a high RTS rate in professional baseball players following UCLR with no significant difference in injury rates, RTS rate, or performance, specifically related to primary outcome performance variables: WHIP ((walks +hits)/innings pitched), fielding independent pitching (FIP), and wins above replacement (WAR)) between those who had UCLR with a palmaris vs. hamstring autograft. **Methods:** All professional baseball players between 2010-2015 who underwent UCLR using hamstring autograft were included. Surgical details of their procedure were recorded using operative reports. Players with a hamstring UCLR were compared to a matched control group of players who underwent UCLR with palmaris autograft. **Results:** Overall, 191 players underwent UCLR using hamstring autograft. No differences in RTS rates or timing to RTS existed between the hamstring vs. palmaris groups. Significantly more subsequent lower extremity injuries were seen in the hamstring group ( $p = 0.040$ ). More subsequent upper extremity injuries existed in the palmaris group, although this difference was not significant ( $p = 0.052$ ). No consistent differences in performance metrics upon RTS existed between hamstring and palmaris groups, although both groups significantly declined in many performance metrics following surgery. Both groups showed a decline in post-operatively in WAR and WHIP; FIP did not decline. No significant difference in WAR, WHIP, or FIP existed between groups post-operatively. **Conclusion:** Baseball players who undergo UCLR with hamstring autograft are more likely to sustain a subsequent lower extremity injury while those who undergo UCLR with a palmaris are more likely to sustain an upper extremity injury. No difference in performance or RTS rates existed between groups. Both groups significantly declined in WAR and WHIP after UCLR.

**80** Board #3 May 29 9:30 AM - 11:30 AM  
**Quantity Time: Identifying The Benefit Of Ulnar Collateral Ligament Reconstruction In Major League Baseball**

J.P. Wong, William E. Herrin, Courtney D. Jensen. University of the Pacific, Stockton, CA.  
 (No relevant relationships reported)

Reconstruction of the ulnar collateral ligament (UCL), known colloquially as Tommy John surgery, was first performed in 1974. Today, approximately 30 Major League Baseball (MLB) players undergo this procedure annually; however, 57% of recipients are youth, age 15-19. Despite the abundance of subjects and accessibility of statistics, few investigations have studied its long-term effects on performance. **PURPOSE:** To evaluate changes in pitching performance following UCL reconstruction. **METHODS:** We compared 3 samples of MLB pitchers: 1) Underwent UCL reconstruction (REC), 2) Sustained an injury without surgical care (INJ), and 3) Never injured (NON). The REC sample was selected at random from a list of players who had pitched at least 2

seasons prior to the operation and at least 2 seasons post-surgery. Matched samples of INJ and NON were created; there were 50 subjects in each group. Mixed ANOVA with repeated measures compared first season statistics to final season statistics, and means of the first 2 seasons to the last 2. Linear regressions tested the effect of UCL reconstruction on changes in performance across those periods, holding all potential confounders constant. **RESULTS:** Among all 150 pitchers, during the first 2 seasons, they won 53.6% of games, struck out  $0.88 \pm 0.23$  batters per inning, and had an earned run average (ERA) of  $4.01 \pm 1.14$ . Between the first 2 and last 2 seasons, REC subjects experienced a 5.7% decrease in win percentage ( $p = 0.063$ ) but struck out 4.7% more batters per inning ( $p = 0.015$ ). Linear regression, evaluating the change from first to last season, found UCL reconstruction to improve winning percentage by 14.4 percentage points ( $p = 0.026$ ); there was no effect on strikeouts per inning ( $p = 0.339$ ) or ERA ( $p = 0.892$ ). UCL reconstruction failed to elicit significance on the change in performance between the first 2 and last 2 seasons in any variable. The ANOVA models found no group effect between first and last season with win percentage ( $p = 0.190$ ), strikeouts per inning ( $p = 0.428$ ), or ERA ( $p = 0.600$ ). Similarly, there was no group effect between the first 2 and last 2 seasons in win percentage ( $p = 0.454$ ), strikeouts per inning ( $p = 0.961$ ), or ERA ( $p = 0.496$ ). **CONCLUSION:** UCL reconstruction does not appear to compromise the quality of pitching performance, but does prolong the quantity of pitches in a player's career.

**81** Board #4 May 29 9:30 AM - 11:30 AM  
**Open Reduction Internal Fixation of Medial Epicondyle Fractures After Ulnar Collateral Ligament Reconstruction in Professional Baseball Pitchers**

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 (No relevant relationships reported)

**Purpose:** Determine the rate of return to sport (RTS) and performance upon RTS in professional baseball pitchers following ORIF of the medial epicondyle, and see if there is a difference in RTS rate and performance between players who underwent ORIF and matched controls. The authors hypothesize that there is a high rate of RTS in professional baseball pitchers following medial epicondyle ORIF with no significant difference in rate of RTS or performance, specifically related to the primary outcome performance variables of win-loss percentage (W-L%), WHIP ((walks +hits)/innings pitched), fielding independent pitching (FIP), and wins above replacement (WAR)) between cases and controls.

**Methods:** All professional baseball pitchers who underwent medial epicondyle ORIF between 2010-2016 were included. Demographic and performance data (pre and post surgery) for each player was recorded. Performance metrics were then compared between cases and matched controls (no history of UCLR or ORIF). **Results:** Overall, 15 pitchers (80% starters, 73.3% right-handed) underwent ORIF of a medial epicondyle fracture. All underwent a prior UCLR using either the American Sports Medicine Institute (n=9, 60%) or docking (n=6, 40%) technique. ORIF techniques included fixation with one screw (n=13, 86.7%) and fixation with suture anchors (n=2, 13.3%). Eleven (73.3%) pitchers were able to RTS (which did not differ from controls  $p = 0.537$ ). No significant differences existed in the primary performance outcome variables when comparing pre-operative to post-operative performance. No significant differences in the primary performance outcome measures were seen between cases and controls following surgery although cases pitched fewer innings than controls following surgery ( $p = 0.003$ ). **Conclusion:** Following medial epicondyle ORIF of professional pitchers with a history of UCLR, 73.3% were able to RTS without a significant decline in most performance variables when compared to their pre-operative performance levels, or when compared to matched controls. Number of innings pitched declined following surgery.

**82** Board #5 May 29 9:30 AM - 11:30 AM  
**Performance and Return to Sport Following Ulnar Nerve Decompression/Transposition in Professional Baseball Players**

John D'Angelo<sup>1</sup>, Brandon Erickson<sup>2</sup>, Peter Chalmers<sup>3</sup>, Kevin Ma<sup>1</sup>, Anthony Romeo<sup>2</sup>. <sup>1</sup>MLB, New York, NY. <sup>2</sup>Rothman Orthopaedic Institute, Tarrytown, NY. <sup>3</sup>University of Utah, Salt Lake City, UT.  
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 (No relevant relationships reported)

**Purpose:** Determine performance and return to sport (RTS) rate in professional baseball players following isolated ulnar nerve decompression/transposition, including those who required an ulnar nerve transposition/decompression following ulnar collateral ligament reconstruction (UCLR), and compare outcomes between cases and matched controls.

**Methods:** All professional baseball players who underwent isolated ulnar nerve decompression/transposition between 2010-2016 were included. Demographic and performance data (pre and post surgery) for each player was recorded. Performance metrics were then compared between cases and a group of matched controls. **Results:** Overall 52 players, 83% pitchers (14 underwent prior UCLR) were included. Most surgeries (92%) were anterior subcutaneous transpositions. Overall, 62% of players were able to successfully RTS and 56% returned to the same or a higher level. There was no significant difference between cases and controls in the majority of performance metrics pre-operative or post-operatively, specifically ERA, WHIP, WAR, and OPS. When players who had a UCLR prior to their ulnar nerve transposition/decompression were compared to controls with a history of a UCLR but who did not go on to have an ulnar nerve transposition/decompression, the only performance difference of all the recorded metrics was cases allowed more walks per 9 innings (4.4 vs. 2.8;  $p=0.011$ ). **Conclusion:** Anterior subcutaneous transposition is the most common surgery in professional baseball players to address ulnar neuropathy at the elbow. Players have a 62% rate of RTS, which is lower than expected for this non-reconstruction or repair procedure. For players who successfully RTS, performance compared to matched controls remained the same in most performance metrics. Post-operatively, pitchers with a UCLR prior to ulnar nerve transposition/decompression that had a successful RTS performed the same as matched controls with prior UCLR.

**83 Board #6 May 29 9:30 AM - 11:30 AM**  
**Land leg vs. Drive Leg Hamstring Graft Harvest Side Does Not Affect Performance or RTS Rates and Does Not Increase Risk for Future Hamstring Injuries Following UCLR in Professional Baseball Pitchers**  
 Peter Chalmers<sup>1</sup>, Brandon Erickson<sup>2</sup>, John D'Angelo<sup>3</sup>, Kevin Ma<sup>3</sup>, Christopher Ahmad<sup>4</sup>, Joshua Dines<sup>5</sup>, Anthony Romeo<sup>2</sup>.  
<sup>1</sup>University of Utah, Salt Lake City, UT. <sup>2</sup>Rothman Orthopaedic Institute, Tarrytown, NY. <sup>3</sup>MLB, New York, NY. <sup>4</sup>Columbia, New York, NY. <sup>5</sup>HSS, New York, NY.  
 Email: Brandon.Erickson@rothmanortho.com  
 (No relevant relationships reported)

**Purpose:** To compare, performance, return to sport (RTS) rate, and injury rates between professional baseball players with a history of UCLR using an ipsilateral (drive leg) hamstring autograft to those with UCLR using contralateral (landing leg) hamstring autograft.

**Methods:** All players between 2010-2015 who underwent UCLR using hamstring autograft were included. Surgical details of their procedure were recorded using operative reports. Players with a hamstring UCLR were compared within group to compare grafts taken from the drive leg vs. landing leg. **Results:** Overall, 191 players underwent UCLR using hamstring autograft (58 [30%] landing/contralateral and 133 [70%] ipsilateral/drive leg). The docking technique was more common in the contralateral/landing leg group while the figure-of-8 technique was more common in the ipsilateral/drive leg group ( $p>0.001$ ). More patients in the ipsilateral/drive leg group underwent concomitant treatment of the ulnar nerve than the contralateral/landing leg group ( $p<0.001$ ). No difference existed in return to sport (RTS) rates, or timing of RTS between groups. No differences in subsequent ipsilateral or contralateral hamstring injuries between players who underwent UCLR using hamstring from the ipsilateral/drive leg or contralateral/landing leg was seen ( $p=1.000$ ;  $p=0.460$  respectively). No difference in overall upper or lower extremity injury rates existed between groups. **Conclusion:** No difference in RTS rate, performance upon RTS, or subsequent hamstring, lower extremity, or upper extremity injury rates existed between players who underwent UCLR using hamstring autograft from the ipsilateral/drive or contralateral/landing leg.

**A-20 Thematic Poster - Walking Biomechanics**

Wednesday, May 29, 2019, 9:30 AM - 11:30 AM  
 Room: CC-101B

**84 Chair: Julia Freedman Silvernail. University of Nevada, Las Vegas, Las Vegas, NV.**  
 (No relevant relationships reported)

**85 Board #1 May 29 9:30 AM - 11:30 AM**  
**Pelvis and Trunk Motion Comparisons Between Male and Female Soldiers While Walking With Heavy Loads**

Joseph F. Seay, Victoria G. Bode, Peter N. Frykman, Nathaniel I. Smith, Rebecca E. Fellin. *U.S. Army Research Institute of Environmental Medicine, Natick, MA.*  
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 (No relevant relationships reported)

With the recent decision permitting female soldiers to enter Combat Arms roles, knowledge of sex differences in military load carriage is more operationally relevant. Limited work comparing the effect of heavy carried loads ( $> 30$  kg) in men and women has attributed differences in gait mechanics to sex without matching for anthropometrics that may contribute to differences. **PURPOSE:** To examine the effect of carrying light to heavy loads on pelvis and trunk range of motion (ROM) between anthropometrically matched male and female soldiers. **METHODS:** Four male and 4 female Soldiers were matched on height and body weight (differences  $< 2.54$  cm and 4.54 kg). All participants walked unloaded (BW), and with vest-borne loads of 15, 35 and 55 kg. Each load was carried for 10 min while walking on a level treadmill at 1.3  $m \cdot s^{-1}$ , with pelvis and trunk segmental angles collected after 5 min. Four mixed model ANOVAs (sex x load) compared trunk and pelvis frontal and transverse plane ROM. **RESULTS:** There were sex x load interactions for trunk transverse and frontal plane motion (Table 1). Specifically, as load increased: (A) trunk axial rotation decreased more in females than males ( $p=0.037$ ), and (B) trunk frontal plane motion increased for males and remained relatively constant for females ( $p=0.034$ ). Pelvis frontal plane ROM also increased at 55 kg in both sexes relative to carrying no additional load. **CONCLUSIONS:** Despite anthropometric matching, preliminary results suggest sex-related differences in trunk frontal plane motion while carrying loads  $\geq 35$  kg and no sex-related differences in pelvis motion. **DISCLAIMER:** The views expressed in this abstract are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government.

Table 1. Pelvis and Trunk Frontal (Y) and Transverse (Z) plane ranges of motion for different loads among male and female Soldiers.

		Sex	BW	15 kg	35 kg	55 kg
Pelvis	Frontal	M	6.9 ± 0.3	8.4 ± 0.2	8.7 ± 1.5	9.3 ± 0.7
		F	8.8 ± 2.2	9.7 ± 3.0	10.5 ± 3.1	11.1 ± 1.9 *
	Transverse	M	6.3 ± 2.1	6.5 ± 2.2	7.3 ± 2.8	6.3 ± 1.8
		F	10.8 ± 2.8	8.8 ± 1.6	8.0 ± 1.8	8.1 ± 1.8
Trunk	Frontal	M	4.9 ± 1.4	5.3 ± 0.5	6.7 ± 1.0	6.2 ± 0.6
		F	4.9 ± 1.7	4.6 ± 1.7	4.2 ± 2.2 ^	4.1 ± 1.1 * ^
	Transverse	M	8.4 ± 2.1	6.2 ± 0.9	7.9 ± 2.7	6.1 ± 1.4
		F	9.0 ± 1.4	6.6 ± 1.1	5.0 ± 0.8 *	4.4 ± 0.7 *

BW = Bodyweight only; # = sig sex x load interaction  
 \* Sig different from BW; ^ sig different from male

**86 Board #2 May 29 9:30 AM - 11:30 AM**  
**Logistic Regression Analyses Regarding Patient Dissatisfaction with Total Knee Replacement Outcomes**

Kevin Valenzuela<sup>1</sup>, Songning Zhang, FACSM<sup>2</sup>. <sup>1</sup>CSULB, Long Beach, CA. <sup>2</sup>University of Tennessee Knoxville, Knoxville, TN.  
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 (No relevant relationships reported)

Current research on patient satisfaction after a total knee replacement (TKR) lacks an examination of objective assessments with respect to gait biomechanics, strength, and balance abilities.

**PURPOSE:** To examine associations between patient satisfaction and the gait biomechanics, strength, balance, functional capacities, and survey data.

**METHODS:** Twenty four TKR patients participated in overground walking, stair ascent and descent, isokinetic strength, static and dynamic balance, and functional tests. Nine patients were in the dissatisfied group and fifteen in the satisfied group. Four models of logistic regression analyses were performed to predict patient satisfaction: one for walking, stair ascent, stair descent, and functional/strength/survey data. If high correlations ( $r \geq 0.7$ ) existed, variables were selected based on biomechanical and functional importance identified through review of literature concerning TKR patients. Selected kinematic, kinetic, strength, and balance variables along with functional test and survey data scores were input into a logistic regression analysis using SAS (Version 9.4, Cary, NC, USA). Models were evaluated using Akaike's Information Criterion.

**RESULTS:** The walking model included 1<sup>st</sup> and 2<sup>nd</sup> peak vertical ground reaction force (VGRF), knee extension moment, and forgotten joint score ( $R^2=0.69$ ,  $AIC=22.73$ ,  $p=0.0026$ ). The stair ascent model included 2<sup>nd</sup> peak VGRF, knee extension moment, preferred gait speed, and peak isokinetic knee extension torque ( $R^2=0.72$ ,  $AIC=23.85$ ,  $p=0.0013$ ). The stair descent model included knee extension moment, preferred gait speed, peak isokinetic knee extension torque, and forgotten joint score ( $R^2=0.80$ ,  $AIC=20.47$ ,  $p=0.0003$ ). The functional model was inclusive of WOMAC total scores, stair ascent and chair rise times, and peak isokinetic knee extension torque ( $R^2=0.87$ ,  $AIC=19.51$ ,  $p=0.0002$ ).

**CONCLUSIONS:** The biomechanical models included both VGRF and knee extension moments, indicating their relevance to patient satisfaction. Additionally, preferred gait speed was significant to both stair ascent and descent models. Pain was not included in any models due to a complete separation of data points.

**Acknowledgements** Supported by Matching Dissertation Grant of International Society of Biomechanics.

### 87 Board #3 May 29 9:30 AM - 11:30 AM Quadriceps Strength and Knee Mechanics in Adults with Prader-Willi Syndrome

Skylar C. Holmes<sup>1</sup>, Brett K. Post<sup>1</sup>, Steven A. Garcia<sup>2</sup>, Eric J. Shumski<sup>1</sup>, Derrick Escano<sup>1</sup>, Daniela A. Rubin, FACSM<sup>1</sup>, Derek N. Pamukoff<sup>1</sup>. <sup>1</sup>California State University Fullerton, Fullerton, CA. <sup>2</sup>University of Michigan, Ann Arbor, MI.  
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(No relevant relationships reported)

Prader-Willi syndrome (PWS) is a form of congenital obesity that occurs 1 in 25,000 births. Progressive obesity and reduced lean mass contribute to muscle weakness, which may alter knee mechanics during gait. **PURPOSE:** To compare quadriceps strength between individuals with and without PWS, and to examine the relationship between quadriceps strength and knee mechanics during gait in adults with PWS.

**METHODS:** 10 individuals with PWS participated in this study ( $1.70 \pm 0.09$  m,  $71.9 \pm 16.1$  kg), and were matched on sex to 10 obese controls ( $1.74 \pm 0.08$  m,  $108.0 \pm 13.2$  kg) and 10 lean controls ( $1.67 \pm 0.06$  m,  $65.3 \pm 7.16$  kg). Participants completed three maximal isometric knee extensor contractions using a dynamometer set at 60° of knee flexion. Early (0-100 ms) and late (100-200 ms) rate of torque development (RTD<sub>100</sub>, RTD<sub>200</sub>), and peak torque were extracted. Gait biomechanics were collected as participants completed 5 walking trials over 2 force plates on a 10-m runway at self-selected speed. Peak knee flexion angle (KFA), excursion (KFE), and knee flexion moment (KFM) were extracted from the first 50% of stance. Strength and joint moments were normalized to lean mass and a product of body weight and height, respectively. One-way MANOVA was used to compare strength variables between groups. Partial correlation controlling for gait speed was used to determine the relationship between strength and gait variables. **RESULTS:** There were group differences in peak torque ( $p=0.001$ ), RTD<sub>100</sub> ( $p=0.010$ ), and RTD<sub>200</sub> ( $p=0.002$ ). Post hoc analyses showed that individuals with PWS had lower peak torque ( $p=0.006$ ,  $p=0.001$ ), RTD<sub>100</sub> ( $p=0.038$ ,  $p=0.015$ ), and RTD<sub>200</sub> ( $p=0.003$ ,  $p=0.016$ ) than obese and lean controls. There were no significant correlations in control groups ( $p>0.05$ ). Greater KFE was related to greater peak torque ( $r=-0.71$ ,  $p=0.016$ ), greater RTD<sub>100</sub> ( $r=-0.59$ ,  $p=0.049$ ) KFA ( $r=0.69$ ,  $p=0.019$ ). **CONCLUSIONS:** Strength variables were associated with knee mechanics in the PWS group, indicating that aberrant gait in PWS may relate to muscle weakness. Adults with knee osteoarthritis (KOA) have a quadriceps avoidance gait pattern indicated by lower KFE. Individuals with PWS had lower quadriceps strength compared to controls, which was associated with lower KFE. Lower quadriceps strength and altered knee mechanics in individuals with PWS may contribute to KOA.

### 88 Board #4 May 29 9:30 AM - 11:30 AM

#### Recovery of Joint Function During Sit to Walk Following Periacetabular Osteotomy: A Case Study

Cailyn Schroeder<sup>1</sup>, Linnea Zavala<sup>1</sup>, Laura Opstedal<sup>2</sup>, James Becker<sup>1</sup>. <sup>1</sup>Montana State University, Bozeman, MT. <sup>2</sup>Build Physio and Performance, PLLC, Bozeman, MT.  
(No relevant relationships reported)

To date, biomechanical analyses of outcomes after periacetabular osteotomy (PAO) have not evaluated short term recovery or assessed activities other than walking or running. **PURPOSE:** Evaluate changes in joint moments and moment distributions during a sit to walk (STW) task before (PRE) and 6 weeks (6WK), 12 weeks (12WK), and 6 months (6MO) following PAO surgery. **METHODS:** A 22 year old female who underwent PAO due to a history of failed hip surgeries participated. She was non-weight bearing for 6 weeks following PAO, with physical therapy initiated in the first week. At each time point STW trials were performed under motion capture while ground reaction forces were recorded using force plates. Peak extensor moments at the hip (HEM), knee, and ankle, peak support moment (Ms), and distribution of peak Ms among joints were calculated. Differences between nonsurgical (NS) and surgical (S) limbs and times were evaluated using single subject analysis techniques. **RESULTS:** At PRE, peak Ms and HEM were higher on the NS side (both  $p<0.01$ ). However, the distribution of peak Ms among joints was not different between limbs (all  $p>0.05$ ). By 6WK after surgery peak Ms and HEM on the NS limb increased by 35.6% ( $p<0.01$ ) and 40% ( $p<0.01$ ), while decreasing by 49.6% ( $p<0.01$ ) and 67% ( $p<0.01$ ) on the S limb. Additionally, within the S limb there was a redistribution of load bearing, with the hip carrying a smaller percentage of peak Ms and the knee a larger percent (both  $p<0.01$ ). While deficits were still present at 12WK, the magnitude of differences decreased (all  $p<0.01$ ). By 6MO Ms, HEM, and distribution of Ms across joints had returned to pre-surgery values (all  $p<0.01$ ). However, moments were still larger on the NS limb compared to S limb (all  $p<0.01$ ). **CONCLUSION:** During recovery from PAO there is a shift in loading from the S limb to the NS limb and a redistribution of load carriage within the S limb which gradually dissipates over 6 months. Rehabilitation programs should include methods cope with this altered loading.

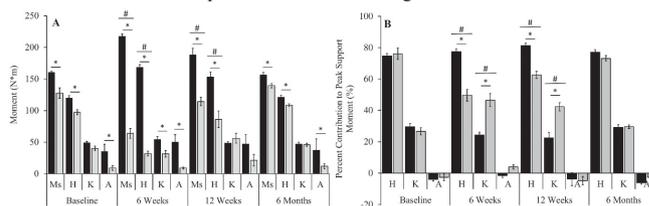


Figure 1. Peak support moment (Ms), hip (H), knee (K), and ankle (A) extensor moments at instance of peak support moment (A), and distributions of the support moment across the hip, knee, and ankle joints (B). Black bars are the nonsurgical limb and grey bars are the surgical limb. \* and # indicate statistically significant differences between limbs and time points, respectively. All differences are at the  $p<0.01$  level.

### 89 Board #5 May 29 9:30 AM - 11:30 AM

#### Recovery of Hip Biomechanics During Walking After Periacetabular Osteotomy

Linnea J. Zavala<sup>1</sup>, Cailyn Schroeder<sup>1</sup>, James Becker<sup>1</sup>, Laura Opstedal<sup>2</sup>. <sup>1</sup>Montana State University, Bozeman, MT. <sup>2</sup>Build Physio & Performance, PLLC, Bozeman, MT.  
Email: linnea.zavala@gmail.com  
(No relevant relationships reported)

To date, studies on biomechanical outcomes following periacetabular osteotomy (PAO) have focused on gait adaptations 6 months or 1 year post-surgery. There are no reports in the literature on how biomechanics recover during the initial months following surgery. **PURPOSE:** To assess changes in hip angles and moments during walking between pre-PAO-surgery (PRE), and 6 weeks (6WK), 12 weeks (12WK), and 6 months (6MO) post-operation. **METHODS:** One female collegiate athlete (age: 22 yrs; mass: 85 kg; height: 181 cm) with a history of failed hip surgeries participated. At each time point hip kinematics and kinetics in the surgical limb were assessed during walking using motion capture and force plates. Variables of interest included peak hip extension (HE), adduction (HAD), and internal rotation (HIR) angles, hip extensor moment (HEM) at the initial vertical ground reaction force peak, and peak hip abductor (HABM) and internal rotator (HIRM) moments. Differences between time points were evaluated using ANCOVA with walking velocity as a covariate. **RESULTS:** Compared to PRE, HE was reduced at 6WK ( $p<0.0001$ ). While HE increased back towards PRE values at each time point ( $p<0.0001$ ), it was still reduced at 6MO. By 12W, HEM increased from B ( $p<0.0001$ ), which was still true at 6M ( $p=0.012$ ). HAD decreased after 12W post-surgery ( $p<0.0001$ ). The same pattern was seen for HABM ( $p<0.0001$ ). HIR decreased from B to 6M ( $p<0.0001$ ) and HIRM decreased after surgery ( $p=0.031$ ) but at 6M was not different than B. **CONCLUSIONS:** Overall, hip angles and moments during walking decreased in the involved limb immediately following PAO but began to return towards baseline by 12WK to 6MO. Increased HEM beyond

baseline was also observed, indicating more use of the surgical leg to move the body through stance than prior to surgery. Understanding these initial recovery patterns may help improve PAO-specific rehabilitation programs.

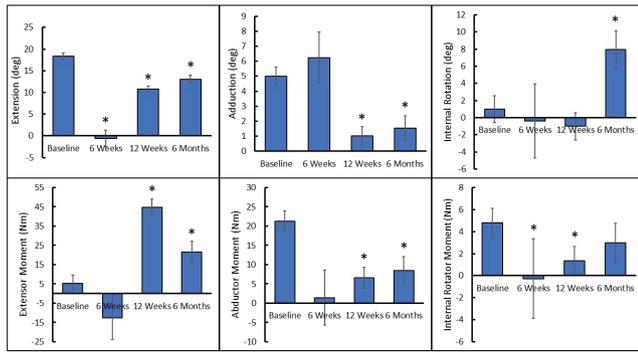


Figure 1 Average hip angles and hip moments for involved leg. Error bars are standard error. The asterisks indicate differences from baseline for p-value < 0.05.

90 Board #6 May 29 9:30 AM - 11:30 AM

**Increased Dynamic Knee Joint Load at the Non-Modified Limb during Medial Knee Thrust Gait Modification**

Oladipo Eddo, Bryndan Lindsey, Matthew Prebble, Shane V. Caswell, Nelson Cortes. *George Mason University, Manassas, VA.*  
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(No relevant relationships reported)

Medial contact force (MCF) is a measure of the internal loads contributing to knee cartilage loss. Including both knee adductor moment (KAM) and knee flexor moment (KFM) peaks in regression equations significantly improves the prediction of MCF. The objective of gait modification is to reduce KAM by lateralizing the resultant vector of the ground reaction force of the targeted limb. Yet, scant research currently exists investigating consequential changes in MCF of the non-modified limb. **PURPOSE:** To compare changes in MCF of the non-modified limb as a result of implementing medial knee thrust (MKT) strategy. **METHODS:** 19 healthy participants (age 26.74.8 years; height 1.690.17 m; mass 72.311.8 kg) volunteered for this study. All analyses were completed on the non-modified limb. Participants completed 10 trials each walking with normal gait and MKT. The prescribed change in knee angle during the MKT trials was participant specific, using the mean and standard deviation (SD) from baseline trials. During MKT trials, visual real-time feedback was provided to ensure joint angles fell within 1-3 SD (1<sup>st</sup> 5 trials) and 3-5 SD (last 5 trials) from baseline average. KAM and KFM were computed on Visual 3D. To assess MCF, a linear regression equation was used. Coefficient values (c1, c2, and c3) were attained from prior studies that quantified MCF using instrumented knee implants. Changes in MCF during the 1<sup>st</sup> and 2<sup>nd</sup> half of stance were assessed using an ANOVA (P<0.05). **RESULTS:** MCF of the non-modified limb for the 1<sup>st</sup> half of stance was significantly greater during the MKT trials (F<sub>2,36</sub> = 6.747, P=0.003). Participants had greater MCF during the 1-3 SD (d=0.36) and the 3-5 SD (d=0.44) compared to the baseline trials. No other statistically significant difference was found (P<0.05). **CONCLUSION:** Increased MCF in the non-modified knee is possibly explained by the lateralization of the force vector from the modified limb. As a result of the repetitive nature of gait, small increases in MCF over each step may instigate significant ramifications over time. Our results suggest that for individuals with bilateral knee osteoarthritis MKT may be contraindicated. Future studies implementing gait retraining within pathological populations should consider investigating biomechanical changes in the non-modified knee.

91 Board #7 May 29 9:30 AM - 11:30 AM

**Diabetes is Associated with Slow Walking Speed in People with Knee Osteoarthritis**

Aqeel M. Alenazi<sup>1</sup>, Mohammed M. Alshehri<sup>2</sup>, Shaima Alothman<sup>2</sup>, Corey Gray<sup>2</sup>, Abdalghani A. Yahya<sup>2</sup>, Jason Rucker<sup>2</sup>, Bader A. Alqahtani<sup>3</sup>, Saad M. Bindawas<sup>4</sup>, Patricia M. Kluding<sup>2</sup>. <sup>1</sup>University of Kansas Medical Center and Prince Sattam Bin Abdulaziz University, Kansas City, KS. <sup>2</sup>University of Kansas Medical Center, Kansas City, KS. <sup>3</sup>Prince Sattam Bin Abdulaziz University, Alkharj, Saudi Arabia. <sup>4</sup>King Saud University, Riyadh, Saudi Arabia.  
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(No relevant relationships reported)

Walking speed is often considered a sixth vital sign and an important predictor for disability and mortality in older adults. Previous research has shown that a decline in

walking speed is associated with diabetes (DM) or osteoarthritis (OA), independently. Slow walking speed may interfere with daily living and basic mobility needs.

**Purpose:** The aim of this study was to investigate the impact of diabetes on walking speed in people with knee OA. **Methods:** A cross sectional analysis of Osteoarthritis Initiative (OAI) data at 96 months follow up was performed for 2122 individuals aged between 53-87 years with knee pain over 30 days. Participants were grouped into knee OA+diabetes or knee OA only. Walking speed was measured using the average speed of two trials of 20 meter walk test. Diabetes and knee pain over 30 days were assessed via a self-reported questionnaire. Walking speed was categorized as either slow walking speed (<1.0 m/s) or normal walking speed (≥1.0 m/s). Knee pain while walking was assessed immediately after each walk test using a numeric rating scale from 0 to 10. Knee pain while walking was categorized as follows: no pain (0), mild pain (1-3), moderate pain (4-6) and severe pain (7-10). Logistic regression analyses were performed at 0.05 alpha level. **Results:** A total of 1848 participants had knee OA only and 274 had knee OA+diabetes. A total of 245 individuals had a walking speed < 1.0 m/s with 26.5% of these individuals having diabetes. A total of 1877 participants had a walking speed ≥1.0 m/s with 11.1% of these individuals having diabetes. Logistic regression analyses showed that diabetes was significantly associated with slow walking speed (<1.0 m/s), (odds ratio 1.62; 95% confidence interval [1.11, 2.36], p=0.013) after controlling for age, sex, race, body mass index, depression and pain while walking. **Conclusion:** This study found an association between diabetes and slow walking speed in people with knee OA, independent of knee pain. People with diabetes and knee OA are about 1.6 times more likely to have a slow walking speed (<1.0 m/s) than those with OA alone. Previous research has linked slow walking speed to adverse health outcomes. Further research should explore the complex relationships between walking speed, functional ability, and health outcomes in this population.

92 Board #8 May 29 9:30 AM - 11:30 AM

**Obesity Moderates the Association Between Knee Adduction During Gait and Femoral Cartilage Thickness**

Derek N. Pamukoff<sup>1</sup>, Michael N. Vakula<sup>2</sup>, Eric J. Shumski<sup>1</sup>, Skylar C. Holmes<sup>1</sup>, Brett K. Post<sup>1</sup>, Steven A. Garcia<sup>3</sup>. <sup>1</sup>California State University, Fullerton, Fullerton, CA. <sup>2</sup>Utah State University, Logan, UT. <sup>3</sup>University of Michigan, Ann Arbor, MI.  
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(No relevant relationships reported)

Mechanical stimuli are necessary for the maintenance of articular cartilage. Individuals with obesity have large joint loads during gait yet are at high risk for knee osteoarthritis. As such, the association between joint loading and cartilage thickness in individuals with obesity is unclear. **PURPOSE:** To examine the moderating effect of obesity on the association between knee adduction characteristics during gait and femoral cartilage thickness.

**METHODS:** 48 young adults with and 48 without obesity matched on age and sex completed assessments of gait biomechanics and ultrasound imaging. Ultrasound imaging was completed in 140° of knee flexion, and outcome variables included cartilage thickness of the medial and lateral femoral condyles, and the medial to lateral (M:L) thickness ratio. 3-dimensional gait analyses were conducted over 5 trials on a 10m runway at a self-selected speed. Biomechanical outcomes included the peak knee adduction angle (KAA), first (KAM<sub>1</sub>) and second (KAM<sub>2</sub>) peaks of the knee adduction moment, and the knee adduction angular impulse (KAI). Kinetics were normalized to a product of height and weight. Multiple linear regression was used to examine the association between biomechanical and cartilage outcomes after accounting for sex, gait speed, and step width. The moderating effect of body mass index (BMI) on the association between biomechanical and cartilage outcomes was assessed via the addition of the interaction term (BMI x biomechanical variable). Significant interactions were assessed via post hoc probing of the conditional slopes at each level of BMI group (α=0.05). **RESULTS:** There was a significant interaction between BMI group and KAA (β=-0.029, p=0.03), KAM<sub>1</sub> (β=-15.70, p<0.01), and KAI (β=-34.50, p=0.04) on the M:L ratio. Post hoc probing indicated that KAA (Effect=0.02, p=0.05), KAM<sub>1</sub> (Effect=12.63, p<0.01), and KAI (Effect=29.40, p=0.02) were only associated with M:L ratio in individuals without obesity. No associations were found between biomechanical outcomes and medial or lateral femoral condyle cartilage thickness. **CONCLUSIONS:** Results suggest that obesity influences the ability of cartilage to positively adapt to ambulatory joint loads. Obesity is associated with proinflammatory cytokines, which may impair cartilage remodeling in response to mechanical stimuli.

## A-21 Free Communication/Slide - Factors Influencing Work Capacity in the Heat

Wednesday, May 29, 2019, 9:30 AM - 11:00 AM  
Room: CC-202C

**93 Chair:** Ollie Jay, FACSM. *University of Sydney, Lidcombe, Sydney, Australia.*

(No relevant relationships reported)

## 94 May 29 9:30 AM - 9:45 AM Relationship Between Muscle Oxygenation and Oxygen Uptake During Exercise in the Heat

Margaret C. Morrissey, Luke N. Belval, Gabrielle E. W. Giersch, Rachel K. Katch, Brad D. Endres, Taylor A. Duhart, Douglas J. Casa, FACSM. *Korey Stringer Institute, University of Connecticut, Storrs, CT.* (Sponsor: Douglas Casa, FACSM)  
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(No relevant relationships reported)

Exercising in the warm environments increases thermoregulatory demand for skin blood flow, influencing oxygen delivery and oxygen consumption ( $\text{VO}_2$ ) systemically and to active muscle. Near infrared spectroscopy (NIRS) is a non-invasive technique that indirectly assesses local tissue oxygen delivery and  $\text{VO}_2$  and accounts for systemic oxygen uptake. Limited evidence exists on the relationship between muscle oxygenation and systemic oxygen uptake during combined heat stress and exercise. **PURPOSE:** To examine the relationship between muscle oxygenation and  $\text{VO}_2$  at different exercise intensities in the heat. **METHODS:** Six participants (4 males, 2 females, age:  $21 \pm 1.0$  years, height:  $173.41 \pm 15.84$  cm, weight:  $73.14 \pm 17.28$  kg,  $\text{VO}_{2\text{max}}$ :  $46.41 \pm 3.53$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) performed a treadmill exercise protocol (30°C, 60% relative humidity) with 10 minutes each at 30%, 40%, 60%, 70%, and 80% of velocity at  $\text{VO}_{2\text{max}}$ . NIRS (Moxo, Fortiori Design LLC, Minnesota, USA) was used to assess muscle oxygen saturation ( $\text{SmO}_2$ ) of the vastus lateralis muscle and systemic  $\text{VO}_2$  was measured using expiratory gas analysis. Pearson correlations coefficients were calculated to evaluate the relationship between average  $\text{SmO}_2$ , relative changes from baseline ( $\Delta$ ) in  $\text{SmO}_2$ , mean  $\text{VO}_2$  at percent of peak velocity, and percent of  $\text{VO}_{2\text{max}}$ . **RESULTS:** There was a positive correlation between  $\Delta\text{SmO}_2$  and  $\text{VO}_2$  at 80% of peak velocity ( $r=0.857$ ,  $p=0.029$ ). There were no significant correlations between  $\Delta\text{SmO}_2$  and  $\text{VO}_2$  at 30%, 40%, 60%, or 70% of peak velocity (30%:  $r=0.483$ ,  $p=0.332$ ; 40%:  $r=0.554$ ,  $p=0.254$ ; 60%:  $r=0.653$ ,  $p=0.160$ ; 70%:  $r=0.620$ ,  $p=0.189$ ). There were no significant correlations between mean  $\text{SmO}_2$ ,  $\text{VO}_2$  at percent of peak velocity, or percent  $\text{VO}_{2\text{max}}$ . **CONCLUSION:** At 80% of peak velocity,  $\Delta\text{SmO}_2$  and  $\text{VO}_2$  are positively correlated and may suggest this relationship exists while running at high intensities. Therefore, the relationship between NIRS measured  $\text{SmO}_2$  and oxygen uptake during exercise in the heat must be further explored in order to use NIRS as an assessment for energy efficiency and substrate utilization.

**95 May 29 9:45 AM - 10:00 AM**

## Application of the Thermal-Circulatory Ratio to Individuals Without History of Exertional Heat Illness

Brad D. Endres, Luke N. Belval, Gabrielle E. W. Giersch, Rachel K. Katch, Margaret C. Morrissey, Rebecca L. Stearns, Douglas J. Casa, FACSM. *Korey Stringer Institute, Storrs, CT.* (Sponsor: Douglas J Casa, FACSM)

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(No relevant relationships reported)

The thermal-circulatory ratio (TCR) is a supportive measure for the assessment of heat tolerance (HT) that was developed for use in military-age males with a history of exertional heat illness (EHI). Examining the heat tolerance test (HTT) and the TCR in a healthy population would give evidence for the application of these as functional measures of heat tolerance in this population. **PURPOSE:** To assess the sensitivity and specificity of the TCR threshold value during a HTT in a subset of individuals without a history of EHI. **METHODS:** 12 participants (8 males, 4 females; age:  $20 \pm 2$  years; height:  $171 \pm 11$  cm; weight:  $68.7 \pm 12.97$  kg;  $\text{VO}_{2\text{max}}$ :  $46.83 \pm 4.59$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) completed a HTT composed of two hours of treadmill walking at a speed of  $5 \text{ km} \cdot \text{hour}^{-1}$  at a 2% grade in 40°C and 40% relative humidity. Rectal temperature ( $T_{\text{re}}$ ) was assessed and heart rate (HR) was assessed. The Israeli Defense Force (IDF) criteria for heat intolerance was utilized and determined when  $T_{\text{re}}$  exceeded 38.5°C, HR exceeded 150 bpm, or when either did not reach a plateau. The TCR was calculated by dividing  $T_{\text{re}}$  by HR. The TCR threshold value to determine heat tolerance at the end of the HTT ( $\text{TCR}_{\text{HTT}}$ ) was  $0.279^\circ\text{C}/\text{bpm}$ . Independent t-tests were performed to compare ending  $T_{\text{re}}$  and HR between HT and heat intolerant (HI) groups. Data are presented as mean  $\pm$  SD and significance level ( $p < 0.05$ ) was set a priori. Diagnostic accuracy of the

TCR criterion in comparison to IDF HTT criterion was assessed using sensitivity and specificity. **RESULTS:** The mean  $T_{\text{re}}$ , HR, and  $\text{TCR}_{\text{HTT}}$  were  $38.02 \pm 0.79^\circ\text{C}$ ,  $119 \pm 19$  bpm, and  $0.327 \pm 0.04^\circ\text{C}/\text{bpm}$ , respectively. There were no differences in  $T_{\text{re}}$  at the end of the HTT between HT and HI, though HR was observed to be lower in HT versus HI ( $p=0.006$ ). Sensitivity and specificity of the TCR in healthy individuals was 50% and 100%, respectively. The positive likelihood ratio was unable to be calculated due to a lack of false positives. The negative likelihood ratio (-LR) was 0.5. **CONCLUSIONS:** The specificity of the TCR in this study is similar to findings in previous research. The TCR threshold identified all healthy participants who were HT ( $n=8$ ) based on IDF criteria but lacked the ability to determine HI participants. Further research is needed to determine the application of the TCR to varying groups of individuals and if it may be a potential predictor for future EHI risk.

## 96 May 29 10:00 AM - 10:15 AM Sex Differences in Internal Temperature Responses to Prolonged Exercise in the Heat

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(No relevant relationships reported)

Given the increased female presence in military populations and the extreme environmental stress of many military operations, it is important to fully elucidate possible differences in response to environmental stresses between the sexes. **PURPOSE:** To investigate the sex differences in temperature responses to prolonged, dynamic exercise in the heat. **METHODS:** Six individuals (3 males, 3 females, age:  $20 \pm 2$  y height:  $166 \pm 9.5$  cm weight:  $69.58 \pm 13.6$  kg  $\text{VO}_{2\text{max}}$ :  $43.2 \pm 2.1$  ml/min/kg) completed nine-hour trials with three 80-minute blocks of exercise that consisted of bouts of walking at 30% and 40%  $\text{VO}_{2\text{max}}$  and running at 70% and 80% of velocity at  $\text{VO}_{2\text{max}}$ , followed by 50 minutes of rest. Exercise was completed in two hot environmental conditions (dry: 35°C, 30% relative humidity (RH); and humid 30°C, 60% RH) and two clothing conditions (t-shirt and shorts, and Army Combat Uniform). Internal temperature ( $T_{\text{int}}$ ) was assessed continuously via rectal probe. Independent samples t-tests were utilized to assess differences between the sexes. Data are presented as mean  $\pm$  SD, significance was set a priori at  $p < 0.05$ . **RESULTS:** The only differences in this data set were present in the maximum  $T_{\text{int}}$  in the third block of exercise (male:  $39.23 \pm .40$ , female:  $38.82 \pm .15^\circ\text{C}$ ,  $p=0.028$ ). Environmental and clothing condition data was pooled for this preliminary analysis. No differences were observed in mean temperatures for any blocks of exercise (Block 1 – male:  $38.06 \pm 0.30^\circ\text{C}$ , female:  $38.08 \pm 0.39^\circ\text{C}$ ,  $p=0.542$ ; Block 2 – male:  $38.46 \pm 0.31^\circ\text{C}$ , female:  $38.19 \pm 0.31^\circ\text{C}$ ,  $p=0.941$ ; Block 3 – male:  $38.66 \pm 0.35^\circ\text{C}$ , female:  $38.27 \pm 0.19^\circ\text{C}$ ,  $p=0.157$ ). Additionally, there were no differences in sweat rate between sexes any blocks of exercise throughout the trials (Block 1 – male:  $1.20 \pm 0.39 \text{L} \cdot \text{hr}^{-1}$ , female:  $0.58 \pm 0.33 \text{L} \cdot \text{hr}^{-1}$ ,  $p=0.693$ ; Block 2 – male:  $1.05 \pm 0.20 \text{L} \cdot \text{hr}^{-1}$ , female:  $0.88 \pm 0.31 \text{L} \cdot \text{hr}^{-1}$ ,  $p=0.337$ ; Block 3 – male:  $1.14 \pm 0.47 \text{L} \cdot \text{hr}^{-1}$ , female:  $0.65 \pm 0.35 \text{L} \cdot \text{hr}^{-1}$ ,  $p=0.410$ ). **CONCLUSION:** While these preliminary data show only maximum temperature difference in the final block of exercise, additional data is needed to fully elucidate the impact of prolonged exercise heat exposure on both males and females. This investigation aims to help to answer any questions about special military considerations for males and females during prolonged missions or training in the heat.

**97 May 29 10:15 AM - 10:30 AM**

## Effects of Solar Radiation Exposure on Self-regulated Exercise Intensity and Thermoregulation in the Heat Outdoors

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(No relevant relationships reported)

High radiant heat load reduces endurance exercise performance in the heat indoors, but this remains unconfirmed in outdoor exercise. **PURPOSE:** The present study examined the effects of variations in solar radiation exposure on self-regulated exercise intensity and thermoregulatory responses in the heat outdoors at a fixed rating of perceived exertion (RPE). **METHODS:** Ten male participants completed 45-min cycling exercise in hot outdoor environments (about 31°C) at a freely chosen resistance and pedal cadence at an RPE of 13 (somewhat hard). Participants were blinded to resistance, pedal cadence, distance and elapsed time and exercised at three sunlight exposure conditions: clear sky (mean  $\pm$  SD:  $1072 \pm 91 \text{ W} \cdot \text{m}^{-2}$ ; HIGH); thin cloud ( $592 \pm 32 \text{ W} \cdot \text{m}^{-2}$ ; MID); and thick cloud ( $306 \pm 52 \text{ W} \cdot \text{m}^{-2}$ ; LOW). Rectal and skin (chest, upper arm, thigh and calf) temperatures, heart rate, skin blood flow and blood pressure were recorded at rest and during exercise. **RESULTS:** Power output (HIGH  $96 \pm 22 \text{ W}$ ;

MID 103±20 W; LOW 108±20 W) and resistance (HIGH 1.3±0.3 kp; MID 1.4±0.2 kp; LOW 1.5±0.3 kp) were lower in HIGH than MID and LOW (Power output  $p<0.001$ ; Resistance  $p<0.01$ ). Pedal cadence was lower as solar radiation increases (HIGH 64.5±5.1 rpm; MID 65.9±4.2 rpm; LOW 67.7±3.9 rpm) and was different between all trials (all  $p<0.001$ ). The core-to-skin temperature gradient was narrower, body heat gain from the sun (SHG) was greater and thermal sensation was higher with increasing solar radiation and all variables were different between all trials (all  $p<0.01$ ). Mean skin temperature was higher in HIGH than MID and LOW ( $p<0.01$ ), but rectal temperature was similar between trials ( $p=0.485$ ). **CONCLUSIONS:** We conclude that self-regulated exercise intensity in the heat outdoors at a fixed RPE of somewhat hard is reduced with increasing solar radiation because of greater thermoregulatory strain, perceived thermal stress and SHG. Moreover, solar radiation below about 600  $W\cdot m^{-2}$  might be of benefit to maintain endurance physical performance in the heat.

98 May 29 10:30 AM - 10:45 AM

### A New Paradigm To Quantify The Reduction Of Physical Work Capacity In The Heat.

Josh Foster<sup>1</sup>, James Smallcombe<sup>1</sup>, Simon Hodder<sup>1</sup>, Ollie Jay, FACSM<sup>2</sup>, Andreas Flouris<sup>3</sup>, George Havenith, FACSM<sup>1</sup>.  
<sup>1</sup>Loughborough University, Loughborough, United Kingdom.  
<sup>2</sup>University of Sydney, Sydney, Australia. <sup>3</sup>University of Thessaly, Thessaly, Greece. (Sponsor: Professor George Havenith, FACSM)  
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Heat stress reduces physical work capacity (PWC), which can incur major economic deficits. In the context of climate change, an accurate prediction model for PWC as a function of heat stress severity is urgently required, allowing accurate forecasting of its expected future economic impacts. **PURPOSE:** Evidence shows that physical work at self-selected intensities is characterised by a largely stable working heart rate (HR) indicating a constant cardiovascular strain. Given that both heat stress and work load affect HR, we developed a constant cardiovascular strain methodology to quantify heat-induced reductions in PWC at a workload between moderate and heavy based on WHO definitions. **METHOD:** Sixteen young adult male participants (heterogenous in fitness and body characteristics) performed ten experimental trials each consisting of 1-hour of treadmill walking exercise at a HR clamped at 125  $b\cdot min^{-1}$ . The first experimental trial was conducted in a reference environment with no heat stress (15°C, 50% rh). The remaining nine trials were conducted at the same fixed target HR in WBGT ranges of 21 to 41°C (variations in both temperature and humidity). The total kilojoules of energy above resting, generated during treadmill work in each heat-stress experimental trial was expressed as a percentage of that achieved in the reference condition, enabling quantification of the change in PWC (%). **RESULTS:** Clamping the heart rate during physical work in the heat produced individualised predictions of PWC which were sensitive to WBGT and aerobic fitness. Reductions in PWC (12 ± 10 %) were noted at a WBGT of 20°C (i.e. 30°C, 20% rh). In this condition, no losses in PWC were reported in those with high aerobic fitness ( $\geq 60$  ml/kg/min), whereas PWC fell by 20-25% for individuals with a  $\dot{V}O_{2max}$  of 35 to 40 ml/kg/min. At a WBGT of 41°C, PWC fell by 75 ± 11%, indicating that some work was still possible even during extreme heat exposure. **CONCLUSION:** Reductions in PWC were sensitive to WBGT and fitness, allowing for computation of a new formula to predict PWC changes and associated losses in GDP as a result of climate change. Funding was provided by 'Heat-Shield', European Union's Horizon 2020 research and innovation programme under the Grant agreement no. 668786.

99 May 29 10:45 AM - 11:00 AM

### Impact of Fan Use on Physical Work Capacity in Extreme Heat

James W. Smallcombe<sup>1</sup>, Josh Foster<sup>1</sup>, Simon Hodder<sup>1</sup>, Ollie Jay, FACSM<sup>2</sup>, Andreas D. Flouris<sup>3</sup>, Katy Griggs<sup>1</sup>, Lucy Dorman<sup>1</sup>, George Havenith, FACSM<sup>1</sup>. <sup>1</sup>Loughborough University, Loughborough, United Kingdom. <sup>2</sup>The University of Sydney, Sydney, Australia. <sup>3</sup>University of Thessaly, Thessaly, Greece.  
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 (No relevant relationships reported)

Emerging evidence suggests that electric fan use can reduce thermoregulatory and cardiovascular strain at air temperatures as high as 42°C during rest. However, there is a dearth of empirical evidence relating to the safety limits for fan use at various combinations of air temperatures and humidity, and how their use impacts physical work capacity (PWC). **PURPOSE:** The aim of the current study is to provide new threshold limit values for electric fan use during physical work. **METHODS:** Sixteen young adult males (heterogenous in fitness and anthropological characteristics) performed ~20 trials, consisting of 1 hour of treadmill walking at a fixed heart rate of 130  $beats\cdot min^{-1}$ . The first experimental trial was conducted in a reference environment with no heat-stress (15°C, 50% rh). The remaining trials were conducted at the same fixed heart rate for a maximum of 1 hour at 30-50°C at various humidities.

Each experimental trial was conducted with and without electric fans. The PWC in each heat-stress trial was defined as the total energy expended during 1 hour of treadmill walking and was expressed relative (%) to that expended during the reference condition. The study cohort was split into two subgroups with one group performing trials in minimal clothing (shorts only) whilst the second group undertook trials wearing protective clothing covering the legs, torso and arms (e.g. coveralls). **RESULTS:** Based on individual responses to fan exposure during moderate to heavy work undertaken wearing minimal clothing, forced convection was always beneficial at air temperatures  $\leq 34^\circ C$ . Between 34 and 43°C, a consistent fan benefit was only observed between 40 and 60% relative humidity, with lowered PWC above and below. In contrast, when protective clothing was worn, the beneficial impact of fans between 34 and 43°C was eroded with negligible effects on PWC observed. PWC was consistently impaired by fan use at air temperatures  $>43^\circ C$ . **CONCLUSION:** These empirical data will facilitate the formulation of comprehensive threshold limit values for fan use during physical work based on biophysical parameters. Funding was provided by 'Heat-Shield', European Union's Horizon 2020 research and innovation programme under the Grant agreement no. 668786.

## A-22 Free Communication/Slide - Respiratory

Wednesday, May 29, 2019, 9:30 AM - 11:15 AM  
 Room: CC-105A

100 **Chair:** Stephanie Kurti. James Madison University, Harrisonburg, VA.

(No relevant relationships reported)

101 May 29 9:30 AM - 9:45 AM

### Mechanical Unloading of the Respiratory System during 5km Cycling Time Trials in Hypoxia

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 (No relevant relationships reported)

In trained endurance athletes, the ability to defend arterial oxy-hemoglobin saturation ( $SaO_2$ ) during high intensity constant-workload exercise in moderate hypoxia depends in part on the ability to increase minute ventilation ( $\dot{V}_E$ ). Previous data have shown, however, that despite the existence of a substantial amount of ventilatory reserve ( $\dot{V}_{Eres}$ ) in some cyclists,  $\dot{V}_E$  surprisingly does not increase during 5km time trials (5kTT) in hypoxia, despite a significant decrease in both  $SaO_2$  and mean power output ( $P_{TT}$ ) from normoxia. **PURPOSE:** To determine the effect of reducing the work of breathing ( $W_b$ ) on  $\dot{V}_E$ , breathlessness (RPB), and  $P_{TT}$  during a 5kTT in hypoxia in highly trained cyclists. We hypothesized no change in RPB, while  $\dot{V}_E$  would increase with an attenuated decrement in  $SaO_2$  and  $P_{TT}$  from normoxia.

**METHODS:** Fourteen trained male cyclists ( $\dot{V}O_{2max} = 58.7 \pm 4.7$   $ml\cdot kg^{-1}\cdot min^{-1}$ ) performed a 5kTT under 3 conditions at sea level: 'CON' ( $FiO_2 = 0.21$ ), 'HYP' ( $FiO_2 = 0.16$ ), and 'HYP+He' ( $FiO_2 = 0.16$ , with balance helium). Esophageal balloons were used to assess  $W_b$  in each condition. Inspiratory capacity maneuvers were performed at each km, and flow-volume loop analyses were used to assess the %EFL and  $\dot{V}_{Eres}$ . The modified Borg scale (0-10) was used to assess RPB at each km.

**RESULTS:**  $W_b$  decreased from HYP to HYP+He by 30 ± 18% ( $p < 0.01$ ). Despite a substantial  $\dot{V}_{Eres}$  throughout CON (52 ± 44  $L\cdot min^{-1}$ ),  $\dot{V}_E$  was not different between CON (117.4 ± 17.9  $L\cdot min^{-1}$ ) and HYP (124.8 ± 17.9  $L\cdot min^{-1}$ ) but increased during HYP+He (139.5 ± 22.0  $L\cdot min^{-1}$ ;  $p < 0.05$ ). While  $SaO_2$  decreased from CON to HYP by 10 ± 1% ( $p < 0.01$ ),  $SaO_2$  increased by 4 ± 1% from HYP to HYP+He ( $p < 0.01$ ).  $P_{TT}$  decreased from CON to HYP (-14.2%;  $p < 0.01$ ) and increased from HYP to HYP+He (+5.5%;  $p < 0.01$ ). When comparing HYP to HYP+He, a significant correlation was observed between  $\Delta SaO_2$  and  $\Delta P_{TT}$  ( $r = 0.69$ ;  $p < 0.05$ ). RPB increased from CON (6.0 ± 2.0) to HYP (7.0 ± 2.0;  $p < 0.05$ ) and was unchanged from HYP to HYP+He (6.6 ± 2.0).

**CONCLUSIONS:** In moderate hypoxia, a low ventilatory reserve does not limit 5km time trial performance, where by design, individuals are free to adjust power output. The ability to utilize ventilatory reserve while remaining below a critical threshold of perceived breathlessness appears conducive to maintaining aerobic exercise performance in moderate hypoxia.

102 May 29 9:45 AM - 10:00 AM

**Dysanapsis Ratio as a Predictor of Expiratory Flow Limitation in Endurance Trained Athletes**

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(No relevant relationships reported)

**PURPOSE:** To investigate whether the dysanapsis ratio (DR) predicts expiratory flow limitation in highly trained athletes, as has been shown in healthy, active men and women. **METHODS:** Data from 124 highly trained men (age 21.9 ± 3.6 yrs) who performed maximal incremental tests to exhaustion were analyzed. The maximum expiratory flow-volume curve, along with inspiratory capacity maneuvers, were used to determine lung volumes, determine expiratory flows, and to quantify flow limitation. The subjects were partitioned into 'flow-limited' (EFL) and 'non flow-limited' (NEFL) groups, where tidal vs. maximal flow-volume overlap >5% qualifies as EFL. Group differences were evaluated using independent T-tests, while logistic regression was used to assess the predictive ability of DR, forced vital capacity (FVC), and VO<sub>2max</sub> on EFL. **RESULTS:** 63% of subjects (n = 78) displayed EFL with an average severity of 43.3 ± 21.0%. EFL showed significantly lower FEV<sub>1</sub> (4.5 ± 0.6 vs. 4.9 ± 0.6 L, p < .001), FEV<sub>1</sub>/FVC (86.3 ± 7.8 vs. 91.3 ± 5.7%, p < .001), and FEF<sub>50</sub> (6.1 ± 2.0 vs. 7.6 ± 1.4 L·s<sup>-1</sup>, p < .001). However, no significant differences were found in FVC (5.2 ± 0.7 vs. 5.3 ± 0.8 L, p = .191) between groups. EFL showed a significantly smaller DR (0.2 ± 0.1 vs. 0.3 ± 0.1, p = .001) compared to NEFL. There were no differences between EFL and NEFL at peak exercise with respect to VO<sub>2max</sub> (67.1 ± 8.1 vs. 65.4 ± 4.5 ml·min<sup>-1</sup>·kg<sup>-1</sup>, p = .246), VE (155.9 ± 26.0 vs. 158.6 ± 26.6 L·min<sup>-1</sup>, p = .59), or frequency of breathing (56.8 ± 8.6 vs. 55.4 ± 10.3 br·min<sup>-1</sup>, p = .42). A significant predictive relationship was observed between DR on EFL (*Odds Ratio* (OR): 0.55, 95% CI 0.36 to 0.81, p < .01). A multivariate analysis indicated that DR (OR 0.35, 95% CI 0.21 to 0.58, p < .001), FVC (OR 0.49, 95% CI 0.31 to 0.78, p = .003), and VO<sub>2max</sub> (OR 1.63, 95% CI 1.05 to 2.53, p = .028) were significant predictors of EFL. **CONCLUSIONS:** Consistent with previous findings in active subjects, an increase in DR or FVC significantly decreases the likelihood of EFL in highly trained athletes. However, results from this analysis show that when controlling for DR and FVC, an increase in VO<sub>2max</sub> significantly increases the likelihood of EFL. This relationship was previously found to be non-significant in healthy active individuals and may highlight potential differences that exist within endurance trained populations.

103 May 29 10:00 AM - 10:15 AM

**No Sex Differences In Diaphragmatic Fatigue When Matched For Absolute Force During Inspiratory Pressure-threshold Loading**

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(No relevant relationships reported)

It has recently been demonstrated that women experience an attenuated cardiovascular response to inspiratory pressure-threshold loading (PTL). Furthermore, due to a significantly longer time to task failure, the rate of development of diaphragmatic fatigue (DF) is slower in women compared to men. It is unclear if the abovementioned differences are due to discrepancies in absolute diaphragm force output. **PURPOSE:** To examine sex differences in DF when matched for absolute diaphragmatic pressure during inspiratory PTL. **METHODS:** Fourteen healthy men (n = 6) and women (n = 8) performed a single bout of PTL for five minutes. Subjects were required to breathe in a square-wave fashion whilst targeting a transdiaphragmatic pressure (P<sub>di</sub>) of 92 cm H<sub>2</sub>O. Fatigue of the diaphragm was assessed via twitch P<sub>di</sub> (P<sub>di,tw</sub>) using cervical magnetic stimulation. Cardiovascular responses, including heart rate (HR) and mean arterial blood pressure (MAP) were monitored beat-by-beat throughout PTL. **RESULTS:** Following inspiratory PTL, the total work done by the diaphragm (~13,500 cm H<sub>2</sub>O·s, p = 0.50) and the reduction in P<sub>di,tw</sub> was not different between sexes (M = 26 ± 8%, W = 25 ± 9%; p = 0.82). When scaled to body mass, women produced more diaphragmatic pressure (M = 38 ± 7 cm H<sub>2</sub>O·s·min<sup>-1</sup>·kg<sup>-1</sup>, W = 45 ± 8 cm H<sub>2</sub>O·s·min<sup>-1</sup>·kg<sup>-1</sup>; p = 0.01). There was no effect of sex on ΔHR (M = +14 ± 12 bpm, W = +15 ± 9 bpm; p = 0.50) during PTL; however, ΔMAP was lower in women compared to men (M = +31 ± 16 mmHg, W = +21 ± 13 mmHg; p = 0.03). **CONCLUSION:** Inspiratory PTL matched for absolute diaphragmatic work results in a similar degree of DF between sexes. Despite performing the same level of absolute diaphragmatic work and developing the same degree of DF, women demonstrate an attenuated inspiratory muscle metaboreflex. Sponsor: Natural Sciences and Engineering Research Council of Canada, UBC Physical Activity and Precision Health Cluster

104 May 29 10:15 AM - 10:30 AM

**Effects of Acute Intermittent Hypoxia on Maximal Respiratory Ability after Spinal Cord Injury**

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(No relevant relationships reported)

After spinal cord injury (SCI), respiratory complications are a leading cause of morbidity and mortality. A novel technique, acute intermittent hypoxia (AIH) triggers spinal motor plasticity, and can increase tidal volume at rest in humans with SCI. Only sparse, inconclusive literature exists about the effects of AIH on maximal effort respiratory maneuvers after SCI. **Purpose:** this pilot study seeks to investigate the effects of AIH on maximal effort respiratory ability in adults with SCI. **Methods:** 4 community-dwelling, adult males with SCI completed a single AIH or sham treatment in randomized order, 7+ days apart. AIH consisted of 15, 1 minute periods breathing a hypoxic gas mixture (9-13% oxygen), interspersed with 1.5 minute periods breathing room air. Sham treatments replicated AIH, but used air (21% oxygen) versus hypoxic episodes. Blood oxygen saturation was monitored. Maximal inspiratory pressure (MIP) and maximal expiratory pressure (MEP) were recorded prior to and 30 minutes after AIH and sham. Pre and post scores for each condition were compared using non-parametric Friedman's two-way ANOVA by ranks. **Results:** Baseline blood oxygen saturation averaged 97 ± 2%. During AIH, saturation decreased to an average of 82 ± 3%, then returned to baseline. Blood oxygen saturation remained stable during sham treatments. MIP did not differ at any point on either day (pre-AIH, 90.4 cmH<sub>2</sub>O +/- 34.33; post-AIH, 99.35 cmH<sub>2</sub>O +/- 17.6; pre-sham, 98.8 cmH<sub>2</sub>O +/- 21.3; post-sham, 85.2 cmH<sub>2</sub>O +/- 17.3; X<sup>2</sup> = 6.231, p = .101). MEP did not differ at any point on either day (pre-AIH, 91.2 cmH<sub>2</sub>O +/- 23.1; post-AIH 93.4 cmH<sub>2</sub>O +/- 26.8; pre-sham 80 cmH<sub>2</sub>O +/- 25.6; post-sham 85.4 +/- 21.1; X<sup>2</sup> = 2.4, p = .494) Individually, 3 participants increased MIP after AIH, but decreased after sham; the fourth participant increased MEP after AIH, but decreased after sham. **Conclusion:** These pilot study results suggest AIH may affect maximal effort respiratory ability in adults with SCI. Although group means did not differ, individual outcomes varied with AIH improving one outcome in each participant versus sham. Further research is warranted to examine response variations and to determine the therapeutic potential of AIH after SCI. **Support:** Brooks-PHHP Research Collaboration; Center for Respiratory Research and Rehabilitation at the University of Florida.

105 May 29 10:30 AM - 10:45 AM

**Combined Influences of Inspiratory Loading and Subsystemic Circulatory Occlusion on Blood Pressure Responses**

Joshua R. Smith, Eric J. Bruhn, Jessica D. Berg, Thomas P. Olson, FACSM. *Mayo Clinic, Rochester, MN.* (Sponsor: Thomas Olson, FACSM)

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(No relevant relationships reported)

Group III/IV muscle afferent feedback from the respiratory and locomotor muscles influence the blood pressure response during exercise. Stimulation of these respiratory and locomotor muscle afferents (via inspiratory loading (IL) or subsystemic circulatory occlusion (CUFF), respectively) augments the blood pressure response during exercise. However, it is unknown if the combination of IL and CUFF (IL+CUFF) results in a greater blood pressure response than observed with IL or CUFF. **PURPOSE:** To compare the blood pressure responses with IL, CUFF and IL+CUFF during exercise in healthy adults. **METHODS:** Nine adults (6M/3W; 29±6 yrs; BMI: 27±4 kg/m<sup>2</sup>) were recruited. Participants performed four 10 min cycling exercise bouts at 40% peak oxygen uptake. For each exercise bout, the first 5 min consisted of spontaneous breathing (SB). The second 5 min consisted of voluntary hyperventilation (i.e. breathing frequency of 40 breaths per min with 50% duty cycle) with IL (30% maximum inspiratory pressure), CUFF (80 mmHg), IL+CUFF or no intervention (CTL) in randomized order. Systolic and diastolic blood pressure (SBP and DBP, respectively) were measured using manual sphygmomanometry. MAP was calculated as (SBP-DBP)/3+DBP. **RESULTS:** Compared to SB, MAP and SBP were greater with CTL, IL, CUFF and IL+CUFF (all, p < 0.01). Compared to SB, DBP was greater with IL, CUFF, and IL+CUFF (all, p < 0.01). During the second 5 min of exercise, there were differences across all conditions in MAP (CTL: 93±11; IL: 100±10; CUFF: 107±10; IL+CUFF: 113±11 mmHg) (all, p < 0.01). During the second 5 min of exercise, there were significant differences across all conditions in SBP (all, p < 0.01) except IL was not different than CUFF (p = 0.09) (CTL: 134±20; IL: 144±20; CUFF: 150±22; IL+CUFF: 159±23 mmHg). During the second 5 min of exercise, there were significant differences across all conditions in DBP (all, p < 0.01) except no differences existed between CUFF and IL+CUFF (p = 0.15) (CTL: 73±8; IL: 79±8; CUFF: 86±6; IL+CUFF: 89±7 mmHg). **CONCLUSIONS:** These data demonstrate that combined stimulation of respiratory

and locomotor muscle afferent feedback results in a greater blood pressure response than either alone. These findings have important implications for populations that exhibit exaggerated locomotor and respiratory muscle reflexes (e.g., heart failure).

106 May 29 10:45 AM - 11:00 AM

### Roles Of ROS and Akt In Reoxygenated Respiratory Muscle from PO<sub>2</sub> Cycling-Treated Smoking Mice

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(No relevant relationships reported)

**PURPOSE:** To test the hypothesis that reactive oxygen species (ROS) and protein kinase B (AKT) are signaling molecules involved in the protective effect of PO<sub>2</sub> cycling during reoxygenation in smoking-induced COPD mice. **METHODS:** To develop COPD symptoms, male C57BL6 mice were exposed to cigarette smoking for two hr per day, five days a week for three consecutive months. The smoking mice were then sacrificed, and their diaphragm was dissected out for muscle function analysis. Each muscle strip was mounted in a contractile chamber treated either with 5 cycles of PO<sub>2</sub> cycling or with the respective inhibitors for ROS (Tiron, 1 mM; N-acetyl cysteine, NAC, 1 mM; n = 7) or AKT (MK-2206, 50 μM; n = 5) for 30 min before PO<sub>2</sub> cycling. Muscle was then switched to hypoxia for 30 min, followed by 15 min of reoxygenation. In the middle of reoxygenation (5-10 min), each muscle strip was electrically stimulated for five min using square-wave electrical pulses (70 Hz, 250-ms train duration, at 30 V) at 37 °C. Muscle force was recorded and end contractile force during the 5-min contraction was normalized by the maximal baseline force to represent muscle function. Control muscles followed the same protocol but in the absence of PO<sub>2</sub> cycling or inhibitor treatment. Data were expressed as mean ± SE and statistically compared using one-way ANOVA. **RESULTS:** Our data indicate that PO<sub>2</sub> cycling significantly improved diaphragm function during reoxygenation in smoking mice (18 ± 1.3% for PO<sub>2</sub> cycling vs. 8 ± 1.5% for control, p < 0.05). However, inhibition of either ROS or AKT abolished such protective effects on diaphragm (11 ± 2.5% for Tiron + NAC + PO<sub>2</sub> cycling; 6 ± 2.1% for AKT inhibitor + PO<sub>2</sub> cycling; 18 ± 1.3% for PO<sub>2</sub> cycling, p < 0.05). **CONCLUSIONS:** In smoking-induced COPD mice, we suggest that PO<sub>2</sub> cycling can improve the diaphragmatic function during reoxygenation potentially through the intracellular signaling of ROS and AKT.

107 May 29 11:00 AM - 11:15 AM

### Does Acute Preprandial Exercise Attenuate Postprandial Airway Inflammation In Active Younger And Older Adults?

William S. Wiseman<sup>1</sup>, Elizabeth S. Edwards<sup>1</sup>, Hannah Frick<sup>1</sup>, Morgan Medeiros<sup>1</sup>, Camden Sutton<sup>1</sup>, Michael White<sup>1</sup>, Steve Malin, FACSM<sup>2</sup>, Dave Edwards<sup>2</sup>, Stephanie P. Kurti<sup>1</sup>. <sup>1</sup>James Madison University, Harrisonburg, VA. <sup>2</sup>University of Virginia, Charlottesville, VA. (Sponsor: Steven Kenneth Malin, FACSM)  
(No relevant relationships reported)

Even a single high-fat meal (HFM) is associated with increased airway inflammation. While exercise may modify postprandial airway inflammation, the protective effect may be diminished by age. **Purpose:** To determine whether an acute bout of preprandial exercise attenuates postprandial airway inflammation in active younger and older adults. **Methods:** 8 younger active (YA: 23.5±4.5 y/o) and 5 older active (OA: 64.8±2.6 y/o) that habitually exceed physical activity (PA) guidelines completed two HFM sessions in a randomized order. In exercise + HFM (EX+HFM), subjects performed exercise at a heart rate of 65% VO<sub>2peak</sub> to expend 75% of the caloric content of the HFM. In both sessions, subjects refrained from exercise for 48 hours prior to the HFM challenge (except for the exercise session in EX+HFM), and visited the lab after a 12-hour fast to consume the HFM (12 kcal/kg BW: 57% fat, 39% CHO, 4% protein). Triglycerides (TG) and exhaled nitric oxide (eNO) were measured at baseline, 2- and 4-hours post-HFM. **Results:** The mean eNO at baseline for the YA and OA was not significantly different (p=0.17). The increase in eNO from baseline to 2 hours in the HFM condition was 13.1±26.9% and during the EX+HFM was 2.5±11.6% in the YA adults, and was -1.2±11.3% in the HFM alone and 10.8±15.0% in the EX+HFM. However when analyzing all subjects together, the airway inflammatory response was not significantly different across time (p=0.08), by age (p=0.23), or by condition (p=0.80). There was a significantly greater TG response in the HFM condition compared to the EX+HFM condition in OA (p<0.05), which was also lower in the YA (p<0.05). **Conclusions:** With these preliminary analyses, airway inflammation does not appear to be altered by age or preprandial exercise, however the triglyceride response is modified by acute exercise and age.  
Supported by 4-VA grant

## A-23 Clinical Case Slide - Elbow and Wrist

Wednesday, May 29, 2019, 9:30 AM - 11:30 AM  
Room: CC-304E

108 **Chair:** Anne Allen, FACSM. *Allen Spine and Sports Medicine, Wilmington, NC.*

(No relevant relationships reported)

109 **Discussant**

Karen Newcomer, FACSM. *Mayo Clinic, Rochester, MN.*

(No relevant relationships reported)

111 May 29 9:30 AM - 9:50 AM

### Unusual Wrist Injury Presentation in a Football Player

Hamad Saleemi, Jill Sadoski. *UHS Sports Medicine, Vestal, NY.*  
(Sponsor: James Dunlap, FACSM)  
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(No relevant relationships reported)

**HISTORY:** 17-year-old high school football player presented for sideline evaluation with right wrist pain. The injury occurred when he was tackled and had his wrist twisted and caught under another player. His coach kept him in the game and after one more play, his teammates called out for medical attention. He had diffuse swelling and pain along the ulnar aspect of the distal forearm and wrist. He was placed in a volar splint and sent to the emergency department where x-ray imaging of the wrist was read by radiologist as normal. The athlete followed up in clinic four days later. He continued to have pain, restricted range of motion, and decreased strength. Review of systems was otherwise normal. Past medical history was unremarkable.

**PHYSICAL EXAMINATION:** Wrist examination showed moderate diffuse swelling but no ecchymosis or deformity. He had tenderness along the ulnar aspect of the distal wrist. There was no tenderness at the anatomic snuff box or scaphoid tubercle. Range of motion was limited in all directions, especially in supination. Strength was 4+/5 in all motions except for supination, which was 3+/5. Special tests including triangular-fibrocartilage complex grind, Watson's, and Finkelstein's were equivocal. Sensation to light touch was intact. Radial pulses were equally palpable bilaterally.

**DIFFERENTIAL DIAGNOSIS:** 1) Ulnar styloid or hook of hamate fracture. 2) Distal radioulnar joint injury. 3) TFCC injury. 4) Scapholunate or lunotriquetral dissociation.

**TESTS AND RESULTS:** Initial x-rays at ED were read as normal.

Repeat x-rays were concerning for volar ulna dislocation.

MRI without contrast showed volar dislocation of the ulna.

**FINAL/WORKING DIAGNOSIS:** Radioulnar joint dislocation with volar displacement of ulna.

**TREATMENT AND OUTCOMES:**

1. Orthopedic hand surgery referral. Given the length of time since initial injury, closed reduction was performed under general anesthesia.

2. Long arm cast with the forearm in supination position for 4 weeks. Repeat x-rays demonstrated maintenance of reduction. After cast removal, the patient returned to football with a removal wrist splint.

112 May 29 9:50 AM - 10:10 AM

### Forearm Pain in a High School Weightlifter

Matthew Severson, Karen Newcomer, FACSM, David Soma. *Mayo Clinic, Rochester, MN.*  
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(No relevant relationships reported)

**HISTORY:** A 17 year-old left-handed high school senior baseball player with a history of Langerhans cell histiocytosis presented to the outpatient clinic with pain on the ulnar aspect of his proximal right forearm. The pain had developed over the course of 2 months after he had increased the intensity of his offseason weight training regimen. He first noticed the pain while performing a high volume of upper body lifting, specifically bicep curls; pain was most severe during weightlifting but now occurred even during non-lifting activities. The patient denied any constitutional or neurologic symptoms.

**PHYSICAL EXAMINATION:** Inspection was unremarkable. Examination revealed moderate tenderness approximately at the junction of the proximal to mid one-third of the right ulna. There was very mild tenderness over the proximal extensor tendons and muscle bellies on the right forearm. He had subtle pain over the ulna with resisted elbow flexion but otherwise normal, pain free range of motion and full strength in the right upper limb. Reflexes and sensation were normal.

**DIFFERENTIAL DIAGNOSIS:**

1. Muscle strain

2. Extensor tendinopathy
3. Bone tumor
4. Posterior interosseous nerve entrapment
5. Ulnar fracture
6. Exertional compartment syndrome

**TEST AND RESULTS:**

Right forearm AP and lateral x-rays: negative for fracture or bony abnormality  
MRI right forearm without contrast: Incomplete intracortical stress fracture of the mid ulnar diaphysis

**FINAL WORKING DIAGNOSIS:**

Ulnar stress fracture

**TREATMENT AND OUTCOMES:**

1. Rest and avoidance of weightlifting or loading of the right upper extremity until follow up
  2. Due to patient reluctance to rest, right wrist/forearm brace while awake to remind him to rest the limb
  3. At 4-5 week follow-up, pain was completely resolved
  4. At that time he was instructed to gradually re-introduce weight-bearing exercises of the right upper limb as tolerated, beginning with isometric wrist strengthening followed by low intensity flexion/extension exercise before progressing to heavier lifts involving larger muscles groups and multi-joint movements
- Patient was able to return to all activities and declined physical therapy.

**113** May 29 10:10 AM - 10:30 AM

**Elbow Pain in an Adolescent Pitcher**

Nicholas C. Canzanello, Brittany J. Moore, Karen L. Newcomer, FACSM. *Mayo Clinic, Rochester, MN.* (Sponsor: Dr. Karen Newcomer, FACSM)

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(No relevant relationships reported)

**HPI**

Patient is a 16 year old right-hand dominant male baseball pitcher with past medical history of partial tear of the right UCL and OCD of the right lateral trochlea managed with casting 9 months prior. He presented to our clinic with insidious onset right posterolateral elbow and arm pain 2 months after returning to pitching in summer baseball in May.

He described sharp pain in the right lateral elbow with radiation into the posterolateral arm exacerbated with push-ups and bench press. He noticed a painless popping sensation with elbow extension, but denied weakness or sensory changes. The pain was not specifically associated with baseball or pitching and was different from his previous pain.

**PHYSICAL EXAM**

Mild tenderness at right common extensor tendon origin worsened with 5 push-ups and improved with rest. Mild tenderness at right posterolateral triceps border. Slight weakness of the right triceps with pain. Varus and valgus stress caused no pain, but there was asymmetry with minimally increased laxity during valgus stress on the right. Negative extensor wad stress tests including Cozens, middle finger extension and Mills. No pain with flexor-pronator stretching. No pain with resisted pronation or supination.

**DIFFERENTIAL DIAGNOSIS**

1. Triceps tendinitis
2. Lateral epicondylitis
3. Radial nerve irritation
4. OCD radiocapitellar joint
5. Intraarticular loose body
6. Stress reaction/stress fracture distal humerus
7. Bony tumor/infection

**TEST AND RESULTS**

Right elbow non-contrast MRI- Bone marrow edema within the olecranon and distal humerus medially as a result of stress reaction from excessive valgus stress. Thickening of the UCL. Healed osteochondral lesion of the right elbow trochlea.

**FINAL DIAGNOSIS**

Valgus overload stress injury to distal humerus

**TREATMENT AND OUTCOMES**

3 months of rest from pitching followed by throwing progression via a pitching rehabilitation program. The program consists of focused strength training (RTC, scapular stabilizers) followed by normalizing throwing mechanics with gradual return to pain free baseball. We discussed with the patient the harmful effects on single sports athletes, particularly pitchers. We recommended he watch his pitch counts closely in the future (he admitted he hadn't been doing that) and take at least 2 months off of baseball during the year.

**114** May 29 10:30 AM - 10:50 AM

**Medial Elbow Pain - Recreational Athlete**

Arie J. van Duijn<sup>1</sup>, Shawn D. Felton<sup>2</sup>. <sup>1</sup>*Florida Gulf Coast University, Fort Myers, FL.* <sup>2</sup>*Florida International University, Miami, FL.* (Sponsor: Mitchell L Cordova, FACSM)

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(No relevant relationships reported)

**HISTORY:** 22-year female recreational athlete with history of left elbow pain following a fall on outstretched arm during a running/cutting activity. She noted immediate local pain of 7/10 on VAS and swelling of the medial elbow and forearm. She was unable to fully extend the elbow. **PHYSICAL EXAMINATION:** Edema was noted at the medial elbow, extending into the medial forearm. Palpation of soft tissues, tendon and bony structures revealed significant point tenderness at the medial joint space and at the medial epicondyle. Limited active ROM with extension was noted due to pain. Valgus stress test was positive, with significant discomfort upon moderate loading. Due to significant pain complaints, further physical examination was suspended and clinician progressed to point-of-care ultrasound imaging of the medial elbow complex. **DIFFERENTIAL DIAGNOSIS:** 1. Medical Collateral ligament sprain 2. Medial Collateral ligament disruption 3. Common Flexor Tendon Pathology 4. Pronator Teres Strain 5. Medial epicondyle avulsion fracture 6. Biceps tendon pathology. **TESTS AND RESULTS:** Bilateral ultrasound imaging of the medial elbow complex revealed disruption of the ligamentous fibers of the UCL anterior band at the joint line. A large hypoechoic gap in the UCL is present, denoting the presence of significant fluid. Gravity valgus stress loading revealed a joint gap of 0.76cm compared to 0.38cm of the uninvolved side. **FINAL WORKING DIAGNOSIS:** Full thickness tear of the anterior bundle of the medial collateral ligament. **TREATMENT AND OUTCOMES:** Since the athlete did not participate in overhead throwing activities, conservative management approach was selected. ROM was limited 0-100 degrees initially to full ROM at 4 weeks post injury. Strengthening was initiated with initial emphasis on core and shoulder musculature, progressed to elbow and forearm musculature, including the flexor/pronator group as an active stabilizer against valgus forces. Patient was symptom-free at 4 months following injury, and ultrasound imaging revealed reduced valgus joint gapping. This case presentation illustrates the utility of ultrasound imaging in diagnosing MCL pathology, especially when physical examination is limited due to patient discomfort, and further illustrates the successful conservative management of a full thickness MCL tear.

**115** May 29 10:50 AM - 11:10 AM

**Acute Bilateral Elbow Pain In a College Volleyball Player**

Jonathan Smith, Dennis Khalili-Borna, FACSM. *Kaiser Permanente Fontana Medical Center, Fontana, CA.*

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(No relevant relationships reported)

**History:** A 19 year old college volleyball player presents to the athletic training room with chief complaint of bilateral elbow stiffness and swelling for one day. Her evaluation in the training room revealed mild decrease in elbow extension bilaterally with pain at terminal elbow extension. She was observed and treated conservatively with NSAIDs, compression wraps, over a two day period. Elbow swelling improved initially then began to track down the forearm. After day 2 of observation she continued to have muscle soreness and swelling. She denied abdominal pain, changes in urine color or decreased urine output. She was sent the Urgent Care for further evaluation of her symptoms.

**Physical Exam:** Vitals were normal during training room visits. Initial exam revealed tenderness to palpation over the flexor and extensor masses of the elbow as well as mild swelling. She had a slight decrease in active and passive elbow extension bilaterally and she exhibited pain at terminal elbow extension bilaterally. Flexion was preserved.

**Differential Diagnosis:** 1) Delayed Onset Muscle Soreness 2) Epicondylitis 3) Valgus Extension Overload 4) Olecranon Stress Fracture 5) Rhabdomyolysis 6) Exertional Compartment Syndrome 7) Olecranon Fossitis

**Tests:** CBC was within normal limits. Electrolytes were within normal limits. Creatinine showed mild elevation. CPK was significantly elevated at 40,000 U/L

**Final Working Diagnosis:** Rhabdomyolysis

**Treatment and Outcomes:** The patient was admitted the hospital for a 4 day period for IV fluids and observation. Over the course of her hospitalization her CK levels were trended and she was released after CK levels were below 5,000 U/L. Her PCP continued to trend Creatinine levels after she was discharged and they continued to trend downwards. Two weeks after discharge she started on a 3 week gradual return protocol and she remained symptom-free. Follow up labs were drawn prior to her first match and showed only mildly elevated CK (230 U/L) with normal creatinine and GFR. She has been participating in matches at full capacity and remains asymptomatic.

**116** May 29 11:10 AM - 11:30 AM  
**Management of a 58-Year Old Crossfit Athlete with Elbow Pain by Treating the Contralateral Hip Region**  
 Megan L. Pfeffer, DACBSP, DC, ATC. *Voodoo Chiropractic, Nashville, TN.*  
 Email: drmegan13@gmail.com  
*(No relevant relationships reported)*

**MANAGEMENT OF A 58-YEAR OLD CROSSFIT ATHLETE WITH ELBOW PAIN USING MYERS FASCIAL LINES**

*M. L. Pfeffer, DC, CCSP, ATC, Voodoo Chiropractic, Nashville, TN*

**ABSTRACT**

**HISTORY:** 58 y/o male recreational CrossFit athlete presented with insidious left lateral elbow pain, progressing over several weeks and exacerbated by pull-ups and overhead barbell movements.

**CLINICAL EXAMINATION:** Patient had mild tenderness over the left lateral epicondyle, as well as moderate tenderness and increased tone in extensor group muscles. Gripping increased left elbow pain. No strength or neurological deficits were noted. Mill's Test was negative. Cozen's Test was positive for pain over the lateral epicondyle. **DIFFERENTIAL DIAGNOSES:** 1. Lateral Epicondylitis 2. Radial Tunnel Syndrome **TREATMENT & RESULTS:** Manual therapy to the forearm extensor group decreased local muscle tension, but had little to no effect on elbow pain following three visits. Stretching, contrast, and rest did not positively impact pain. Referencing the Myers Functional and Arm Lines, treatment of the thoracolumbar junction and right hip region by cupping, dry needling, and spinal adjustment were performed with noticeable improvement noted after the fourth visit. Following another similar treatment, the patient's condition resolved. **FINAL DIAGNOSIS:** Elbow pain secondary to fascial restriction along Myers Functional & Arm Lines **DISCUSSION:** Little has been published regarding the role of fascial lines in diagnosis or treatment of orthopedic injuries. Since local treatment appeared ineffective, looking elsewhere in the biomechanical chain was necessary. Both provocative movements increase lumbar extension if done improperly, creating compensatory dysfunction. Therefore, shoulder & thoracic mobility and core stability were also addressed to prevent future injury. While other factors may have contributed, it appears releasing seemingly unrelated fascial restrictions noticeably impacted the results.

injury that he can recall. He experiences some tightness when running. He denies feeling weak in the hip or knee. He denies any bruising. He can feel a hard mass in the location of his symptoms.

**PHYSICAL EXAMINATION:** He has a normal gait without limp. There is no visible swelling, bruising or deformities of the left thigh. Approximately over the mid to superior quadriceps there is an area of approximately 4 cm x 3 cm that is slightly indurated, non-tender but the patient reports it is uncomfortable to palpate. There is no fluctuance. There is no limitation or pain with active and passive range of motion at the knee or hip. Hip flexion and knee extension strength are a 4/5 without pain with resistance. The remainder of the physical examination is non-contributory.

**DIFFERENTIAL DIAGNOSIS:**

1. Quadriceps strain
2. Myositis ossificans
3. Quadriceps hematoma
4. Lipoma
5. Occult tumor

**TEST AND RESULTS:**

Initial imaging included plain radiographs, which did not show any acute or chronic osseous abnormalities. The soft tissues appear normal. Musculoskeletal ultrasound demonstrated a large hypoechoic defect within the rectus femoris muscle. An MRI showed a full-thickness tear of the indirect muscle of the rectus femoris, with a 1.5 cm craniocaudad gap/retraction of the indirect muscle at the myotendinous unit.

**FINAL/WORKING DIAGNOSIS:**

Full-thickness tear of the indirect head of the left rectus femoris tendon with retraction of the myotendinous unit

**TREATMENT AND OUTCOMES:**

Due to the fact that the patient was not very symptomatic, we recommended a trial of non-operative management. This included rest from sports and physical therapy to work on strengthening. Displeased with this plan, the family sought a second opinion from the team physician for a local Division I college volleyball team. In a telephone follow up conversation with the patient's mother, the team physician also recommended non-operative management.

**A-24 Clinical Case Slide - Hip and Thigh II**

Wednesday, May 29, 2019, 9:30 AM - 11:30 AM  
 Room: CC-306

**117 Chair:** Andrea Stracciolini, FACSM. *Children's Hospital Boston, Boston, MA.*  
*(No relevant relationships reported)*

**118 Discussant**  
 Angela Smith, FACSM. *Nemours Children's Health System, Bryn Mawr, PA.*  
*(No relevant relationships reported)*

**119 Discussant**  
 Robert E. Sallis, FACSM. *Kaiser Permanente Medical Center, Fontana, CA.*  
*(No relevant relationships reported)*

**120** May 29 9:30 AM - 9:50 AM  
**Atraumatic Left Thigh Mass In An Adolescent Multi-sport Athlete**  
 Mark Riederer. *C.S. Mott Children's Hospital, Ann Arbor, MI.*  
 Email: mriedere@med.umich.edu  
*(No relevant relationships reported)*

Atraumatic left thigh mass in an adolescent multisport athlete  
 Mark F. Riederer, C.S. Mott Children's Hospital/University of Michigan, Ann Arbor, MI

**HISTORY:** A 14-year-old adolescent volleyball, baseball, and soccer athlete presents for evaluation of a two month history of left mid-thigh tightness, discomfort and bulge. Upon multiple attempts to elicit an injury mechanism, there was no single, discrete

**121** May 29 9:50 AM - 10:10 AM  
**Thigh Pain In A Multi-sport Youth Athlete**  
 Aloiya R. Earl, Brett C. Bentley, Earl R. Stewart. *The University of Alabama, Tuscaloosa, AL.*  
 Email: aloiya.earl@gmail.com  
*(No relevant relationships reported)*

**HISTORY:** A healthy 10-year-old male multi-sport athlete experienced insidious onset of right thigh pain associated with limp for about one week prior to office presentation. The pain started during his school day and had progressively worsened over the week, which caused him to be unable to complete his baseball practices. The pain was worse with running and jumping. He did not have nocturnal pain, weight loss, or night sweats. Of note, he had an identical presentation about 8 months prior in his contralateral thigh which was diagnosed as a compression-sided stress fracture of his left femoral neck and treated conservatively. **EXAM:** Afebrile. Well-appearing. Limping gait. Lumbar spine exam WNL. Bilateral knee exam WNL. Left hip exam WNL. On exam of his right hip, he had tenderness diffusely in his proximal anterior and lateral thigh and over his AHS. He had full hip ROM but with pain at the extremes of flexion, IR, and ER. Strength of LLE WNL. Strength of RLE limited to 4/5 with hip abduction and hip flexion due to pain. Seated and supine log roll positive for pain. Unable to perform a single-leg hop on his right side. He had pain with bowing of his femur. Neurovascular examination of bilateral LE WNL. **DDX:** Acute synovitis, stress fracture, Legg-Calve-Perthes disease, SCFE, pathologic fracture **RESULTS:** XR pelvis 10/10/18: No apparent osseous abnormality. MRI right hip 10/11/18: Edema within the medial femoral neck, most likely stress-related. 10/15/18 CMP, PTH, TSH, Vit D: WNL. **FINAL/WORKING DIAGNOSIS:** Compression-sided stress reaction of the right femoral neck, which was his second stress injury within 8 months, the first being in his left femoral neck **TREATMENT/OUTCOME:** The patient was treated for his second stress injury with conservative management again. He was instructed to be NWB with crutches for 6 weeks, after which he would have a follow up visit and if doing well clinically and radiographically, would progress to partial protected weight bearing and formal PT to transition back to sport. Given his normal lab workup, he was also referred to an orthopedic hip specialist to evaluate for possible biomechanical contributions to abnormal stress through the femoral neck or connective tissue disorders. His sports schedule was reviewed. Multi-sport participation was encouraged, but with a 3-month consecutive break during the year.

122 May 29 10:10 AM - 10:30 AM

**Insidious Onset of Thigh Swelling After Trauma in a Triathlete**

Alexander Jason Bressler<sup>1</sup>, Hanh Larson<sup>2</sup>, Robert Sallis, FACSM<sup>1</sup>. <sup>1</sup>Kaiser Permanente, Fontana, CA. <sup>2</sup>Pomona Valley Hospital Medical Center, Pomona, CA. (Sponsor: Robert Sallis, FACSM)

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(No relevant relationships reported)

**HISTORY** A 78-year-old female triathlete presented to clinic to follow-up on injuries sustained during a cycling accident. Evaluation in the ED on the day of injury showed facial bone fractures and small peripheral parenchymal hematomas in the right frontal and temporal lobes for which she had follow-up scheduled. In clinic two days later, she complained of pain and bruising over her right hip. She was diagnosed with an abrasion and contusion of the right hip and treated with ice and NSAIDs. She returned four weeks later with worsening right hip pain, described as constant, throbbing, non-radiating, and worse with weight-bearing. It was associated with swelling and a tender mass that had developed gradually over the right hip. She denied fevers or chills.

**PHYSICAL EXAMINATION** Vitals were normal at both visits. Initial exam of the right hip showed a large abrasion, mild ecchymosis, and tenderness. She had full range of motion without pain or edema. She also had normal balance and gait. Four weeks later, the right hip had a 15 x 17 cm, warm, tender mass over the lateral aspect of the thigh, without erythema. FABER and FADIR were negative, and muscle strength, pulses, and sensation were normal. The abrasion was well-healed. **DIFFERENTIAL DIAGNOSIS** 1. Hematoma 2. Contusion 3. Bursitis 4. Abscess 5. Neoplasm **TESTS AND RESULTS** CBC was normal. Radiographs of right hip were negative for fracture or soft tissue abnormalities. MRI of the right lower extremity showed a heterogeneous fluid collection measuring 22 x 4 x 6 cm (H x W x D, 528 cc) overlying the right hip with small internal foci of hemorrhage/debris, and peripheral rim enhancement without any areas of internal enhancement. **FINAL WORKING DIAGNOSIS** Morel-Lavallée lesion **TREATMENT AND OUTCOMES** The patient underwent aspiration, doxycycline sclerotherapy, and percutaneous drainage. Post-procedure US was negative for any significant fluid collection. Repeat MRI three weeks after the procedure showed incomplete resolution/recurrence of the lesion measuring 20 x 1.5 x 2.8 cm (84 cc). The patient had follow-up with orthopedics and elected for conservative treatment with compression dressings. She returned to triathlon training and has subsequently completed a 100-km bike race at 6 months post injury.

123 May 29 10:30 AM - 10:50 AM

**Hamstring Pain - Biker**

Kathleen Shaughnessy, Sean M. Harris. *Memorial Hermann, Houston, TX.*

(No relevant relationships reported)

**HISTORY:** A 53-year-old male reports to physical therapy with L posterolateral thigh pain. Three years prior, pt's spring ligament popped and required surgical reconstruction. During the patient's surgery, he had a nerve block to the lateral hamstring. Patient completed necessary therapy and attempted to return to exercise. Following attempts at exercising, patient reported sporadic symptoms of leg weakness. Patient has had two normal nerve conduction tests as well as a normal MRI of the back, knee, and hip. At initial evaluation, patient is unable to bike or run, and describes symptoms of localized weakness and achiness post-exercise.

**PHYSICAL EXAMINATION:**

Posture normal, no apparent gait deviations. Pain localized to the distal lateral hamstring. Full, pain-free lumbar spine, hip, and knee AROM and overpressure. Gross LE strength testing within normal limits except for L hamstring (3+/5). Dynamometer reading R: 38lbs, L 25lbs. Contraction did not reproduce patient's pain. Symptoms present with elongation of L hamstring muscle. Deep squat limited by "tightness" in L calf.

**DIFFERENTIAL DIAGNOSIS:**

1. Distal Peripheral Nerve Entrapment
2. Hamstring Tendinopathy
3. Mechanical Dysfunction

**TESTS AND RESULTS:****Neural Tissue Testing:**

- Positive slump test
- Painful arc of motion: Patient had symptoms at 40 degrees short of vertical that dissipate once patient's leg was lifted to 35 degrees
- Positive straight leg testing
- Reflexes were within functional limits

**FINAL/WORKING DIAGNOSIS:**

Distal peripheral nerve entrapment of mechanical nature.

**TREATMENT AND OUTCOMES:**

- 5 physical therapy sessions over 5 weeks
- Ergonomic desk set up
- Sciatic nerve sliders from slump position
- Progressive hamstring strengthening

- Aerobic circuit training

- Dry needling

- Two needles were inserted into the short head of the biceps and laterally to where the nerve runs.

- Improved LEFS from 60 to 80 in 5 weeks

- Neural symptoms normalized at 3 weeks

- Hamstring strength improved to 37lbs at 4 weeks (per dynamometer)

- Return to running/biking activities at 5 weeks

124 May 29 10:50 AM - 11:10 AM

**Thigh Pain in a Baseball Player**

Valerie Rygiel, Hallie Labrador. *NorthShore/University of Chicago, Chicago, IL.* (Sponsor: Carrie A. Jaworski, FACSM)

(No relevant relationships reported)

**HISTORY:**

Patient is a 14 year old male who presented to sports medicine clinic for evaluation of three weeks of right quadriceps pain that began while running during baseball practice. He was initially prescribed physical therapy for a presumed right quadriceps strain but on follow up two months later he continued to have pain with activities as well as a deformity in his right thigh that was growing in size.

**PHYSICAL EXAMINATION:**

On exam patient was well appearing, his right quad had no erythema or ecchymosis. He had a palpable mobile mass in the mid-thigh that was nontender to palpation but protruded with resisted knee extension. The remainder of the quadriceps muscle belly was nontender. His lower extremity strength and sensation were preserved.

**DIFFERENTIAL DIAGNOSIS:**

1. Quadriceps tear with retraction
2. Normal anatomic variant
3. Fascial herniation
4. Soft tissue mass

**TEST AND RESULTS:**

XRAY Right Femur: No acute fracture

MRI Right Femur w/wo Contrast: Grade 1 strain of rectus femoris muscle at the myotendinous junction, suggesting intramuscular degloving mechanism.

**FINAL WORKING DIAGNOSIS:**

Rectus Femoris intramuscular degloving injury

**TREATMENT AND OUTCOMES:**

The patient continued to work with physical therapy and was able to slowly reintroduce sport specific activities over the next month without recurrence of pain. His deformity has reduced significantly in size.

125 May 29 11:10 AM - 11:30 AM

**Thigh Injury- Lacrosse**

Timothy O. Boone, Jr. *University Of Maryland, Baltimore, MD.*

(No relevant relationships reported)

**HISTORY:** 20 year old sophomore lacrosse player sustained an acute injury to his right thigh while playing football during his senior year of high school. At that time, patient had reported immediate swelling of the thigh but had a delay in presentation to an outside sports medicine physician for about 3 months. Patient completed medical therapies outside of the recommendation of the sports medicine physician which allowed patient to play lacrosse during his senior year and throughout his freshman season of college. When completing off season workouts during his sophomore year, he complained of focal pain at his right thigh with his right knee giving out.

**PHYSICAL EXAMINATION:** His initial examination revealed a palpable mass over the right thigh with mild tenderness. When presenting 2 years later, his exam revealed no abnormality on inspection but there was a deep, immobile, non-tender palpable growth over anterior right femur with full range of motion of the right knee, hip and back.

**DIFFERENTIAL DIAGNOSIS:** 1. Heterotopic Ossification 2. Parosteal osteosarcoma

**TEST AND RESULTS:**

1. Right Femur X-ray (1/9/2017): 15.8 x 4.8 cm soft tissue calcification overlying the proximal femoral diaphysis with a 1.6 x 0.6 cm bone island in the distal femur.
2. Right Femur X-ray (9/18/2018): 13.9 x 1.8 cm matured soft tissue calcification over the anterior lateral aspect of the femur with 1.3 cm oval sclerotic density in the distal femoral metaphysis
3. MRI right thigh( 10/2/2018): Mature heterotopic ossification that is contiguous with the anterolateral femoral diaphysis. Heterotopic ossification extends within the vastus intermedius muscle and measures 1.5cm x 6cm x 13cm.

**FINAL/WORKING DIAGNOSIS:** Mature heterotopic ossification of the right thigh

**TREATMENT AND OUTCOMES:**

1. Referred for surgical resection of the mass from right thigh due to symptoms, which was completed 1 month after secondary presentation
2. Immediately after surgical intervention, patient was allowed partial eight bearing x 1-weeks with knee locked in full extension and will continue Indomethacin for a total of 6 weeks

3. Patient about 7 days after from surgical intervention, patient advised by surgeon to begin work with physical therapy to wean off crutches and out of brace to work on knee ROM and quadriceps activation
4. Pathology results pending at this time

**A-25 Clinical Case Slide - Knee I**

Wednesday, May 29, 2019, 9:30 AM - 11:10 AM  
Room: CC-105B

**126 Chair:** William W. Dexter, FACSM. *Maine Medical Center, Portland, ME.*

*(No relevant relationships reported)*

**127 Discussant**

Bryan Wiley. *Kaiser Permanente, Rancho Cucamonga, CA.*

*(No relevant relationships reported)*

**128 Discussant**

Beverly C. Land, FACSM. *US Army Retired, Fairfax, VA.*

*(No relevant relationships reported)*

**129 May 29 9:30 AM - 9:50 AM**

**Knee Pain - Baseball**

Scott Goldberg, John H. Stevenson, Lee Mancini. *University Of Massachusetts, Worcester, MA.*

*(No relevant relationships reported)*

**HISTORY:** A 16 year old high school hockey player and baseball pitcher noticed lateral knee pain and intermittent swelling for about 2 months prior to presentation. He does not recall any trauma or injury. He did have a viral URI and episode of strep pharyngitis several weeks before this started. He denies radiation of the pain. He does note some catching and locking sensation of the knee. He feels that his knee flexion is limited. He treated the knee with ice, ibuprofen, and acetaminophen through the season and was able to complete his baseball season prior to presenting to his PCP for evaluation. Because no definite etiology was identified in this visit, MRI was ordered, which showed complex loculated effusion, enlarged popliteal lymph nodes, and synovial thickening. There were no structural injuries appreciated.

**PHYSICAL EXAMINATION:** Initial exam in the sports medicine clinic revealed tenderness at the lateral joint line and 1+ knee effusion. There was no erythema or warmth at the joint. He had full active and passive range of motion and full strength. Ligamentous testing was normal.

**DIFFERENTIAL DIAGNOSIS:**

- PVNS
- Rheumatologic condition
- Lymphoma/Leukemia
- Lyme disease
- Traumatic hemarthrosis

**TEST AND RESULTS:**

Repeat MRI with additional views: Complex loculated effusion; Synovitis/synovial proliferation; No hemosiderin staining with blooming artifact

Joint aspiration: 20 cc cloudy yellow synovial fluid; TNC 37,270, Neutrophils 73%

Cytology: No malignant cells

ANA: 1:80 homogeneous

Rheumatoid Factor: Negative

Lyme: Negative

ESR: 9

CRP: 21.8

CBC: WBC 5.9, Hgb 15.5, Hct 45.4, Plt 287

**FINAL WORKING DIAGNOSIS:** Juvenile idiopathic arthritis (JIA)

**TREATMENT AND OUTCOMES:**

- Referred to pediatric rheumatologist
- Bilateral knee aspiration and corticosteroid injection
- Prednisone taper
- Methotrexate therapy
- Check anti-CCP antibodies
- Referred to ophthalmology to rule out uveitis

**130 May 29 9:50 AM - 10:10 AM**

**Knee Pain- Football**

Megan Liberty<sup>1</sup>, Jason Read<sup>2</sup>. <sup>1</sup>*University of Florida College of Medicine- Jacksonville, Jacksonville, FL.* <sup>2</sup>*Nemours Children's Specialty Care, Jacksonville, FL.*

*(No relevant relationships reported)*

**HISTORY:** A 14-year-old male football player presented to our sports medicine clinic complaining of left knee pain and swelling. Onset of knee pain was 2 months prior and he began to complain of intermittent swelling over the last 3-4 weeks prior to this initial visit. There was no reported history of trauma or injury. Pain worsened with activity and was localized to his anterior knee and medial joint line. NSAIDs and a knee brace did not alleviate his symptoms. He denied any associated knee instability, popping, locking or patellar instability. Neurological signs and symptoms were absent. Review of systems was otherwise negative. **PHYSICAL EXAMINATION:** Examination revealed a moderate sized left knee effusion with tenderness to palpation around the patella and medial joint line. There was no ecchymosis or erythema. Strength exam was normal. Knee range of motion was decreased in both flexion and extension secondary to swelling. There was pain on patellofemoral grind test with a negative patellar apprehension test. He had a negative Lachman and McMurray test. Anterior and posterior drawer tests were also negative. No ligament laxity was appreciated with varus or valgus stress testing. Examination of the contralateral knee was normal. He was otherwise well appearing with a normal gait. **DIFFERENTIAL DIAGNOSIS** 1. ACL tear 2. Meniscus tear 3. Fracture 4. Juvenile idiopathic arthritis 5. Osteochondritis dissecans **TESTS AND RESULTS** 3 view x-rays of left knee were obtained and normal. MRI revealed distal femoral osteomyelitis with associated intraosseous and subperiosteal abscess with deep posterior knee soft tissue abscess. CBC showed WBC 11.7, Hgb 10.5, Hct 32.2, Platelets 576. CRP 9.45mg/dL, ESR 57mm/hr. **FINAL/WORKING DIAGNOSIS** Osteomyelitis of the left distal femur with intraosseous and subperiosteal abscess **TREATMENT AND OUTCOMES** 1. Taken to the OR for incision and drainage 2. Cultures returned positive for oxacillin sensitive staphylococcus aureus. Pediatric infectious disease was consulted. A PICC line was placed and he completed a 6-week course of IV clindamycin. 3. Follow up x-rays taken 1-month post-op were normal 4. A full return to sports is expected.

**131 May 29 10:10 AM - 10:30 AM**

**Knee Injury - Trampoline**

Sabrina P. Sawlani, Brian McCall, Brian J. Donohue. *Presence Resurrection Medical Center, Chicago, IL.* (Sponsor: Poonam Thaker, FACSM)

*(No relevant relationships reported)*

**HISTORY:** 21-year-old male presents to ER for left knee injury after mis-landing a flip while jumping on a trampoline. He hyperextended his left leg, felt a pop and severe pain with numbness of left foot. Notable deformity which self-reduced.

**PHYSICAL EXAMINATION:** LLE: Ecchymoses and edema of distal thigh, knee and proximal leg. ROM- active and passive knee flexion and extension limited due to pain. DP/PT pulses nonpalpable, capillary refill mildly delayed, and cooler to touch distally. Diminished sensation of dorsomedial foot and lateral leg. Unable to extend toes or dorsiflex ankle. Exam under anesthesia with positive Lachman, anterior drawer, posterior drawer and varus stress tests.

**DIFFERENTIAL DIAGNOSIS:**

1. Knee dislocation with vascular compromise and peroneal nerve injury
2. Anterior cruciate ligament tear
3. Posterior cruciate ligament tear and posterolateral corner injury
4. Lateral collateral ligament rupture
5. Meniscus tear
6. Tibial plateau fracture
7. Distal femur fracture

**TEST AND RESULTS:**

-XR L Knee 4+ Views: Medial tibial condyle possible fracture.

-CT Angiogram LLE: Popliteal artery severe stenosis at level of tibial plateau.

Comminuted medial tibial plateau fracture.

-Diagnostic angiogram: Cut-off of popliteal artery at level of knee, unable to cross with stent.

**FINAL WORKING DIAGNOSIS:** Left knee dislocation with popliteal artery rupture and left medial tibial plateau fracture

**TREATMENT AND OUTCOMES:**

1. Emergent vascular surgery with ligation of L popliteal artery and repair of transected L popliteal artery with reverse saphenous vein interposition graft.
2. Orthopaedic Surgery external fixator placement and fasciotomies with skin closure to prevent possible reperfusion injury/compartement syndrome.
3. 2 weeks post-injury, ORIF medial tibial plateau and replaced ex-fix. Delayed ligament reconstructions unnecessary due to ligaments remain stable.
4. 6 weeks post-injury, removal of L leg external fixator. Nonweightbearing and in physical therapy.
5. 3 months post-injury, EMG for persistent foot drop with severe L peroneal neuropathy at knee.

6. 4 months post-injury, ambulating.  
 7. 8 months post-injury, referred to peripheral nerve surgery specialist for decompression of L common peroneal nerve at fibular head, and excision of posterior and anterior crural intermuscular septae.

**132** May 29 10:30 AM - 10:50 AM

### Postoperative Knee Complication - Soccer

Kathleen Maguire, Lyle Micheli, FACS. *Boston Children's Hospital, Boston, MA.* (Sponsor: Lyle Micheli, FACS)

(No relevant relationships reported)

#### History:

17 year old female status post left ACL reconstruction with hamstring autograft presents one week after surgery with pain and swelling over posteromedial knee. A blood blister was noted and drained. She started on Keflex to prevent superficial wound infection. The following day she returned in exquisite pain with skin discoloration and formation of a collection over the posteromedial knee. This was presumed to be an infected hematoma and she was taken to the operating room for a postsurgical knee washout.

#### Physical Examination:

Examination noted an abscess at the popliteal fossa medially with surrounding erythema. The area over this collection was warm and tender to touch. The patient had no calf pain or swelling.

#### Differential Diagnosis:

1. Hematoma
2. Knee infection, bacterial or fungal
3. DVT
4. Contact dermatitis
5. Hemophagocytic lymphohistiocytosis (HLH)
6. Still's disease
7. Pyoderma gangrenosum
8. Behcet's

#### Tests and Results:

1. Single OR tissue culture positive for *s. hominis* and *p. acnes* early in hospital course, subsequent OR cultures negative for growth
2. Multiple blood cultures negative for growth
3. OR tissue biopsy shows marked neutrophilic infiltrate and abscess formation, clinically consistent with pyoderma gangrenosum (PG)

**Final Working Diagnosis:** Pyoderma gangrenosum

#### Treatment and Outcomes:

1. Surgery: 19 combined orthopedic and plastic surgery procedures including irrigation and debridement, wound VAC changes, and skin grafting of left knee
2. Infectious Disease (ID): Multiple courses of antibiotics for presumed left knee postoperative infection. Antibiotics discontinued once PG diagnosis was established
3. Hematology: PICC related DVT treated with anticoagulation, anemia managed with transfusions
4. Rheumatology/Dermatology: Due to the patient's highly elevated inflammatory markers, coagulopathy, anemia, and repeated procedures without significant detectable pathogenic organism, there was concern for an immune-mediated systemic inflammatory response. OR tissue biopsy supported this diagnosis. The patient was started on prednisone and Anakinra and the antibiotics were discontinued
5. She completed her course of anticoagulation, weaned off steroids and immunosuppressive medication and has had no recurrent symptoms

**133** May 29 10:50 AM - 11:10 AM

### Unexpected Knee Pain in a Young Field Hockey Player

Terrence Tsui, John Herbert Stevenson. *University of Massachusetts, Worcester, MA.* (Sponsor: Pierre Rouzier, FACS)

(No relevant relationships reported)

**HISTORY:** A healthy 12-year-old-female field hockey player presented with 2 weeks of left knee pain that began while she was running in a straight line going into a game. She denied trauma to her knee and did not previously have knee pain. She suddenly felt a severe sharp pain localized to her proximal tibia and had trouble ambulating due to pain. She took ibuprofen, iced, and rested for a few days and was able to ambulate with minimal pain afterwards. She tried returning to practice but still had significant pain with running and stairs so was referred to sports medicine clinic by her PMD for further evaluation. Denied knee swelling, buckling, and locking. Denied numbness and tingling in her leg.

#### PHYSICAL EXAMINATION:

Left knee exam: Full ROM, 5/5 strength in knee flexion and extension, negative effusion, TTP immediately medial to the tibial tuberosity and over the medial tibial plateau, negative varus/valgus stress test, negative anterior and posterior drawer test, negative Lachman's test, negative McMurry's test, negative patella facet tenderness, negative grind test.

#### DIFFERENTIAL DIAGNOSIS:

Osgood-Schlatter disease  
 Pes anserine bursitis  
 Salter-Harris fracture  
 Tibial plateau stress fracture  
 Proximal tibial fracture  
 Bone contusion

#### TESTS AND RESULTS:

Labs: Vit. D 25-OH level low, normal PTH and TSH levels  
 Left knee XR: No acute fracture or other osseous abnormality detected.  
 Left tibia/fibula: No acute fracture or other osseous abnormality detected.  
 Left knee MRI: Transverse undisplaced fracture of the proximal tibial metaphysis.  
 DEXA scan: WNL

#### FINAL WORKING DIAGNOSIS:

Left knee pain secondary to a transverse undisplaced fracture of the proximal tibial metaphysis.

#### TREATMENT AND OUTCOMES:

Non-weightbearing with crutches for 6 weeks, PT  
 Ice and acetaminophen for pain  
 Vit. D supplementation  
 Improvement in pain at 3 week FUV and complete resolution of pain at 6 week FUV  
 Started weight-bearing after 6 week FUV with gradual increase in weight-bearing activities and eventually back to field hockey

## A-26 Rapid Fire Platform - Biomarkers in Sport, Performance and Health

Wednesday, May 29, 2019, 9:30 AM - 10:50 AM

Room: CC-Hall WA2

**134** **Chair:** William Byrnes, FACS. *University of Colorado Boulder, Boulder, CO.*

(No relevant relationships reported)

**135** May 29 9:30 AM - 9:40 AM

### Relationship Between Hepcidin, Interleukin-6, And Ferritin In Division-I Cross-country Runners Over A Competitive Season

Jesse A. Goodrich<sup>1</sup>, Sewan Kim<sup>1</sup>, Dillon J. Frisco<sup>1</sup>, Kimberly Detwiler<sup>1</sup>, Miguel Rueda<sup>1</sup>, Sourav Poddar<sup>2</sup>, William C. Byrnes, FACS. <sup>1</sup>*University of Colorado Boulder, Boulder, CO.* <sup>2</sup>*University of Colorado Denver, Denver, CO.* (Sponsor: William C Byrnes, FACS)

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(No relevant relationships reported)

Iron deficiency, which can be assessed by the iron storage protein ferritin (fer) can negatively affect athletic performance. We have previously observed that Division I cross country (XC) runners have fer levels that are at the low end of normal ranges despite being iron supplemented. The hormone hepcidin and the cytokine/myokine interleukin-6 (IL6) can both influence iron regulation but have not been evaluated in this population.

**Purpose:** The purpose of this study was to determine how hepcidin and IL6 change over a season in DI XC runners and determine whether changes in these parameters were related to changes in fer, hemoglobin concentration (Hb) or hematocrit (Hct). **Methods:** 45 athletes (25 female, 20 male) were recruited from the University of Colorado DI XC team in the fall of 2017. Fasted blood samples were collected in October (before NCAA XC championships), January, and March (during the outdoor track season). Blood samples were analyzed for Hb, Hct, fer, IL6 and hepcidin. All runners were provided with oral iron supplements from a certified nutritionist during this period.

**Results:** All biomarkers remained stable across the season except Hb, which was significantly higher in March. In males vs. females, there were no differences in hepcidin ( $24 \pm 11$  vs.  $21 \pm 11$  ng/mL;  $p > 0.05$ ) or IL6 ( $16 \pm 21$  vs.  $12 \pm 24$  pg/mL;  $p > 0.05$ ). When compared to females, males had higher fer ( $64 \pm 33$  vs  $47 \pm 24$  ng/mL;  $p < 0.05$ ), Hct ( $48 \pm 2$  vs  $44 \pm 3$  %;  $p < 0.001$ ), and Hb ( $16.3 \pm 0.7$  vs  $14.8 \pm 0.8$  g/dl;  $p < 0.01$ ). After controlling for sex, there was a positive relationship between hepcidin and fer ( $r = 0.47$ ,  $p < 0.01$ ); 20% of the variability in fer was explained by hepcidin and 51% was explained by individual variability. There were no relationships between IL6 and hepcidin or IL6 and fer.

**Conclusion:** Despite a consistent iron supplementation regime, hepcidin, IL6 and fer do not seem to systematically change across a season in collegiate runners. As expected, hepcidin and fer were positively related, but there were no relationships between IL6 and other measured parameters. Although fer was at the low end of

normal for both men and women, all other parameters were normal at all time points, suggesting that the normal range of fer for endurance athletes may be lower than the general population.

136 May 29 9:40 AM - 9:50 AM

### Patterns Of Change In Proteomic Markers Of Overreaching In Collegiate Swimmers

Amy M. Knab<sup>1</sup>, David C. Neiman, FACSM<sup>2</sup>, Arnold J. Groen<sup>3</sup>, Artyom Pugachev<sup>3</sup>, Alexander Rakitko<sup>4</sup>, Ariel E. Blount<sup>1</sup>, McKenzie Stevens<sup>1</sup>, Lola Bulatova<sup>1</sup>. <sup>1</sup>Queens University of Charlotte, Charlotte, NC. <sup>2</sup>Appalachian State University, Boone, NC. <sup>3</sup>ProteIQ Biosciences, Berlin, Germany. <sup>4</sup>Lomonosov Moscow State University, Moscow, Russian Federation.  
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(No relevant relationships reported)

Using global proteomic analysis, a previous study identified a panel of proteins that were linked to FOR and were associated with the acute phase response and innate immune system activation in athletes. **PURPOSE:** The purpose of this study was to track changes in this panel of proteins in 35 swimmers during the course of their normal training cycles during the 2017-2018 competitive season, and then identify relationships between protein expression data, external markers of overreaching (such as training distress scale (TDS)) and academic stress and performance. **METHODS:** Thirty-five NCAA Division II swimmers were recruited to the study (male n=19, female n=16; Age 19.1±1.6 y). Every Monday prior to morning practice, athletes provided a blood sample (via fingerpick) using the Volumetric Absorptive Micro-sampling (VAMS) technology. Athletes also reported TDS, illness, and RPE. **RESULTS:** Thirty-five swimmers completed the protocol (body fat, males = 12.6±5.1%, females 22.6±4.5%; VO<sub>2max</sub> males = 55.8±5.10, females = 48.1±6.7 ml/kg/min). 1) GLMM on each protein taking week numbers as factor showed that protein levels after Bonferroni correction and tukey test were significant (p-values < 0.05) in selected weeks. 2) In the next step, the weeks were labelled based on objective events or no-events (exams, competitions, exams+competitions, baseline, no-events). LDA analysis including TDS, RPE and illness data was performed, and this analysis separated the baseline week significantly (p-value 0.000972) from exam weeks and weeks with both exams and competitions. 3) Adding protein expression data enhanced this separation between these groups of weeks (p-value 2.237e-05). 4) Protein expression data without metadata gave clear separation between these groups of weeks (p-value 1.435e-07). We were also able to use protein expression data to predict the week groups with an accuracy of 69-73%. **CONCLUSIONS:** Protein expression data shows a separation of baseline, exams and exams + competition time frames indicating a distinct physiologic response to external academic and performance stress. Use of protein expression data, albeit so far to a modest extent, to predict stress levels of the swimmers under these circumstances deserves further study.

137 May 29 9:50 AM - 10:00 AM

### The Association Between Sonographic Metrics of Shoulder Injury and Serum Biomarker Profile in Response to a Hand-Cycling Task

Prakash Jayabalan<sup>1</sup>, Dhruval Amin<sup>2</sup>, Hyungtaek Kim<sup>1</sup>, Julia Fram<sup>3</sup>, Yen-Sheng Lin<sup>1</sup>, Jennifer Soo Hoo<sup>4</sup>. <sup>1</sup>Shirley Ryan AbilityLab, Chicago, IL. <sup>2</sup>Rosalind Franklin University, Chicago, IL. <sup>3</sup>Northwestern Feinberg School of Medicine, Chicago, IL. <sup>4</sup>Weill Cornell Medicine, New York, NY.

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(No relevant relationships reported)

#### PURPOSE:

Providing the physician the means of screening for 'at risk' individuals for shoulder pathology would be of benefit in the development of treatment strategies and counseling manual wheelchair users (MWC), who have a high incidence of shoulder pain. The objective of this study is to compare the sonographic and biomarker changes at baseline and following a shoulder related functional task in individuals who are able bodied (AB) versus manual wheelchair MWC. **METHODS:** MWC users (with prior spinal cord injury, n=6) and age-matched AB individuals (n=7) performed a 30-minute hand-cycling task on a stationary, recumbent hand-cycle with standardized increasing resistance during this time-period. Pre- and post hand-cycling, subjects reported their shoulder pain using the visual analog scale, and underwent a physical examination. They also had a standardized sonographic assessment, including assessment of the acromiohumeral distance (AHD), reduction in which is associated with pathology and tendon cross sectional area, and blood/serum measurement of specific biomarkers of cartilage turnover (COMP), inflammation (TNF- $\alpha$ , IL-1 $\beta$ ), cartilage degradation (MMP-1) and collagen type-1 (CTX-1) breakdown.

**RESULTS:** There was no significant difference in physical examination and pain related metrics post hand-cycling. However, there was a significant reduction in the AHD in the neutral positions (p=0.045) and 60 degrees of passive abduction (0.047) in the dominant arm compared to baseline in both groups. MWC users had significantly

higher baseline concentrations of IL-1 $\beta$  (p=0.047) compared to AB. Irrespective of group, following 30 minutes of hand-cycling, there was also a significant increase in MMP-1 (p=0.013). Across time-points there was a positive correlation between the CTX-1 concentration in the serum and the AHD in the subject's dominant arm (r=0.7, p=0.03).

#### CONCLUSIONS:

Ultrasound metrics and certain biological markers are potentially sensitive to anatomic and physiologic changes that may occur in response to a functional shoulder task more so than patient report of symptoms or physical examination. Further delineation of the changes seen in this study could aid in the development of a shoulder evaluation protocol that highlights 'at risk' individuals for shoulder pathology.

138 May 29 10:00 AM - 10:10 AM

### Are Molecular Deficits Relevant to Concussion Present in Collegiate Football Players Entering the NFL Draft?

Laura J. Kunces<sup>1</sup>, John Keenan<sup>2</sup>, Amanda Carlson-Phillips<sup>2</sup>, Michael A. Schmidt<sup>3</sup>, Caleb M. Schmidt<sup>3</sup>, Zung V. Tran<sup>4</sup>.

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(No relevant relationships reported)

**PURPOSE:** Factors that influence individual susceptibility to brain acceleration forces or poor outcomes in brain injury are not well understood. Characterization of molecular variants in athletes entering a highly competitive contact environment may provide additional insight into factors that influence the longitudinal followhoney-up of concussion incidence and its trajectory. We examined the metabolic phenotype of collegiate football players entering the 2016 National Football League (NFL) draft. The principal aims were to observe and characterize the molecular status of individual athletes and to quantify the prevalence of athletes with multiple concurrent molecular deficits. These will serve as baseline measures, as concussion incidence and trajectory of this cohort of athletes is followed in their NFL careers. **METHODS:** Blood samples were taken from 30 elite American collegiate football players seven weeks before the NFL scouting combine, and 15 weeks before entering the NFL draft. **RESULTS:** Of 74 analytes, results revealed me a undesirable values in Omega-3 Index (4.66%), AA:EPA fatty acid ratio (29.13), homocysteine (11.4  $\mu$ mol/L), vitamin D (30 ng/mL), and magnesium (4.1 mg/dL). Using reference ranges optimized for athletic performance, no athlete had 0, 1 or 2 abnormalities in blood values; 10% had 3, 40% had 4, and 50% of athletes had 5 undesirable values. **CONCLUSIONS:** Molecular deficits in this cohort entering the NFL draft appear to be common. Historical evidence exists showing that the molecular deficits observed in this study have mechanistic correlations with concussion trajectory and outcome. A more thorough examination of molecular features that contribute to poor outcomes in concussion may open the door to precision nutrition and clinical countermeasures, not only in football, but in any sport in which acceleration forces to the brain may be present.  
Supported by WellnessFX

139 May 29 10:10 AM - 10:20 AM

### Associations Between Circulating Basal BDNF, IGF-1 and Physical Fitness

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(No relevant relationships reported)

Exercise-induced increase in circulating insulin-like growth factor 1 (IGF-1) levels might stimulate brain-derived neurotrophic factor (BDNF) expression. Thus, circulating IGF-1 can travel from the periphery to the brain and there stimulate the expression of BDNF and facilitate long-lasting changes in neural activity. It has been shown that chronic training leads to upregulation of basal levels of both BDNF and IGF-1. Several longitudinal studies have also shown that aerobic exercise acutely elevates circulating BDNF levels in humans. **PURPOSE:** To investigate associations of peripheral BDNF and IGF-1 with several physical fitness components at rest. **METHODS:** 792 adults (26±6 yr) men participated. BDNF and IGF-1 concentrations were analyzed from venous blood samples using an ELISA Assay (Human BDNF ELISA kit, ScienCell Research laboratories, San Diego, California) and Dynex DS 2 ELISA processing system (Dynex Technologies, Chantilly, Virginia). Cardiorespiratory fitness (VO<sub>2max</sub>) was determined using an indirect graded cycle ergometer test until exhaustion. Bilateral maximal isometric leg (MVCleg) and arm extension forces (MVCarm) were measured using dynamometers. Muscular endurance tests consisted of repeated 1-min push-ups and sit-ups, while standing long jump assessed muscular power. **RESULTS:** The mean±SD BDNF and IGF-1 concentrations were 15.20±3.96 ng/ml, 25.0±6.9nmol/l, respectively, while VO<sub>2max</sub> was 41.1±8.8ml/kg/min, MVCleg 3394±933N, MVCarm 871±216N, push-ups 28±14reps/min, sit-ups 35±12reps/min, standing long jump 227±26cm. BDNF and IGF-1 correlated weakly with each

other ( $r=-0.146$ ,  $p=0.003$ ). Linear regression analysis (adjusted for age, smoking and education) revealed that associations between BDNF and physical fitness were weak for  $VO_{2max}$  ( $\beta=-0.077$ ,  $p=0.006$ ) and muscle fitness ( $\beta=-0.077$ ,  $p=0.895$ ). This was also the case for IGF-1. **CONCLUSIONS:** The associations between peripheral BDNF, IGF-1 and physical fitness components were weak or non-existent at rest in the present cross-sectional design. Thus, it seems that only exercise-induced elevated values of BDNF and IGF-1 may associate with each other and physical fitness components. Therefore, their interactions should be investigated in future studies during acute and / or chronic exercises.

**140** May 29 10:20 AM - 10:30 AM

### Effects Of An Intensified Training Period On Resting Metabolic Rate, Energy Availability, Blood-biomarkers And Performance

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(No relevant relationships reported)

Cyclists often block periodize their training in micro and meso periods with high training volumes to prepare for competition. The effect of such periods on surrogate markers for Relative Energy Deficiency in Sport (RED-S) have not yet been properly investigated. **PURPOSE:** To determine how a mesocycle of four weeks of interval training affects RED-S associated surrogate markers and performance variables in well-trained male cyclists. **METHODS:** Twenty-two participants (age:  $33.5 \pm 6.6$  years, height:  $181.4 \pm 5.2$  cm, weight:  $76.5 \pm 7.4$  kg,  $VO_{2peak}$ :  $63.5 \pm 6.6$  mL·kg<sup>-1</sup>·min<sup>-1</sup>) were recruited for a four-week interval training protocol, consisting of three high-intensity interval training sessions per week with an accumulated work duration of 32 minutes per session. Unlimited low intensity training was permitted. Protocol included pre- and post-intervention assessment of resting metabolic rate (RMR) (ventilated hood), body composition by dual x-ray absorptiometry, blood samples, energy intake and exercise energy expenditure to calculate energy availability (EA), and aerobic- and anaerobic performance. **RESULTS:** Four weeks of interval training increased aerobic performance (mean  $\pm$  SD of difference); peak power output [ $18.5 \pm 12.4$  W, ( $p < 0.001$ )],  $VO_{2peak}$  [ $1.5 \pm 2.1$  mL·kg<sup>-1</sup>·min<sup>-1</sup>, ( $p = 0.005$ )], and functional threshold power [ $17.0 \pm 11.8$ W, ( $p < 0.001$ )] as well as testosterone levels [ $1.35 \pm 2.13$  nmol·L<sup>-1</sup>, ( $p = 0.011$ )]. However, triiodothyronine ( $T_3$ ) [ $-0.12 \pm 0.18$  nmol·L<sup>-1</sup>, ( $p = 0.008$ )], absolute RMR [ $-52.2 \pm 81.4$  kcal per day<sup>-1</sup>, ( $p=0.01$ )], relative RMR [ $-0.8 \pm 1.2$  kcal per kg FFM<sup>-1</sup>, ( $p=0.01$ )], and  $RMR_{ratio}$  [ $-0.03 \pm 0.04$ , ( $p = 0.01$ )] decreased, and cortisol levels increased ( $49.3 \pm 87.3$  nmol·L<sup>-1</sup>,  $p = 0.02$ ) indicating energy deficiency, while no changes were observed in body weight or -composition, EA, or insulin and insulin-like growth factor 1 (IGF-1). **CONCLUSION:** A successive four weeks of intensified training increased performance and testosterone levels in this group of well-trained male endurance athletes, although surrogate markers of RED-S such as decreased RMR,  $T_3$  and increased cortisol levels were observed. These results indicate the complexity, and the methodological challenges of assessing and evaluating RED-S in male athletes.

**141** May 29 10:30 AM - 10:40 AM

### Salivary Biomarkers in College Female Basketball Players during the Late Competition Season

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The college basketball season involves multiple competitions and strenuous practice that have been linked to signs of overtraining. During the late competition period, evaluation of stress and recovery can assist coaches in determining player loads to ensure optimal performance. **Purpose:** To assess factors that reflect on stress and recovery through the study of salivary biomarkers. **Methods:** Fifteen members of the college women's basketball team volunteered to participate. Saliva samples (0.75mL) was collected 24 hours before (pre) and 24 hours after (post) a competition during the last three weeks of the regular season. Salivary samples were stored frozen and then sent to a laboratory for analyses at the end of the study period. Biomarker concentrations were determined using indirect ELISA for testosterone, cortisol and secretory immunoglobulin A. In addition, at the time of the saliva collection, subjects were asked to report their perception of overall health, level of anxiety, and mood. ANOVA were used to test for significance (95 level of confidence) for pre-post measures and weekly variance. Correlations between perceptions of health, anxiety, mood, and salivary biomarkers were conducted. **Results:** The means (SD) of the biomarkers and subjective measures are reported below.

Week		Testosterone (pmM)	Cortisol (nmM)	SigA	Health Score	Anxiety	Mood
1	Pre	247.35 (131.34)	4.49 (1.33)	NA	7.67 (1.30)	2.23 (0.83)	3.08 (0.90)
	Post	229.26 (153.70)	5.02 (3.07)	111.84 (88.89)	7.20 (1.70)	2.20 (0.94)	3.21 (0.80)
2	Pre	202.34 (129.75)	7.41 (8.48)	NA	8.00 (1.62)	2.07 (0.92)	3.29 (0.83)
	Post	230.44 (151.49)	6.05 (4.04)	92.31 (54.18)	7.83 (1.34)	1.75 (0.62)	3.45 (0.82)
3	Pre	222.37 (165.02)	5.18 (3.68)	NA	7.73 (1.67)	1.87 (0.74)	3.36 (0.63)
	Post	257.36 (126.07)	4.43 (1.95)	81.55 (29.45)	8.27 (1.27)	1.55 (0.69)	3.00 (0.45)

None of the salivary biomarkers were significantly different in pre-post comparisons nor across the three weeks. Changes in health scores, anxiety, or mood were not significantly different. Overall the testosterone showed significant correlations with cortisol ( $r=0.51$ ), sigA ( $p=0.46$ ), and health score ( $p=-.31$ ). In addition, cortisol was significantly related to health score ( $p=-0.24$ ). Health score showed a negative relationship with anxiety ranking ( $r=-.30$ ) while no other relationships were evident. **Conclusion:** The lack of significance between these variables might indicate that these players did not show indication of stress or lack of recovery during this period of competition.

**142** May 29 10:40 AM - 10:50 AM

### Salivary IgA as a Predictor of Upper Respiratory Tract Infections in Elite Rugby Union Players

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(No relevant relationships reported)

For athletes to optimise their performance, minimising the risk of injuries and illness is essential to reduce the number of training days missed. Upper Respiratory Tract Infections (URTI) are amongst the most common illnesses reported in athletes. An URTI can result in missed training days, which in turn may lead to performance decrements.

**PURPOSE:** The purpose of this study was to investigate if salivary Immunoglobulin A (sIgA) is a predictor of URTI in elite Rugby Union players.

**METHODS:** Nineteen male elite Rugby Union players provided morning saliva swabs and completed an illness log documenting symptoms of URTI, bi-weekly (Monday and Friday), over a 10-week training period. Test re-test reliability of sIgA was completed under controlled conditions prior to the study. Multi-level logistic regression was used to analyse the relationship between sIgA and the binary outcome of presence or absence of an URTI.

**RESULTS:** The results found that a significant decrease in sIgA ( $-0.00537$  (0.00268) ug.ml  $p=0.046$ ) (beta (SE)), increased the odds of a player contracting an URTI. A player was at a greater risk of contracting an URTI, within the subsequent 2-week period, if sIgA decreased by 65% or more.

**CONCLUSION:** The results show that sIgA is a useful predictor for determining the likelihood of players contracting an URTI. These results provide coaches with an objective monitoring marker, to help reduce the risk of players contracting an URTI and missed training days, which may lead to performance decrements. These results may assist the coaches and support staff in making evidenced based decisions, where sIgA decreases by 65% or more, by adjusting individual player training load and implementing appropriate recovery strategies to ensure optimisation of training.

**A-37 Free Communication/Poster - Cardiovascular**

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
Room: CC-Hall WA2

**163** Board #1 May 29 9:30 AM - 11:00 AM

**Influence of Whole Blood Donation (~ 470ml) on Peak Power Outputs Across a 96hr Period**

Diane Johnson, Justin Roberts, Dirk Dugdale, Henry Hodgkins, Ronique Gordon, Madie Rowland, Ellen Lockwood, Viviane Merzbach, Antonio Femminile, Flora Veres, Dan Gordon. *Anglia Ruskin University, Cambridge, United Kingdom.*

(No relevant relationships reported)

**PURPOSE:** Previous studies investigating the effects of blood donation (BD) on power output (PO) concerning all out sprints appear elusive, thus this study determines the effects of BD (~ 470ml) over a period of up to 96 hours on power output during four repeated 15s sprints. **METHODS:** Following local institutional ethical approval 11 participants, 8 males (age  $30.3 \pm 13.1$  years, mass  $85.6 \pm 10.5$  Kg, height  $177.8 \pm 6.9$  cm) and 3 females (age  $34.7 \pm 10.3$  yrs, mass  $69.1 \pm 11.6$  Kg, height  $171.2 \pm 9.1$  cm) volunteered to participate. Testing was conducted in the morning over a two week block with a rest week between testing phases. Week one (W1) was pre-BD and week two (W2) was post BD. Visit one on W1 established haematological levels and  $\dot{V}O_{2max}$ . Subsequent visits during W1 were for Sprint Interval Testing (SIT), with a resistance of  $0.07\text{kg}\cdot\text{kg}^{-1}$  of body mass, with 90s of unloaded pedalling prior to each efforting a Lode Excalibur Sport cycle ergometer. W2 was identical except the participant donated blood on visit 1 post haematological testing only. Additionally throughout testing  $\dot{V}O_2$ , cardiac output, stroke volume and heart rate using thoracic impedance cardiography, while Near Infrared Spectroscopy measured  $O_2$  delivery at the muscle. **RESULTS:** Pre-BD (Hb= $14.61 \pm 0.72\text{g}\cdot\text{dL}^{-1}$ , Hct= $42.91 \pm 2.12\%$ ) compared to post BD of day 1 (Hb= $13.57 \pm 0.97\text{g}\cdot\text{dL}^{-1}$ , Hct= $39.91 \pm 3.02\%$ ) reduced by 7.09%. Hb percentage decreases continued over days 1-2 (2.68%) and days 2-3 (2.55%), a percentage increase (1.98%) occurred between days 3-4, values yielded significance in all cases ( $P < 0.0001$ ).  $\Delta\text{PPO}$  (W) pre-BD on day 1 ( $46.2 \pm 180.3$ ), 2 ( $45.5 \pm 150.7$ ), 3 ( $18.7 \pm 74.7$ ) and 4 ( $31.9 \pm 99.4$ ) compared to post BD on day 1 ( $170 \pm 153.0$ ), 2 ( $156.6 \pm 125.4$ ), 3 ( $88.7 \pm 106.6$ ) with the exception of day 4 ( $84.9 \pm 72.7$ ) all revealed significance ( $P = 0.006$ ,  $P = 0.005$  and  $P = 0.04$  respectively). There was no interaction for time for either pre or post BD periods for either  $\Delta\text{PPO}$  or mean PO ( $P > 0.05$ ).

**CONCLUSIONS:** The data suggests that BD has significant effects on Hb and Hct up to 96 hours post BD.  $\Delta\text{PPO}$  was also significantly influenced up to 72 hours post BD, this is potentially attributed to a down regulation of the resynthesis of PCr between sprints from decreased  $O_2$  availability. These findings have significant implications for individuals wishing to undertake sprint interval-based exercise post BD.

**164** Board #2 May 29 9:30 AM - 11:00 AM

**Is Heart Rate Variability a Suitable method For Monitoring The Effect Of A Training Session In Synchronized Swimming?**

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(No relevant relationships reported)

**PURPOSE:** To determine whether heart rate variability (HRV) is a suitable method for monitoring the effect of a training session (TS) in elite synchronized swimmers **METHODS:** We recorded resting HRV (Rest) in 12 elite swimmers (mean age:  $21.5 \pm 3.5$  yrs) for 3 days over one week, interspersed by 48 h, prior to the 2015 World Swimming Championships. During the last TS, we continuously monitored heart rate (HR) and obtained salivary cortisol (SC) samples before and after the session. We measured capillary blood lactate ( $La_{peak}$ ) 2, 4, and 8 min after the TS and monitored recovery HRV (Rec), which was averaged for the following 5-min periods after the TS:  $Rec_{20-25}$ ,  $Rec_{25-30}$  and  $Rec_{30-35}$ . We assessed rate of perceived exertion (RPE) and tested the association between  $La_{peak}$ , SC, and RPE and the relative changes ( $\Delta\%$ ) of the natural logarithm (Ln) of the HRV-derived indices [standard deviations of the distance of rate to rate (SD<sub>r</sub> and SD<sub>d</sub>), the root mean square successive difference of intervals (RMSSD), and the high- and low-frequency domain parameters (HF and LF, respectively)]. We calculated the individual coefficient of variation (CV) of LnRMSSD for each recovery period.

**RESULTS:** LnLF ( $\text{ms}^2$ ) was lower in  $Rec_{25-30}$  ( $5.72 \pm 1.05$ ) than in  $Rec_{20-25}$  and  $Rec_{30-35}$  ( $6.68 \pm 0.97$ ,  $6.26 \pm 1.29$ ;  $P < 0.05$ ). On average,  $CV = 10.7\%$ .  $La_{peak}$  was correlated positively with  $\Delta\%$ LnRMSSD,  $\Delta\%$ LnLF,  $\Delta\%$ LnSD<sub>r</sub>, and  $\Delta\%$ SC.

**CONCLUSIONS:** Isolated HRV data from synchronized swimmers may be less accurate than other physiological markers for assessing the effect of TSs as a result of exercise bouts performed in apnea.

**165** Board #3 May 29 9:30 AM - 11:00 AM

**Synchronization Of Foot Strike And Cardiac Cycle During Treadmill Running In Non-endurance Trained Individuals**

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(No relevant relationships reported)

Synchronizing cardiac diastole with foot strike during running may maximize the efficiency with which skeletal muscle promotes venous return of blood to the heart. Recent research has found that diastolic stepping results in a lower heart rate (HR) compared to systolic stepping in elite endurance runners. **PURPOSE:** To assess HR, metabolic responses, and perceived exertion to running when foot strike occurs during either cardiac systole (CS) or cardiac diastole (CD) in non-endurance trained individuals. **METHODS:** Eight non-endurance trained participants (7 males; Age:  $25.3 \pm 8$  yr; BMI:  $23.6 \pm 3.2\text{kg}\cdot\text{m}^{-2}$ ) performed 2, 5-min bouts of treadmill running at a comfortable pace ( $5.4 \pm 0.5$  mph) with foot strike occurring during either CD or CS. Participants wore a chest strap that transmitted accelerometer and HR data to a tablet computer with proprietary software. The software generated an auditory beep that was synced with either 45% (CD) or 100% (CS) of each cardiac cycle. Participants were instructed to match their steps to the beeps during both conditions (CD or CS) which were randomized between trials and blinded to the participants. HR, oxygen consumption ( $\dot{V}O_2$ ),  $O_2$ -pulse, minute ventilation (VE), and respiratory exchange ratio (RER) were recorded continuously and averaged over the last 3 minutes of each condition. Rating of perceived Exertion (RPE) was recorded during the final minute of each condition. Paired T-tests were used to compare the dependent variables between conditions and all tests were considered significant at the 0.05 level. **RESULTS:** HR was significantly lower when foot strike occurred during CD compared with CS ( $163.0 \pm 5$  vs.  $170.1 \pm 4$  bpm;  $P < 0.05$ ). Furthermore, there was a trend for  $O_2$ -pulse to be greater during CD ( $16.3 \pm 1.5$  vs.  $15.7 \pm 1.4$  ml/beat;  $P = 0.07$ ). VE ( $73.3 \pm 5$  vs.  $74.4 \pm 4$  l/min),  $\dot{V}O_2$  ( $35.0 \pm 1.3$  vs.  $35.3 \pm 1.2$  ml/kg/min), and RPE ( $10.5 \pm 0.7$  vs.  $10.3 \pm 0.8$ ) were not significantly different between CD and CS, respectively. **CONCLUSION:** During relatively short, steady-state running conditions, synchronization of foot strike with CD results in a significantly lower HR when compared to CS. This may lead to enhanced cardiac filling, which may be beneficial to running performance in non-endurance trained individuals.

**166** Board #4 May 29 9:30 AM - 11:00 AM

**Heart Rate Response During A Collegiate Esports Tournament**

SILVIO VALLADAO, Thomas Andre, Damon Cox. *University of Mississippi, OXFORD, MS.*

(No relevant relationships reported)

**HEART RATE RESPONSE DURING A COLLEGIATE ESPORTS TOURNAMENT**

S. Valladao, T.L. Andre, D. Cox. The University of Mississippi, Oxford, MS. During the last decade, electronic sports (esports), or competitive video gaming, has rapidly increased, generating nearly \$1 billion per year and is now composed of millions of gamers around the globe (online and live). However, the physiological effects of these gaming competitions have not been thoroughly examined yet. A myriad of literature focuses on heart rate (HR) and traditional athletic competition but very little research has addressed the heart rate responses of individuals playing competitive esports and none to date have examined heart rate during collegiate esports tournament in collegiate club sport competitors. **METHODS:** Male members of the University of Mississippi esports team ( $n = 14$ ; age =  $19.8 \pm 1.0$  years; BMI =  $24.1 \pm 5.5$ ; esports mean hours per week =  $18.9 \pm 11.6$ ) participated in the study during the Egg Bowl esports tournament. A 5-minute ambient (seated) heart rate was collected using a Polar H10 HR monitor prior to esports competition. Upon sitting on stage, recordings for HR began immediately prior and ended immediately post to their esports matches while remaining seated. For the statistical analyses, Paired-samples t-tests were utilized. Results were considered significant at  $\leq 0.05$ . **RESULTS:** Mean HR during was significantly elevated compared to pre ( $131.4 \pm 19.0$  bpm vs.  $97.1 \pm 19.9$  bpm;  $p = 0.000$ ) and peak HR during was significantly elevated compared to pre ( $188.1 \pm 32.9$  bpm vs.  $119.6 \pm 20.1$  bpm;  $p = 0.000$ ). **CONCLUSION:** Given the elevated HR observed in the study, further understanding of the physiological response to competitive esports in the tournament setting is critical for developing interventions to potentially mitigate the physiological stress experienced by esports athletes.

167 Board #5 May 29 9:30 AM - 11:00 AM  
**Heart Rate Response During Esport: Fortnite**  
 T. L. Andre<sup>1</sup>, S. Valladao<sup>1</sup>, D. Cox<sup>1</sup>, and J. D. Middleton<sup>2</sup>. <sup>1</sup>The University of Mississippi, Oxford, MS; <sup>2</sup>Esports Performance Lab, Kansas City, MO.  
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 (No relevant relationships reported)

**Abstract**

Esports popularity has rapidly grown both in online play and viewing. Little research has addressed the heart rate responses of individuals playing esports and none in the platform of the Esport: Fortnite over a longer duration. **Purpose:** Determine the heart rate response during a 3-hour seated session of the Esport: Fortnite. **Methods:** Individuals (n=23; age = 20.7 ± 2.1 years; BMI = 25.8 ± 3.5) who play at least 6 hours of esports per week were recruited to participate in the study from around the University of Mississippi. On two separate occasions a 15-minute seated HR was collected using a Polar H10 heart rate monitor to measure mean resting HR. Participants wore the Polar heart rate monitor during their regular Esport: Fortnite session time for 3-hours. Paired sample t-tests were utilized to compare mean resting and peak heart rates to mean and peak esport HR. Results were considered significant at  $p < 0.05$ . **Results:** There was a significant increase in mean esport session HR compared to resting HR (75.6 ± 9.6bpm vs. 69.8 ± 10.5bpm;  $p = 0.003$ ) and peak seated esport session HR (119.8 ± 16.3bpm vs. 80.1 ± 10.8bpm;  $p < 0.001$ ). **Conclusions:** Further understanding of the physiological stress induced with chronic playing of esports is warranted given this initial studies results given the increases in individuals seated heart rate.

168 Board #6 May 29 9:30 AM - 11:00 AM  
**Association Between Supine Versus Standing Heart Rate Variability, Aerobic Fitness and Exercise Responses in Women**  
 Brenee K. Rockholt, Andrew A. Flatt. Georgia Southern University, Savannah, GA.  
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 (No relevant relationships reported)

Heart rate variability (HRV) is used to guide endurance training prescription but the optimal body position for daily recordings is unclear. **PURPOSE:** To assess supine and standing HRV associations with aerobic fitness and submaximal exercise heart rate (HRex) responses to an aerobic interval session. **METHODS:** Healthy women (n = 8, age = 23 ± 3 years) performed a graded treadmill test for the determination of maximal oxygen consumption (VO<sub>2</sub>max). Over the subsequent 5 days, post-waking measures of supine and standing natural logarithm of the root mean square of successive RR intervals (LnRMSSD) were averaged to establish baseline. Subjects then performed an interval training session consisting of 7 x 3 min of treadmill running at 90% of the velocity attained at VO<sub>2</sub>max (vVO<sub>2</sub>max), with two minutes of walking at 4 km·h<sup>-1</sup> between sets. Immediately before and 24 h post-interval session, a submaximal test consisting of 3 min of running at 60, 70, 80, and 90% of vVO<sub>2</sub>max was performed with HRex recorded at the end of each stage. HRV measures were recorded the morning after the interval session for comparison to baseline and changes in HRex. **RESULTS:** VO<sub>2</sub>max ranged from 32.5 - 54.4 ml·kg<sup>-1</sup>·min<sup>-1</sup>. Baseline supine LnRMSSD was significantly associated with VO<sub>2</sub>max ( $r = 0.77$ ,  $p = 0.03$ ). No differences in supine (4.26 ± 0.57 vs. 4.30 ± 0.70,  $p = 0.81$ ) or standing (3.26 ± 0.67 vs. 3.26 ± 0.87,  $p = 0.98$ ) LnRMSSD were observed between baseline and 1 day post-interval session. However, individual changes in standing LnRMSSD were significantly associated with their changes in HRex at 60% vVO<sub>2</sub> ( $r = -0.71$ ,  $p < 0.05$ ) where those with a decrease in LnRMSSD relative to baseline demonstrated increases in HRex and vice versa. Additionally, we observed a large, non-significant relationship between VO<sub>2</sub>max and changes in standing LnRMSSD ( $r = 0.69$ ,  $p = 0.056$ ) where those with reduced standing LnRMSSD relative to baseline at 24 h post-interval session tended to have lower VO<sub>2</sub>max and vice versa. **CONCLUSIONS:** These results indicate that standing HRV may provide a better indication of individual exercise responses whereas supine HRV provides a better indication of aerobic fitness level among healthy women.

169 Board #7 May 29 9:30 AM - 11:00 AM  
**Relationship Between Heart Rate Variability Threshold and 5-km Outdoor Running Performance in Non-athletes**  
 Carlos J. Cruz<sup>1</sup>, Luiz Grossi Porto<sup>1</sup>, Gledson Alves Costa Jr<sup>2</sup>, Guilherme Eckhardt Molina<sup>1</sup>. <sup>1</sup>University of Brasília, Brasília-DF, Brazil. <sup>2</sup>Centro Universitário Euro Americano-UNIEURO, Brasília-DF, Brazil.  
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The analyses of heart rate variability threshold (HRV<sub>T</sub>) under a controlled treadmill incremental exercise test (IET) is considered a practical strategy for cardiac parasympathetic depression and anaerobic threshold assessment. However, the prognostic value of HRV<sub>T</sub> for outdoor running performance is unknown. **Purpose:** To correlate the exercise intensity at the HRV<sub>T</sub> assessed during a treadmill incremental test and the 5-km outdoor running time in young men. **Methods:** 14 beginner runners (23.5 ± 4.4 yrs, BMI: 23.2 ± 2.7 kg/m<sup>2</sup>) underwent a treadmill IET. The R-R intervals were collected continuously during exercise test using a heart rate monitor (Polar® v800) and heart rate variability was analyzed by the SD1 index of Poincaré Scatterplot map. HRV<sub>T</sub> was considered the load (km/h) corresponding to the point of stabilization at which there was no further significant decline in the values of the SD1 index even with increasing intensity. After a 48h period, the participants individually performed a 5-km running trial on an outdoor 250-m track. The participants were encouraged to conclude the 5-km running test as quickly as possible. Due to non-normality of the data and the sample size, we used the Spearman's correlation test with p-value set at 5%. **Results:** The exercise intensity at HRV<sub>T</sub> was 7 (7-8) km/h and the time to complete the 5-km trial was 25.2 (23.2-28.5) minutes. A strong correlation was observed between the treadmill speed at the HRV<sub>T</sub> and the time expended to cover the 5-km running test (Figure 1). **Conclusion:** HRV<sub>T</sub> evaluated during an IET under controlled conditions was negatively correlated with the outdoor 5-km running performance in young non-athlete men. Our results may open a new application to the HRV<sub>T</sub> as a practical tool for the prognostic evaluation of a 5-km running performance.

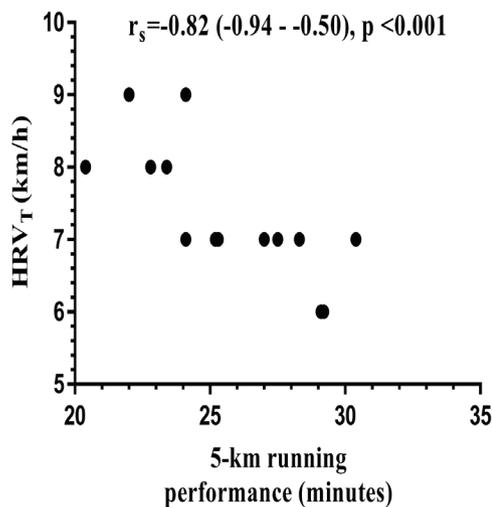


Figure 1- Relationship between HRV<sub>T</sub> and 5-km time trial.

170 Board #8 May 29 9:30 AM - 11:00 AM  
**Effects of Hemodynamic Responses and Vascular Endothelial Function to Blood Flow Restriction Exercise Training**  
 Yan Zhao<sup>1</sup>, Aicui Lin<sup>2</sup>, Andong Chen<sup>1</sup>, Beibei Lu<sup>1</sup>. <sup>1</sup>Nanjing Sport Institute, Nanjing, China. <sup>2</sup>Nanjing First Hospital, Nanjing, China.  
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 (No relevant relationships reported)

**PURPOSE:** The study aimed to compare hemodynamic responses and vascular endothelial function after 8 weeks resistance exercise with different blood flow

restriction (BFR) in healthy adults. **METHODS:** Twenty-four participants (men 20.63±0.88 yr) were randomly assigned to three groups: resistance exercise without occlusion cuff (CON), resistance exercise with occlusion cuff pressure set at 65% resting systolic blood pressure (BFR-L) and resistance exercise with occlusion cuff pressure set at 130% resting systolic blood pressure (BFR-H). Each subject underwent five bouts of 1-minute 30%1RM resistance exercise with 2-min interval, 5 times a week for 8 weeks. Left ventricular fractional shortening (FS), left ventricular ejection fraction (LVEF), velocity, stroke volume (SV) resistance index (RI), Vascular endothelial growth factor (VEGF), vascular endothelial growth factor receptor (VEGF-R) and interleukin-6 (IL-6) were measured. **RESULTS:** 1. After 8 weeks, compared with AC in BFR-H group (94.42±20.99), AC in the CON group (106.13 ±18.86) and BFR-L group (108.08±19.22) significantly increased ( $p < 0.05$ ). 2. After 8 weeks, SBP was increased in the BFR-L group (3.37±0.674mmHg), BFR-H group (4.50±1.21mmHg) and in the CON group (-6.37± -1.02mmHg). Exercise immediately after 8 weeks, DBP decreased in the BFR-H group (6.44±0.305mmHg) and the CON group (4.25±0.281mmHg), and the difference was statistically significant ( $p < 0.05$ ). 3. After 8-week training, compared with the expression of VEGF-R and IL-6 in CON group (641.23±12.68pg/ml, 7.00±0.76 pg/ml), their expression in the BFR-L group (711.12±16.88pg/ml, 7.39±0.51pg/ml) and BFR-H group (703.63±15.49 pg/ml, 11.16±0.82pg/ml) significantly increased ( $p < 0.05$ ). **CONCLUSIONS:** BFR-L is beneficial to the improvement of aortic compliance. BFR-L and BFR-H all can cause reduction of DBP after exercise, which can be related to increased secretion of local VEGF and VEGF-R, causing angiogenesis and reducing peripheral resistance.

**171 Board #9 May 29 9:30 AM - 11:00 AM**  
**Comparing Total Hemoglobin Mass Between Selected NCAA Division I Athletes And Recreationally Active Students**

Sewan Kim, Jesse A. Goodrich, William C. Byrnes, FACSM. *University Colorado Boulder, Boulder, CO.* (Sponsor: William C. Byrnes, FACSM)  
*(No relevant relationships reported)*

Total hemoglobin mass (tHb) is linearly related to total body mass, however, whether this relationship is altered by lean tissue mass, training or sex remains controversial. **PURPOSE:** To investigate if lean mass is a more appropriate determinant of tHb compared to body mass across NCAA DI athletes and controls. We will also determine if this relationship is altered by sex and/or training status. **METHODS:** Nordic (6F & 6M) and alpine (5M) skiers, football players (7M) and recreationally active student controls (9F & 10M) from the University of Colorado Boulder participated. The optimized carbon monoxide rebreathing procedure was used to determine tHb. Body composition was determined via DXA. Since female athletes were not present in all groups, statistical analyses were performed for males across all groups and a separate comparison was made between female nordic skiers and control groups. **RESULTS:** The overall correlations of tHb with body mass or lean tissue mass were significant ( $R^2 = 0.73$  &  $R^2 = 0.88$ ), but the positive relationship was stronger when using lean mass ( $p < 0.001$ ). For males, body mass and lean tissue mass were greater in football with no significant differences between any other group. Football had a greater tHb compared to control and alpine (1168.7 ± 126.9 vs. 925.9 ± 123.0 & 936.8 ± 151.9 g), but was not different than nordic (1052.5 ± 166.7 g). Nordc tHb was greater than control, but not different from alpine. When tHb was normalized using body mass and lean mass, nordic (14.5 ± 1.5 & 16.5 ± 1.2 g/kg) was greater than football (10.4 ± 0.9 & 14.4 ± 1.5 g/kg), alpine (11.6 ± 1.1 & 14.2 ± 0.6 g/kg) and control (11.8 ± 0.6 & 14.6 ± 0.8 g/kg) groups while no differences between any other groups were found. For females, body mass, lean tissue mass and tHb (656.4 ± 72.9 vs. 566.1 ± 66.0 g) were not different between nordic and control. When tHb was normalized using body mass, nordic (11.3 ± 0.7 g/kg) was greater than control (9.5 ± 1.0 g/kg), but when tHb was normalized using lean mass there was no difference (14.5 ± 1.1 vs. 13.8 ± 1.4 g/kg). **CONCLUSION:** Lean tissue mass explains a greater amount of variability in tHb compared to total body mass. In males, to examine the effect of endurance training on tHb, it is more appropriate to normalize by lean mass. Additional research is needed when comparing the effects of endurance training between female groups.

**172 Board #10 May 29 9:30 AM - 11:00 AM**  
**Observation Of Heart Rate Variability Response To Collegiate Esports Tournament**

Gunner B. Rhoden, Silvio P. Valladao, Thomas Andre, Damon Cox. *University of Mississippi, University, MS.*  
*(No relevant relationships reported)*

**OBSERVATION OF HEART RATE VARIABILITY RESPONSE TO COLLEGIATE ESPORTS TOURNAMENT**  
 G.B. Rhoden, S. Valladao, T.L. Andre, D. Cox. The University of Mississippi, Oxford, MS'

Heart rate variability (HrV) derives from the intricate relationship of sympathetic and parasympathetic autonomic regulation of heart rate. HrV has been utilized as a marker of stress and recovery in traditional sports, however, to date no investigations examined the HrV response to esports. **PURPOSE:** To determine the HrV response during a competitive live esports tournament in collegiate club esports competitors. **METHODS:** Male members of the Ole Miss esports team (n=14; age = 19.8±1.0 years; BMI = 24.1±5.5; esports mean hours per week = 18.9±11.6) participated in the study during a live esports tournament. A pre-HrV and post-HrV (5-minutes each) measures were collected using a Polar H10 HR monitor with the Elite HrV mobile app while seated. Participants were seated for 5 minutes before obtaining pre- and post-HrV measures. For during competition HrV measure, recordings for HrV began immediately prior to their esports matches and ended immediately post while remaining seated. For the statistical analyses, One-Way Analysis of Variance (ANOVA) was used for RMSSD, ln(RMSSD), and R-R intervals. Tukey's post hoc test were used when necessary. Paired-samples t-test were utilized for LF:HF ratio and HF. Results were considered significant at  $p \leq 0.05$ . Results are reported as mean ± standard deviation. **RESULTS:** R-R intervals during were significantly lower than pre- and post- (pre: 643.64ms ± 138.54ms; during: 465.71ms ± 68.99ms; post: 616.07ms ± 109.98ms,  $p = 0.002$ ). HF post competition was significantly decreased compared to pre (325.83ms<sup>2</sup> ± 341.81ms<sup>2</sup> vs. 494.55ms<sup>2</sup> ± 526.84ms<sup>2</sup>;  $p = 0.046$ ). No significant differences were found for RMSSD (pre: 25.67ms ± 17.48ms; during: 15.50ms ± 12.34ms; post: 23.72ms ± 18.07ms;  $p = 0.223$ ), ln(RMSSD) (pre: 3.00ms ± 0.77ms; during: 2.51ms ± 0.69ms; post: 2.86ms ± 0.90ms;  $p = 0.249$ ), or pre and post LF:HF ratio (pre: 4.47 ± 2.96 vs. post: 5.54 ± 3.62;  $p = 0.260$ ). **CONCLUSION:** This is the first investigation to observe the HrV response to a live esports competition. Future investigations should examine differences between esports games and time durations.

**173 Board #11 May 29 9:30 AM - 11:00 AM**  
**One-Year Changes in Cardiovascular Risk Markers in Police Officers**

Steven E. Martin, Danielle Kravits, Kory Sealy, Karina Wilson, Jason R. Lytle, Sean T. Stanelle, John S. Green, FACSM, Stephen F. Crouse, FACSM. *Texas A&M University, College Station, TX.* (Sponsor: Stephen F. Crouse, FACSM)  
*(No relevant relationships reported)*

**PURPOSE:** The present study retrospectively examined one-year changes in certain traditional and non-traditional cardiovascular disease (CVD) risk markers in police officers (n = 84). Subjects were full time police officers employed by a moderate-to-large municipality. **METHODS:** As a part of their annual physical exam, police officers underwent evaluation of several CVD risk markers including body weight, a graded exercise test (GXT; Bruce protocol), pushups completed in 1 minute, situps completed in 1 minute, handgrip strength, body composition (through DEXA), and fasting bloodwork. Maximal oxygen uptake ( $VO_{2max}$ ) was estimated using the Foster equation. Resting systolic blood pressure (RSBP) and resting diastolic blood pressure (RDBP) were measured before the start of the GXT protocol. Blood analysis was performed by a College of American Pathologists-accredited laboratory. All blood samples were analyzed for total cholesterol (TC), triglycerides (TG), high-density lipoprotein (HDL) cholesterol (HDL-C), low-density lipoprotein (LDL) cholesterol (LDL-C), glucose (GLU), LDL particle number (LDLnum), LDL size (LDLsz), small LDL particle number (sLDLnum), HDL particle number (HDLnum), and HDL size (HDLsz). All data were analyzed using paired t-tests ( $p < 0.05$ ). **RESULTS:** With respect to the fitness testing variables measured, significant increases were noted in pushups performed (4 pushups) and handgrip strength (4.45 kg) while RDBP was significantly reduced (4 mm/Hg). Within the traditional fasting blood panel, GLU was significantly increased (5.5 mg/dL) while LDL-C was significantly reduced (8.4 mg/dL). Non-traditional CVD risk markers were also significantly altered. Increases were noted in LDLnum (309 nmol/L), sLDLnum (347 nmol/L), and HDLnum (6.6 umol/L) while reductions in LDLsz (0.53 nm) and HDLsz (0.5 nm) researched statistical significance. **CONCLUSIONS:** While beneficial changes were noted in several traditional CVD risk markers, unfavorable alterations occurred in the majority of the non-traditional CVD risk markers measured. In addition, these findings support the need for required health and fitness programs for law enforcement personnel.

**174 Board #12 May 29 9:30 AM - 11:00 AM**  
**The Impact of Isometric Exercise Muscle Mass on Post-Exercise Blood Pressure**

Lindsay A. Lew, Morgan D. Silvester, Kaitlyn Liu, Sarah Bailey, Kyra E. Pyke. *Queen's University, Kingston, ON, Canada.*  
 Email: 131a12@queensu.ca  
*(No relevant relationships reported)*

A single bout of aerobic or resistance exercise can lead to a temporary drop in blood pressure (BP) following exercise; a phenomenon referred to as post-exercise hypotension (PEH). Like aerobic and resistance exercise, isometric exercise training can reduce resting BP however, considerably less is known regarding the ability of this type of exercise to elicit PEH. PEH may be more robustly stimulated with a larger

active muscle mass, therefore, isometric leg exercise (ILX) (large muscle mass) may have greater potential than isometric handgrip exercise (IHGX) (small muscle mass) to evoke PEH. **PURPOSE:** To determine the impact of a bout of large (ILX) and small (IHGX) muscle mass isometric exercise on post-exercise blood pressure. **METHODS:** Twelve healthy males ( $23.7 \pm 3.5$  yrs) completed 3 experimental visits (1 IHGX, 1 ILX, 1 control (rest no exercise)). Blood pressure (systolic and diastolic; SBP and DBP) was assessed at baseline and at 15, 30, 45 and 60 min post-exercise or control with an automated sphygmomanometer. Isometric exercise consisted of 4 alternating 2 min isometric contractions (quadriceps (ILX) or handgrip (IHGX)) at 30% maximum voluntary contraction. Contractions were separated by 1 min of rest. Participants completed each condition on a separate day (order counterbalanced). **RESULTS:** SBP was lower than baseline at 15 and 45 min post ( $p=0.013$  and  $p=0.014$  respectively); but this did not differ between the control, IHGX and ILX conditions ( $p=0.256$ ). Control: baseline  $110 \pm 7.3$  mmHg, average post  $106.7 \pm 8.6$  mmHg; IHGX: baseline  $110 \pm 10.3$  mmHg, average post  $107.4 \pm 8.3$  mmHg; ILX: baseline  $113.25 \pm 11.7$  mmHg, average post  $111.8 \pm 11.2$  mmHg. DBP did not differ from baseline (Baseline DBP: control  $69.17 \pm 7.4$  mmHg, IHGX  $68.6 \pm 7.9$  mmHg, ILX  $72.3 \pm 7.4$  mmHg) at any time point in any condition ( $P>0.05$ ). However, DBP 15 min post was higher in the ILX ( $73.4 \pm 8.9$  mmHg) vs. the IHGX ( $68.3 \pm 7.9$  mmHg) and Control ( $68.3 \pm 8.6$  mmHg) conditions. **CONCLUSION:** PEH did not occur following a single session of either IHGX or ILX suggesting that this type of exercise may not be a potent stimulus for PEH in this population, even when engaging the larger quadriceps muscle mass. Further research is required to identify the importance of the duration and intensity of isometric exercise on post-exercise blood pressure. Funded by NSERC

**175** Board #13 May 29 9:30 AM - 11:00 AM  
**The Effects Of Long-term Functional Training On  $VO_{2max}$**   
 Adrian Aron, Heather Cumbea, Emily Hiatt, Ross Copeland, Amanda Slaughter. *Radford University, Radford, VA.* (Sponsor: Trent Hargens, FACSM)  
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 (No relevant relationships reported)

High intensity functional training (HIFT) programs have been gaining popularity as an alternative to enhance many fitness domains in a more efficient time period. These programs are characterized by alternation of short periods of intense multimodal exercises with low paced activities or rest. Recent analysis demonstrated inconclusive evidence for beneficial adaptations following short term HIFT participation (Claudio et al., 2018). Aerobic capacity showed disparity results following 5-12 weeks of training, highlighting the limited research for longitudinal aerobic adaptations of HIFT participants. **PURPOSE:** The aim of this study was to investigate the  $VO_{2max}$  changes of long-term participation in HIFT on subjects with previous training experience. **METHODS:** The subjects were 11 male,  $34.7$  years  $\pm 8.3$ , with at least five months of HIFT training prior to enrolling in this study. While frequently participating in HIFT, they underwent two  $VO_{2max}$  graded exercise maximal exertion tests using a modified treadmill protocol separated by at least 1 year. Subjects warmed up for 3 minutes at 8 km/h and 0% grade, then started running at 9 km/h with 0.5 km/h increase every 30 seconds until exhaustion. Exhaustion was defined as two of the four criteria: plateau of  $VO_2$  for at least two consecutive readings, RPE of at least 18,  $RER \geq 1.1$  and peak heart rate (HR) of at least 90% of age-predicted maximal HR. **RESULTS:** There was no statistically significant changes between pre and post  $VO_{2max}$  ( $-2.02 \pm 3.99$  ml/kg/min). Similarly, weight ( $91.06 \pm 13.41$  vs  $91.97 \pm 14.07$ ) and  $RER$  ( $1.05 \pm 0.04$  vs  $1.05 \pm 0.08$ ) did not change. Subjects did experience a statistically significant decrease in peak HR from pre-testing ( $184.18 \pm 7.65$  bpm) to post-testing ( $176.45 \pm 9.71$  bpm),  $p = 0.009$ . **CONCLUSIONS:** These results suggest that long-term HIFT training provides no improvement in  $VO_{2max}$  in participants that already have experience with HIFT, as aerobic adaptations seem to be better evidenced during the early stage of the training period. The decreased peak HR denotes a positive cardiovascular response induced by HIFT and its effects on the increased stroke volume, diminished sympathetic drive, increased blood volume and oxidative adaptations in type II muscle fibers.

**176** Board #14 May 29 9:30 AM - 11:00 AM  
**Prime: Hemodynamic/vascular Changes Following Peripheral Focused Low-mass, High-repetition Training In Older Adults**  
 Joaquin Ortiz de Zevallos<sup>1</sup>, Michael A. Welsch, FACSM<sup>2</sup>, Mary N. Woessner<sup>3</sup>, Neil M. Johannsen<sup>4</sup>, Daniel P. Credeur<sup>5</sup>, Conrad P. Earnest, FACSM<sup>6</sup>, William E. Kraus, FACSM<sup>7</sup>, Jason D. Allen, FACSM<sup>1</sup>. <sup>1</sup>University of Virginia, Charlottesville, VA. <sup>2</sup>University of Mississippi Medical Center, Jackson, MS, USA, Jackson, MS. <sup>3</sup>Victoria University, Melbourne, Australia. <sup>4</sup>Louisiana State University, Baton Rouge, LA. <sup>5</sup>University of Southern Mississippi, Hattiesburg, MS. <sup>6</sup>Texas A&M University, College Station, TX. <sup>7</sup>Duke University School of Medicine, Durham, NC. (Sponsor: Professor Jason D. Allen, FACSM)  
 (No relevant relationships reported)

Advancing age is associated with changes in arterial structure and function that contribute to increased blood pressure, pulse pressure and cardiovascular disease risk. Exercise training beneficially moderates these risks. Peripheral Remodeling through Intermittent Muscular Exercise (PRIME) is a novel training approach, involving peripheral focused low-mass high-repetition exercises that imposes a low cardiorespiratory strain. Initiation of structured exercise with PRIME, rather than aerobic training (AT) yields superior benefits in functional ability/capacity, in elderly subjects.

**PURPOSE:** To determine if PRIME, improves hemodynamic and vascular profiles in subjects  $>70$  who are at risk for losing functional independence. **METHODS:** Seventy-five subjects (52 F, Age:  $76 \pm 5$  yrs) were tested at baseline and after 4 wk (Phase I) of either PRIME or AT. All subjects were then enrolled in an 8-wk of combined AT and resistance training (RT) (Phase II). The change scores for (1) Blood Pressure (Brachial-B and Aortic-A), (2) Vascular Stiffness (Pulse Wave Reflection-PWR, and velocity-PWV and Augmentation Index AIX) and (3) Vascular function (Brachial artery flow-mediated dilation - BAFMD), were analyzed. **RESULTS:** At the end of Phase II, there was a significant time effect for B and A blood pressures (bSBP =  $-4.37 \pm 11.95$ , bMAP =  $-2.77 \pm 8.69$ , bDBP =  $-2.64 \pm 8.66$ , aSBP =  $-4.13 \pm 11.31$ , aMAP =  $-2.42 \pm 8.31$ , and aDBP =  $-1.97 \pm 7.40$  mmHg, all  $p < 0.05$ ). Additionally, there was a significant effect for time for BAFMD from baseline ( $4.35 \pm 2.90\%$ ) for both interventions after Phase I and Phase II ( $5.25 \pm 3.12$  and  $6.68 \pm 2.76\%$  respectively,  $p < 0.01$ ). There was a group effect in favor of PRIME at Phase I for bMAP ( $-4.66 \pm 10.08$  vs  $-0.35 \pm 9.11$  mmHg), bDBP ( $-4.08 \pm 8.27$  vs  $-0.49 \pm 7.56$  mmHg), aMAP ( $-4.70 \pm 10.08$  vs  $-0.76 \pm 8.60$  mmHg), and aDBP ( $-4.32 \pm 7.93$  vs  $-0.89 \pm 6.86$  mmHg) (all  $p < 0.05$ ). No significant changes were noted in PWR, PWV or AIX. **CONCLUSIONS:** These findings confirm that exercise training improves hemodynamic profile and vascular reactivity in individuals  $>70$  years. Interestingly, individuals who followed PRIME showed greater hemodynamic benefits at 4 wks. PRIME may represent a novel approach to achieve hemodynamics benefits in individuals with limited cardiovascular function.

**177** Board #15 May 29 9:30 AM - 11:00 AM  
**Effects of Domestic and International Tournaments on Heart Rate Variability in Elite Rugby Sevens Players**  
 Andrew A. Flatt<sup>1</sup>, Daniel Howells<sup>2</sup>, Sean Williams<sup>3</sup>. <sup>1</sup>Georgia Southern University, Savannah, GA. <sup>2</sup>Rugby Football Union, Twickenham, United Kingdom. <sup>3</sup>University of Bath, Bath, United Kingdom.  
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 (No relevant relationships reported)

Rugby sevens tournaments involve up to six matches within two days, are often held over consecutive weekends and frequently involve travel to and from international venues. The intense physical demands of competition, short recovery time between tournaments and the added stress of international travel warrant further investigation into recovery status monitoring among elite players. **PURPOSE:** To retrospectively evaluate heart rate variability and athlete self-report measures of recovery status (ASRM) in response to consecutive domestic and international tournaments among an elite rugby sevens team. **METHODS:** Olympic-level players ( $n = 10$  males) recorded post-waking natural logarithm (Ln) of the root mean square of successive R-R interval differences (RMSSD) and ASRM (subjective ratings of Sleep, Energy, Soreness, Recovery and Mood) throughout a 1-week period prior to the domestic tournament to serve as baseline and daily thereafter until 2-days post-international tournament. Daily LnRMSSD and ASRM parameters were compared with baseline values. Total distance (TD), high speed distance ( $>18$  km $\cdot$ h $^{-1}$ , HS) and session rating of perceived exertion (sRPE) were compared between tournaments. The team advanced to the finals on both occasions. **RESULTS:** Relative to baseline ( $4.53 \pm 0.40$ ), large and moderate effect size reductions in LnRMSSD ( $p = 0.02 - 0.07$ ) were observed on day-two of the international tournament ( $4.05 \pm 0.36$ ) and one day post-international tournament ( $4.06 \pm 0.59$ ), respectively. Travel to the international tournament (1650 km) involved an early departure time, missed flight connection and 3 a.m. hotel arrival,

which negatively affected ratings of LnSleep ( $2.09 \pm 0.06$  vs.  $1.82 \pm 0.35$ ,  $p < 0.05$ ) and LnEnergy ( $2.04 \pm 0.08$  vs.  $1.73 \pm 0.23$ ,  $p < 0.05$ ). No differences in TD ( $3662 \pm 967$  vs.  $4018 \pm 973$  m), HS ( $641 \pm 251$  vs.  $611 \pm 191$  m) or sRPE ( $602 \pm 241$  vs.  $658 \pm 277$  au) were observed between tournaments ( $p > 0.05$ ). **CONCLUSIONS:** Decrements in LnRMSSD were observed in response to the international, but not domestic tournament, despite no differences in match-physical demands. Thus, factors separate from competition alone (e.g., travel-related stress) may impact players' physiological response to a tournament.

**178 Board #16 May 29 9:30 AM - 11:00 AM**  
**The Effects of an Intensive Endurance Training Period on Nocturnal HRV and Endurance Performance**

Piia Kaikkonen<sup>1</sup>, Juha Ahtiainen<sup>2</sup>. <sup>1</sup>Tampere Research Center of Sports Medicine, Tampere, Finland. <sup>2</sup>Neuromuscular Research Center, Faculty of Sport and Health Sciences, University of Jyväskylä, Jyväskylä, Finland.  
 (No relevant relationships reported)

**PURPOSE:** The optimal balance between training load and recovery is essential for the development of physical performance. In the athletic population, relatively good knowledge usually exists of individual tolerance for training. In recreationally training individuals with less training background, the optimal balance may be more difficult to estimate. The main aim of this study was to find out whether a ten-day intensive endurance training period of the non-athletic population is overreaching, and whether the changes in endurance performance can be detected in nocturnal HRV.

**METHODS:** 13 recreationally endurance trained healthy men ( $25 \pm 3$  y,  $179 \pm 6$  cm,  $79 \pm 14$  kg,  $VO_{2max} 43 \pm 6$  ml/kg/min) participated in two-week baseline training period with two exercises in a week (PRE, 30 min at 70% of  $P_{max}$ ) and a 10-day intensive training period with nine exercises (INT, 30 min at 70% of  $P_{max}$ ). All the exercises on were performed on a bicycle ergometer. Each exercise included a 5-minute warm-up and cool-down (50%  $P_{max}$ ). Maximal aerobic performance test on a bicycle was carried out before and at the end of both training periods. Nocturnal RR-intervals were measured during three consequent nights at the end of PRE and INT. A mean of all three nights was used in the analysis.

**RESULTS:** Endurance performance improved during the INT (from  $294 \pm 41$  W to  $306 \pm 41$  W,  $P = 0.006$ ). No change occurred in  $VO_{2max}$  (PRE  $45 \pm 6$ , INT  $46 \pm 4$  ml/kg/min). Nocturnal HR (PRE  $71 \pm 9$  bpm, INT  $69 \pm 9$  bpm) or RMSSD (PRE  $50 \pm 14$  ms<sup>2</sup>, INT  $54 \pm 21$  ms<sup>2</sup>) did not change. Participants were retrospectively divided to higher (Resp<sub>H</sub>) and lower responders (Resp<sub>L</sub>) according to the change (%) in P<sub>max</sub> during the INT. Resp<sub>H</sub> had lower RMSSD at PRE ( $38 \pm 4$  ms<sup>2</sup> vs.  $51 \pm 9$  ms<sup>2</sup>,  $P = 0.019$ ) and INT ( $40 \pm 4$  ms<sup>2</sup> vs.  $53 \pm 11$  ms<sup>2</sup>,  $P = 0.043$ ) when compared to Resp<sub>L</sub>. No difference in nocturnal HR or P<sub>max</sub> at PRE was detected between groups.

**CONCLUSIONS:** A ten-day intensive training period was not overreaching for the recreationally trained young men, as the improvement in endurance performance indicates. Despite the rather high training intensity, no change in nocturnal cardiac autonomic function was detected. The results of the present study suggest that in order to improve endurance performance of recreationally trained individuals, relatively high training intensities may be well tolerated.

**A-38 Free Communication/Poster - Monitoring**

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
 Room: CC-Hall WA2

**179 Board #17 May 29 9:30 AM - 11:00 AM**  
**Validity And Reliability Of Heart Rate Devices Compared Second-by-second Versus Minute-by-minute**

James W. Navalta, FACSM, Gabriela Guzman, Crystal Maxwell, Jeffrey Montes. University of Nevada, Las Vegas, Las Vegas, NV.  
 Email: james.navalta@unlv.edu  
 (No relevant relationships reported)

The Consumer Technology Association (CTA) has guidelines for heart rate that wearable devices should be evaluated second-by-second. However, many investigations in the literature have reported minute-by-minute evaluations.

**PURPOSE:** To determine whether the interpretation of validity and reliability of three heart rate sensing bras during exercise would be similar if data were evaluated second-by-second versus minute-by-minute. **METHODS:** Nine females completed 14-min protocols while wearing the Sensoria Fitness biometric sports bra, the Adidas Smart sports bra, or the Berlei sports bra concurrently with the Polar H7 heart rate monitor (criterion measure). The protocol involved 1-min standing rest on the treadmill, 3-min walking warm up, 5-min run, 5-min walk. Participants rested between bouts until heart rate was within 10 bpm of resting. Validity was determined through three methods: Mean Absolute Percent Error (MAPE), Bland-Altman bias and Limits of Agreement (LOA), and Intraclass Correlations (ICC). Reliability was determined through ICC

analysis, and significance was accepted at  $p < 0.05$ . **RESULTS:** MAPE, bias and LOA, and ICC for second-by-second and minute-by-minute evaluations are shown in table 1. The reliability ICC values are shown in table 2.

Table 1. Validity of heart rate sensing bras evaluated each second versus each minute.

Device	MAPE (Sec)	MAPE (Min)	Bias (Sec)	Bias (Min)	LOA (Sec)	LOA (Min)	ICC (Sec)	ICC (Min)
Sensoria	1.08	0.98	0.17	-0.07	4.78 to -4.43	3.19 to -3.33	0.996	0.998
Adidas	3.11	3.04	0.44	-0.10	22.63 to -21.76	25.66 to -25.85	0.902	0.955
Berlei	1.08	4.81	-0.34	0.40	6.93 to -7.62	21.44 to -20.64	0.989	0.911

Table 2. Reliability of heart rate sensing bras evaluated second-by-second versus minute-by-minute

Device	Reliability ICC (Sec)	Reliability ICC (Min)
Sensoria	0.965	0.956
Adidas	0.864	0.842
Berlei	0.961	0.955

**CONCLUSIONS:** The validity measures of MAPE, Bland-Altman bias and LOA, and ICC appear to be minimally influenced by sampling rate. Reliability measures are consistent regardless of rate. While further investigation is necessary, this data provides evidence that CTA guidelines for heart rate sampling are minimally influenced if taken at longer periods.

**180 Board #18 May 29 9:30 AM - 11:00 AM**  
**Validity In Step Counting Of Wearable Devices During Uphill Trail Running**

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 (No relevant relationships reported)

In today's technological society, there are many options for wearable exercise tracking technology. With a growing emphasis for outdoor recreation, there is a need to validate these devices in a natural setting. **Purpose:** The purpose of this study was to examine the reliability of wearable step tracking devices during uphill trail running. **Methods:** Participants (n=12) completed a self-paced one-mile uphill run, wearing step tracking devices including: Stryd Power Meter (criterion) Garmin Fenix 5 watch (wrist), Suunto Sport watch (wrist), Motiv ring (finger), Fitbit Surge 2 (ankle), Polar A360 (ankle), Garmin Vivosmart (ankle), and Samsung Gear 2 (ankle). Validity was determined via Bland-Altman analysis (limits of agreement; LoA), a mean absolute percentage error (MAPE) lower than 10%, and Intraclass Correlation (ICC) greater than 0.70. Significance was accepted at the  $p < .05$  level. **Results:** The wrist and finger-worn devices were all valid compared to the criterion measure (see table 1). Of the devices secured around the ankle, only the Polar A360 was considered valid for step count (see table 1).

Table 1. Validity measurements for wearable devices during an uphill run compared to the Stryd Power

Number	Device	MAPE (%)	ICC, p-value	Bias, LoA
1	Garmin Fenix*	5.1	0.962, <0.001	-59±87, -229 to 112
2	Suunto Sport*	8.5	0.971, <0.001	-145±82, -306 to 15
3	Motiv Ring*	5.1	0.907, <0.001	-29±144, -252 to 311
4	Fitbit Surge 2	16.1	0.741, =0.001	-245±274, -293 to 783
5	Polar A360*	9.1	0.774, =0.001	-70±293, -644 to 505
6	Garmin Vivosmart	11.0	0.506, =0.033	-240±654, -1522 to 1041
7	Samsung Gear 2	12.5	0.785, =0.001	-149±240, -321 to 618

**Conclusion:** Several devices (1, 2, 3, 5) demonstrated reliable step counting during uphill trail running. The devices that were not valid (4, 6, 7) were attached around the ankle. Results indicate that several valid devices are available for tracking steps in a trail running situation, however caution should be used for choice of wearable and where it is positioned on the body.

- 181** Board #19 May 29 9:30 AM - 11:00 AM  
**Changes In Lower Body Strength Among 5676 Free-living Persons Using An App-based Program**  
 Joey Eisenmann, James Moreland, Jace Derwin, Trevor Watkins, Dan Giuliani. *Volt Athletics, Seattle, WA.* (Sponsor: Shawn Arent, FACSM)  
*Reported Relationships: J. Eisenmann: Consulting Fee; Volt Athletics.*

The myriad of beneficial effects of strength training are well-known in humans. However, most previous studies have relatively small sample sizes ( $n < 50$ ) and a brief duration of training ( $< 3$  months). Furthermore, they lack ecological validity. **PURPOSE:** In this study, we leverage the widespread usage of smartphones and a mobile app-based strength training program to investigate the development of muscular strength in 5676 free-living humans from 4 months to 4 years. **METHODS:** We studied a dataset consisting of 5676 people with 24,471 total observations over a period of 4 months to 4 years (mean duration  $463 \pm 271$  days). Lower body muscular strength was taken as the estimated 1-repetition maximum (1RM) using the Epley equation for the barbell back squat exercise. Participants must have had more than one estimated 1RM to be included in the analysis during the period in which they participated in a progressive, periodized strength training program consisting mainly of compound exercises 1-3 times per week. A multi-level growth model with random effects was used to describe strength gains. Variables of baseline strength, gender, training experience, training frequency, volume and intensity were also included in the modeling. **RESULTS:** Lower body strength increased significantly over time (L-Ratio = 91985,  $p < .0001$ ). The mean  $\pm$  SE baseline 1RM squat was  $98.2 \pm 1.12$  kg and the largest gains occurred within the first 6 months of initiating the training program (e.g.  $3.9 \pm 0.12$  kg/month from baseline to 6 months; 24% increase) with improvements continuing through 1 year ( $1.9 \pm 0.15$  kg/month from 6-12 months; 36% increase from baseline), 2 years ( $0.9 \pm 0.08$  kg/month from year 1 to 2; 46% increase from baseline), 3 years ( $0.5 \pm 0.19$  kg/month between years 2-3), and 4 years ( $0.3 \pm 0.65$  kg/month in years 3-4). **CONCLUSIONS:** This study showed that an app-based strength training program results in substantial and continual increase in lower body strength in a large free-living sample up to 4 years. Subsequent analyses will examine the influence of several demographic and acute training variables and their interactions to confirm and expand upon existing meta-analyses. This study has implications for the application of mobile technology, Big Data, and the Living Lab concept to the field of exercise science.

- 182** Board #20 May 29 9:30 AM - 11:00 AM  
**Validity of the Adidas Smart Bra in Measuring Heart Rate during Exercise Transitions**  
 Gabriela Guzman, Crystal Maxwell, James W. Navalta PhD., FACSM. *University of Nevada, Las Vegas, Las Vegas, NV.* (Sponsor: James W. Navalta, FACSM)  
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*(No relevant relationships reported)*

Wearable technology is becoming very popular; offering a variety of applications for it. **PURPOSE:** The current investigation was designed to evaluate the validity of a heart rate sensing bra during transitions from rest to self-paced running and walking. **METHODS:** Nine females completed a 14-min protocol while simultaneously wearing the Adidas Heart Rate Monitoring Smart Bra and Polar H7 heart rate monitor (criterion measure). The protocol involved 1-min standing rest on the treadmill (to determine resting heart rate), 3-min walking warm up, 5-min run, and 5-min walk. The validity of the sports bra was determined by three methods: mean absolute percent error (MAPE), Bland-Altman bias and limits of agreement (LOA), and intraclass correlations (ICC) with a value greater than 0.7 and significance  $< 0.05$ . Those three methods were used to compare second to second data. **RESULTS:** When all conditions were considered (7569 datapoints), MAPE = 3.11%, bias =  $0.44 \pm 11.34$  and LOA range = -21.75 to 22.63, and ICC = 0.902 ( $p < 0.001$ ). For the resting condition (549 datapoints), MAPE = 2.07%, bias =  $0.08 \pm 3.46$  and LOA range = -6.69 to 6.86, and ICC = 0.977 ( $p < 0.001$ ). The transition from rest to a walking warm up (1621 datapoints) yielded MAPE = 0.047%, bias =  $94.38 \pm 13.88$  and LOA range = 67.16 to 121.59, and ICC = 0.923 ( $p < 0.001$ ). With respect to the transition from warm up to running (2700 datapoints) MAPE = 5.60%, bias =  $0.47 \pm 18.38$  and LOA range = -35.55 to 36.49, and ICC = 0.768 ( $p < 0.001$ ). When the transition from running to walking was considered (2700 datapoints) MAPE = 1.09%, bias =  $0.11 \pm 1.97$  and LOA range = -3.74 to 3.96, and ICC = 0.995 ( $p < 0.001$ ). **CONCLUSION:** These pilot results indicate that the Adidas Heart Rate Monitoring Smart Bra is valid for most conditions (rest, warm-up, walking). Progressing from active warm-up to run should be viewed with caution, as heart rate measurements were not all valid in this condition.

- 183** Board #21 May 29 9:30 AM - 11:00 AM  
**Impact Identification With Machine Learning From Low Frequency Wearable Sensor Data Among National Ice-hockey Players**  
 Aaron M. Pilotti-Riley<sup>1</sup>, Davor Stojanov<sup>1</sup>, Muhammad Sohaib Arif<sup>1</sup>, Erik M. Bollt<sup>2</sup>, Stephen J. McGregor<sup>1</sup>. <sup>1</sup>Eastern Michigan University, Ypsilanti, MI. <sup>2</sup>Clarkson University, Potsdam, NY. (Sponsor: Dr. Andrew R. Coggan, FACSM)  
*(No relevant relationships reported)*

#### Purpose

To determine if machine learning approaches could be used to improve impact identification from low frequency data collected from wearable sensors (WS) among national ice-hockey team members.

#### Methods

23 members of the U.S. National (NTDP) U18 team consented to procedures approved by EMU Human Subjects Committee. Using previously validated impact events identified from data collected at 100 Hz (Impact Processor, Zephyr MD), we used two neural network approaches, autoencoder (AE), neural network that can reconstruct inputs of large data sets and multi-layer perceptron (MLP), a neural network that uses non-linear activation of multiple layers of interconnecting nodes as well as support vector machine (SVM) to attempt to improve the identification of impacts from summary data recorded at 1 Hz. A dataset, selected from 8 players with the highest ice time in one game, was comprised of 86 impacts and 88602 samples were used to train the AE. Variables from 1 Hz data used to train the AE included Activity and Peak resultant acceleration as well as Peak and Min accelerations in the Vertical, Lateral and Sagittal planes. The trained AE was then applied to the validated test set from 8 players for 3 games consisting of 409 impacts and 462138 datapoints. Accuracy was determined by F1 score ( $F1 = 2 * (\text{precision} * \text{recall}) / (\text{precision} + \text{recall})$ ), where precision = true positives / (true positives + false positives) and recall = true positives / (true positives + false negatives).

#### Results

Using only trained AE, 187 true positives, 3299 false positives and 222 false negatives were identified with an F1 score of 0.096. To improve accuracy, AE was used as filter with MLP for classification, which identified 184 true positives, 225 false negatives and only 26 false negatives resulting in an F1 score of 0.594. Finally, using AE filter and the SVM classifier with class weights produced the best results with 272 true positives, 137 false negatives and only 50 false positives and an F1 score of 0.744.

#### Conclusion

These data show that using autoencoder programming with additional classification (MLP or SVM) impacts can be identified at 1 Hz with relatively high F1 scores in ice hockey using trunk-worn wearable sensors. Finally, using sensor fusion techniques, it is likely impact identification in ice-hockey could be entirely automated.

- 184** Board #22 May 29 9:30 AM - 11:00 AM  
**Monitoring External Training Loads and Neuromuscular Performance For Division I Basketball Players Over the Pre-Season**  
 Aaron Heishman, Ryan M. Miller, Eduardo D.S. Freitas, Brady S. Brown, Bryce D. Daub, Michael G. Bembem, FACSM. *University of Oklahoma, Norman, OK.* (Sponsor: Michael G. Bembem, FACSM)  
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*(No relevant relationships reported)*

External training load ( $TL_E$ ) is used to quantify the biomechanical load accrued during training. The countermovement (CMJ) jump is used to evaluate neuromuscular fatigue and recovery in response to  $TL_E$ . However, limited research has coupled  $TL_E$  parameters with changes in neuromuscular performance variables from the CMJ. **PURPOSE:** The purpose of this investigation was twofold: 1) to characterize  $TL_E$  across the pre-season and 2) examine the differences in  $TL_E$  per session and CMJ performance across the 5 weeks of pre-season training in NCAA D1 basketball athletes. Additional analyses examined the influence of position and scholarship standings. **METHODS:**  $TL_E$  was monitored in 14 male athletes during 22 basketball practice sessions over the course of the pre-season. In addition, weekly CMJs were used as an indicator of neuromuscular fatigue and performance. A 3-way (2 X 2 X 5) Repeated Measures Analysis of Variance with Bonferroni post hoc analysis was used to examine differences in the average  $TL_E$  per session each week and differences in the CMJ variables of Flight Time: Contraction Time (FT:CT) and Jump Height (JH) across time and between position (Guard vs. Forward/Center) and academics (Scholarship vs. Walk-on). Statistical significance was set at  $p \leq 0.05$ . **RESULTS:** Player load per minute (PL; PL/min) was significantly higher during Week 1 and Week 2 compared to Week 3 ( $p < 0.05$ ). No significant differences were observed for average PL, high inertial movement analysis (IMA), or Total Jumps per session across the 5 weeks of pre-season ( $p > 0.05$ ). A significant group X time interaction indicated Scholarship athletes had greater PL, PL/min, 2 Dimensional PL, High IMA, and Total Jumps compared to the Walk-on athletes. Player position did not influence  $TL_E$ . No significant

differences were observed in FT:CT or JH over the 5 weeks of preseason ( $p > 0.05$ ) or between groups ( $p > 0.05$ ). **CONCLUSION:** The present study characterizes the  $TL_E$  demands in collegiate basketball during the pre-season. The average  $TL_E$  per week did not vary across 5 weeks of training, while differences in intensity (PL/min) were evident. While no differences were observed between position groups, there was a significant difference in  $TL_E$  between scholarship and walk-on athletes.

185 Board #23 May 29 9:30 AM - 11:00 AM

### Accuracy of Activity Monitors in Measuring Energy Expenditure and Heart Rate During a Gym-based Routine

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(No relevant relationships reported)

**PURPOSE:** Two wrist-worn monitors (FBS and GVF) and an armband (SWA) were evaluated in measuring energy expenditure (EE) and heart rate (HR) during a gym-based routine. **METHODS:** Men ( $n = 21$ ) and women ( $n = 16$ ) completed a gym-based routine comprised of 15-min stationary cycling (SC), 15-min treadmill running (TR), and 35-min resistance training (RTR) at self-selected intensities while wearing the monitors. All monitors were compared to a portable metabolic analyzer (OM) for EE. The FBS and GVF were compared to a chest HR monitor (PM) for maximal HR ( $HR_{max}$ ) and average HR ( $HR_{avg}$ ). **RESULTS:** Compared to the OM, the FBS and GVF produced higher EE estimates while the SWA overestimated EE during TR and underestimated EE for the rest (Table 1). Equivalency testing determined that no monitor was equivalent to the OM, although the SWA yielded the most favorable agreement for whole session as the 90% CI (410.9-500.1 kcal) overlapped the higher end of the equivalency zone (423.6-517.7 kcal) by only 12.7 kcal. Acceptable measurement error ( $\leq 20\%$ ) for whole session was produced by the SWA and for TR by the SWA and GVF, while for RTR the GVF had the highest measurement error (Table 1). Significant bias was observed for the FBS and GVF during SC ( $10.1 \pm 39.2$  kcal and  $18.6 \pm 33.7$  kcal), RTR ( $47.4 \pm 52.7$  kcal and  $82.0 \pm 79.2$  kcal), and whole session ( $83.2 \pm 93.7$  kcal and  $104.4 \pm 131.9$  kcal). In regards to  $HR_{avg}$  and  $HR_{max}$ , both monitors' 90% CIs fell in the equivalency zones with the exception of  $HR_{avg}$  measured by the FBS for RTR. The GVF had an improved accuracy over the FBS as indicated by lower error rates for  $HR_{avg}$  (SC: 2.0% vs 5.9%; TR: 2.4% vs 3.1%; and RTR: 2.4% vs 9.5%) and  $HR_{max}$  (SC: 0.8% vs 1.4%; TR: 0.9% vs 1.5%; and RTR: 0.9% vs 7.0%). **CONCLUSION:** The study protocol simulated real-world conditions to facilitate naturalistic application of the findings. No monitor accurately estimated EE, however, the SWA had the most favorable estimates. The FBS and GVF demonstrated comparable performance for both EE and HR estimates.

186 Board #24 May 29 9:30 AM - 11:00 AM

### Innovations in Heart Rate Monitoring Devices and Smart Applications: Physical Configuration Matters!

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(No relevant relationships reported)

Bluetooth/ANT+ heart rate monitors and smart device applications have the potential to advance heart rate monitoring in non-clinical settings. New innovative applications allow for heart rate monitoring of multiple users simultaneously; however, preliminary attempts to use a particular commercially available model in a typical university gymnasium setting revealed persistent issues with signal interruption; thus, the trustworthiness of the data was limited.

**PURPOSE:** To reduce the prevalence of signal interruption by determining the best physical configuration of components.

**METHODS:** A quasi-experimental repeated measures design was utilized to determine the best configuration of the system components. Cluster and ANOVA analyses determined good, better, and best configurations. The dependent variable was signal interruption and the unit of analyses was the number of signal interruptions per two-minute session. The independent variables were height (1.8m, 3.6m, and 5.4m), angle (60°, 75°, and 90°), and location (left corner, middle, right corner) of the transmitter component. University students, male and female adults ages 19-25 with no apparent health problems, were recruited to participate during undergraduate physical education teacher education lab classes. Participants were monitored while participating in physical activities during normal class sessions. Classes were conducted in a typical indoor gymnasium slightly larger than a single standard collegiate-sized basketball court.

**RESULTS:** Inspection of the graphs and ANOVA analyses revealed that the best configuration of the system was transmitter device placement at a height of 1.8m<sup>2</sup> F(2,

1,052) = 54.86,  $p < .001$ , partial  $\eta^2 = .09$ , at a 60° angle F(2, 1,052) = 12.50,  $p < .001$ , partial  $\eta^2 = .02$ , and in the left corner location F(2, 1,052) = 24.28,  $p < .001$ , partial  $\eta^2 = .04$ .

**CONCLUSIONS:** The height, angle, and location of the transmitter component all played a significant role in reducing the prevalence of signal interruption. It was determined that the best results were found with the lowest height and smallest angle chosen. Therefore, random placement of transmitter height, angle and location will not yield the best heart rate monitoring results.

187 Board #25 May 29 9:30 AM - 11:00 AM

### Absolute Validity And Test-retest Reliability Of Step Counts For Fitbit Flex 2 In Pram Walking

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(No relevant relationships reported)

**PURPOSE:** To test the absolute validity and test-retest reliability in two kinds of pram walking settings and help researchers and postnatal women to choose suitable tools for monitoring physical activity levels. **METHODS:** 12 participants who were adult women ( $23.2 \pm 0.7$  years old) wore Fitbit Flex 2 on both wrists to perform the outdoor protocol: Two rounds of state distance pram walking of two settings (one round for each setting): (1) Both hands pushing setting; (2) One hand pushing setting. The step counts from Fitbit Flex 2 were compared to video recording to assess the absolute validity and test-retest reliability. **RESULTS:** The average Mean Absolute Percentage Error(MAPE) of step counts for left and right wrists in both hands pushing setting were -43.1% and -49.1%. In one hand pushing setting, the average MAPE of step counts for wrist of dominant hand was -52.6%, and -5.1% for wrist of non-dominant hand. In both hands pushing setting, the Fitbit Flex 2 had a low correlation (ICC=0.40) for wrist of dominant hands while the correlation of wrist of non-dominant hand was good (ICC=0.85). In one hand pushing setting, the correlations are excellent (ICC=0.99) for wrist of non-dominant hand and moderate for wrist of dominant hand (ICC=0.68). **CONCLUSIONS:** The absolute validity of step counts for Fitbit Flex 2 was poor when device applied on the wrists of both hands in both hands pushing setting and dominant hand in one hand pushing setting while the absolute validity was high when the device applied on the wrist of non-dominant hand in one hand pushing setting. The test-retest reliability is excellent to good when the device wore on the wrist of non-dominant hand and moderate to poor on the wrist of dominant hand.

188 Board #26 May 29 9:30 AM - 11:00 AM

### Comparisons of Portable Metabolic Sensors During Outdoor Cycling

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(No relevant relationships reported)

Wearable technology has increased in prevalence and in the ability to monitor health related data. Additionally, the ability to record training data through various sensors has become essential in developing highly personalized training programs. Metabolic measurements have typically been confined to laboratory settings, but portable metabolic carts make the collection of these metrics in real world conditions possible.

**Purpose.** The purpose of this study was to compare measurements of  $VO_2$  from two different portable metabolic carts, a new consumer focused cart (A) and a research grade cart (B), in outdoor cycling under steady state conditions.

**Methods:** A total of 10 participants were included in the study. All participants were recreationally trained cyclists who had track racing experience. Participants completed a ramped  $VO_{2max}$  test with lactate sampling from capillary blood at one minute intervals. Lactate threshold (LT) was estimated as the first stage prior to an increase of  $>1$  mmol in lactate concentration. Participants later completed six 10-minute intervals in a pairwise manner at 50, 70, and 85% of their power at LT on an outdoor velodrome. Expired gasses during these intervals were analyzed by two different portable metabolic carts (A&B). Data from approximately 6-9 min of each interval were averaged. Comparisons between the two devices were made using paired t-tests.

**Results:** Average age of participants was  $44.3 \pm 3.01$  years and  $VO_{2max}$  was  $51.56 \pm 2.74$  ml/kg/min. Cart A was unable to capture enough data when cycling at 50% of LT and therefore no comparisons were possible. There were significant differences ( $p < 0.001$ ) in absolute  $VO_2$  ( $1890.0 \pm 245.1$  mL/min vs.  $2627.3 \pm 262.0$  mL/min) between carts A&B respectively when cycling at 70% of LT. Additionally, there were significant differences ( $p < 0.001$ ) in absolute  $VO_2$  ( $2269.9$  mL/min  $\pm$   $362.3$  vs.  $3069.3 \pm 317.5$  mL/min) between carts A&B respectively when cycling at 85% of power at LT.

**Conclusions:** Measurements of  $VO_2$  while cycling in an outdoor environment may not be consistent across devices.

Supported by FAST Grant from Sam Houston State University

189 Board #27 May 29 9:30 AM - 11:00 AM

**Accuracy of an Armband Heart Rate Monitor**

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(No relevant relationships reported)

Activity monitors have demonstrated success at facilitating positive physical activity behavior changes in diverse populations by providing self-monitoring, motivation, and timely feedback, yet questions loom due to a paucity of data on the accuracy of armband heart rate monitors (ABM). **Purpose:** The purpose of this investigation was to assess the accuracy of the ABM under aerobic exercise conditions. **Methods:** 15 male and 5 female college-aged subjects (age 20.9 ± 1.7, ht. 177.0 ± 9.1 cm, body mass 72.8 ± 13.4 kg) engaged in steady state aerobic exercise on a treadmill while wearing the ABM and a hard wire electrocardiograph (ECG). PAR-Q+ and a brief medical screening preceded participation. Resting measures were obtained pre (sitting & standing) and post (sitting) aerobic exercise. The treadmill protocol included 3 minute stages at 1% grade with speeds of 53.6 meters/min, 80.4 meters/min, 107.2 meters/min, 160.8 meters/min, 187.6 meters/min, 214.4 meters/min, and a cool-down at 53.6 meters/min. **Results:** Statistical analysis by paired t-tests revealed NSD between HR of 74 ± 14 & 74 ± 14, 98 ± 14 & 98 ± 14, 120 ± 16 & 121 ± 19, 156 ± 17 & 156 ± 19, 175 ± 17 & 176 ± 17, and 187 ± 16 & 187 ± 16 b/min at speeds of 80.4, 107.2, 160.8, 187.6, and 214.4 m/min, for ABM & EKG, respectively. Only the 53.6 speed revealed a significant difference in HR of 90 ± 13 vs 92 ± 13 for ABM and EKG, respectively. In addition, there was a high correlation and low standard error between the ABM and ECG measures ( $r = .998$ ,  $SE = .2$ ). At speeds of 80.4 ( $r = .981$ ,  $SE = .59$ ), 107.2 ( $r = .952$ ,  $SE = 1.31$ ), 160.8 ( $r = .99$ ,  $SE = .7$ ), 187.6 ( $r = .98$ ,  $SE = .77$ ), and 214.4 meters/min ( $r = .995$ ,  $SE = .38$ ) there was also a high correlation and low standard error. Contrary to all other trials, the 53.6 meters/min trial ( $r = .992$ ,  $SE = .38$ ) showed a significant difference at the  $p < .01$  level (.004). **Conclusion:** At all workloads in excess of 53.6 m/min, the ABM provides accurate HR measures, however for the novice exercise enthusiast or the slow paced walker, ABM may be insufficient for accurate HR monitoring.

190 Board #28 May 29 9:30 AM - 11:00 AM

**Validation of Garmin Fitness Tracker Biomechanics**

Bryson Carrier, Tim Holmes, Lauren Williams, Siri Dahl, Libby Weber, Andrew Creer, Tyler Standifird. *Utah Valley University, Orem, UT.*  
(No relevant relationships reported)

**Purpose:** As fitness trackers become more available, the need for independent validation has become more important to drive accuracy in training decisions and physiologic research. Therefore, the purpose of this study was to find the reliability and accuracy of the data collected from the Garmin fenix 3 HR fitness tracker. **Methods:** 17 healthy, recreational runners (9 male, 8 female, 28.11 ± 7.38 yrs, 70.26 ± 10.76 kg, 173.77 ± 5.96 cm) performed three running conditions (flat, incline (5%), and decline (-5%)) on an instrumented treadmill used to collect ground reaction force data. Infrared markers were placed on the foot and trunk and tracked with a 16 camera motion capture system. The data was processed using Visual 3D software (5.0, C-Motion, Inc., Germantown, MD, USA) and variables extracted were compared to data collected by the Garmin fenix 3 HR (Garmin Ltd., Olathe KS). **Results:** Statistical analysis was done via a 2-tailed paired t-test comparing the data taken from the motion capture system and instrumented treadmill to the data collected by the Garmin watch. There were no differences between the Garmin and the treadmill for flat stride length, declined stride length, inclined run cadence, declined run cadence, and inclined ground contact time. Differences ( $p < 0.05$ ) were observed in inclined stride length, flat run cadence, flat vertical oscillation, inclined vertical oscillation, declined vertical oscillation, flat ground contact time, and declined ground contact time. **Conclusion:** Overall the Garmin fenix 3 HR fitness tracker was found to be reasonably reliable for certain variables, such as stride length and run cadence, but not reliable for vertical oscillation and ground contact time. Certain considerations should be taken as to the accuracy of the variables when using this data to drive training adaptations.

191 Board #29 May 29 9:30 AM - 11:00 AM

**Validation of Garmin Fitness Tracker Metabolic Data (VO<sub>2max</sub>)**

Brayden Jolley, Bryson Carrier, Tyler Standifird, Andrew Creer. *Utah Valley University, Orem, UT.*  
(No relevant relationships reported)

**Purpose:** As fitness trackers become more available, the need for independent validation has become more important to drive accuracy in training decisions and physiologic research. Therefore, the purpose of this study was to determine the accuracy of predicted maximal aerobic fitness assessment (VO<sub>2max</sub>) from the Garmin

fenix 3 HR fitness tracker when compared to a lab based VO<sub>2max</sub> test. **Methods:** 6 healthy recreational runners (4 male, 2 female, 25.4 ± 2.5 yrs, 69.0 ± 6.0 kg, 174 ± 5.7 inches, 35.4 ± 29.9 km/wk) participated in two testing sessions; a graded exercise test to exhaustion (GXT) on a treadmill and a 15-minute submaximal outdoor track session. During the treadmill GXT expired gases were collected and analyzed using a metabolic cart, with the highest value being considered VO<sub>2max</sub>. Heart rate was measured continuously via telemetry, with the highest value recorded as the maximal heart rate (HR<sub>max</sub>). Participants then completed a submaximal outdoor run on a track between 48 hrs and 7 days after the lab test. The outdoor run involved maintaining at least 70% of HR<sub>max</sub> for 15 minutes while wearing a Garmin fenix 3 HR watch and Garmin HR monitor chest strap. The watch was reset to default settings prior to inserting participant data into the watch for each test. Statistical analysis was done via a 2-tailed paired t-test, comparing the lab and field measures. **Results:** There was no difference between the treadmill GXT (51.8 ± 7.8 ml/kg/min) and the Garmin estimated value from the outdoor run (53.2 ± 4.1 ml/kg/min) for VO<sub>2max</sub>. **Conclusion:** Overall the Garmin fenix 3 HR fitness tracker was found to provide an accurate estimate of VO<sub>2max</sub> when compared to an actual GXT. Based on these data it would appear that the Garmin fenix 3 HR watch with chest strap may provide individuals an accurate assessment of their aerobic capacity for simple self-monitoring.

192 Board #30 May 29 9:30 AM - 11:00 AM

**Sports Performance Wearable Technology, sEMG, and Manual Muscle Testing: Practical Methods for Measuring Maximal Voluntary Contractions**

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(Sponsor: Daniela A. Rubin, FACSM)

(No relevant relationships reported)

**PURPOSE:** The development in sports performance wearable technology has allowed for the monitoring of an athletes' internal load via surface electromyography (sEMG) - based garments. These garments have been shown to be a valid tool for measuring sEMG in sports settings. However, to conduct valid comparisons of sEMG, current methods often involve referencing data from a particular movement to a maximal voluntary contraction (MVC). MVCs are typically measured using an isokinetic dynamometer (ISO); however, with the application of sEMG in a sports environment utilizing an ISO can be impractical. An alternative is the use of manual muscle testing (MMT), in which manual resistance is applied by a trained practitioner to invoke a MVC. The purpose of this study was to compare sEMG-based garment measurement of MVCs elicited using ISO versus MMT in lower extremity muscles. **METHODS:** Twelve healthy, physically active participants (7 males, 5 females) were recruited for this study. Participants were fitted with a sEMG-based compression short or legging embedded with sEMG sensors. Following a dynamic warm-up, participants performed, in a randomized order, either ISO or MMT normalization protocols to measure the MVC of the vastus medialis (VM), vastus lateralis (VL), bicep femoris (BF) and gluteus maximus (GM). Data were sampled at 1KHz and band pass filtered, with the peak amplitude of the MVC used for analysis. Paired samples t-tests ( $p < .05$ ) were used to compare the mean peak amplitudes from each muscle between ISO and MMT protocols. Pearson's correlations ( $p < .05$ ) were conducted to evaluate the degree of the relationship of peak amplitudes obtained by the two protocols for each muscle. **RESULTS:** No significant differences ( $p = .47-.88$ ) were found between any of the muscles when comparing mean peak amplitudes for the ISO and MMT protocols. Significant correlations indicated a positive association between peak amplitudes obtained through ISO and MMT for the VM, RF, and BF ( $r > 0.80$ ,  $p < .001$  for all) and for the GM ( $r = .63$ ,  $p = .022$ ). **CONCLUSIONS:** The present data demonstrated that similar sEMG MVC data for the VM, VL, BF, and GM were recorded for the ISO and MMT. This suggests that the use of MMT, when administered by a trained member of staff, could be a practical method for normalizing each of the measured muscles to the MVC in a field environment.

193 Board #31 May 29 9:30 AM - 11:00 AM

**NICA Injury Surveillance System: Concussion Risk Factors**

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(No relevant relationships reported)

**Scientific Abstract**

Clinical experience highlights the dangers of the sport of mountain biking, with a high volume of contusions, laceration, fractures and concussions. Scientific literature to date has been sparse with regards to injuries in this population. While participation in this sport can transform the lives of the racers with its emphasis on fitness and fun, injuries can significantly limit the student-athlete's ability to exercise. However, this project has strong potential to make high school mountain bike racing a safer sport.

**PURPOSE:** To determine the most common injury occurring in mountain biking athletes and identifying specific risk factors in the most common injury—concussions. **METHODS:** An incident survey was developed using redcap software to give coaches the capacity to report trauma and all circumstances contributing to their athletes' injuries. The Spring 2018 league presented 4,671 students, and the end of the Fall 2018 league added 13,343 more student athletes. In total, this presented a total of 18,014 student athletes from 2018 to look at. Demographics were recorded: age, year in school, division, sex, league, and state. The incline and trail conditions were also accounted for as variables. Weather was marked on the survey, and circumstances for crashes were accounted for—practice, race, passing, familiarity with trail, etc. Statistical and machine learning methods were then used to recognize the most commonly occurring injury and decipher risk factors. **RESULTS:** It is still too early in the project for firm conclusions, but early analysis of the NICA database has shown concussions to account for up to 23% of all injuries recorded in the injury surveillance system in 2018. Team practice accounts for 56.3% of injuries. Downhill racing accounts for 72% of concussions, as well as a distinct gender bias with males. **CONCLUSION:** Concussions account for the most injuries with regard to competitive mountain biking. The varsity league accounts for the least amount of concussions, which suggests injury prevention needs to be taught early on to less experienced riders. Safety strategies on courses, with equipment, and with skills training should be implemented to lower the amount of concussions (and total injuries) for athletes in the coming years.

### A-39 Free Communication/Poster - Muscle Dynamics

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
Room: CC-Hall WA2

#### 194 Board #32 May 29 9:30 AM - 11:00 AM EEG Measurement In Elderly People During Stepping Exercise With Visual Perception Tasks

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(No relevant relationships reported)

The increased risk of falling with aging leads to a recurrent problem in elderly in need of long-term care and may become a major social problem. A reduction in muscular strength and a decline in perceptual function are listed as causes of falls. As a countermeasure to fall risk the effect of various types of exercise training and visual perception tasks (VPT) were tried. Recently, previous studies measured electroencephalograms (EEG) during exercise with wireless electroencephalograph. The evaluation of EEG in elderly during exercise with VPT and comparing results in young may provide a novel insight on prevention of falls. **PURPOSE:** The aim of this study was to examine whether the EEG signals during stepping exercise could be amplified by VPT and aging. We measured EEG during stepping exercise with or without VPT for subjects of ages: 70s, 40s, and 20s. **METHODS:** 11 males in 70s (73±5 yrs), 10 males in 40s (44±3 yrs), and 10 males in 20s (20±1 yrs) carried out stepping exercise for 5 min with or without VPT. EEG during stepping exercise was measured using a wireless electroencephalograph (EMOTIV EEG headset). We analyzed the averaged power spectral density (PSD) for all electrodes with time frequency analysis, and a phase locking index (PLI) with phase synchronization quantification. Statistical comparisons were made using two-way ANOVA. **RESULTS:** PSD without VPT in age 70s (1692±77 dBμ) was larger than in 40s (1374±78 dBμ) and 20s (828±78 dBμ) ( $p < 0.05$ ). Moreover, PSD magnitude increased with VPT in all ages (70s: 1795±73, 40s: 1645±79, 20s: 1075±79 dBμ,  $p < 0.05$ ). PLI of  $\theta$  wave with VPT in age 70s (0.086±0.0019) was smaller than 40s (0.101±0.0021) and 20s (0.110±0.0021) ( $p < 0.05$ ). PLI of  $\alpha$  wave with VPT in age 70s was less than without VPT (0.087±0.0011 vs. 0.091±0.0012,  $p < 0.05$ ), whereas PLI of  $\beta$  wave with VPT in 70s was larger than without VPT (0.094±0.0006 vs. 0.091±0.0007,  $p < 0.05$ ). **CONCLUSIONS:** EEG signals in elderly during stepping exercise is larger than in middle age and young, and is enhanced by VPT. Additionally, the phase pattern may help explain the differences of cognitive functions for VPT between age groups. Supported by The Naito Research Grant.

#### 195 Board #33 May 29 9:30 AM - 11:00 AM

### Does Squat Depth and Width Influence Quadriceps Muscle Activation?

Matt Denning<sup>1</sup>, Brad Gardiner<sup>2</sup>, Tyler Standifird<sup>3</sup>, Lauren Williams<sup>3</sup>. <sup>1</sup>Brigham Young University - Idaho, Rexburg, ID. <sup>2</sup>Weber State University, Ogden, UT. <sup>3</sup>Utah Valley University, Orem, UT. (Sponsor: Doug Powell, FACSM)  
(No relevant relationships reported)

Squats are a popular closed-chain exercise that benefit strength, power, and balance. Squats are often performed with varying depths and widths. Squat variation may elicit different demands on the neuromuscular system. **PURPOSE:** This study investigated muscle activation of the vastus lateralis (VL) and vastus medialis (VM) during 9 different squat variations. **METHODS:** 13 healthy, college-aged adults (6 female, 7 male, mass = 73.5 ± 15.0 kg; height = 1.7 ± 0.09 m) performed body-weight squats at 3 widths (standard (shoulder width), wide (150% of shoulder width), and widest (200% of shoulder width)) and 3 squat depths (shallow (55 degree knee flexion), parallel (90 degree knee flexion), and deep (125 degree knee flexion)). Electromyography (EMG) and marker data were used to determine peak EMG amplitudes during the eccentric and concentric phases of the squat. 2x3 ANOVAs were used to evaluate the simultaneous effect of squat depth and width on peak EMG amplitude. EMG data were filtered using a root mean square approach and normalized to a 30-degree squat reference position. **RESULTS:** Generally, muscle activation increased with greater squat depth, but did not change with greater squat width. Specifically, VL amplitude during the concentric phase was 61% and 119% greater during the parallel (232.7 ± 81.5% reference value;  $p < 0.01$ ) and deep squat (315.2 ± 133.3% reference value;  $p < 0.01$ ) when compared to the shallow squat (144.2 ± 52.4% reference value). Similarly, VM amplitude during the concentric phase was 70% and 88% greater during the parallel (262.9 ± 207.6% reference value;  $p = 0.03$ ) and deep squat (292.2 ± 171.4% reference value;  $p < 0.01$ ) when compared to the shallow squat (155.6 ± 99.8% reference value). Surprisingly, there was no statistical difference in EMG amplitude during the eccentric phase or for the depth by width interactions ( $p > 0.05$ ). **CONCLUSIONS:** These data support the idea that deep squats can be used to generate increased muscle activity of the lower-extremities. Our data also indicate that increased squat width does not increase muscle activity, although our study only examined muscles primarily used for sagittal-plane movement. Further research is needed to investigate the intertwined relationship between squat depth and width on muscle activation for additional lower-extremity muscles.

#### 196 Board #34 May 29 9:30 AM - 11:00 AM

### Contractile Parameters Of The Knee Extensors In Young, Middle-aged, And Older Males

Phuong L. Ha, Alex A. Olmos, Matthew T. Stratton, Alyssa R. Bailly, Micah J. Poisal, Joshua A. Jones, Benjamin E. Dalton, Amber N. Haire, Trisha A. VanDusseldorp, Yuri Feito, FACSM, Garrett M. Hester. *Kennesaw State University, Kennesaw, GA.* (Sponsor: Dr. Yuri Feito, FACSM)  
(No relevant relationships reported)

Peak power (PP) is decreased in older adults; however, less is clear regarding the determinants of PP, contractile torque and velocity. Furthermore, it is unknown if these measures are affected differently in middle and old age. **PURPOSE:** To compare PP and its determinants for the knee extensors in young, middle-aged, and older males. **METHODS:** As part of a larger ongoing investigation, contractile properties of the knee extensors were assessed in healthy, untrained young (YM: n = 8, age = 20.5 ± 1.6 yrs), middle-aged (MM: n = 6, age = 46.0 ± 2.9 yrs) and older (OM: n = 6, age = 69.0 ± 3.10 yrs) males using a Biodex System 4 dynamometer. Upon completing a familiarization visit, a testing visit involving three maximal voluntary isotonic knee extensions, performed at 40% of isometric peak torque, was completed. Participants were instructed to "kick out as hard and fast as possible" prior to each contraction. Power was calculated as the product of torque and velocity for the isotonic contractions using custom written software and PP was recorded. In addition, velocity (VEL) and torque (TQ), at the moment in time PP occurred, were recorded. One-way analyses of variance and Games-Howell post hoc tests were used to compare groups. **RESULTS:** PP was lower in OM compared to YM (50%;  $p = 0.021$ ), but was similar in MM compared to YM and OM ( $p > 0.05$ ). VEL was decreased in OM compared to YM (36%;  $p = 0.007$ ) and MM (24%;  $p = 0.044$ ), however, no difference was noted between MM and YM. TQ was similar between groups ( $p = 0.147$ ). **CONCLUSION:** Our preliminary data indicate that reductions in VEL for the knee extensors occur between middle and old age prior to a decrease in PP, while TQ is maintained in old age. Thus, VEL appears to be more dramatically affected by age, and the age-related decrease in PP may be primarily mediated by impaired velocity capacity.

197 Board #35 May 29 9:30 AM - 11:00 AM

**Effect Of Knee Joint Angle On Neuromuscular Activation Of The Quadriceps Femoris During Fatiguing Contractions**

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(No relevant relationships reported)

In muscle fatigue studies, repetitive muscle contractions at a submaximal force level (e.g., 50% of maximum voluntary contraction [MVC]) are frequently used as a fatiguing task such as isometric knee extensions. Contrary to submaximal fatiguing contractions, when MVC is used to induce muscle fatigue, muscle force will decrease despite maximal effort and amplitude and/or frequency of electromyographic (EMG) signals will also change with the development of muscle fatigue. However, it is unclear the effect angle of knee joint on the neuromuscular activation of individual muscles of quadriceps femoris during repetitive knee extension tasks. **PURPOSE:** We sought of this study was to assess the effect of knee joint angle on the neuromuscular activation pattern of the four individual muscles in the quadriceps femoris during repetitive fatiguing MVCs. **METHODS:** Fifteen healthy men and women (age, 25 ± 3 years; height, 165 ± 11 cm; weight, 57 ± 10 kg) performed two fatiguing tasks consisting of 40 MVCs at knee joint angles of 80° (flexed) and 140° (extended). Neuromuscular activation of the vastus intermedius (VI), vastus lateralis (VL), vastus medialis (VM) and rectus femoris (RF) was recorded using surface electrodes, and median frequency (MF) and root mean square (RMS) of EMG signals (normalized by pre-test MVCs) were calculated. **RESULTS:** MVCs significantly decreased from the 10th to the 40th repetition at both knee joint angles. The MFs of VI and VM in the flexed knee joint angle and that of RF at the flexed and extended knee joint angles were significantly decreased after the 10th repetition. There were no significant changes in normalized EMG amplitude in any muscles specific to knee angle. Stepwise regression analysis revealed predictive synergistic action may take place in RF, VM, and VI in the flexed joint angle and between RF and VM at the extended joint angle. **CONCLUSION:** These results suggest that neuromuscular activation of RF and VM is independent, but activation of VI and VL is dependent, upon knee joint angle, which may, in part, explain joint angle-specific muscle fatigue.

198 Board #36 May 29 9:30 AM - 11:00 AM

**Joint Flexibility is Affected by Muscle Size in Human Planter Flexors**

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(No relevant relationships reported)

**PURPOSE:** Only one study has reported that a larger muscle thickness may relate to a lower joint flexibility in the planter flexors (Kubo et al. *Eur J Appl Physiol* 85, 2001). Muscle volume (MV), compared to muscle thickness, is known to be more appropriate for evaluating muscle size. To further clarify the findings of the previous study, in this study, we examined the relationship between joint flexibility and MV in the planter flexors. **METHODS:** In study 1, we recruited 96 healthy young males (age: 21.6 ± 1.4 years). The planter flexor muscle thickness was measured using ultrasonography (US). The planter flexor MV was estimated using lower leg length and muscle thickness based on a multiple regression equation, which was reported in previous study (Miyatani et al. *Eur J Appl Physiol* 91, 2004). In study 2, we recruited 38 healthy young males (age: 21.5 ± 2.2 years). The planter flexor MV was calculated by multiplying the sum of successive cross-sectional areas measured using magnetic resonance imaging (MRI), and included MVs of the soleus (SOL), gastrocnemius medialis (GM), and gastrocnemius lateralis (GL). In both studies, to evaluate planter flexor flexibility, dorsiflexor active range of motion (ROM) and planter flexor passive stiffness were measured using a dynamometer system. The dorsiflexor ROM was defined as dorsiflexion angle (i.e., end-ROM) which was reached by maximal effort during active dorsiflexion. The planter flexor stiffness was calculated from the liner slope of the torque-angle curve between 10° and 20° dorsiflexor angles during passive dorsiflexion. **RESULTS:** In study 1, US-estimated planter flexor MV was significantly correlated with dorsiflexor ROM ( $r = -0.431$ ,  $P < 0.001$ ) and planter flexor stiffness ( $r = 0.474$ ,  $P < 0.001$ ). In study 2, MRI-measured planter flexor MV was significantly correlated with dorsiflexor ROM ( $r = -0.484$ ,  $P = 0.002$ ) and planter flexor stiffness ( $r = 0.592$ ,  $P < 0.001$ ). Furthermore, all three MVs among planter flexors were significantly correlated with dorsiflexor ROM ( $r = -0.481$ ,  $P = 0.002$  for SOL;  $r = -0.360$ ,  $P = 0.027$  for GM;  $r = -0.432$ ,  $P = 0.007$  for GL) and planter flexor stiffness ( $r = 0.559$ ,  $P < 0.001$  for SOL;  $r = 0.502$ ,  $P = 0.001$  for GM;  $r = 0.510$ ,  $P = 0.001$  for GL). **CONCLUSION:** The present findings suggest that joint flexibility of planter flexors is affected by their MVs in healthy young males.

199 Board #37 May 29 9:30 AM - 11:00 AM

**Lower Extremity Joint Power and Muscle Activation in High and Low Lactate Threshold Cyclists**

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(No relevant relationships reported)

When comparing cycling and inclined treadmill running in well-trained cyclists, two groups have emerged in prior research: 1) cyclists with equally high  $LT_{VO_2}$  while cycling and running uphill (HLT) and 2) cyclists with low cycling  $LT_{VO_2}$  (LLT) but high running  $LT_{VO_2}$  (closely matching those of the HLT cyclists). The physiological and biomechanical differences between HLT and LLT cyclists have yet to be completely described.

**PURPOSE:** To determine differences in absolute/relative joint powers and knee extensor muscle activation between HLT and LLT cyclists. **METHODS:** Sixteen well-trained endurance athletes completed cycling and running  $VO_{2max}$  and cycling and running lactate threshold ( $LT_{VO_2}$ ) testing, and were separated into two groups based on cycling  $LT_{VO_2}$  (HLT: n=8) and (LLT: n=8). Hip, knee, and ankle absolute and relative joint powers (the percent contribution to total joint powers) and electromyography (EMG) assessed muscle activation of the knee extensors (vastus lateralis (VL), vastus medialis (VM), and rectus femoris (RF)) were compared between groups during submaximal cycling (60-90%  $VO_{2max}$ ). **RESULTS:**  $VO_{2max}$  was similar in the two groups when cycling (HLT:  $4.57 \pm 0.17$  vs LLT:  $4.42 \pm 0.15$  L/min) and running (HLT:  $4.47 \pm 0.13$  vs LLT:  $4.49 \pm 0.16$  L/min). HLT cyclists had higher  $LT_{VO_2}$  while cycling compared with the LLT group (HLT:  $3.68 \pm 0.21$  vs LLT:  $3.10 \pm 0.15$  L/min); however, no differences in running  $LT_{VO_2}$  were found (HLT:  $3.73 \pm 0.18$  vs LLT:  $3.71 \pm 0.13$  L/min) ( $p > 0.05$ ). Blood lactate concentration increased with work rate and was lower in the HLT group at 80 and 90% of  $VO_{2max}$  compared with the LLT group ( $p < 0.05$ ). There were no differences between groups in absolute joint specific power across work rates ( $p > 0.05$ ). However, relative hip contribution was significantly greater in the HLT group at 90%  $VO_{2max}$  compared to the LLT group ( $p < 0.05$ ). Furthermore, VM EMG activity was higher in the LLT group at 60 and 70%  $VO_{2max}$  ( $p < 0.05$ ); yet there were no between group differences in VL or RF activation ( $p > 0.05$ ). **CONCLUSION:** HLT cyclists have a greater relative hip contribution during submaximal cycling power and reduced stress on a knee extensor muscle (i.e. lower VM activation) compared to LLT cyclists.

200 Board #38 May 29 9:30 AM - 11:00 AM

**Can Transcranial Direct Current Stimulation Improve Counter-movement Jump Performance ?**

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(No relevant relationships reported)

Transcranial direct current stimulation (tDCS) is a non-invasive brain stimulation technique and has been known to reliably alter motor cortical excitability. Anodal stimulation increases cortical excitability and cathodal stimulation inhibits cortical excitability. However, the effects of tDCS on counter-movement jump (CMJ) is currently unknown. **PURPOSE:** The aim of this study was to investigate the effects of tDCS on CMJ performance in healthy men. **METHODS:** A double-blinded crossover design was used. Fourteen male subjects (age: 22 ± 2 yrs, height: 174.43 ± 5.74 cm, weight: 68.66 ± 9.47 kg) received three time stimulations, each time an anodal tDCS (a-tDCS) or cathodal tDCS (c-tDCS) or sham tDCS randomly. The electrodes are placed over primary motor cortex (M1) bilaterally and the opposite electrodes pair over the ipsilateral shoulders. Each stimulation lasted 20 min, 48-72 hours apart and current was set at 2mA. Participants were required to get anthropometric measurements and familiar with CMJ in advance. Then, completed five CMJ tests before and after each stimulation, with one minute recovery interval between each test. The best three of the five CMJ in each moment was selected for analysis. Two-way (condition × time) ANOVA with repeated measures were used for CMJ height, flight time, and initial velocity. **summary of RESULTS:** There was a significant interaction between condition and time for CMJ height ( $F_{(2,39)} = 7.948$ ,  $p < 0.001$ ), flight time ( $F_{(2,39)} = 8.228$ ,  $p < 0.001$ ), and initial velocity ( $F_{(2,39)} = 8.375$ ,  $p < 0.001$ ). There were no significant main effects for condition or moment for any of the outcome measures ( $p > 0.05$ ). Post-hoc analysis showed that there were no significant differences between conditions both on pre- and post-stimulation moments ( $p > 0.05$ ). However, post a-tDCS performance was significantly superior to pre a-tDCS for CMJ height, flight time and initial velocity ( $p < 0.001$  for all). There were no significant pre-post changes in both c-tDCS and sham-tDCS conditions ( $p > 0.05$  for all). **CONCLUSION:** Our findings demonstrate that anodal tDCS may be a valuable tool to enhance vertical jumping ability, which is very important for human sport performance.

201 Board #39 May 29 9:30 AM - 11:00 AM  
**Relationship between Muscle Damage Magnitude and Sense of Knee Position**

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It has been proposed in the literature that muscle damage may temporarily and negatively affect proprioceptive capacity, which can be tested through the ability to replicate angles, while muscle damage can be verified by quantifying creatine kinase (CK) in the bloodstream.

**PURPOSE:** to verify the relationship between muscle damage and sense of position in the isokinetic dynamometer, in knee extensors, after an eccentric exercise protocol.

**METHODS:** ten male college students (age:  $20.6 \pm 1.8$  years, body mass:  $75.0 \pm 11.7$  kg, height:  $177.4 \pm 6.9$  cm), with no prior experience with resistance exercises, were submitted to an eccentric exercise protocol, in the isokinetic dynamometer, for induction of muscle damage composed of two phases: 1st phase: 10 sets of 10 repetitions with 30 seconds of rest (100 eccentric contractions) - Speed =  $30^\circ/s$ . There was a 5 minute break between the phases. 2nd phase: 11 sets of 10 repetitions and 30 seconds of rest (110 eccentric contractions) - Speed =  $180^\circ/s$ . To evaluate the muscle damage was used the values of CK peak found in the post-tests shortly after exercise, 24h, 48h, 72h and 96h. To verify the sense of position, the subjects, blindfolded, should find the angle of  $60^\circ$  in the right knee on the isokinetic dynamometer. Was used a subtraction of the target value ( $60^\circ$ ) by the angle performed by the subjects on the day of CK peak. The normality of the sample data was verified using the Shapiro-wilk test and Pearson's correlation was applied between peak CK and significance level of 5%.

**RESULTS:** There was a significant correlation ( $p = 0.014$ ) between CK and knee position sense, with  $r = 0.742$  classified as strong (Devore, 2006).

**CONCLUSIONS:** the induction of muscle damage caused by eccentric exercise significantly influences the subjects' proprioception, since the higher the CK values, the greater the angular discrepancies between the expected value and the one performed by the subjects.

202 Board #40 May 29 9:30 AM - 11:00 AM  
**Muscle Activity While Swimming in Triathlon Wetsuits**

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(No relevant relationships reported)

In a triathlon event, people use various strategies and equipment for enhancing their triathlon performance in each exercise mode (i.e., swim, bike, run). During the swimming portion of a race, triathletes will typically wear a wetsuit that is categorized as either full sleeve or sleeveless. Anecdotally, triathletes may select a sleeveless wetsuit because the full sleeve may increase shoulder movement resistance. **Purpose:** The purpose of this study was to investigate shoulder muscle activity influenced by wetsuit design. **Methods:** Seven subjects (5 male and 2 female, age:  $45.7 \pm 8.0$  yrs, height:  $174.8 \pm 10.5$  cm, mass:  $70.1 \pm 9.4$  kg) participated in the experiment. Muscle activity of the Anterior Deltoid (AD) and Posterior Deltoid (PD) was measured (2000 Hz) using a water proofed electromyography (EMG) system (MiniWave, Cometa, Italy). After a self-directed warm-up, participants were asked to swim 50m at a 'somewhat hard' pace that they could maintain the pace for a sprint triathlon distance (750m) for each condition: No wetsuit (NWS), sleeveless wetsuit (SLW), and full sleeve (FSW). PD EMG data were smoothed using a 4<sup>th</sup> order Butterworth filter (cutoff frequency = 4 Hz). The smoothed data were used to identify the beginning and ending points of a stroke cycle. Five consecutive stroke cycles were then extracted for analysis as well as the time to complete the five cycles. Data analysis was performed using the raw unfiltered EMG data which were reduced by removing any zero offset, full wave rectifying the signal, and calculating the average EMG across the 5 stroke cycles (PDavg, ADavg). Time and average data were compared between conditions using a 1 x 3 (wetsuit condition) repeated measures ANOVA. **Results:** Muscle activity of both AD and PD were not different among all wetsuit conditions ( $p > 0.05$ ). However, time was different among conditions ( $p < 0.05$ ) with FSW being shorter than NWS ( $p < 0.05$ ), but between the two wetsuits (FSW and SLW) were not different ( $p > 0.05$ ). **Conclusion:** While swimming at a somewhat hard intensity, wetsuit design did not influence muscle activity of the shoulder muscle. However, stroke time was influenced by wearing a wetsuit regardless of design. Triathletes might get a benefit to reduce their swimming race time by wearing a wetsuit regardless of full-sleeve or sleeveless.

203 Board #41 May 29 9:30 AM - 11:00 AM  
**Sex Differences in Correlations Between Muscle Architecture and Impulse in a Heterogenous Group of Athletes**

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(No relevant relationships reported)

**BACKGROUND:** Previous investigations have identified moderate to strong relationships between skeletal muscle architecture (SMA) and performance measures in athletes, however differences between males and females in this regard are not well known. A better understanding of relationships between task-specific impulse windows and SMA in males and females may allow coaches to direct training stimuli toward improving specific morphological underpinnings of sport performance for the athletes under their care. **PURPOSE:** The purpose of this analysis was to determine relationships between components of SMA and isometric impulse in male and female athletes. **METHODS:** Pennation angle (PA), fascicle length (FL), and anatomical cross-sectional area (ACSA) were determined for the vastus lateralis muscle via  $\beta$ -mode ultrasonography in a group of male ( $n = 94$ ) and female ( $n = 61$ ) collegiate, club, and international athletes. Net isometric impulse at 50, 90, 200, and 250 ms was measured during an isometric mid-thigh pull (IMTP) test administered pre-season as part of an ongoing athlete monitoring program. **RESULTS:** Pearson product-moment correlation revealed weak correlations between FL and impulse in males ( $r = 0.33$  to  $0.36$ ,  $p < 0.05$ ) but not in females, weak correlations between CSA and impulse in males ( $r = 0.39$  to  $0.48$ ,  $p < 0.05$ ), and weak to moderate correlations between CSA and impulse in females ( $r = 0.55$  to  $0.62$ ,  $p < 0.05$ ). **CONCLUSIONS:** These results indicate that there may be sex-based differences in the physiological underpinnings of impulse generation in trained athletes, particularly in relation to both muscle size and fascicle length of the vastus lateralis. Further research should investigate changes in these relationships over time and consider contributions from neuromuscular components.

204 Board #42 May 29 9:30 AM - 11:00 AM  
**Comparison in Peak Torque Rotations Between Dominant and Non-Dominant Arms in Powerlifters**

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The shoulder joint is naturally instable because of anatomic structure, and depends of passive and active elements, ligaments and muscle, respectively, for proper stability. The bench press, upper body exercise, is one of three exercises of Powerlifting (PL), based on maximum strength. The strength balance between dominant (D) and non-dominant (ND) upper limbs is fundamental to develop a good lift and joint safety. Therefore, not only major muscles are important as pectoral major, but also stability muscles as rotator cuff for shoulder external rotation.

**PURPOSE:** To compare, in recreational powerlifters, relative peak torque between dominant and non-dominant arms, in external and internal rotation at  $60^\circ/s$  and  $180^\circ/s$  concentric action velocity for external (ER) and internal rotation (IR) in shoulder joint. **METHODS:** Participants, nine powerlifters (height:  $1.73 \pm 0.06$  cm; weight:  $84.1 \pm 13.0$  kg; bench press 1 repetition maximum:  $116.4 \pm 19.1$  kg; PL minimal experience: 2 years). The muscle group strength for ER and IR were assessed bilaterally by Biodex System 4Pro isokinetic dynamometer. The participants were in a seated position,  $45^\circ$  shoulder abduction,  $60^\circ/s$  and  $180^\circ/s$  concentric mode was adopted for lever velocity for ER and IR in shoulder joint. Dominant and non-dominant sides peak torque normalized to body weight (PT/BW;  $Nm \cdot kg^{-1}$ ) were compared with paired student's t-test. **RESULTS:** Significant difference ( $p = 0.02$ ) was found at the PT/BW for the ER movements between the dominant ( $47.8 \pm 5.8$   $Nm \cdot kg^{-1}$ ) and non-dominant ( $44.3 \pm 6.1$   $Nm \cdot kg^{-1}$ ) sides at the velocity of  $60^\circ/s$ , but there was no significant difference between sides in IR ( $p = 0.15$ ;  $D = 71.7 \pm 16.3$   $Nm \cdot kg^{-1}$ ,  $ND = 66.1 \pm 12$   $Nm \cdot kg^{-1}$ ); and at  $180^\circ/s$  for ER ( $p = 0.24$ ;  $D = 48 \pm 5.3$   $Nm \cdot kg^{-1}$ ,  $ND = 45.7 \pm 8.6$   $Nm \cdot kg^{-1}$ ) and IR ( $p = 0.24$ ;  $D = 68.7 \pm 15.5$   $Nm \cdot kg^{-1}$ ,  $ND = 64.6 \pm 8.6$   $Nm \cdot kg^{-1}$ ). **CONCLUSION:** For recreational powerlifters, there is only difference between dominant and non-dominant arms in ER movement at  $60^\circ/s$ , which suggests a necessity of unilateral exercises for a better balance between sides.

Supported by CNPq scholarship.

205 Board #43 May 29 9:30 AM - 11:00 AM

**Age-related Differences in Vertical Jump Power and Muscle Size and Quality of the Vastus Lateralis**

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(No relevant relationships reported)

Previous studies have reported that decreases in muscle size and quality of the vastus lateralis (VL) may contribute to the lower vertical jump power observed in old compared to young males. However, we are aware of no previous studies that have examined the contribution of VL muscle size and quality to age-related power differences in females, nor have there been any studies that examined these differences between young, middle, and older age groups. **PURPOSE:** To determine the effects of age on vertical jump power and muscle size (cross-sectional area [CSA]) and quality (echo intensity [EI]) of the VL in young, middle-aged, and old females. **METHODS:** Twenty-six young (age = 22 ± 2 yr; height = 163 ± 7 cm; mass = 61 ± 8 kg), 30 middle-aged (36 ± 5 yr; 164 ± 7 cm; 62 ± 11 kg), and 23 old (71 ± 5 yr; 161 ± 5 cm; 59 ± 10 kg) females underwent two diagnostic ultrasound assessments followed by three countermovement vertical jumps (CMJs). Peak power output (Pmax; W) was measured during the CMJs using a portable force plate. VL CSA (cm<sup>2</sup>) and EI (AU) were measured on the right leg using a portable B-mode ultrasound imaging device and linear-array probe. One-way ANOVAs and post-hoc analyses were used to compare Pmax, CSA, and EI between age groups. Pearson product-moment correlation coefficients (*r*) were used to examine the relationships between Pmax and CSA and EI. **RESULTS:** Higher Pmax and CSA values were observed for the young (Pmax = 2257.40 ± 438.42 W; CSA = 20.59 ± 4.23 cm<sup>2</sup>) compared to the old (Pmax = 1098.55 ± 242.10 W; CSA = 10.69 ± 2.47 cm<sup>2</sup>) and middle-aged (Pmax = 1958.20 ± 341.87 W; CSA = 18.05 ± 4.24 cm<sup>2</sup>) and the middle-aged compared to the old (*P* ≤ 0.001-0.039). EI values for the young (104.29 ± 16.86 AU) and middle-aged (107.71 ± 17.30 AU) were lower than the old (128.35 ± 14.99 AU) (*P* < 0.001), but they were not different from each other (*P* = 0.720). There was a significant positive relationship between Pmax and CSA (*r* = 0.830; *P* < 0.001) and a significant negative relationship between Pmax and EI (*r* = -0.442; *P* < 0.001). **CONCLUSION:** These findings demonstrated that vertical jump power and muscle size and quality decrease with age. The significant relationships observed between Pmax and CSA and EI perhaps suggest that these age-related declines in VL muscle size and quality may play an important role in the lower vertical jump power observed in middle-aged and older adults.

206 Board #44 May 29 9:30 AM - 11:00 AM

**Rate Of Velocity, Torque, And Power Development In Middle-Aged And Older Males**

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(No relevant relationships reported)

Rapid contractile measures such as rate of velocity (RVD), torque (RTD) and power (RPD) development dramatically decrease with age, but have rarely been concurrently investigated. Further, few studies have examined the relationship between these parameters and functional performance. **PURPOSE:** To compare rapid contractile parameters of the knee extensors in middle-aged and older males, and examine correlates of 5-chair rise (5CR) performance. **METHODS:** As part of a larger ongoing investigation, twelve healthy untrained, middle-aged (n = 6, age = 46 ± 2.90 yrs) and older (n = 6, age = 69 ± 3.10 yrs) males completed a familiarization visit followed by one testing visit. Using a Biodex System 4 dynamometer, participants performed three maximal voluntary isometric contractions of the right knee extensors followed by three maximal isotonic contractions at 40% of isometric peak torque. Participants were instructed to "kick out as hard and fast as possible" prior to each contraction. The torque and velocity signals were acquired and the power curve was derived from multiplying torque and velocity. RVD and RPD were obtained from isotonic contractions, as the linear slope of the velocity- and power-time curve, respectively. RTD was calculated for the first 50 ms of the isometric torque-time curve. In addition, 5CR, the time to rise 5 times from a chair as quickly as possible was recorded. Groups were compared with independent samples t-tests, while Pearson correlation coefficients were used to examine relationships between age, RVD, RPD, RTD, and 5CR. **RESULTS:** RVD (32.15%; *p* = 0.004) and RPD (53.27%; *p* = 0.03) were decreased in older males, but not RTD (*p* = 0.497). In addition, only RVD was correlated with 5CR (*r* = -0.588; *p* = 0.044). **CONCLUSIONS:** While preliminary, these data suggest that dynamic, rapid contractile measures are preferentially affected by age as compared to RTD, and only RVD was related to 5CR performance.

207 Board #45 May 29 9:30 AM - 11:00 AM

**The Effects Of Muscular Fatigue And Gender On Lower Extremity Biomechanics During The Forward Lunge**

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**Purpose.** The forward lunge is a common exercise used in strength training and rehabilitation to improve lower extremity strength<sup>1</sup>. In other lower extremity exercises, fatigue from high repetitions has been shown to alter biomechanics and increase injury risk<sup>1,2</sup>. Moreover, fatigue responses appear to be gender specific<sup>1,2</sup>. Therefore, the purpose of this study was to determine the effects of fatigue and gender on lower extremity biomechanics during the forward lunge. **Methods.** 29 young adults (13 males) participated in the study. Subjects repeatedly completed a set of 7 walking lunges across a ~8 m walkway and 4 stationary lunges on force plates until fatigued. A fatigued state was identified as two consecutive sets that scored a 9 on a modified Borg RPE scale, or a single set that scored a 10. A Vicon motion capture system (Vicon Motion Systems, Oxford, UK) was used to collect the data. Average peak lower limb angles and internal moments of the forward limb were calculated for the baseline set of stationary lunges and the last set (i.e. fatigued set) of stationary lunges. Main effects of gender and fatigue and their interaction were evaluated using a repeated-measures MANOVA. **Results.** Neither a significant fatigue × gender interaction nor gender main effect at the multivariate level were found. A significant multivariate omnibus main effect of fatigue, however, was detected. Variables that changed with fatigue are outlined in Table 1. **Conclusion.** The increase in hip adduction angle, knee adduction angle, and knee adduction moment with fatigue may stress internal stabilizers of the knee<sup>2,4</sup>. As such, individuals should exercise caution when performing the forward lunge to fatigue.

**References.** 1) Chappell, JD et al. *Am J Sports Med*, 33, 2005; 2) McLean SG et al. *Med Sci Sports Excer* 39, 2006; 3) Longpré, HS et al. *J Electromyogr Kinesiol* 25, 2015; 4) Power et al. *J. Orthop. Sports Phys. Ther* 40, 2010

Variable	Baseline	Fatigued	P	Change from Baseline
Hip Adduction Angle (°)	3.1 ± 0.9	7.1 ± 0.9	< 0.001	Increase
Hip Abduction Angle (°)	8.2 ± 0.8	6.5 ± 0.7	0.019	Decrease
Hip Flexion Moment (Nm/kg)	0.3 ± 0.02	0.2 ± 0.02	< 0.001	Decrease
Hip Extension Moment (Nm/kg)	1.6 ± 0.06	1.9 ± 0.05	< 0.001	Increase
Hip Adduction Moment (Nm/kg)	0.4 ± 0.06	0.5 ± 0.07	0.004	Increase
Knee Adduction Angle (°)	19.8 ± 2.0	20.9 ± 2.0	0.037	Increase
Knee External Rotation Angle (°)	11.8 ± 1.0	13.5 ± 1.2	0.001	Increase
Knee Flexion Moment (Nm/kg)	0.3 ± 0.02	0.4 ± 0.024	< 0.001	Increase
Knee Extension Moment (Nm/kg)	1.1 ± 0.05	0.9 ± 0.05	< 0.001	Decrease
Knee Adduction Moment (Nm/kg)	0.8 ± 0.01	1.1 ± 0.01	0.048	Increase
Ankle Plantarflexion Angle (°)	6.9 ± 1.4	11.8 ± 1.6	0.001	Increase
Ankle Plantarflexion Moment (Nm/kg)	0.9 ± 0.03	1.1 ± 0.03	< 0.001	Increase
Ankle External Rotation Moment (Nm/kg)	0.2 ± 0.01	0.2 ± 0.01	0.013	Decrease

208 Board #46 May 29 9:30 AM - 11:00 AM

**Acute Effects Of Elastic Resistance Band On Post-activation Potentiation In Elite Handball Athletes**

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**PURPOSE:** to evaluate whether a heavy back squat protocol combining free weight plus elastic band (CR) could promote a post-activation potentiation (PAP) during a countermovement jump (CMJ) test and to determine the optimal recovery time to elicit it.

**METHODS:** : Nine male elite Brazilian handball athletes [21.4 ± 2.1 years; 90.3 ± 10 kg; 187.5 ± 5 cm; 10.5 ± 4.2 body fat; 9.7 ± 1.8 years of training experience; 1.81 ± 0.23 of Relative 1RM back squat (kg·kg<sup>-1</sup>); 15 hours of weekly training volume] were recruited into the study. The experimental sessions were performed seven days apart in a counterbalanced order. The athletes were required to complete either a CR protocol or a control protocol (CMJs only). Athletes completed a standardized warm-up consisting of 5 min of light-intensity cycling, static stretching exercises, and three consecutive CMJs. After a 3 min rest period, athletes performed baseline CMJs test. The CR protocol was consisted of three sets of 5 repetitions at 85% of 1RM with 3 minutes of rest between sets. Back squat was loaded with 85% of 1RM combining 55% of 1RM using weight-plate and 29.7 ± 2.04% of the athlete's 1RM in fully erect position (starting position) with elastic band resistance. During control session, the same warm-up routine was included so that the only difference between the PAP and control protocol was the absence of a potentiating stimulus.

**RESULTS:** One-way repeated measures ANOVA indicated a significant effect of time in CMJ performance within CR condition ( $p < 0.01$ ,  $n^2_p = 0.39$ ). The vertical jump height was significantly greater (6.5%,  $ES = 0.85$ ) at 2-min as compared to baseline. No significant differences in jump height were detected when compared with baseline at 4-, 6-, and 8-minute recovery. Two-way repeated-measures ANOVA revealed an interaction effect ( $p < 0.05$ ,  $n^2_p = 0.40$ ) in PAP response. At 2-min, PAP response was significantly larger (4.9%,  $ES = 1.38$ ) in CR condition than control ( $p < 0.05$ ).

**CONCLUSIONS:** The combination of free weight and elastic bands during heavy squat exercise seems to be effective to create a post-activation potentiation effect to enhance acute neuromuscular performance at 2-min after preconditioning stimulus.

**209 Board #47 May 29 9:30 AM - 11:00 AM**

**Knee Extensor Torque Is Increased By Far-Infrared Emitting Fabric**

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(No relevant relationships reported)

Far-infrared (FIR) emitting materials can increase the availability of nitric oxide and calcium in cell culture, and delay fatigue during ex-vivo skeletal muscle contractions. However, FIR effects on humans' neuromuscular performance remains unknown.

**Purpose:** To verify the effects of FIR emitting fabric on knee extensors torque and electromyography activity. **Methods:** Fourteen healthy strength trained men (24.3 ± 4 years; 82.8 ± 11.3 kg; 176.3 ± 4.2 cm, 7.3 ± 2.9 years of training experience) participated in one familiarization and two experimental sessions. Experimental sessions occurred two weeks apart and after 96 hours of continuous FIR or Placebo fabric usage, in a randomized, crossover, double-blind, placebo-controlled design study. Isometric and dynamic torques were assessed using isokinetic dynamometer. The best result out of 3 maximum ballistic knee extension contractions (MBC) was recorded pre- and post-dynamic test. Dynamic test was composed by 30 maximum repetitions of knee flexion and extension at 180°/s. Peak torque (PT) of each repetition, total work (TW) and fatigue index (FI) of knee extensors were recorded. The mean RMS was calculated from electromyography activity records of superficial quadriceps muscles. Mean quadriceps temperature was assessed pre-protocol with a thermal camera. **Results:** See table. FIR fabric increased pre and post MBC and trend to increase TW. RMS at isometric and dynamic tests, FI, and quadriceps temperature did not change. Additionally, FIR fabric demonstrated higher values of PT at 8<sup>th</sup>, 12<sup>th</sup> to 14<sup>th</sup> and 17<sup>th</sup> repetitions (all  $p < 0.05$ ). **Conclusion:** FIR emitting fabric is effective to increase isometric and dynamic neuromuscular performance. Further, the absence of changes in electromyography activity and increased performance in single MBC, lead us to suggest that FIR effects are related to muscle contractile machinery improvements.

	FIR		Placebo		p
pre-MBC (Nm)	318.5	± 68.7	299.3	± 68.2	0.01
post-MBC (Nm)	284.1	± 58.2	268.8	± 55.4	0.04
pre-MBC RMS (mV)	0.139	± 0.062	0.142	± 0.082	0.70
post-MBC RMS (mV)	0.143	± 0.059	0.128	± 0.066	0.24
TW (J)	4142.2	± 699.8	4009.3	± 743	0.06
FI (%)	41.7	± 6.6	40.3	± 8.3	0.01
Temperature (°C)	32.48	± 0.77	32.42	± 0.62	0.62

Data are mean ± standard deviation. p-values are paired T-test ( $p \leq 0.05$ ).

**A-40 Free Communication/Poster - Resistance Training**

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
Room: CC-Hall WA2

**210 Board #48 May 29 11:00 AM - 12:30 PM**

**The Acute Effects of a Resistive Exercise on Sprint Times in High School Track Athletes**

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(No relevant relationships reported)

The ability to achieve high velocities in a short period of time is a requisite for success in many sporting activities. Post activation potentiation (PAP) can be defined as an increase in neuromuscular activity that occurs immediately after a high intensity exercise or conditioning activity. PAP may improve subsequent exercise performance that requires high muscular power output. **PURPOSE:** This study attempted to determine the acute effects of incorporating a resistive sprint exercise as a PAP conditioning activity on subsequent sprint time in high school track athletes.

**METHODS:** A randomized repeated measures crossover study design was used to test fifteen high school track athletes (9 male: 16.8 ± 0.7 years, 183.7 ± 9.7 cm, 77.2 ± 5.8 kg, 6 female: 16.0 ± 1.1 years, 156.2 ± 3.5 cm, 52.2 ± 1.2 kg). Each participant completed two testing sessions: a dynamic WU prior to a 36.6 meter sprint and a dynamic WU followed by a resisted sprint sled pull as a PAP conditioning activity (10-15% of body mass) prior to a 36.6 meter sprint. Testing sessions occurred on two different days with at least 48 hours between each session. A paired T-test was used to determine if there were significant differences in sprint times between the WU strategies. **RESULTS:** The 36.6 meter sprint times following a dynamic WU combined with a resisted sprint sled pull as a PAP conditioning activity were significantly lower (5.54 ± 0.52 seconds) than the 36.6 meter sprint times following the dynamic WU alone (5.64 ± 0.51 seconds) ( $p < 0.01$ ). **CONCLUSION:** Within the parameters of this study it can be concluded that a dynamic WU including a resisted sprint sled pull as a PAP conditioning activity is successful at improving short distance sprint times when compared to sprint times following a dynamic WU alone.

**211 Board #49 May 29 11:00 AM - 12:30 PM**

**The Effects of Five Weeks of Bench Press Training on Salivary Biomarkers of Inflammation in Recreationally-trained College-age Males**

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**INTRODUCTION:** Improvements in immunosenescence have been reported to be associated with regular exercise and physical activity. Multiple investigations have elucidated the effectiveness of aerobic exercise on the attenuation of biological markers of systemic inflammation. However, few studies have evaluated the impacts of resistance training on inflammation, and even fewer have examined the effects of resistance training on salivary biomarkers of inflammation. **PURPOSE:** To evaluate the impacts of 5 weeks of bench press-only training on salivary biomarkers of inflammation in trained college-age males ( $N = 23$ ). Pre and post analyses of salivary biomarkers (IL-1 $\beta$ , IL-6, IL-8, TNF $\alpha$ , CRP, and Testosterone) were conducted. Five weeks of either standard bench press ( $n = 12$ ) or leg drive focused bench press ( $n = 11$ ) was completed. **RESULTS:** No significant ( $p > 0.05$ ) main effects between groups were observed. Within groups measures did reveal that testosterone significantly decreased by 17.0% in the standard bench press group from pre to post ( $p = 0.02$ ). **CONCLUSIONS:** Five weeks of bench press training did not alter pre-training levels of inflammation measured in saliva. Subjects were required to be currently training and have completed a minimum of 6 months of resistance training (including bench press) prior to starting this study. Since the bench press was the only training exercise, the intensity of training administered may not have been sufficient to elicit notable alterations in overall inflammatory status in this sample.

WEDNESDAY, MAY 29, 2019

212 Board #50 May 29 11:00 AM - 12:30 PM

**Evidence Of A Ceiling Effect For Training Volume In Muscle Hypertrophy And Strength In Trained Men**

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(No relevant relationships reported)

**Purpose:** To compare the effects of different resistance training (RT) volumes on muscle performance and hypertrophy in trained men.

**Methods:** The study included 37 volunteers that performed RT for 24 weeks and were divided into groups that performed five (G5), 10 (G10), 15 (G15) and 20 (G20) sets per muscle group per week. Ten repetition maximum (10RM) tests were performed for the bench press, lat pull down, 45° leg press, and stiff legged deadlift. Muscle thickness (MT) was measured using ultrasound on biceps brachii, triceps brachii, pectoralis major, quadriceps femoris and gluteus maximus. All measurements were performed at the beginning (pre) and after 12 (mid) and 24 weeks (post) of training.

**Results:** All groups showed significant increases in all 10RM tests and MT measures after 12 and 24 weeks of TR ( $p < 0.05$ ). There were no differences in any 10RM test between G5 and G10 ( $p > 0.05$ ) after 12 and 24 weeks. G5 and G10 showed significantly greater increases of 10RM than G15 and G20 for bench press, lat pulldown, leg press and stiff legged deadlift, both at 12 and 24 weeks. There were no group by time interaction for any MT measure

**Conclusions:** Five to 10 sets per week might be sufficient for bringing about optimal gains in muscle size and strength in trained men over a 24-week period. There appears to be a deleterious effect for higher volumes ( $\geq 15$  sets per week), especially after 12 weeks of training. These results bring evidence of an inverted "U shaped" curve for the dose response curve for muscle strength, with a possible deleterious effect after exceeding a certain training volume. Whilst the same trend was noted for muscle hypertrophy, the results did not reach significance. Therefore, using low volume RT programs might be an interesting alternative for personal trainers, strength coaches and medical practitioners to increase muscle size and strength in trained men.

213 Board #51 May 29 11:00 AM - 12:30 PM

**Effects Of An 8-week Mixed-methods Strength Training On Maximal Strength Of Weightlifting Athletes.**

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(No relevant relationships reported)

The maximal strength training implies the greatest possible activation of the central nervous system, improving inter and intramuscular coordination and causing considerable benefits recognized by the international scientific community. It is well known that the pyramidal training can give powerful performance results thanks to a progressive increase in the load. However, there are different traditional methods to strength training and all have already been successfully tested. **PURPOSE:** This randomized controlled trial study design with experimenter blinding aimed to compare the effects of an 8-week training period of a Mixed-Methods Strength Training (MST) or Pyramidal Training (PT) on maximal strength performance in weightlifting athletes. **METHODS:** Study participants (20 men, age:  $23.9 \pm 2.05$  years, body mass:  $75.6 \pm 9.45$  kg, height:  $1.77 \pm 0.05$  m, body mass index:  $24.09 \pm 2.46$  kg·m<sup>-2</sup>) were assigned to the MST group ( $n = 10$ ) performed strength training with maximal loads (80-95% of 1RM, 3-min rest) for two sessions per week interspersed with a pyramidal training session (90-sec rest), and PT group ( $n = 10$ ) performed pyramidal training alone (90-sec rest) for three sessions per week. Both groups trained for 8 weeks using a 3:1 loading structure. Measures pre-intervention and post-intervention included one-repetition maximum [1-RM] bench press, barbell deadlifts, lat pull-down, and standing barbell military press. Repeated-measures ANOVA and a paired t-test were used to assess differences in outcome variables across conditions ( $p < 0.05$ ). **RESULTS:** The MST group showed significantly greater improvements than PT in bench press ( $13.1 \pm 0.91$  vs.  $3.7 \pm 0.47$  kg,  $p < 0.0001$ ), barbell deadlifts ( $19.3 \pm 1.27$  vs.  $5.3 \pm 0.97$  kg,  $p < 0.0001$ ), lat pull-down ( $17.2 \pm 1.72$  vs.  $2.8 \pm 0.79$  kg,  $p < 0.0001$ ), and standing barbell military press ( $13.1 \pm 1.54$  vs.  $1.9 \pm 0.59$  kg,  $p < 0.0001$ ). **CONCLUSIONS:** These findings suggest that a Mixed-Methods Strength Training characterized by two sessions with maximal loads interspersed with a pyramidal training session may be more effective than the pyramidal training alone for enhancing the maximal strength in weightlifting athletes. It could therefore be considered a valid and motivating alternative to the traditional strength training methods.

214 Board #52 May 29 11:00 AM - 12:30 PM

**Temporary Increasing in Muscle Thickness and Upper Arm Circumference Immediately After Resistance Exercise**

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(No relevant relationships reported)

Temporary Increasing in Muscle Thickness and Upper Arm Circumference Immediately After Resistance Exercise

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Temporary muscle thickness and limb circumference increased immediately after resistance exercise are strongly affected by reactive hyperemia, which is different from muscle hypertrophy induced by resistance exercise. This study is necessary for determining condition of measuring muscle cross sectional area as a muscle hypertrophic effect induced by resistance exercise. Furthermore, this is useful for bodybuilding and physique contests where muscle volume affects results.

**PURPOSE:** The purpose of this study was to investigate the duration of temporary increasing in muscle thickness and upper arm circumference induced by resistance exercise in the triceps brachii for resistance-trained and untrained subjects.

**METHODS:** Four kinds of resistance exercises were performed on 28 healthy adult males ( $26 \pm 3$  yrs), resistance-trained ( $n = 14$ ) and untrained ( $n = 14$ ). The extracellular water content, muscle thickness, upper arm circumference, oxygenated hemoglobin (oxy-Hb) were examined before exercise, within 5-minute, 30-minute, and 60-minute after exercise. Two-way analysis of variance was used to confirm acute effects.

**RESULTS:** The extracellular water content of upper arm ( $+0.22$  L), triceps brachii muscle thickness ( $+3$  mm), upper arm circumference ( $+2$  cm) increased only in the resistance-trained subjects 5-minute after exercise compared with before exercise. However, there was no difference between before exercise and 30-minute after exercise values. The oxy-Hb increased immediately after exercise in both resistance-trained ( $+42\%$ ) and untrained subjects ( $+39\%$ ), but no significant difference was observed between resistance-trained and untrained subjects. **CONCLUSION:** Temporary increasing in muscle thickness and upper arm circumference within 5 minute after resistance exercise was a response occurred only in the resistance-trained subjects, and it was confirmed that the response disappeared within 30-minute.

215 Board #53 May 29 11:00 AM - 12:30 PM

**The Effect Of Strength Training On Physical Performance In Adolescent Female Soccer Players**

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(No relevant relationships reported)

Strength training (ST) is amongst the most frequently used strategies to improve soccer performance and it has been used to obtain significant increases in the levels of maximum strength and muscle hypertrophy. Therefore, using appropriate ST programs could enhance several explosive actions that are crucial to the outcome of the game. ST is a method that has shown to be effective in male soccer players but the scarce studies of ST on female soccer players must also be pointed out. **PURPOSE:** To examine the effects of ST on physical performance after a 12-week training period in adolescent female soccer players. **METHODS:** 37 adolescent female soccer players from Spanish soccer team (age:  $16.1 \pm 1.1$  years; height:  $159.7 \pm 7.1$  cm; body mass:  $55 \pm 7.1$  kg) were randomly assigned to an experimental (EG;  $n = 19$ ) or a control group (CG;  $n = 18$ ). All players underwent a regular soccer training 3 times per week. Participants in the EG received ST program (12 weeks, 2 times per week, 20 min per session). The ST program included lower limb strength and core muscle. The players were tested at the beginning and the end of the intervention on bilateral countermovement jump (CMJ) test, unilateral CMJ test, 40m sprint, 180° COD test and V-cut test. Paired t-test was conducted to detect significant differences between the pre and post-tests in both groups. Statistical significant was inferred from  $p < 0.05$ . **RESULTS:** EG made significantly greater improvement than CG did on CMJ (GE pre  $23.5 \pm 3.30$  cm vs post  $25.6 \pm 3.65$  cm,  $p < 0.01$ ; GC pre  $23.3 \pm 3.73$  cm vs post  $23.9 \pm 4.35$  cm), right CMJ (GE pre  $12.9 \pm 1.95$  cm vs post  $14.3 \pm 2.44$  cm,  $p < 0.05$ ; GC pre  $12.1 \pm 2.77$  cm vs post  $13.1 \pm 2.65$  cm), 40m sprint (GE pre  $6.51 \pm 0.26$  s vs post  $6.24 \pm 0.25$  s,  $p < 0.01$ ; GC pre  $6.24 \pm 0.21$  s vs post  $6.29 \pm 0.25$  s), left 180° COD (GE pre  $2.96 \pm 0.16$  s vs post  $2.89 \pm 0.18$  s,  $p < 0.05$ ; GC pre  $2.93 \pm 0.15$  s vs post  $2.91 \pm 0.11$  s) and V-cut (GE pre  $8.05 \pm 0.38$  s vs post  $7.81 \pm 0.27$  s,  $p < 0.01$ ; GC pre  $7.98 \pm 0.38$  s vs post  $7.97 \pm 0.39$  s). **CONCLUSIONS:** Twelve weeks ST could improve bilateral and unilateral muscular power, speed and

COD ability performance in adolescent female soccer players. The results indicate that safe, effective, and alternative ST can be useful to coaches, especially in competition season where less time is available to training.

**216** Board #54 May 29 11:00 AM - 12:30 PM  
**Effect of a 2-Week Strength Training Learning Intervention on Self-selected Weight Training Intensity**

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(No relevant relationships reported)

**PURPOSE:** Research has found that novice clients, fail to self-select weight that is heavy enough to promote strength gain. The purpose of this study was to determine the effectiveness of a 2-week strength training learning intervention on self-selected resistance training intensity. **METHODS:** Subjects between 18-40 y were placed in a control (CON n=7) or experimental (EXP n=8) group. Each subject was provided practice training on 5 resistance training machines (chest press, leg press, triceps extension, bicep curl, shoulder press). On 6 different training days, separated by at least 48h, subjects completed 2 sets on each machine while blinded to the load. CON were instructed to self-select a load to build strength without feedback. Load, repetitions and ratings of perceived exertion (RPE) were recorded. Starting with a self-selected load, EXP were encouraged to lift to fatigue. If EXP exceeded 12 repetitions, the load was increased (Goal- attain 70%IRM). RPE was assessed each set. Post training days, CON and EXP completed self-selection trials for all lifts, plus 3 novel lifts (pec fly, leg extension, shoulder raise). One repetition maximum (1RM) was assessed last. All loads were converted to % 1RM. Comparisons between groups were made using 2Way ANOVA. **RESULTS:** For % 1RM there were significant main effects for both condition and day (Day 1 EXP=57.2±12.0%; CON=47.2±13.7%; Day 6 EXP=74.7±10.8%; CON=66.2±13.4%). For repetitions there were significant effects across days (Day 1 EXP=10.8± 4.8; CON=12.3± 4.0; Day 6 EXP=9.3±3.6; CON=10.0±3.0) with significant interaction effects indicating CON did not change repetition number as load increased. There were significant main effects across days for RPE (Day 1=15.4±2.0; Day 6=16.5±1.9). All loads selected exceeded 60% 1RM indicating that both EXP and CON treatment achieved adequate training loads. However, among the novel lifts only the pec fly was greater than 60% 1RM (pec fly 63.0±11.0%; leg extension 39.8±12.5%; shoulder raise 53.1±12.8%). **CONCLUSION:** Two weeks of supervised resistance training resulted in EXP and CON self-selecting loads greater than 60% 1RM. Repeated training exposure resulted in higher self-selected training loads suggesting that repeated exposure to resistance training sessions is an important factor to attain loads that promote strength gain.

**217** Board #55 May 29 11:00 AM - 12:30 PM  
**Acute Resistance Training Does Not Impair Cognitive Function in Costa Rican Older Adults**

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(No relevant relationships reported)

Aging imposes a gradual deterioration of brain function and cognitive abilities, which hinder older adult's daily activities and limit their independence and safety. There is a lack of evidence on the acute effects of resistance training (RT) on cognitions in older adults. **PURPOSE:** To determine the acute effect of RT on cognitive performance in healthy Hispanic older adults. **METHODS:** Volunteers were 45 cognitive intact older adults (Mean age = 65.3 ± 3.7 yr.) recruited from a University extension program. Participants were randomly assigned to one of three possible groups (n = 15 in each group): a) High-intensity RT: 3 sets, 8 repetitions at 70% 1-RM, 2-min rest between sets (G1), b) Low-intensity RT: 4 sets, 14 repetitions at 30% 1-RM, 2-min rest between sets (G2), or c) Inactive control (G3). Before and following the experimental intervention, participants completed a comprehensive battery of cognitive tests assessing processing speed, visuospatial processing, executive function and cognitive control, working memory and immediate memory. Following a familiarization phase to RT exercises, participants in G1 and G2 performed 1-RM needed to define the exercise intensity. The intervention session consisted of the cognitive battery tests and five-minute warm-up on a stationary bicycle, followed by the exercise training protocol (knee extension, chest press, knee flexion, seated row, leg press, biceps curl). Immediately after finishing, the cognitive post-test was applied. The control group remained seated on a chair for 30-min and then performed the post-test. A two-way (group x measurement) ANCOVA was carried out using education level as a covariate. **RESULTS:** Significant improvements were found on visuospatial processing in G1 (Pre = 61.6 ± 2.1 vs. Post = 69.7 ± 2.4 pts.; CI95% = 4.8, 11.4; p ≤ 0.001) and G2 (Pre = 62.4 ± 2.2 vs. Post = 67.0 ± 2.5 pts.; CI95% = 1.2, 8.1; p = 0.009). Processing speed, executive function and cognitive control, working memory and immediate memory were unchanged by acute exercise or rest. **CONCLUSION:** Acute RT enhanced or maintained cognitive performance in older adults. Repetitive acute bouts of RT might chronically improve or retard the aging effects on cognitions in older adults.

**218** Board #56 May 29 11:00 AM - 12:30 PM  
**Does the Physiological Tremor Identify the Intensity of Resistance Exercise?**

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(No relevant relationships reported)

Although the various methods are commonly used to predict the intensity of aerobic exercise, there is a lack of information on resistance exercise intensity.

**PURPOSE:** Accordingly, the primary purpose of this study was to determine whether the physiological tremor assessed by accelerometer could recognize the intensity of resistance exercise. **METHODS:** Twenty healthy young men (23.8 ± 0.7 years; mean ± SEM) who have not experienced resistance exercises, were recruited for this study. A variety of intensity (resting, 30%, 50%, and 70% of their predetermined one-repetition maximum (1-RM)) of arm-curl exercise was used to reveal physiological tremor. Total work was held equally by varying the number of repetitions with 5 sets during each of the intensities. The session of intensities was performed in random order with at least a week of wash-out period. The physiological tremor responses were recorded during exercise using accelerometers (3-axis) attached at the dominated wrist and left ear. Also, electromyography (EMG) data were collected from the biceps brachii muscle during the exercise. Physiological tremor and EMG data were shown as average root mean square index.

**RESULTS:** As we expected, EMG amplitude increased significantly (0.01 ± 0.001 mV, 0.40 ± 0.02 mV, 0.70 ± 0.04 mV, and 1.03 ± 0.05 mV in resting, 30%, 50%, and 70% of RM, respectively, P<0.01) as the intensity of exercise increased. Physiological tremor amplitude significantly increased as the intensity of exercise increased (wrist; 0.008 ± 0.001 m×s<sup>-2</sup>, 0.08 ± 0.002 m×s<sup>-2</sup>, 0.09 ± 0.002 m×s<sup>-2</sup>, and 0.09 ± 0.004 m×s<sup>-2</sup> in resting, 30%, 50%, and 70% of RM, respectively, P<0.01, ear; 0.01 ± 0.001 m×s<sup>-2</sup>, 0.03 ± 0.01 m×s<sup>-2</sup>, 0.05 ± 0.002 m×s<sup>-2</sup>, and 0.07 ± 0.004 m×s<sup>-2</sup> in resting, 30%, 50%, and 70% of RM, respectively, P<0.01). EMG amplitude was significantly related to physiological tremor (r=.632 and r=.649 in wrist and ear, respectively, P<0.01).

**CONCLUSION:** To our knowledge, this is the first study to suggest the physiological tremor could be an index of the intensity of resistance exercise.

**219** Board #57 May 29 11:00 AM - 12:30 PM  
**The Comparison of Velocity between Front Squat, Back Squat, Sumo and Conventional Deadlift**

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(No relevant relationships reported)

Average concentric velocity (ACV) during barbell exercises varies inversely as a function of load and can be used for determining training loads. It is unclear if ACV differs between variations of similar lifts such as the conventional deadlift (CD) and sumo deadlift (SD) or between the front squat (FS) and back squat (BS). **PURPOSE:** To compare ACV, peak concentric velocity (PCV), and range of motion (ROM) between the FS and BS and between the CD and SD. **METHODS:** In a randomized order, nine participants (N=9; age: 22±4) underwent one-repetition maximum (1RM) testing for the FS, BS, CD, and SD. The open barbell system was used to measure ACV, PCV, and ROM during the 1RM protocol. During the first testing session, height, body mass, femur and humerus length were measured; training age, frequency of training, and estimated 1RM were obtained via questionnaire. Paired samples t-tests were used to determine differences in ACV, PCV, and ROM between the between the FS and BS and between the CD and SD. **RESULTS:** Paired samples t-tests indicated no differences between the 1RM FS and BS for: ACV (0.24±0.06 vs 0.25±0.06 m/s; p=0.930), PCV (0.66±0.11 vs 0.66±0.16 m/s; p=0.969), or ROM (0.49±0.06 vs 0.51±0.11 m; p=0.819). For the SD and CD there were no differences in ACV (0.27±0.11 vs 0.26±0.08 m/s; p=0.691) or PCV (0.55±0.19 vs 0.51±0.13 m/s; p=0.445) but significant differences were observed in ROM (0.48±0.06 vs 0.53±0.05 m; p=0.015). **CONCLUSIONS:** Despite a lower ROM for the SD compared to the CD, bar velocity is similar at maximal loads (e.g. 1RM). If using velocity to determine training loads, these data suggest that the same velocity ranges for regulating training loads could be used for the SD and CD as well as for the FS and BS.

- 220** Board #58 May 29 11:00 AM - 12:30 PM  
**The Effects of Eccentric Duration on Squat and Bench Press Concentric Performance**  
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Many resistance training exercises incorporate both eccentric and concentric phases of muscle contraction. Through the stretch shortening cycle, the velocity and magnitude in which the eccentric phase is completed directly affects performance during the concentric phase. **PURPOSE:** Therefore, the purpose of this research was to investigate the effects of eccentric phase duration on concentric outcomes at 60% and 80% of one-repetition maximum (1RM) in the back squat and bench press. **METHODS:** Sixteen resistance-trained males (Age: 23.25±2.57yrs, Height: 171.82±7.48cm, Body Mass: 81.96±12.16kg) completed four laboratory visits as follows: Day 1- 1RM testing; Day 2- establishment of normative eccentric durations; Days 3 and 4- randomized fast (0.75 times) or slow (2.0 times) eccentric duration conditions, which were controlled by visual and auditory metronomes. Outcome measures assessed during the concentric phase were: average concentric velocity (ACV), peak concentric velocity (PCV), rating of perceived exertion (RPE), range of motion (ROM), and barbell path. A one-way ANOVA and Pearson's Product Moment correlations were used for analysis with significance set at  $p \leq 0.05$ . **RESULTS:** Eccentric duration was significantly and inversely correlated with average concentric velocity (ACV) at 60% ( $r = -0.408$ ) and 80% ( $r = -0.477$ ) of 1RM squat and at 100% ( $r = -0.604$ ) of 1RM bench press. At 60% of 1RM squat, both fast and slow eccentric conditions produced greater ( $p < 0.001$ ) peak concentric velocity (PCV) than normative duration with fast also producing greater PCV than slow ( $p = 0.044$ ). Eccentric duration had no impact on RPE, ROM, or barbell path. **CONCLUSIONS:** Therefore, our results show that well-trained athletes performing a deliberately faster eccentric phase may enhance squat and bench press performance. However, caution should be used when interpreting these results as athletes who already perform a fast eccentric duration may not benefit from deliberately increasing eccentric velocity.

- 221** Board #59 May 29 11:00 AM - 12:30 PM  
**Workout-Life Balance: How Psychological Stress Affects Force Production in Competitive Powerlifters and Healthy Controls**  
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 (No relevant relationships reported)

Powerlifters often focus more on physiological stresses of programming and performance than psychological stress. However, total allostatic load could influence the capacity to generate force. Understanding this relationship can give coaches and athletes tools to optimize workout-life balance. **PURPOSE:** To determine the effect of psychological stress on force production in distinct populations. **METHODS:** Competitive powerlifters (PL) and recreationally active college students (RA) were tested. The RA group consisted of 10 men and 13 who performed knee extension and flexion at 2 time points using a Cybex dynamometer. Once during an academic respite and once during exams. Psychological stress was assessed with a 10-Point Cohen Perceived Stress Scale Questionnaire. Linear regression measured the effect of psychological stress on peak force. The PL group consisted of 26 men and 8 women competing in the 2018 USAPL Raw Nationals. The day before the competition, all athletes were interviewed; peak and expected performances and 10-point stress were recorded. Linear regression tested the effect of stress on the difference between expected and achieved performances. **RESULTS:** In the RA group, between the 2 time points, men produced 257.5 ± 68.9 ft-lbs of torque for flexors and extensors summed; women produced 213.5 ± 26.6 ft-lbs ( $p = 0.082$ ). Holding bodyweight constant, stress did not affect peak torque at time point 1 ( $p = 0.217$ ) or 2 ( $p = 0.506$ ), and change in stress did not affect change in force output ( $p = 0.640$ ). Sex was insignificant in all analyses and no relationships emerged when evaluating flexors or extensors separately. In the PL group, the summation of bench press, squat, and deadlift was 625.4 ± 74.4 kg in men and 377.8 ± 79.5 kg in women ( $p < 0.001$ ). In the regression analysis ( $R^2 = 0.325$ ;  $p = 0.003$ ), holding weight class constant, the deficit precipitated by psychological stress was 3.4 kg per point ( $p = 0.006$ ; 95% CI: -5.69 to -1.06). Results were stronger for women ( $R^2 = 0.824$ ;  $p = 0.013$ ); holding weight class ( $p = 0.032$ ) constant, each additional point of stress predicted a 4.8 kg reduction in performance ( $p = 0.005$ ; 95% CI: -7.43 to -2.27). **CONCLUSION:** Psychological stress does not impair strength performance among untrained individuals. However, stress management may be critical for strength athletes, particularly women.

- 222** Board #60 May 29 11:00 AM - 12:30 PM  
**A Three-Dimensional Assessment of Push-Pull Power Ratios Across Various Loads**  
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 (No relevant relationships reported)

Capturing a true assessment of power in upper body motions is problematic owing to difficulty reproducing a testing environment that matches kinematic profiles performed in sport. New technology permits more accurate reflections of three-dimensional power in isotonic environments. **PURPOSE:** To quantify power ratios of single-arm press and pull exercises across various loads. **METHODS:** 64 subjects performed a total of 1,145 sets on Proteus (Boston Biomed, Inc.): 570 sets of single-arm horizontal presses and 575 sets of single-arm horizontal rows. All subjects performed both exercises. Three-dimensional magnetic resistance was applied at 5, 10, 15, 20 and 25lb. ANOVA tested the subjects' kinematic profile across loads. **RESULTS:** On average, across all sets, maximum power per set was 175.2 ± 103.0 for presses and 183.6 ± 108.5 for pulls. For mean power throughout a set, subjects achieved 159.5 ± 96.3 for presses and 168.2 ± 102.5 for pulls. The different loads had significant differences for maximum ( $p < 0.001$ ) and mean ( $p < 0.001$ ) power; the higher the load, the higher the value in each measurement. At a 5lb load, maximum power (presses and pulls combined) was 31.7 ± 10.8; at a 25lb load, it was 366.4 ± 96.0. Similarly, for mean power, at 5lb, subjects achieved 26.8 ± 10.2 while at 25lb, it was 335.1 ± 92.0. Dominant and non-dominant arms were similar in maximum ( $p = 0.497$ ) and mean power ( $p = 0.530$ ) although overall, pulling was stronger than pushing. Across all sets and loads, push-to-pull ratio was 0.95:1 for both maximum and mean power. This ratio changes at different loads. For peak power, at 5lb, the push-to-pull ratio was 1.22:1. At 10lb, it was 0.99:1. At 15lb, it was 0.98:1. At 20lb, it was 0.95:1. At 25lb, it was 0.94:1. For mean power, the same pattern, though slightly more extreme, was found. **CONCLUSIONS:** Numerous investigations have quantified ideal force ratios of the knee while similar assessments of the upper limbs have received relatively little attention. New technology provides a systematic approach to measure strength ratios of the shoulder and elbow in three-dimensional space. In this context, strength ratios change with load; push power exceeds pull power at low loads whereas the inverse is true at higher loads. These strength ratios may be considered for sport application and recognition of risk for upper limb injury.

- 223** Board #61 May 29 11:00 AM - 12:30 PM  
**Correlations Between Resistance Exercise Repetitions Achieved At 60% And 80% 1rm Load In Female Subjects**  
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To determine the appropriate load for resistance training (RT), exercise professionals (EPs) commonly have clients complete one repetition maximum testing (1RM). Then, submaximal loads can be easily calculated for RT sessions. A higher load (approximately 80% 1RM) is chosen if lower repetitions (reps) are desired (~ 10 reps) and a lower load (approximately 60% 1RM) is chosen if higher reps are desired (~ 20 reps). However, the number of reps generated (at both low and high loads) varies quite dramatically in standard populations. It is important to determine if there are strong relationships between the number of reps generated at lower and higher loads. The hypothesis is that individuals tend to perform similarly at different loads (i.e. generate above average reps at both loads or below average reps at both loads). However, this topic has not been thoroughly studied. **PURPOSE:** Determine correlations between RT reps achieved at 60% 1RM load and 80% 1RM load. This will help us understand if the number of reps generated at lower loads predicts the number or reps generated at higher loads. **METHODS:** Participants were 19 college-aged (25 ± 4.3 years) females with a minimum of 2 months RT experience. Three exercise sessions were completed under the supervision of certified EPs. For session one, 1RM testing was completed. For sessions two and three, participants completed as many reps as possible for 60% 1RM or 80% 1RM (load and order was randomized) for 8 cam-mediated variable resistance training exercises. For all 8 exercises, Pearson correlation was used to assess the strength of the relationship between the two loads. **RESULTS:** The reps generated at 60% 1RM and 80% 1RM and correlations between the two were determined for the following 8 exercises: bench press (8.2±3.4 reps to 18.3±4.2 reps;  $r = 0.51$ ), leg press (17.9±5.0 reps to 37.3±15.9 reps;  $r = 0.63$ ), shoulder press (7.8±2.5 reps to 13.6±3.5 reps;  $r = 0.59$ ), pull-down (10.3±2.1 reps to 24.1±8.3 reps;  $r = 0.05$ ), knee extension (11.4±4.7 reps to 17.3±5.8 reps;  $r = 0.71$ ), knee flexion (12.4±4.5 reps to 23.4±6.7 reps;  $r = 0.74$ ), elbow extension (12.5±5.0 reps to 23.0±10.3 reps;  $r = 0.63$ ), and

elbow flexion (9.9±5.4 reps to 17.3±6.4 reps;  $r = 0.86$ ). **CONCLUSIONS:** EPs should understand that correlations between repetitions achieved at different loads tend to be moderate.

**224** Board #62 May 29 11:00 AM - 12:30 PM  
**Prioritization of Resistance Training in NCAA Division I Track and Field Athletes**

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(No relevant relationships reported)

**PURPOSE:** Resistance training is a powerful systemic stimulus known to improve a multitude of physiological variables. These include but are not limited to musculoskeletal strength, power, muscle mass, bone mass, and connective tissue. The sport of track and field is composed of many different events that focus on strength, power, and muscular endurance. Therefore resistance training is typically a vital part of athletic preparation for track and field athletes. The purpose of this study was to investigate specific manipulations of the acute program variables within the off-season resistance training program. **METHODS:** 34 NCAA Division I track and field student-athletes men participated in 12 week mesocycle of a non-linear periodized training program between the months of September and December. Groups were separated by needs of their athletic event and thus, performance primary goals (Group 1 (*Power*):  $n=12$ , age: 20.1±1.10, body mass: 87.8±13.3 kg; Group 2 (*Local Muscular Endurance*):  $n=12$ , age: 21.1±1.10, body mass: 82.9±10.4 kg; Group 3 (*General Strength*):  $n=10$ , age: 18.9±0.8, body mass: 80.4±8.1 kg). The training groups prioritized resistance loads and volume for development of power, local muscular endurance, and general strength, respectively. Performance variables were assessed at the beginning and end of this training program and consisted of counter movement vertical jump with arm swing, 1-repetition-maximum in the barbell bench press, and barbell back squat. **RESULTS:** The primary findings of this investigation are Group 1 saw significant ( $p \leq 0.05$ ) statistical increases in vertical jump (4.4±1 cm), and back squat maximum (13.1±3.6 kg). Group 2 saw significant ( $p \leq 0.05$ ) statistical increases in bench press maximum (14.2±0.5 kg), and back squat maximum (15.0±0.6 kg). Group 3 saw significant ( $p \leq 0.05$ ) statistical increases in vertical jump (4.7±0.7 cm) and maximum back squat (20.0±5.0 kg). **CONCLUSIONS:** Our data indicate that the prioritization of strength within a 12 week mesocycle in the off-season training program had the best effect on the performance variables that were needed by each group. It appears that multiple stressors of the academic school year and athletic preparation are better mediated with a type of non-linear flexible program for competitive NCAA Division I track and field athletes.

**225** Board #63 May 29 11:00 AM - 12:30 PM  
**Optimal Load Based on Body Mass: A Pilot Study with The Hang Power Clean**

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A key factor for success in sports is the athletes' capacity of producing mechanical power output. Implementation of weightlifting derivatives such as the hang power clean (HPC) in training programs have been utilized and substantial increases in muscle power are reached when the athletes train at the load in which they produce the peak power output, also defined as the optimal load. The optimal load is commonly determined as a relative percentage of the maximum weight one can lift a single time during a specific exercise, defined as the 1-repetition maximum (1RM) for that exercise. Given the disadvantages of 1RM tests utilization such as risk of injuries and excessive amount of time required for those assessments, it has become apparent the need for alternative strategies for the optimal load identification. **PURPOSE:** To estimate the optimal load of the HPC from body mass (BM) percentages. **METHODS:** Nine healthy young men (age: 21.3 ± 1.8, height: 174.6 ± 6.8 cm, weight: 80.6 ± 6.2 kg, 1RM HPC: 90.8 ± 9.6 kg, 1RM to weight ratio: 1.13 ± 0.07) participated in this study. Subjects performed a 1RM in the HPC in the first session and during the second session the peak power was calculated across loads of 30, 40, 50, 60, 70, 80, and 90% of their BM in the HPC in a randomized order. **RESULTS:** Our results showed significant differences among the power output and the percentages of the BM. Briefly, power output at 30% of the BM was similar in relation to 40% and 50% of the BM, whilst significantly lower than 60%, 70%, 80% and 90% of the BM. For 40% of the BM, it was observed similar result in relation to 50% of the BM, whilst results significantly lower than 60%, 70%, 80% and 90% of the BM. For 50% of the BM, similar result it was observed only 60% of the BM, while lower power output it was observed in comparison to 70%, 80% and 90% of the BM. For 60% of the BM, lower

power output was observed when compared to 70%, 80% and 90% of the BM. Finally, no significant differences were observed between 70% and 80% and 90% of the BM, as well as 80% and 90% of the BM. **CONCLUSION:** Our results indicate that the optimal load based on BM for HPC exercise occurs at 70%, 80% and 90% of the BM.

**226** Board #64 May 29 11:00 AM - 12:30 PM  
**Comparing Relative Attempt Progressions Of Elite Male And Female Raw Powerlifters**

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(No relevant relationships reported)

**PURPOSE:** In powerlifting, each lifter is given 3 attempts to contest the back squat (BS), bench press (BP), and deadlift (DL). The summation of the best valid attempt for each discipline constitutes a powerlifting total (PT). However, little information is available regarding attempt selection strategies to maximize PT. Therefore, the purpose of this study was to determine and compare the magnitude of load progression from one attempt to the next for each lift between elite raw male and female powerlifters. **METHODS:** Data used in this study was retrieved from the International Powerlifting Federation (IPF) online database for all Classic World Championships from 2012-2018. Males ( $n=65$ ) and females ( $n=41$ ) from all weight classes who completed 9 out of 9 lifts successfully were included in the analysis. A Welch's *t*-test was used to compare relative attempt progressions (percent increase from attempt 1 to 2 and 2 to 3) between males and females for all lifts with alpha level set at  $p \leq 0.05$ . **RESULTS:** Relative attempt progression was similar between females (6.08±2.11%) and males (5.59±1.80%) from attempt 1 and 2 on BS and from attempt 2 to 3 on DL (females: 4.33±2.01%; males: 3.75±1.84%). However, relative attempt progression was greater for females compared to males between attempt 1 and 2 on BP (6.50±2.10% vs 5.35±2.18%,  $p=0.008$ ) and DL (6.76±4.19% vs 5.40±2.28%,  $p=0.03$ ), and between attempt 2 and 3 on BP (4.28±1.74% vs 2.85±1.24%,  $p<0.001$ ) and BS (4.04±1.89% vs 3.31±1.43%,  $p=0.03$ ), respectively. **CONCLUSIONS:** These data indicate that successful elite male powerlifters are on average more conservative with their attempt progressions for each lift than females. This may be due to differences in opening attempt selection or perceived effort during subsequent attempts between males and females. Importantly, these findings provide general attempt progression guidelines for coaches working with elite raw (i.e., classic) male and female powerlifters.

**A-41** Free Communication/Poster - Biomechanics of Resistance Training

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
Room: CC-Hall WA2

**227** Board #65 May 29 11:00 AM - 12:30 PM  
**Validity of the Two-Point Method for Estimating Squat and Bench Press One Repetition Maximums**

Brandon W. Snyder, Dylan S. Zangakis, Gavin L. Moir, Shawn N. Munford, Shala E. Davis, FACSM. East Stroudsburg University, East Stroudsburg, PA. (Sponsor: Shala Davis, FACSM)  
(No relevant relationships reported)

**PURPOSE:** To assess the validity of the two-point method for estimating one repetition maximums (1RM) in the squat and bench press exercises with varied pairs of loads. **METHODS:** Thirteen resistance-trained men (age: 21.7±0.4 years; height 1.74±0.07 m; mass: 82.9±9.5 kg; 1-repetition maximum (1RM) back squat: 149.9±20.7 kg; 1RM bench press: 114.8±18.5 kg) performed three trials of squat and bench press using the following percentages of 1RM: 20, 30, 40, 50, 60, 70, 80%. The order of the loads was counterbalanced across the participants. The mean vertical velocity of the barbell during the concentric phase of each repetition was recorded using a 3-D motion analysis system (Vicon; 200 Hz). Varied loading pairs (20% & 80%, 30% & 70%, 40% & 50%, 40% & 70%) were selected and regressions were created to estimate 1RMs. Analysis of variance was used to compare differences between the measured and estimated 1RMs for the squat and bench press. **RESULTS:** No significant differences were found ( $p>0.05$ ) between estimated and measured 1RMs despite large range of mean differences in the squat (MD: 6.45 kg-27.47kg) and bench press (MD: 1.09 kg-4.32kg). **CONCLUSION:** The two-point method represents a useful means of estimating 1RM during the back squat and bench press exercises without inducing the fatigue associated with directly measuring 1RM. However, individualized force-velocity characteristics should be considered when utilizing the two-point method for estimating a 1RM.

228 Board #66 May 29 11:00 AM - 12:30 PM

**The Influence of Trunk and Tibia Orientation on the Hip/Knee Extensor Moment Ratio During Squatting**

Adam J. Barrack, Rachel Straub, Jordan Cannon, Christopher M. Powers, FACSM. *University of Southern California, Los Angeles, CA.* (Sponsor: Christopher M Powers, FACSM)  
(No relevant relationships reported)

The squat is a common and versatile exercise in both the rehabilitation and sports performance settings. Sagittal plane trunk and shank orientations have been theorized to modulate extensor moments at the hip and knee during squatting. For example, increasing trunk inclination is thought to increase the extensor moment at the hip and decrease the extensor moment at the knee, while increasing shank inclination has been theorized to increase the knee extensor moment and decrease the hip extensor moment. Although the influence of sagittal plane tibia and trunk orientations on hip and knee extensor moments have been established in computational models, experimental validation in human subjects is lacking. **Purpose:** To determine the influence of sagittal plane trunk and shank orientations on hip and knee extensor moments during the lowering phase of a barbell back squat. **Methods:** Kinematic and kinetic data were obtained from 8 male and 8 female participants during the execution of 8 different squat conditions in which the tibia and trunk orientations were manipulated. Foot position, bar position, bar load, and stance width were controlled across subjects. Inverse dynamics equations were used to calculate the hip/knee extensor moment ratio at 60, 90, and 120 degrees of knee flexion. Linear regression was used to evaluate the association between the difference in the sagittal plane trunk and tibia angles and the hip/knee extensor moment ratio at each knee flexion angle of interest. **Results:** The difference between trunk and shank inclination explained 67%, 71%, and 67% of the variance in the hip/knee extensor moment ratio at 60 degrees ( $p < 0.001$ ), 90 degrees ( $p < 0.001$ ), and 120 degrees ( $p < 0.001$ ) of knee flexion, respectively. Across all of the examined depths, the squat was deemed to be hip extensor biased (hip/knee extensor moment ratio  $> 1.0$ ) when the sagittal plane trunk angle exceeded the sagittal plane shank angle. **Conclusion:** The relationship between sagittal plane trunk and shank orientation can function as an acceptable inference as to whether a particular squat technique is hip extensor biased or knee extensor biased.

229 Board #67 May 29 11:00 AM - 12:30 PM

**Differences In Maximal Force Production Of The Squat And Knee Extension With Different Verbal Commands**

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(No relevant relationships reported)

It is suggested that verbal commands influence the ability to produce peak force during maximal voluntary isometric contractions (MVC). When determining peak force capabilities during MVC it is recommended to use the verbal command, as "hard" as possible. Additionally, when instructing conditions to achieve maximal rate of force development (RFD), using the verbal command as "fast" as possible. **PURPOSE:** To examine the influence of two different verbal commands on peak force production during MVC's performed during the squat (SQ) and knee extension (KE) exercises. **METHODS:** Twenty-five lower-body resistance trained males ( $n = 16$ , mean  $\pm$  SD;  $24 \pm 3$  yrs;  $88.08 \pm 11.09$  kg;  $175 \pm 7$  cm) and females ( $n = 9$ ,  $23 \pm 4$  yrs;  $62.53 \pm 6.84$  kg;  $164 \pm 7$  cm) performed two separate MVC during both SQ and KE exercises. Knee joint angles were set at  $110^\circ$  during both exercise conditions, and hip angle was  $\sim 110^\circ$  during SQ and  $\sim 105^\circ$  during KE. During both exercise conditions, peak force (N) was measured using an S-beam load cell. Throughout both exercise conditions, subjects performed MVCs under two different verbal command to; 1.) determine maximal force capabilities, subject were verbal instructed to push as "hard" as possible, and 2.) determine maximal RFD capabilities, subjects were instructed to push as "quick" as possible. **RESULTS:** One-way repeated measures analysis of variance indicated that, when instructed to push as "quick" as possible compared to as "hard" as possible, peak force was significantly higher during both the SQ (mean  $\pm$  SE;  $2258.11 \pm 131.01$  N vs  $2094.33 \pm 123.58$  N) and KE ( $785.90 \pm 49.03$  N vs  $757.45 \pm 47.04$  N) conditions ( $P < 0.05$ ). **CONCLUSION:** Contrary to previous recommendations, these findings indicate that during isometric SQ and KE exercises, performed at the same knee joint angle, peak force is greater when specifically instructed to produce maximal force MVCs as "quick" as possible vs as "hard" as possible.

230 Board #68 May 29 11:00 AM - 12:30 PM

**Validity of Barbell Velocities Recorded from the GymAware Device during Squat and Bench Press Exercises**

Dylan S. Zangakis, Gavin Moir, Brandon Snyder, Shawn Munford. *East Stroudsburg University of Pennsylvania, East Stroudsburg, PA.* (Sponsor: Dr. Shala Davis, FACSM)  
(No relevant relationships reported)

**Purpose:** To assess the validity of the GymAware linear position transducer (LTP) during the squat and bench press exercises. **Methods:** Thirteen resistance-trained men (age:  $21.7 \pm 0.4$  years; height  $1.74 \pm 0.07$  m; mass:  $82.9 \pm 9.5$  kg; squat 1RM:  $149.85 \pm 20.68$  kg; bench 1RM:  $114.77 \pm 18.47$  kg.) performed three trials of squat and bench press using the following percentages of a one repetition maximum (1RM): 20, 30, 40, 50, 60, 70, 80%. The order of the loads was counterbalanced across the participants. The mean vertical velocity of the barbell during the concentric phase of each repetition was recorded using a 3-D motion analysis system (Vicon; 200 Hz) and the GymAware LTP. Analysis of variance was used to assess the differences in the vertical velocities across the seven load conditions for each of the two exercises. **Results:** Mean velocities were significantly different between devices for both the squat and bench press exercises ( $p < 0.05$ ). Specifically the GymAware LTP provided significantly greater velocities under the 20% 1RM and 40% 1RM load conditions in the squat exercise (mean differences:  $0.05 \pm 0.03$  m/s;  $0.02 \pm 0.02$  m/s;  $p < 0.05$ ) in addition to the 30% 1RM load for the bench press exercise (mean difference:  $0.04 \pm 0.02$  m/s;  $p < 0.05$ ). **Conclusion:** The GymAware LTP had a tendency to overestimate barbell velocities during the squat and bench press exercises when compared to the Vicon 3-D motion analysis system, particularly at the lighter loads. Such differences may bring into question the validity of the force-velocity characteristics derived from the LTP device during these resistance exercises.

231 Board #69 May 29 11:00 AM - 12:30 PM

**Influence of Heart Rate Variability Variables in Half Squat Performance in Female Athletes**

María Alejandra Sastoque Hernández<sup>1</sup>, Diana Carolina Camacho Serna<sup>1</sup>, Jorge Mario Cabrera Garavito<sup>1</sup>, Jaime Alfredo Albarracín Trujillo<sup>2</sup>, Camilo Ernesto Povea Combariza<sup>1</sup>, Rodrigo Esteban Argotho Bucheli<sup>3</sup>, Natalia María Rodríguez Zárate<sup>4</sup>.  
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(No relevant relationships reported)

The search of non-invasive and easy-to-monitor variables is essential to improve the athlete performance. The assessment of neuromuscular characteristics, such as velocity, with a linear position transducer (LPT), allows training optimization and just like heart rate variability (HRV) guarantees an adequate athlete monitoring. The autonomic nervous system (ANS) and Sympathetic nervous system (SNS) exert an important influence on skeletal muscle functions. However, there are no studies that correlate the activity of SNS with current technologies such as LPT to calculate several neuromuscular performance variables. Otherwise, the results of HRV assessment could be related to a TLP strength test performance.

**PURPOSE:** The aim of this study is to find correlations between HRV variables and TLC variables during a half squat movement in young female soccer players. **METHODS:** Thirteen professional female soccer players were tested (Age  $20.7$  years  $\pm 2.62$ , Weight  $60.9$  kg  $\pm 4.4$ ), we analyzed HRV during standing, we also evaluated the velocity of a half squat movement with a LPT, during a maximal strength test, statistical analyses were performed to determine associations. **RESULTS:** Associations were found between Stress index during standing position and Mean acceleration to Maximal velocity (m/s) ( $R^2$   $0.3115$   $P$   $0.0381$ ), Mean velocity ( $R^2$   $0.3284$   $P$   $0.0322$ ), Propulsive mean velocity ( $R^2$   $0.3189$   $P$   $0.0354$ ). **CONCLUSIONS:** Stress Index (SI) is a variable that reflects sympathetic activation and suggest autonomic reactivity to stress situations indicating an adequate response to confront the demands presented by the sport. Thus, an abnormal sympathetic predominance could result in chronic fatigue which would evince a SI higher elevation, giving the index greater value. According to our findings the SI during standing position correlated with velocity and acceleration variables during half squat, this suggests that adequate sympathetic reactivity could contribute to the improvement of neuromuscular variables. We hypothesized that SI could be a simple non-invasive way to measure sympathetic reactivity in sports, being part in assessment and monitoring of performance. We also suggest that interventions aimed to improve sympathetic reactivity could improve neuromuscular performance.

**232** Board #70 May 29 11:00 AM - 12:30 PM  
**Reliability of Barbell Velocities Recorded from the GymAware Device during Squat and Bench Press Exercises**

Shawn N. Munford, Dylan S. Zangakis, Gavin L. Moir, Brandon W. Snyder, Shala E. Davis, FACSM. *East Stroudsburg University, East Stroudsburg, PA.* (Sponsor: Shala E Davis, FACSM)

(No relevant relationships reported)

**PURPOSE:** To assess the reliability of velocities recorded with the GymAware linear position transducer (LTP) during the squat and bench press exercises. **METHODS:** Thirteen resistance-trained men (age: 21.7±0.4 years; height 1.74±0.07 m; mass: 82.9±9.5 kg; 1-repetition maximum (1RM) back squat: 149.9±20.7 kg; bench 1RM: 114.8±18.5 kg.) performed three trials of squat and bench press using the following percentages of 1RM: 20, 30, 40, 50, 60, 70, 80%. The order of the loads was counterbalanced across the participants. The mean vertical velocity of the barbell during the concentric phase of each repetition was recorded using a 3-D motion analysis system (Vicon; 200 Hz) and the GymAware LTP. Reliability of the GymAware was determined using intraclass correlations (ICC) and coefficients of variance (CV%). **RESULTS:** The GymAware showed high intersession reliability for both exercises with ICCs ranging from good to excellent (squat: 0.71-0.91; bench press: 0.83-0.91). CV% showed precision in the recorded velocities during both exercises (squat: 3.6%-5.8%; bench press: 4.9%-7.4%). **CONCLUSION:** The GymAware LTP shows high intersession reliability for recorded velocities during the squat and bench press exercises.

**233** Board #71 May 29 11:00 AM - 12:30 PM  
**Comparison of Pre-stretch and Reactive Strength Between Men and Women During Bench Press**

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(No relevant relationships reported)

Pre-stretch augmentation (PAI) and reactive strength (RSI) indices have been used to assess the stretch-shortening cycle (SSC) contribution to vertical jumping. SSC activation is also a part of many upper extremity (UE) activities, however quantification of SSC contribution to UE function largely remains unknown. Furthermore, based on differences in UE muscle-tendon properties, the SSC effect is likely different between men and women

**PURPOSE:** To compare UE PAI and RSI indices between men and women. **METHODS:** 20 men (26±2.4 yrs) and 17 women (21.4±2.6 yrs) with >6 months of UE resistance training completed 3 bench press trials using 2 styles, pure concentric (PC) and rebound (RB) (no pause between eccentric the concentric phases), using 75% of their one repetition maximum. Participants were instructed to complete the concentric phase as quickly as possible. Concentric phase vertical average force (AF) and power (AP) were computed from barbell kinematic data and used to calculate PAI [(RB-PC)/PC\*100] and RSI (RB-PC). Independent t tests, adjusted for unequal variances, were conducted to compare indexes between sexes

**RESULTS:** Except for one man and one woman, participants demonstrated greater AF and AP during the RB bench press compared to PC bench press. Men (.49±.38) had significantly higher (P=.004, d=.75) AF PAI than the women (.27±.17). There was no significant (P=.068, d=.64) sex difference for AP PAI. Men (AF:3.9±2.9, AP:129.0±56.7) demonstrated significantly higher RSI for both AF (P<.001, d=1.5) and AP (P<.001, d=2.3) than women (AF:.76±.54, AP: 29.6±18.1).

**CONCLUSIONS:** Except for two participants, as expected, preceding the concentric phase with SSC resulted in greater average force and power production. With the exception of AP PAI, SSC augmentation was greater for the men. Consistent with the RSI reflecting the AP/AF difference between RB and PC bench press styles, the sex comparison effects sizes were larger for the RSI than the PAI, which expresses the difference relative to the PC. Further research is needed to determine the extent to which UE muscle-tendon properties explain the sex differences identified.

**234** Board #72 May 29 11:00 AM - 12:30 PM  
**FEM Analysis of LumboSacral Joints on the Lift Barbell Preparation Phase**

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(No relevant relationships reported)

**PURPOSE:** The aim of this study was to analyze the stress characteristics of the lumboSacral segments of the preparation phase of barbell lifting using finite element method and to provide scientific and objective mechanical factors of lumboSacral joint injury in weightlifters for prevention and treatment of lumbar weightlifting injuries.

**METHODS:** The three-dimensional lumboSacral finite element model was established by reverse engineering method based on DICOM data (L5-S5 segments included). The Von Mises stress trends of lumboSacral bone, soft tissue such as intervertebral disc, ligament were analyzed between normal physiological activities during flexion, extension, left bend, right bend and preparation phase of barbell lifting.

**RESULTS:** The von Mises stress (mpa) of lifting weight condition respectively are 81.223,199.099,321.646,99.058,152.357,156.882,461.294,699.506,0,0,104.414,8.66,74.9,9.89.15 on posterior longitudinal ligament, left transverse process ligament, right lateral intercostal ligament, yellow ligament, interspinous ligament, spine on the ligament, left joint capsule ligament, right capsular ligament, left joint capsule contact stress, right joint capsule contact stress, end plate, nucleus, lumbar, sacrum.

**CONCLUSIONS:** The vertebral body is the main stress-bearing part during lifting and the intervertebral disc plays a major role in transmitting the load. Long-term repeated high-stress stimulation could cause slight fractures of cancellous bone and end-plate of vertebrae. Interspinous ligament bears more loads and is more likely to get injured compared to other ligaments. The imbalance of the left and right ligament force also reveals that minimizing spinal flexion and torsion compound action could reduce the possibility of ligament injury.

**235** Board #73 May 29 11:00 AM - 12:30 PM  
**Muscle Excitation During A Weighted And Unweighted Supine Bridge (a Pilot Study)**

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(No relevant relationships reported)

Previous studies have examined the relationship between muscle activities during a single leg bridge (SLB) without including the gluteus maximus muscle (Gmax). Similarly, few studies have evaluated the influence of additional loading during a SLB. **PURPOSE:** To examine muscle activation levels of the Gmax, semitendinosus (ST), and the biceps femoris long-head (BFL) during SLB, and weighted single leg bridge (wSLB). **METHODS:** Two recreationally active college students (1 male; 1 female) were recruited for the study and were free of any muscle or orthopedic injuries. Surface electromyography (sEMG) were used to collect muscle activities. Maximal voluntary contractions (MVC) were collected for each muscle group prior to testing. Each participant performed three repetitions of both SLB and wSLB, following a pattern of 60 beats per minute (~2 beats up, ~3 beat hold, and ~2 beats down) which was verified using an electronic metronome. Data was collected and analyzed using a commercially available sEMG package. MVCs of each muscle were used to normalize the observed peak sEMG during the exercise. Peak root mean square (RMS) was obtained for each muscle and the peak RMS in SLB was set to 100% to provide a means of comparison. Burst threshold was defined as 10% of the observed peak value. This value determined the onset and offset of the muscle excitation. **RESULTS:** There was a 37.0 +/- 1.7 average difference in magnitude between the two exercises. The duration of activity of the Gmax, BFL, and ST during the unweighted trials were 4.0 +/- 1.25 seconds, 3.5 +/- 0.75s and 4.2 +/- 0.45s, respectively. Muscle activity duration remained unchanged in the wSLB in the Gmax and STN. However, there was an increase in BFL activity during the wSLB trials (4.0 +/- 0.7s). **CONCLUSION:** In the male participant, it was concluded that the main muscle activated during the original single leg bridge and the weighted single leg bridge was BFL. However, for the female participant, the main muscle was the STN. Muscle activation of the hamstring muscles increased as a whole from the unweighted exercises to the weighted exercise. As well as the duration of BFL activity. This study is preliminary and will be conducted at a larger scale in the future to enhance credibility and reliability.

**236** Board #74 May 29 11:00 AM - 12:30 PM  
**The Influence of Menthol on Joint Range of Motion**

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(No relevant relationships reported)

**PURPOSE:** To use the known topical analgesic menthol to explore the influence of one's perception of muscle tension on joint range of motion (ROM).

**METHODS:** This study received approval from the Salem State University Institutional Review Board. In a familiarization session, 15 participants first completed weight-bearing lunge (WBLT) and active ankle dorsiflexion (AADF) tests (Pre-test) to assess ROM in the soleus-gastrocnemius complex. Participants were always instructed to stretch to a 'maximal tolerable stretch'. They immediately then completed a 6x60s static stretching routine for the ankle plantarflexors, and again completed the WBLT and AADF tests (Post-test). These testing conditions established a control (CONTROL). On two separate occasions participants returned to complete the aforementioned pre-tests, immediately after which they had 5mL of a 4% menthol gel (M) applied to their soleus-gastrocnemius complex on one visit, and on the other visit they had 5mL of a Placebo gel (P) spread over the same area. Participants then

underwent the stretching routine and post-tests as previously described. The following measures were made during each test: ROM, thermal sensation (TS), thermal comfort (TC), electromyography (EMG), and the Hoffman reflex (HR). A two-way RM ANOVA detected differences between time (Pre vs. Post), condition (CONTROL vs. M vs. P), and any interaction, with post-hoc testing used to indicate directionality ( $\alpha=0.05$ ).

**RESULTS:** Menthol significantly improved AADF ROM by 2.67 degrees compared to P ( $p<0.001$ ), coinciding with significantly cooler sensations ( $p<0.01$ ) and a loss of thermal comfort ( $p<0.05$ ) with menthol. Similarly, menthol improved WBLT ROM by 2.98 degrees compared to P ( $p<0.01$ ), coinciding with a significant loss of thermal comfort ( $p<0.05$ ) with menthol.

**CONCLUSION:** Menthol appears to improve active joint range of motion during stretches that are held to a maximal tolerable tension. This suggests that one's perception of tension per se, rather than actual muscle tension, may be more important in determining maximal active joint ROM. It is not clear whether menthol achieves this by specifically reducing one's perception of muscle tension during a maximal stretch, or whether other sensory inputs arising from menthol i.e. TS, TC, divert attention from it.

## A-42 Free Communication/Poster - Cycling

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
Room: CC-Hall WA2

### 237 Board #75 May 29 11:00 AM - 12:30 PM

#### Effect Of Chamois Design on Rider Comfort And Saddle Pressure During Sub-Maximal Cycling

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(No relevant relationships reported)

Previous research on the link between saddle pressure, rider comfort and urological disorders have focused predominantly on saddle design, bicycle setup and workload. Yet, the effect of chamois design on saddle pressure and perceived comfort during cycling in both men and women remains unresolved.

**PURPOSE:** In this study we investigated the effects of chamois design on perceived comfort and peak saddle pressure during seated sub-maximal cycling in men and women. **METHODS:** Eighteen subjects (9 M; 9 F) participated in two separate protocols, one laboratory- and one field-based. The laboratory protocol required subjects to ride at 2.5 W.kg<sup>-1</sup> for 5 minutes using either a new (A) or old (B) chamois design. Saddle pressure was captured for 30 seconds during each trial. At the conclusion of each trial, subjects were asked to rate the chamois on seven different comfort categories (Overall Comfort, Genital Sensation, Genital Comfort, Sit Bone Comfort, Buttocks Comfort, Stability on the Saddle, Off Saddle Comfort). The field protocol required subjects to complete one week of regular cycling training in each chamois design and were asked to complete the same comfort questionnaire at the end of each week. A repeated measures, two-way ANOVA was performed to test for main and interaction effects (Chamois x Sex) on saddle pressure and each comfort category in both the laboratory and field study.

**RESULTS:** The laboratory protocol resulted in a significant main effect of chamois design on 'Overall Comfort' (A>B,  $p<0.05$ ). The field protocol also resulted in a significant main effect of chamois design on 'Overall Comfort' (A>B,  $p<0.05$ ) as well as 'Buttocks Comfort' (A>B,  $p<0.05$ ). Peak saddle pressures were significantly higher in Chamois B than Chamois A (B=24.5±3.54 psi vs. A=23.06±3.53 psi,  $p<0.05$ ). There was a significant main effect of Sex on Genital Sensation and Genital Comfort (Males>Females,  $p<0.05$ ) under both laboratory and field conditions.

**CONCLUSIONS:** Chamois design is an important factor that affects both peak saddle pressure and perceived comfort for males and females during cycling. Innovation of future chamois designs should focus on providing individualized comfort for males and females. Further research is needed to investigate the possible link between chamois design and the development of urological disorders.

### 238 Board #76 May 29 11:00 AM - 12:30 PM

#### Effects of Bicycle Crank Length on Gross Efficiency, Power, and Joint Kinematics During Cycling Ergometry

Christiane R. O'Hara, Robert D. Clark, Kelly Bodwin, Cameron Swick, Natalie Grohmann, Austin Bohn, Ashley Shen. *California Polytechnic State University, San Luis Obispo, CA.* (Sponsor: Todd Hagobian, FACSOM)

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(No relevant relationships reported)

**PURPOSE:** To determine the effects of six different crank lengths (150, 165, 170, 172.5, 175, and 180 mm) on gross efficiency, maximum power, optimal pedaling rate (cadence at maximum power), and joint kinematics of the hip and knee.

**METHODS:** Elite level cyclists (n = 18) participated in two visits to the Cal Poly Cycling Lab. The purpose of the first lab session was to measure VO<sub>2</sub> peak (60.6 ± 7.6 mL·min<sup>-1</sup>·kg<sup>-1</sup>), participant characteristics (28.2 ± 5.3 yrs; 175.6 ± 7.4 cm; 70.5 ± 5.3 kg; 255 ± 105 km/week), and complete familiarization trials with four different crank lengths. These practice trials consisted of 4 second seated maximal sprints on the participant's original crank length (170, 172.5, or 175 mm) and three other crank lengths (150, 165, and 180 mm). The second test session was a single-blind randomized crossover design with the six different crank lengths. After a 5 minute warm up, participants performed a 3 minute steady state effort at 65% VO<sub>2</sub> peak and 90 rpm. This was followed by two maximum effort 4 second seated sprints with 90 seconds rest prior to each sprint. Participants rested for 5 minutes before the next crank length trial. **RESULTS:** During steady state cycling, shorter cranks had a higher gross efficiency (150 mm: 22.1%) compared to longer cranks (180 mm: 21.6%), ( $p < 0.001$ ). No significant differences were found between crank lengths for maximum power output during the 4 second sprints. There was an increase in optimal pedaling rate between 150 mm cranks (130 rpm) and all other lengths (180 mm: 120 rpm) ( $p < 0.001$ ). 150 mm cranks have a significantly smaller hip (45°) and knee (67°) range of motion than all other cranks measured (180 mm: hip 51°, knee 75°) ( $p < 0.001$ ). **CONCLUSIONS:** Shorter cranks resulted in a significantly higher gross efficiency, smaller knee and hip range of motion, and a higher optimal pedaling rate.

### 239 Board #77 May 29 11:00 AM - 12:30 PM

#### Analysis of Kinematics And Electromyography of Cyclists In The Length of Handling

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(No relevant relationships reported)

**PURPOSE:** The cyclist's accommodation on the bicycle is essential to avoid injuries and improve performance. The adjustment of the handlebar range of the bicycle can have similar or contrary effects to the horizontal adjustment of the saddle. The backward position generates pelvic anteversion, decreased hip angle, greater activation of the hamstring muscles, plantar flexors and greater tibio-femoral shearing force. On the other hand, the forward position of the saddle generates retroversion of the hip, increase in the angle of the knee, decrease in the activation of the hamstrings and increase of the strength in the quadriceps and can generate patello-femoral pain.

**PROPOSITION:** Evaluate the variations in muscular activity and joint ranges of the lower extremities in the cycle of pedaling, by changing the length of the handlebar reach in amateur cyclists

**METHODS:** Eight male cyclists (Age: 41.75 ± 10.08 years; Weight: 72.56 ± 5.53 Kg) of right predominance were measured. The hip, knee and ankle joint angles (three-dimensional kinematics) and muscle activity of the Biceps Femoral, Lateral Gastrocnemius, Lateral and Medial muscles (surface electromyography) and the adjustment of their bicycles in three handlebar lengths were recorded: a) preferred, b) advanced (preferred + 3 centimeters) and c) delayed (preferred - 3 centimeters). It was carried out two stress tests one of incremental load of maximum power and another of constant load to 57% of the maximum power at 90 rpm

**RESULTS:** A variance analysis (ANOVA) finding differences in the activation units of the left lateral gastrocnemius muscle in the preferred position vs. back (0.34 vs. 0.18,  $p = 0.042$ ) and between the position of the left hip at 150 ° between the forward vs. back position (96.64 vs. 101.20,  $P = 0.05$ ).

**CONCLUSIONS:** The modification of the handlebar ranges of the bicycle from the preferred position to the backward one, produces an increase in the angle of the hip generating pelvic anteversion. This variation is presented at 150 degrees of the cycle of pedaling in the transition from maximum power to that of the bottom dead center, with the decrease in the activation of the left lateral gastrocnemius muscle.

**240** Board #78 May 29 11:00 AM - 12:30 PM  
**Effects of Saddle Height and Workrate on Frontal Plane Knee Joint Biomechanics**

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Cycling is one of the most popular exercises for knee osteoarthritis (OA) or total knee replacement (TKR) rehabilitation. It is known for reduced loading to lower extremity joints compared to walking. One way to fit a bicycle to an individual is adjusting saddle height. There have been limited studies on effects of saddle height on frontal-plane knee joint loading.

**PURPOSE:** To determine the effects of saddle height and workrate on the knee joint biomechanics. **METHODS:** Fourteen experienced cyclists (age 50-70 years) were recruited from bicycle shops and clubs. Subjects participated in a single testing session that included six test conditions of three saddle heights at two workrates. Saddle heights were set at 20°, 30°, and 40° of knee flexion while the crank was at the bottom position. Workrate was electronically controlled at 80 and 120 watts. Three-dimensional kinematic (240 Hz, Vicon) and pedal reaction force (1200 Hz, Customized instrumented pedal) data were recorded for five successful cycles in each condition. Joint kinematics and kinetics were calculated and compared using a 3x2 ANOVA and paired t-tests with a Bonferroni correction. **RESULTS:** There were no significant interactions or saddle height main effect for peak knee abduction moment. There was a significant effect of saddle height on knee extension ROM, peak knee extension moment, and peak knee flexion moment (all  $p < 0.012$ ). The post hoc comparisons showed that the knee extension ROM was different from one another between 20°, 30°, and 40° saddle heights (80.1° vs. 73.7° vs. 67.6°, respectively). The peak knee extension moment for 20° saddle height (19.9 Nm) was different from 30° and 40° saddle heights (22.6 Nm and 23.6 Nm, respectively). Additionally, the peak knee flexion moment was different between all three saddle heights (-33.4 Nm vs. -23.4 Nm vs. -18.9 Nm). There was a significant workrate main effect on knee extension ROM, peak knee extension moment, and peak knee abduction moment (all  $p < 0.008$ ). **CONCLUSIONS:** Although decreased saddle height increased the knee extension moment, the knee abduction moment was not affected. These results suggest that saddle height adjustment could be a potential and safe method to modulate knee joint loading without concern of impacting frontal-plane knee loading in rehabilitation for patients with knee OA or TKR.

**241** Board #79 May 29 11:00 AM - 12:30 PM  
**Determining If A Bike-mounted Aerodynamic Sensor Can Detect Changes In Wheel Rolling Resistance During Cycling With Different Tire Pressures Outdoors**

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Rolling resistance represents a key resistance force to overcome during cycling. This resistance force is calculated as the product of the coefficient of rolling resistance (Crr) and rider+bike system weight. Crr is influenced by a number of factors including tire pressure. Typically, Crr is measured in a laboratory situation but more recently, bike-mounted instruments have been developed that are mounted on a bike to measure Crr in the field. **Purpose** To determine if a bike-mounted aerodynamic sensor is able to measure changes in Crr with changes in tire pressure while cycling outdoors. **Methods** A cyclist rode a road bike (combined mass 80.45 kg) equipped with an aerodynamic sensor to measure Crr (Aerolab). The bike-mounted sensor measures a number of parameters such as wind speed, global position system (GPS) data, cycling power, and air temperature, for example. Processing algorithms are used to generate Crr. For this experiment, tire pressure was manipulated in a manner that changes in Crr were expected. Specifically, three tire pressures were tested: 100, 70, and 40 PSI. Tire pressure was measured using a custom made valve system connected to a digital pressure gauge (Ashcroft Digital Gauge, 0.05% terminal point accuracy, 0-200 PSI range). The rider completed 2 trials per pressure condition with each trial consisting of a coast-down test. The rider reached a target velocity and then stopped pedaling. Data were recorded for at least 60 seconds for each trial. The rider maintained the same ride position for each trial. Data were processed using custom software to yield Crr per trial using an iterative algorithm that calculates Crr multiple times using different sections of data with corrections for air temperature. The research team member processing data was not aware of the conditions. Crr values were normalized such that the Crr during the 100 psi condition was set to 100%. **Results** Relative Crr values were 100±2.7% at 100 psi, 95.7±1.8% at 70 psi, and 119.6±2.7% at 40 psi. **Conclusions** Using a bike-mounted aerodynamic sensor, changes in rolling resistance were detected when

tire pressure was manipulated. However, confounding factors that could influence the calculation of Crr include the influence of subtle changes in rider position, yaw angle, and tire temperature, for example.

**A-43** Free Communication/Poster - Sports Biomechanics

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
 Room: CC-Hall WA2

**242** Board #80 May 29 9:30 AM - 11:00 AM  
**A Comparison of Forehand Swing Biomechanics between Male and Female Tennis Players**

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 (No relevant relationships reported)

The forehand is a central component in modern tennis, being the most frequently used swing. However, in comparison to the serve, it has not been analyzed to the same degree under the focus of kinematics. Our study is the first to compare joint angular displacement between male and female athletes during the forehand swing. We selected the shoulder and knee joint as the areas of interest. **PURPOSE:** To compare shoulder and knee joint angular position of the forehand between male and female tennis players. **METHODS:** 7 male and 11 female NCAA tennis athletes participated. Subjects had retroreflective markers placed over bony landmarks. Data collection trials were recorded using an 8-camera motion analysis system. The first set of trials consisted of 7 topspin forehands struck at submaximal (sM) ball velocities, and the second set of trials consisted of 7 topspin forehands struck at maximal (M) ball velocities. A custom-made software was used to obtain the angular position of the shoulder and knee joint at the following 5 time points: 1) end of back swing; 2) lowest point; 3) ball contact; 4) midpoint of follow-through; 5) end swing. The four outcomes measured at each time point are: a) shoulder elevation; b) shoulder abduction; c) shoulder internal rotation (SIR); d) knee flexion (KF). A multilevel multivariate model was used and included fixed effects for the between-subjects factor sex, and the interaction between sex and velocity.

**RESULTS:** No significant effects for sex were found. For outcomes regarding interaction between sex and velocity: 1) during the end of back swing phase, men showed a greater change in KF from sM to M compared to women (-49.5 to -59.5 vs -47.1 to -51.2 degrees,  $p < 0.05$ ); 2) during ball contact phase, females showed greater change in SIR from sM to M (-56.3 to -66.9 vs -85.9 to -87.5 degrees,  $p < 0.01$ ); 3) during ball contact phase, males showed less change in KF from sM to M (-26.5 to -26.7 vs -35.4 to -42.7 degrees,  $p < 0.01$ ); 4) during midpoint of follow-through phase, men showed less change in KF from sM to M (17.7 to -20.0 vs -25.1 to -39.2 degrees,  $p < 0.01$ ).

**CONCLUSION:** At similar velocities, shoulder and knee angular position do not vary significantly between male and female athletes. When transitioning from low to high velocity swings, significant change is found between sex during knee flexion and shoulder internal rotation.

**243** Board #81 May 29 9:30 AM - 11:00 AM  
**Evaluation Of Shoulder Muscle Activity Patterns While Swimming In Triathlon Wetsuits**

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 (No relevant relationships reported)

During the swimming portion of a triathlon, athletes can use a wetsuit if water temperature is below a threshold value. There are two general categories of wetsuits: Full sleeve (FSW) and sleeveless (SLW). It is not known if the type of wetsuit worn influences muscle activity patterns. **Purpose** Compare shoulder muscle activity patterns while wearing different wetsuit designs. **Methods** Subjects (n=7; 45.7±8.0 yrs, 174.8±10.5 cm, 70.1±9.4 kg) completed three swim conditions on the same day: no wetsuit (NWS), FSW, or SLW. Rest was provided between conditions as needed. Muscle activity (posterior deltoid (PD), anterior deltoid (AD)) was measured (2000 Hz) using a water proofed electromyography (EMG) system (Cometa). After a self-directed warm-up, subjects swam a length of the pool at a 'somewhat hard' pace (25 m or 50 m depending on pool set up). EMG data were processed by removing any zero offset, calculating the absolute value, and smoothing (low-pass, cutoff frequency = 4 Hz). PD smoothed data were used to identify the beginning and ending points of five consecutive stroke cycles with extracted data time normalized. Pearson correlation coefficients (r) were calculated between NWS-FSW, NWS-SLW, and FSW-SLW for each extracted pattern data set per muscle with each r transformed to a Z-score. Z-scores and r were each compared between conditions using a 1 x 3 (wetsuit condition) repeated measures ANOVA ( $\alpha = 0.05$ ). **Results** Neither r nor Z-score

for either muscle was influenced by wetsuit condition ( $p>0.05$ ). PD EMG patterns were moderately correlated between conditions (NWS-FSW NWS-SLW FSW-SLW:  $r=0.66\pm 0.16$ ,  $0.65\pm 0.16$ ,  $0.62\pm 0.20$ ) whereas strength of AD correlations were weak ( $r=0.37\pm 0.33$ ,  $0.42\pm 0.19$ ,  $0.39\pm 0.21$ ). **Conclusion** Muscle activity patterns of PD were more strongly similar than AD between swimming without a wetsuit then with a wetsuit as well as between wetsuit conditions. The weaker AD correlations between conditions may be influenced by horizontal position due to buoyancy force and/or possible resistance to shoulder movements of the wetsuit.

**244 Board #82 May 29 9:30 AM - 11:00 AM**  
**Comparison Of Torques And Positions Of The Half And Full Golf Swing - A Pilot Study**

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(No relevant relationships reported)

**PURPOSE:** A concern for healthcare workers is how to advise individuals wishing to return to golf following lower extremity (LE) injury or surgery. A common recommendation is to use a half swing, however, it is not known whether this truly reduces the motion or muscular torque for the LE. The purpose of this study was to examine the peak torques and positions of the hip during a half swing versus a full golf. **METHODS:** Five recreational golfers with handicaps  $\leq 20$ , both male and female participated. Participants completed 10 full swings and 10 half swings. A 10-camera motion analysis system, with force plates, was used to record swing data. Data was reduced using a 3-D modeling program and standard inverse dynamics were used to determine internal net joint torques. Peak torques are presented as  $Nm/\%BW*Ht$  and peak position in degrees. Differences were considered significant at the .05 level of probability. **RESULTS:** Subjects average age was  $33 \pm 17$  SD years. The highest torques for the full swing were produced for extension of the trail leg ( $10.32 \pm 1.48$ ), while the half swing trail hip extension torques averaged  $8.62 \pm 1.84$ . This was followed by lead hip abduction, with means of  $9.9 \pm 2.81$  and  $7.55 \pm 2.45$  for the full vs half swing respectively. Significant differences for torques between the full and half swing included trail hip extension, internal rotation, and flexion, along with lead hip extension and abduction. The greatest peak positions were in trail and lead hip flexion, with values of  $44.2 \pm 17.8^\circ$  and  $40.4 \pm 17.3^\circ$  for trail hip flexion, and  $47.8 \pm 20.3^\circ$  and  $44.6 \pm 18.8^\circ$  for lead hip flexion. There were significant differences for the positions of trail hip flexion, internal rotation, extension, abduction.

**CONCLUSIONS:** The preliminary data show that using a half swing does reduce the amount of internal torque around the hip, as compared to a full swing. Interestingly, the changes in peak position of the hip joint and the torques do not appear to be consistent. Our findings showed a great deal of variability in the amount of movement at the joint both for the full and half swing, thus this may be a source of concern for clinicians. In addition, while some of the hip joint torques were reduced with the half swing, some of the torques were still much higher than previously reported torques for walking and activities of daily living.

**245 Board #83 May 29 9:30 AM - 11:00 AM**  
**Comparison of Single-Leg Hopping Parameters Across Different Artificial Turf Systems and Natural Turfgrass**

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(No relevant relationships reported)

During locomotion, leg spring parameters are adjusted to maximize efficiency and reduce injury risk based on the stiffness of the surface. **PURPOSE:** This study compared leg spring parameters during single-leg hopping on different modern sports turfs, including three artificial turf systems with different structural components and a natural turfgrass surface. **METHODS:** Seven participants (ages 19-30 yrs; height =  $1.79 \pm 0.08$  m; mass =  $75.9 \pm 10.1$  kg) were recruited for this study. Each participant performed three trials of single-leg hopping in place on each of the four surfaces at a self-selected pace. Kinematics were collected using the Xsens MVN Awinda inertial motion capture system. Data were then imported into Visual3D where estimated ground reaction force and subsequent leg spring parameters were computed. For each participant, vertical stiffness and hopping frequency data from three trials for each of the four surface conditions were included in the statistical analysis. **RESULTS:** A repeated-measures MANOVA indicated significant differences present between surface conditions for vertical stiffness ( $F(6,15) = 3.48$ ,  $p=.023$ ,  $\eta^2 = .582$ ), with pairwise comparisons revealing vertical stiffness on turf 3 ( $18.3 \pm 6.3$  kN/m) to be significantly less than on turf 2 ( $20.6 \pm 6.2$  kN/m;  $p=.023$ ) and natural turfgrass ( $21.6 \pm 6.2$  kN/m;  $p < .01$ ). Hopping frequency was not significantly different between surface conditions. **CONCLUSIONS:** Modern artificial turf system innovations continue to utilize various structural components in an effort to reduce the overall stiffness of synthetic surface. However, it appears that individuals still interpret some artificial turfs to be stiffer than alternatives and therefore lessen the vertical stiffness of their leg spring while maintaining their preferred self-selected hopping frequency.

Funded by Shaw Industries Group, Inc.

**246 Board #84 May 29 9:30 AM - 11:00 AM**  
**Injuries In Lower Legs Related To The Unipodal Dynamic Stabilization**

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(No relevant relationships reported)

**PURPOSE:** The instability of the knee and ankle joints are the main risk factors for injuries of the musculoskeletal system and soft tissues when they are subjected to high training loads, as is the case of the military in initial training. The lower train is subjected to accelerations, decelerations, changes of direction and jumps that involve high loads that must support the most distal and intermediate joints in order to absorb the impacts. The measurement of stability is routinely used to measure the risk factors of injury to the ankles and knee, being the most frequent in military training. **PURPOSE:** To determine the risk of lower train injury in Colombian military personnel by analyzing the dynamic stability

**METHODS:** cross-sectional study in a cohort of 124 cadets. Of the participants in the study 87 (70.2%) were men and 37 women (29.8%), with an average weight of  $62 \pm 9.2$  kg, age  $18 \pm 1$  years, height of  $1.70 \pm 0.08$  meters, which was admitted in the military school in 2017. The measurement of the unipodal dynamic stability was made by using uniaxial force platform. The variables were measured as a percentage of asymmetry of the dynamic stabilization time ( $26.24 \pm 18.86\%$ ) and percentage of asymmetry of the force peak in the landing ( $28.59 \pm 17.62\%$ ).

**RESULTS:** Of the total number of subjects, 41 presented lesions in the lower limbs during follow-up, corresponding to 33.1%. The logistic regression model developed to determine the risk factors associated with injuries in lower limbs, presented a significance of the model of  $P = 0.017$ , with a probability of success of 70%. The variables: Body mass index (OR 1.001, 95% CI 0.843 - 1.181), gender (OR 2.709, 95% CI 1.15 - 6.37), the difference of the right-left stabilization time (OR 6.66, 95% CI 1.33 - 32.14), the percentage of asymmetry of the stabilization time (OR 1.021, 95% CI 0.999 - 1.043), the percentage of asymmetry of the peak force (OR 1.015, 95% CI 0.977 - 1.055), are those that best predict the model.

**CONCLUSIONS:** The stabilization time is a strong predictor of risk factors for lower train injuries. Likewise, gender and dominance of the lower limb are determining factors in the development of injuries under military training. Based on the results, it is considered a tool that can help to measure the risk factors in the military population in training and the controls throughout their training.

**247 Board #85 May 29 9:30 AM - 11:00 AM**  
**Changes In Complexity At Maximal Speeds May Not Influence Functional Performance Immediately After: Pilot Study**

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(No relevant relationships reported)

Regulatory statistics have been previously used to quantify nonlinear characteristics of gait and infer changes in central regulation of movement. Evaluating changes in movement complexity under varying running conditions is essential as alterations in central regulation may influence performance. However, few studies have characterized movement complexity during functional performance tests. **PURPOSE:** To quantify changes in complexity during an incremental running test to max speed, and during a single leg hop (SLH) test performed immediately before and after.

**METHODS:** Seven healthy runners ( $25.8 \pm 4.9$  yrs) performed a 30s SLH test before and after an incremental running test on a motorized treadmill using 4-minute stages (preferred, 10, 12, 14, 16, 18km/h) until volitional exhaustion. Three-dimensional accelerations of the pelvis were recorded using a triaxial accelerometer (100Hz, G-Walk, BTS Bioengineering, Milan, IT) fixed to the pelvis. The last 30s of each running speed and SLH were analyzed using multiscale entropy (MSE) across 5 time scales. Sample entropy estimates ( $m=2$ ,  $r=.2$ ) for each scaled time series were summed across all scales to compute complexity index (CI). Paired t-test were employed to compare CI measured from SLH tests and repeated measures ANOVAs with a Bonferroni correction were employed to compare differences in CI between stages for each participant. If significant, Dunnett's test was employed to compare fastest and slowest stages with preferred. Vertical accelerations are reported. **RESULTS:** Testing was completed by runners as follows: stage 4 N=7, stage 5 N=5, stage 6 N=3. Mean differences in CI were significant for 4 of 7 runners ( $p<0.007$ ). Post hoc analyses revealed greater CI in the final stage versus preferred ( $\Delta 0.62 \pm 0.1$ ;  $\Delta 1.11 \pm 0.01$ ;  $\Delta 0.35 \pm 0.03$ ;  $\Delta 0.49 \pm 0.07$ ,  $p<0.01$ ) while no differences were observed in the slowest stage. No change in SLH CI was found between pre- vs post-run tests ( $p=0.33$ ,

2.25±0.9 vs 2.14±0.7). **CONCLUSION:** At maximal speeds, an increase in system adaptability was observed compared to preferred running, however, this increase was not transferred to functional performance immediately after. An increase in complexity during perturbed running and not hopping may be due to dissimilarities in task difficulty and constraint type experienced by the runners.

248 Board #86 May 29 9:30 AM - 11:00 AM

### Muscle Activity Magnitude and Patterns During Plyometric Exercise on Land and in Shallow Water

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(No relevant relationships reported)

**PURPOSE:** The aim of this study was to compare muscle magnitude and patterns of key lower extremity muscles while performing plyometrics on land and in shallow water. **METHODS:** 10 Subjects (7 males; age:28.6±6.3 yrs, height:69.4±2.9 in, mass:82.1±8.4 kg, 3 females; age:45.7±6.8 yrs, ht:69.6±3.2 in, mass:84.2±8.3 kg) performed two plyometric exercises (countermovement jump (CMJ), drop jump (DJ)) while in two different environments (on land, in shallow water). A water proof electromyography (EMG) system (Cometa Miniwave Infinity, 2000 Hz) was used to record the signals of the muscle activity. Each sensor measured EMG as well as accelerations (3 dimensions). Four muscles (rectus femoris (RF), bicep femoris (BF), gastrocnemius (GA) and tibialis anterior (TA)) were used to capture EMG data. DJ trials were initiated from a 30.5 cm platform and order of conditions was always land followed by water. Depth of water was set to go no higher than xiphoid process level and no lower than the navel while standing. **DATA ANALYSIS:** Resultant acceleration was calculated for each sensor with a composite score calculated as the sum of the resultant acceleration for all sensors. This signal contained a peak upon initiating movement and a peak upon landing to end the movement. These peaks were identified, and EMG data were extracted 0.25 s before and after these discrete events to represent beginning and ending of analysis. Average (AVG), root mean square (RMS) and movement time were each calculated between the two extraction points. AVG, RMS, and movement time were each analyzed using a 2 (jump type) x 2 (environment) repeated measures ANOVA ( $\alpha=0.05$ ). **RESULTS:** EMG (AVG or RMS) was not influenced by the interaction of environment and jump type ( $p>0.05$ ); nor was there a main effect for jump type or environment for any muscle that was measured ( $p>0.05$ ). However,  $BF_{AVG}$  was different for jumps regardless of environment ( $p>0.05$ ). **CONCLUSION:** Muscle activity magnitudes appears to not be influenced between environments for CMJ and DJ for any of the four muscles measured.

249 Board #87 May 29 9:30 AM - 11:00 AM

### Influence of Testing Position on Hip Torque and Relationships with Frontal Plane Kinematics in Females

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(No relevant relationships reported)

The relationship between hip extension, abduction, and external rotation torque has been correlated to frontal plane biomechanics during functional tasks like the single leg squat. Altering testing position has been identified to influence torque output for hip extension, abduction, and external rotation. However, comparing the relationship between hip torque at different testing positions and frontal plane hip and knee squatting kinematics has yet to be evaluated.

**Purpose:** To assess the influence of testing position on hip extension, abduction, and external rotation torque in females and relationships to frontal plane squatting kinematics. **Methods:** Isometric hip torque was assessed in 19 college aged females at varying degrees of hip flexion. Torque was assessed with hand-held dynamometry for hip extension (0, 45, and 90 degrees of hip flexion); hip abduction (-5, 0, and 45 degrees of hip flexion); and hip external rotation (0, 45 and 90 degrees of hip flexion). Five single leg squats were also completed for 2-dimensional analysis of frontal plane hip and knee kinematics. Repeated measures ANOVAs were used to evaluate differences in hip torque across testing positions. Relationships between hip torque and frontal plane hip and knee kinematics during a single leg squat were explored with correlations. Significance was set at  $p<0.05$ . **Result:** Greater torque was seen during hip extension at 90 degrees of hip flexion ( $0.74\pm0.25\text{Nm/kg}\cdot\text{m}$ ) compared to both 0 ( $0.43\pm0.14\text{Nm/kg}\cdot\text{m}$ ) and 45 ( $0.50\pm0.19\text{Nm/kg}\cdot\text{m}$ ) degrees of flexion ( $p<0.001$ ). A significant decrease in hip abduction torque was seen at 45 degrees of hip flexion ( $0.44\pm0.15\text{Nm/kg}\cdot\text{m}$ ) compared to both -5 ( $0.58\pm0.21\text{Nm/kg}\cdot\text{m}$ ) and 0 ( $0.63\pm0.24\text{Nm/kg}\cdot\text{m}$ ) degree testing position ( $p<0.001$ ). No differences in torque were seen for hip external rotation. Significant, positive, and moderate correlations were seen with hip extension torque and hip adduction kinematics at 90 degrees of hip flexion ( $r=.544$ ,  $p=.016$ ) compared to 0 ( $r=.490$ ,  $p=.033$ ) and 45 ( $r=.477$ ,  $p=.039$ ) degrees of hip flexion. No significant correlations were seen between squatting kinematics and hip

abduction or external rotation torque. **Conclusion:** Testing position alters hip torque in healthy aged females but does not influence the relationship between torque and lower extremity kinematics of a single leg squat.

250 Board #88 May 29 9:30 AM - 11:00 AM

### Descriptive Kinetics on Unique Skills Performed by a Professional Acrobatic Artist

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(No relevant relationships reported)

Acrobatic performers are in essence professional athletes who are employed in the entertainment industry for a vast amount of time. However, there is limited research examining skills through a biomechanical lens. Challenges with analyzing these skills include that the movements can be quite unique to an artist and/or highly complex movement patterns. There may be some insight gained by examining certain basic components of a skill (e.g., landing) that may give some relevance to overall performance. However, there is limited research describing the entirety of a specific movement skill. **PURPOSE:** To describe peak forces during certain acrobatic skills performed by a professional artist. **METHODS:** A professionally trained male subject (age: 24 yo; mass: 65.8 kg) participated in this study. The subject visited the laboratory on one occasion where he performed eight different acrobatic skills. Data collection consisted of the subject performing the movements on top of two force platforms (Kistler) and recording full body kinematics using a 3D motion capture system (Vicon). Each movement was performed twice with some movements including multiple repetitions of a skill (e.g., one-hand hops). In movements that included at least four repetitions, peak forces were identified and averaged. In movements where only two repetitions were recorded, maximum peak force of the repetitions was described. Kinematic data were used to identify which body part was in contact with the ground that corresponded to a particular force peak. **RESULTS:** Average peak forces were: one hand hop hand  $3.60\pm0.10$  BW, air chair (hand)  $1.92\pm0.13$  BW, air chair (head)  $3.64\pm0.57$  BW, and flare  $2.54\pm0.43$  BW. Peak forces for jump/land tasks for jump and landing phases: maximum vertical jump  $3.08$  BW (jump),  $5.80$  BW (land), front flip  $2.22$  BW (jump),  $10.97$  BW (land), back flip  $2.88$  BW (jump)  $11.94$  BW (land), single leg jump right leg  $2.29$  BW (jump)  $4.07$  BW (land), and single leg jump left leg  $2.27$  BW (jump)  $4.20$  BW (land). **CONCLUSION:** Interestingly, peak forces during movements where the hand or head were in contact with the ground were similar in magnitude with landing on the feet from a vertical jump. The collection of these data could be helpful for these types of athletes for injury prevention, enhance performance of these skills or overall performance.

251 Board #89 May 29 9:30 AM - 11:00 AM

### The Analysis Of The Neuromuscular Performance Of The Colombian Military Leap

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(No relevant relationships reported)

**PURPOSE:** Musculoskeletal system injuries associated with military training are one of the major problems that military institutions must confront, due to the high costs. The training programs that are carried out during the initiation of the military, prove the increase in injuries that occur in the first six (6) months of admission. In which the risk factors that provoke it, are not yet clear. As a matter of fact, asymmetries are one of the main risk factors that alter the mechanics of the neuromuscular system. These changes affect the performance and favor the appearance of musculoskeletal injuries that can be acquired by training, or that could have been present in the military before incorporation. Aim, to determine the relationship between the asymmetries and the countermovement jump test with the performance of the lower train. **METHODS:** First, a cross-sectional study in a cohort of 124 cadets (94 men and 32 women) with an average weight of  $61.6 \pm 10.1$  kg, through ages  $18 \pm 1$  years all of whom entered the military school in year 2017. Second, a measurement of the countermovement jump test was performed using uniaxial force platforms. Specifically, variables including peak power ( $43.74 \pm 7.8$  watts), jump height ( $28.29 \pm 6$  cm), asymmetry of the landing peak ( $17.9 \pm 14\%$ ), percentage of the asymmetry of the concentric average force ( $7.1 \pm 5.3\%$ ) and finally, the asymmetry of the Rate of Force Development (RFD) in the eccentric deceleration ( $15.9 \pm 11.5\%$ ).

**RESULTS:** Over a comparison of genders, differences in weight  $64$  vs  $54$  kg,  $p = 0.05$  and jump height ( $30.7$  vs  $21.07$  cm,  $p = 0.001$ ) were found. By segmenting the database into terciles in the percentage of asymmetry of the Rate of Force Development (RFD) of the eccentric deceleration, differences were found in the personnel. Explicitly, asymmetries bigger than  $21\%$  ( $\chi^2 p = 0.05$ ), among the subjects that presented injuries in legs.

**CONCLUSIONS:** An association was found between the performance variables of the countermovement jump that determine the baseline status of the incoming soldiers,

leading to the findings of reference values of the asymmetries in the Colombian military population. Particularly, the eccentric deceleration TDF was used as a reference marker to evaluate injury risk factors and neuromuscular performance in Colombian military.

**252** Board #90 May 29 9:30 AM - 11:00 AM  
**Gender Differences Between Muscle Activation during Star Excursion Balance Test on Stable Versus Unstable Surfaces**

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Anterior (A), posteromedial (PM), and posterolateral (PL) directions of Star Excursion Balance Test (SEBT) are used for rehabilitation. Adding unstable surface to the task has been reported to change electromyographic (EMG) activity. Studies have also reported differences in EMG between males and females. **PURPOSE:** To compare EMG of lower extremity (LE) muscles between males and females during SEBT on stable and unstable surfaces. **METHODS:** Surface EMG was collected on 10 male and 10 female healthy adults for gluteus maximus, gluteus medius (GMED), medial hamstrings, biceps femoris (BF), vastus medialis (VM), rectus femoris (RF), vastus lateralis (VL), anterior tibialis (AT), and medial gastrocnemius (MG) on the stance leg during SEBT. Unstable surface was introduced using Theraband™ stability trainer. Independent t test assessed differences in EMG between males and females for each direction and each muscle during SEBT for both stable and unstable. Paired t tests were run separately for males and females to determine difference in each direction for each muscle between stable and unstable surface with  $\alpha$  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 AT in PL direction ( $63 \pm 14$  vs  $47 \pm 12$  %MVIC;  $P=0.01$ ) on stable surface and A ( $63 \pm 14$  vs  $47 \pm 12$  %MVIC;  $P=0.01$ ) and PL ( $64 \pm 15$  vs  $47 \pm 14$  %MVIC;  $P=0.02$ ) directions on the unstable surface and MG in PM ( $44 \pm 17$  vs  $25 \pm 17$  %MVIC;  $P=0.02$ ) direction on stable surface and A ( $62 \pm 23$  vs  $37 \pm 20$  %MVIC;  $P=0.02$ ), PL ( $76 \pm 29$  vs  $45 \pm 25$  %MVIC;  $P=0.02$ ), and PM ( $58 \pm 26$  vs  $36 \pm 20$  %MVIC;  $P=0.04$ ) directions on unstable surface. EMG was higher for unstable surface in females for VM, RF, and VL in the A direction ( $p \leq 0.05$ ) and MG in all three directions ( $p \leq 0.05$ ) and in males for GMED, VM, RF, VL in the A direction ( $p \leq 0.05$ ) and BF and MG in the PM direction ( $p \leq 0.05$ ). **CONCLUSION:** Females produced higher muscle activation than males for ankle muscles. Adding unstable surface increased LE muscle activation during SEBT. Due to gender differences and surface variability in EMG during SEBT clinicians could consider incorporating both stable and unstable surfaces during rehabilitation especially for women to reduce ankle injuries.

**253** Board #91 May 29 9:30 AM - 11:00 AM  
**Influence of Turf Surface on Change of Direction Parameters**

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The surface over which people complete sports tasks can influence body posture and performance outcomes. **PURPOSE:** This study compared time to complete a change of direction agility drill and stopping strategies during this drill on different modern sports turfs, including three different artificial turf systems (AS1, AS2, AS3) and a natural grass surface (NS). **METHODS:** Six participants (ages 19-30 yrs; height =  $1.79 \pm 0.08$  m; mass =  $75.9 \pm 10.1$  kg) were recruited and provided voluntary consent. Each participant performed three trials of a 5-10-5 agility drill on each of the four surfaces, as quickly as possible. A Fitlight® timing tool was used to collect the performance measure of time to complete the task. The segment positions were collected using the Xsens MVN Awinda inertial motion capture system and the variable of angle between sacrum, heel and ground (SHAng) was determined through Visual3D for the plant leg. **RESULTS:** The data from three trials for each participant, for each surface, was included in the statistical analysis. The repeated measures ANOVA for each variable yielded significant differences between surfaces. Pairwise comparisons indicated that change of direction time on AS1 ( $4.70 \pm 0.14$  s) was significantly less than on AS3 ( $4.83 \pm 0.28$  s;  $p=0.007$ ) and NS ( $4.83 \pm 0.30$  s;  $p=0.014$ ). In addition, SHAng 5 on NS ( $39.0 \pm 4.7$  deg) was significantly larger than on all artificial surfaces (AS1:  $35.1 \pm 3.8$  deg,  $p=0.014$ ; AS2:  $34.9 \pm 2.5$  deg,  $p=0.002$ ; AS3:  $35.4 \pm 3.6$  deg,  $p=0.019$ ). Last, SHAng 10 on NS ( $38.5 \pm 4.5$  deg) was significantly larger than on all artificial surfaces (AS1:  $35.7 \pm 2.9$  deg,  $p=0.024$ ; AS2:  $35.7 \pm 2.4$  deg,  $p=0.022$ ; AS3:  $36.1 \pm 2.5$  deg,  $p=0.028$ ). **CONCLUSION:** This project indicates that these participants adopted a different stopping strategy on the natural surface than the artificial surfaces. To mitigate the lower resistance to shear forces offered by natural grass, the participants adopted a more upright body position, presumably increasing the normal force as well

as the friction utilized at the foot-to-ground interface. Assuming adequate friction is maintained, a smaller SHAng and thus lower body position will provide for an increase in propulsive forces resulting in a faster change in direction and better performance outcome.

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**254** Board #92 May 29 9:30 AM - 11:00 AM  
**Kinetic Strategies during Single-Leg Hopping in Individuals With and Without Chronic Ankle Instability**

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 (No relevant relationships reported)

Adaptability of the motor system indicates successful management of chronic ankle instability (CAI). Research shows that individuals who do not exhibit residual symptoms following an ankle sprain (i.e. copers) exhibit greater adaptability during walking compared to individuals with CAI. However, questions remain surrounding systemic differences exhibited by coper groups, particularly when higher movement demands are imposed on the system. Analysis of load acceptance patterns during single-leg hopping could provide an indication of the systemic movement adaptations between the groups during higher demands of movement tasks. **PURPOSE:** Examine percent contribution (%C) to support moment (MS) during single-leg hopping in healthy, coper, and CAI groups. **METHODS:** 48 individuals (16 per group) participated in the study. Participants performed 15 trials of single-leg hopping. Position data were collected using a motion capture system, and reaction forces were obtained from force platforms. Joint kinetics were calculated using inverse dynamics, and the MS was calculated as the sum of the ankle (A), knee (K), and (H) moments in the sagittal plane. The %C of the A, K, and H moment to MS was calculated at 15 percent of stance phase. A one-way ANOVA was conducted to assess group effects for each dependent measure. **RESULTS:** No significant differences in %C to MS were found between the healthy (A  $81.87 \pm 18.37\%$ , K  $23.81 \pm 16.96\%$ , H  $2.22 \pm 27.19\%$ ), coper (A  $73.78 \pm 23.33\%$ , K  $28.28 \pm 21.05\%$ , H  $-6.51 \pm 33.17\%$ ), and CAI groups (A  $83.76 \pm 17.91\%$ , K  $16.48 \pm 12.58\%$ , H  $0.78 \pm 19.71\%$ ) during the initial loading phase of single-leg hopping. **CONCLUSIONS:** Copers did not exhibit distinct kinetic patterns during single-leg hopping. This finding suggests that adaptation of movement is less likely to occur with higher demands of movement tasks following ankle injury. It is also possible that low amplitude COM displacement associated with the hopping task may not have placed adequate constraint on the subjects to elicit adaptive strategies. More research is needed to explore how individual joint kinetic adaptations contribute to dynamic tasks across groups.

**255** Board #93 May 29 9:30 AM - 11:00 AM  
**Biomechanics of Pitching: Horizontal Abduction Predicts Power; Power Predicts Strikeouts and Wins**

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 (No relevant relationships reported)

Traditional strength training for pitchers focuses on compound lifts, predominantly of the lower extremity, to increase pitching power. Though widely employed, this approach has not been sufficiently validated. **PURPOSE:** To evaluate both predictors and consequences of increased mechanical power in collegiate pitching. **METHODS:** 10 pitchers from a D1 baseball program underwent 4 days of assessment separated by at least 3 days of rest: 1) Squat max was performed and recorded. 2) Sparta force plate (Sparta Science, USA) captured load, explode, and drive. 3) Proteus (Boston Biomotion, USA) measured power and endurance in 10 movements: Left and right core rotation, internal and external rotation, shoulder flexion and extension, elbow flexion and extension, and horizontal adduction and abduction. 4) Proteus recorded throwing mechanics via 5 sets of pitches (4 reps per set) at varying loads of magnetic resistance, ranging from 1-5lbs. For all movements, Proteus calculated and exported power and endurance in 3D space. Linear regressions identified predictors of pitching power and the effect of power on pitching performance. Owing to the small sample and novel technology, trends ( $p < 0.08$ ) were considered. **RESULTS:** Mean pitching endurance did not significantly predict strikeouts or wins. Mean pitching power predicted greater win percentage ( $R=0.734$ ;  $p=0.024$ ), total strikeouts ( $R=0.662$ ;  $p=0.052$ ), and strikeouts per game ( $R=0.656$ ;  $p=0.055$ ). No associations were found between Sparta data or squat max and win percentage or strikeouts. Pitching power had no relationship with Sparta data, squat max, height, weight, class year, or arm length. The strongest predictors of pitching power were horizontal abduction endurance in the dominant arm ( $R=0.941$ ;  $p=0.002$ ) and non-dominant arm ( $R=0.934$ ;  $p=0.002$ ). Strikeouts per game was related to win percentage ( $R=0.680$ ;  $p=0.044$ ). **CONCLUSION:** Power was the most important predictor of on-field pitching performance. It was unrelated to anthropometric variables and showed no association with minor differences in maturation (e.g., freshman to sophomore). There was also

no association with force plate and squat performance. These preliminary data suggest training horizontal shoulder abduction may correspond to power; in turn, power appears to increase strikeouts and win percentage.

**256** Board #94 May 29 9:30 AM - 11:00 AM  
**Knee Injury Risk Stratification With The Less-rmc**  
 Ryan Wexler<sup>1</sup>, Sean Higginbotham<sup>1</sup>, Ryan Colson<sup>2</sup>, Michael Torry<sup>1</sup>, Craig Simons<sup>3</sup>, Kevin Shelburne<sup>3</sup>, Mike Decker<sup>3</sup>. <sup>1</sup>Illinois State University, Normal, IL. <sup>2</sup>Pacific University, Forest Grove, OR. <sup>3</sup>University of Denver, Denver, CO.  
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The Landing Error Scoring System (LESS) is a protocol designed to assess ACL injury risk, and the LESS-RMC (Rocky Mountain Consortium) is a modified version of the LESS designed to be a more objective approach to scoring, and an easier tool to implement for the rater. **PURPOSE:** The purpose of this study was to determine the relationship between the LESS and LESS-RMC and develop an injury risk stratification for the LESS-RMC. **METHODS:** One hundred seventy-eight elite female soccer athletes (14.1 ± 1.5 y, 77.3 ± 33.2 in, 107.6 ± 27.2 lbs), performed three drop-jumps from a height of 30 cm. Front and side views of the landing were recorded with digital video cameras. Movement quality was rated by one researcher evaluating 17 components of the landing with the LESS and a modified, 11 component version of the LESS (LESS-RMC). Each system had a maximum of 17 landing errors and the rater was considered an expert after training with the LESS and LESS-RMC protocols. To accomplish the objectification of the LESS items, cut off points were defined more explicitly for line items: symmetry in feet, joint displacement, and overall impression. These changes, combined with a differentiating score of knee valgus severity/medial knee position (MKP) and its contribution to a new line item, overall asymmetry, added a new component to the LESS's approach to scoring movement quality and assessing injury risk. A one-way ANOVA was used to contrast the number of landing errors determined from the LESS and LESS-RMC. A linear regression was used to determine the relationship between the two scoring system and a LESS value of 5 was used as input to calculate a predicted risk stratification for the LESS-RMC. The alpha level was set at p=.05. **RESULTS:** The number of identified landing errors captured with the LESS-RMC (6.9 ± 2.2) was statistically greater than the LESS (5.6 ± 2.1) (p<lt.001). A significant linear relationship was found between the LESS and LESS-RMC (R=0.811, Adj R2=.656, SEE=1.59, p<lt.001). A LESS-RMC cut-off score for the stratification of low and high knee injury risk was calculated to be 6.79. **CONCLUSIONS:** The bi-lateral assessment of MKP and overall asymmetry were significant variables that contributed to higher risk stratification scores with the LESS-RMC.

**257** Board #95 May 29 9:30 AM - 11:00 AM  
**Association Between Lower Extremity Functional Tests and Injury in Division I Female Collegiate Athletes**  
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 (No relevant relationships reported)

The Landing Error Scoring System (LESS) and Single Leg Squat (SLS) are two clinical tools that have been used for screening of injury risk in athletic populations. Prior scoring of these tests was time intensive and required subjective judgement whereas new technology has allowed for automatic scoring and additional objective data. To date, we are unaware of any studies that have examined the association between LESS and SLS performance, as measured with a markerless motion-capture system, and future injury risk in athletes. **PURPOSE:** To examine the association between LESS and SLS performance and risk of lower extremity musculoskeletal injury (LE-MSKI) in female collegiate athletes. **METHODS:** Fifty-six collegiate female athletes (n=31 lacrosse; n=25 field hockey; 19.5 ± 1.4y; 165.6±8.1cm; 67.1±9.6kg) underwent LESS and SLS testing before the start of their 2017-18 competitive seasons. Incidence of LE-MSKI was tracked throughout the season. Participants completed 3 jump landing tasks followed by 3 consecutive SLSs on each leg. A Microsoft Kinect sensor using Athletic Movement Assessment software (PhysiMax®) was used to automatically score the LESS and SLS. The LESS consisted of 22 items while the SLS was comprised of 14 items. The highest scores possible for the LESS and SLS were 22 and 10, respectively. Independent t-tests were used to compare LESS and SLS total scores between injured and non-injured participants. Chi-square statistics were used to examine the association between injury risk and presence of medial knee displacement (MKD R/L side errors) during performance of the SLS and LESS. **RESULTS:** No differences were found between injured and non-injured participants in total LESS (5.1±2.2 vs. 5.2±2.1; p=0.900) and right-legged (4.0±2.1 vs. 3.4±1.2; p=0.273) or left-legged (3.4±1.2 vs. 3.9±0.9; p=0.107) SLS scores. Participants displaying an error for MKD during a right-legged SLS were roughly twice as likely to suffer a LE-MSKI as those with no error ( $\chi^2=1.27$ ; p=0.260, OR=1.9,

95%CI=0.62-5.83). Similar results were found for participants who displayed MKD on their right leg during performance of the LESS compared to those with no error ( $\chi^2=0.58$ ; p=0.444, OR=1.8, 95%CI=0.39-8.51). **CONCLUSION:** SLS and LESS performance was not associated with incidence of LE-MSKI in this cohort of female collegiate athletes.

**258** Board #96 May 29 9:30 AM - 11:00 AM  
**Predicting Scapular Dynamic Alignment During Throwing From The Scapular Dynamic Alignment During Shoulder Abduction**  
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Observing the resting and dynamic scapular alignments during basic shoulder motion is a common clinical evaluation for a throwing athlete. However, how much of the dynamic scapular alignment during throwing motion can be predicted from resting and dynamic scapular alignments during basic shoulder motion is unknown. **Purpose:** To investigate the relationship between dynamic scapular alignment during throwing motion and shoulder abduction and resting alignment. **Methods:** Ten baseball players without a history of shoulder pathology participated in this study. Scapular alignment was measured with a three-dimensional motion-capture system (VICON System) under three conditions: static standing position, abduction, and throwing motion. Scapular Cluster attached to the acromion was used to track the movement of the scapula. Multiple linear regression analysis was used to investigate the relationship between dynamic scapular alignment during throwing motion and shoulder abduction and resting alignment. **Results:** There was no relationship between dynamic scapular alignment during throwing motion and resting alignment. However, there was a relationship between several inclination variables of dynamic scapular alignment during throwing motion and shoulder abduction. The scapular posterior tilting angle at maximum external rotation (MER) of the shoulder during throwing motion decreased significantly with an increase in the scapular internal rotation angle during shoulder abduction ( $R^2 = 0.426$ ; p = .034). In the same manner, the scapular internal rotation angle at MER and ball release during throwing motion increased significantly with an increase in the scapular internal rotation angle during shoulder abduction ( $R^2 = 0.4$ ; p = 0.04,  $R^2 = 0.415$ ; p = 0.036, respectively). **Conclusions:** Our results indicate that approximately 40% of the dynamic scapular alignment during throwing motion can be predicted by the dynamic scapular alignment during shoulder abduction. The dynamic scapular alignment during shoulder abduction should be given greater consideration when assessing a throwing athlete.

**259** Board #97 May 29 9:30 AM - 11:00 AM  
**The Influence of Medial Knee Position Asymmetry on the LESS**  
 Michael Torry<sup>1</sup>, Ryan Wexler<sup>1</sup>, Sean Higginbotham<sup>1</sup>, Ryan Colson<sup>2</sup>, Craig Simons<sup>3</sup>, Kevin Shelburne<sup>4</sup>, Michael Decker<sup>3</sup>. <sup>1</sup>Illinois State University, Normal, IL. <sup>2</sup>Pacific University, Forest Grove, OR. <sup>3</sup>University of Denver, Denver, CO. <sup>4</sup>University of Denver, Normal, IL.  
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**PURPOSE:** The purpose of this study was to determine the prevalence and effects of knee valgus asymmetry on the LESS score in young female soccer athletes. **METHODS:** A total of 178 elite youth female soccer athletes (14.1 ± 1.5 y, 77.3 ± 33.2 in, 107.6 ± 27.2 lbs) performed three drop-jump maneuvers from a height of 30 cm. Digital video cameras recorded (60 Hz) front and side views of the landing task. An expert rater evaluated 17 components of each recorded landing according to the LESS protocol. In addition, maximum medial knee position (MKP) was evaluated for each leg based on a straight line projection from the center of the patella to the ground. The MKP was scored as none (0), small (1) or large (2) if the line was lateral to the midfoot, between the mid-foot and great toe, and medial to the great toe, respectively. The LESS was calculated for dominant (DOM) and non-dominant (NON) legs for each landing trial. The DOM leg was defined as the leg used to kick a ball for greatest distance. Side-to-side MKP symmetry for each trial was calculated as the difference between the MKP category of the DOM versus the NON legs (dMKP). Negative dMKP values indicated larger MKP on the NON leg and were classified as small (dMKP= -1; -dMKP\_s) and large (dMKP= -2; -dMKP\_l), whereas positive dMKP values indicated larger MKP on the DOM leg and were classified as small (dMKP= +1; +dMKP\_s) and large (dMKP= +2; +dMKP\_l). The LESS scores for DOM and NON legs were grouped according to each non-zero dMKP category (-2, -1, +1, +2) and contrasted using independent t-tests with a Bonferroni adjustment (p=.0125). **RESULTS:** Asymmetrical MKP was found in 50.9% of the trials but the LESS scores were on average not different between legs (DOM, 5.6 ± 2.6; NON, 5.5 ± 2.7, p=.73). However, the LESS scores for the DOM leg were on average 1.3 ± 0.5 (-dMKP small: DOM, 4.9 ± 2.2; NON, 6.2 ± 2.0, p<lt.001) and 2.7 ± 0.5 (-dMKP\_l: DOM, 3.4 ± 2.2;

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NON,  $6.2 \pm 1.9$ ,  $p < .001$ ) landing errors lower when MKP was lower for the DOM leg; whereas landing errors were  $1.2 \pm 0.6$  (+dMKP\_s: DOM,  $6.0 \pm 2.1$ ; NON,  $4.8 \pm 2.5$ ,  $p < .001$ ) and  $2.9 \pm 0.3$ . (+dMKP\_l: DOM,  $6.0 \pm 1.9$ ; NON,  $3.1 \pm 2.1$ ,  $p < .001$ ) higher when MKP was higher.

**CONCLUSIONS:** The asymmetry in MKP influenced the LESS scores by 1 to 3 landing errors and has the potential to miss-classify an athlete's injury risk stratification.

**260 Board #98 May 29 9:30 AM - 11:00 AM**  
**The Effect of Direct Head Impact in Judo on Internal of Cervical Spine**

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**PURPOSE:** Judo is one of the popular combat sports, which is played worldwide and organized even in the Olympic Games. Serious neck injuries, however, have been occasionally noted in judo trainings and/or competitions. Since the pattern and severity of neck injuries largely depend on the kinematic motion of the thrown player, it is essential to investigate the mechanisms of neck injury from biomechanical view point in various different throwing techniques. Thus, the aim of this study was to evaluate a predictive indicator of cervical spine injury, neck injury criterion (Nij) with direct head impact by Judo throwing techniques using an anthropomorphic test device (ATD).

**METHODS:** Two male judo experts (thrower) repeatedly threw the ATD for 5 times by *Seoi-nage* (*Seoi*), *Osoto-gari* (*Osoto*) and *Ouchi-gari* (*Ouchi*) techniques to make ATD's head hit directly to the mat. A 6-axis load cell (force transducer), mounted in the ATD's cervical spine, assessed neck axial force and bending moment in each trial. To evaluate the the ATD's neck load quantitatively, we calculated the Nij value from the neck axial force and bending moment. Kinematic data of the ATD's whole body were also recorded during trials, using high-speed digital video cameras.

**RESULTS:** In all trials, the largest neck loads were observed at the phase of the head contact to the mat. The peak Nij values of ATD ranged from 0.63 to 1.60 (*Seoi*), 0.54 to 0.58 (*Osoto*) and 0.19 to 0.29 (*Ouchi*). The average Nij value in *Seoi* ( $1.03 \pm 0.19$ , mean  $\pm$  S.E.) trials was significantly higher than those in *Osoto* ( $0.56 \pm 0.01$ ) and *Ouchi* ( $0.24 \pm 0.02$ ) trials ( $p < 0.05$ , respectively). In three out of five tests, Nij value in *Seoi* trial exceeded 1.0 implying the real human tolerance limit for neck loading. However, in other two trials (*Osoto* and *Ouchi*), Nij values were less than 1.0.

**CONCLUSIONS:** When thrown forward, the judo player might be accompanied with a direct contact of parietal and/or frontal regions of the head to the mat and suffered from neck injuries. Judo throwing technique, *Seoi*, has higher risk of serious neck injuries than the other techniques thrown backward including *Osoto* and *Ouchi*.

**261 Board #99 May 29 9:30 AM - 11:00 AM**  
**Comparison of Maximal Forces Produced During Different Chokehold Techniques**

Andrew Craig-Jones<sup>1</sup>, Damon McCune<sup>1</sup>, Duncan French<sup>2</sup>, Kyle Larimer<sup>2</sup>, David Chuang<sup>1</sup>, John Mercer, FACSM<sup>1</sup>. <sup>1</sup>UNLV, Las Vegas, NV. <sup>2</sup>UFC Performance Institute, Las Vegas, NV.  
 (No relevant relationships reported)

Mixed martial arts (MMA) has become increasing popular in recent years, with some Pay-Per-View events gaining more than 1.6mil viewers (mmafighting.com). However, with its ever-growing popularity, little is known about kinetics involved with certain movements. **PURPOSE:** The purpose of this study was to compare maximal force production during three different types of MMA chokeholds. We hypothesized that each technique will have a different maximal force associated with it. **METHODS:** Elite MMA fighters ( $n=8$ ;  $1.77 \pm 0.12$ m;  $83.70 \pm 15.73$ kg;  $31.22 \pm 4.21$ yr) completed three chokehold technique conditions: Rear-Naked Choke (RNC), Armbar (AB), and Guillotine (G). Subjects completed 5 repetitions per technique and held each hold for at least 5 s. Each choke was performed on a grappling dummy commonly used in MMA training. A 30 s rest period was required between each repetition, and a 5 minute recovery period was required between conditions. The order of conditions was randomized. Force data were measured at the neck level of the dummy and were collected for the entire application of the choke. Force was measured using a 10cm x 10cm instrument (Loadpad, Novel Electronics USA, St.Paul, MN) secured to the neck portion of the training dummy using elastic bandages. The greatest 1 s average for each repetition was used for analysis. Within each condition, the 5 repetitions were averaged per subject. A repeated-measures ANOVA was used to compare force between conditions ( $\alpha=0.05$ ). Planned comparisons were performed to assess which conditions were significantly different from the others. **RESULTS:** Maximal force was different between chokehold techniques ( $F=6.20$ ,  $p=0.012$ ). Maximal force was different between the RNC ( $avg=457.37 \pm 220.51$ N) which produced a higher maximal force than AB chokehold ( $avg=192.73 \pm 80.05$ N) ( $p < 0.015$ ). No other

significant differences were found between these chokehold techniques and the G chokehold ( $avg=265.37 \pm 164.25$ N) ( $p > 0.05$ ). **CONCLUSIONS:** It is apparent that different chokehold techniques involve different force application. MMA fighters may need to train specific technique to increase force production or to resist forces when experiencing these chokeholds.

**262 Board #100 May 29 9:30 AM - 11:00 AM**  
**A Kinematic, Kinetic, and Electromyographic Comparison of "New" And "Dead" Pointe Shoes in Professional Ballet Dancers**

Tal Amasay<sup>1</sup>, Jessica Aquino<sup>1</sup>, Jatin Ambegaonkar<sup>2</sup>, Sue Shapiro<sup>1</sup>, Yi-Tzu Kuo<sup>1</sup>. <sup>1</sup>Barry University, Miami Shores, FL. <sup>2</sup>George Mason University, Manassas, VA.  
 (No relevant relationships reported)

Ballet dancers wear pointe shoes. As these pointe shoes gain more wear, the shoes may lose structural integrity, potentially altering the normal biomechanics of dancers while performing ballet movements. These alterations may negatively affect the ballet dancer, possibly resulting in harmful compensations and overall decreasing dancers' performance and increasing dancers' injury risks. Even so, little research exists examining pointe shoes.

**PURPOSE:** To compare lower body biomechanics and muscle activity between "new" and "dead" pointe shoes in professional female ballet dancers. **METHODS:** Nine professional female ballet dancers (age:  $22 \pm 2$  yrs; height:  $163 \pm 6$  cm; weight:  $51 \pm 7$  kg), with at least 10 years of pointe shoe training and no limiting pain or injuries, performed three complete relevé and arabesques in "New" (3-36 training hours) pointe shoes and "Dead" (108-144 training hours) pointe shoes. Data were collected using force plate and 3D cameras. Separate ANOVAs compared (1) sway area during quiet stance, (2) peak net ankle joint moments, and (3) the average root mean square (RMS) muscle activity (%MVC) of the gastrocnemius and the tibialis anterior muscles between the shoe conditions. **RESULTS:** Dancers showed significantly higher sway area in the "dead" pointe shoes during both relevé ( $146 \pm 115$  mm<sup>2</sup> vs.  $94 \pm 58$  mm<sup>2</sup>,  $p < 0.05$ ) and arabesque ( $191 \pm 159$  mm<sup>2</sup> vs.  $112 \pm 48$  mm<sup>2</sup>,  $p < 0.05$ ). Dancers showed significantly higher tibialis anterior activation during arabesque in "dead" pointe shoes ( $39 \pm 13\%$  vs.  $33 \pm 7\%$ ,  $p < 0.05$ ). No significant differences were observed in muscle activation for tibialis anterior during relevé and for gastrocnemius during relevé and arabesque ( $p > 0.05$ ). No significant differences were observed in plantarflexion and dorsiflexion moments during relevé and arabesque ( $p > 0.05$ ). **CONCLUSION:** Overall, we found that the biomechanical profiles presented by the dancers when wearing "dead" pointe shoes have been previously linked to increased risk for ankle instability, lateral ankle sprains, and earlier onset of muscle fatigue. Understanding how pointe shoe biomechanics changes over time may inform dancers, educator, researchers, clinicians, and pointe shoe designers how extended training in "dead" pointe shoes may potentially harm dancers' health.

**263 Board #101 May 29 9:30 AM - 11:00 AM**  
**Evaluating Segmental Contribution To Whole-body Center Of Mass Movement In Sub-maximal Overhand Throwing.**

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 (No relevant relationships reported)

Recent advancements in wearable technology have allowed kinematic data collection in field-based settings, improving the ecological validity of research investigations. The wrench notation and quaternion algebra inverse dynamics technique does not require the integration of force platform data, therefore may allow field-based computation of joint kinetics for various sport movements, including overhand throwing. In order to apply this technique efficiently, it is important to understand segmental contributions to whole-body center of mass (CoM) movement. **PURPOSE:** Evaluate segmental contribution to the estimation of whole-body CoM movement both proximal and distal to the throwing elbow. **METHODS:** Three right-handed, male club baseball players performed forty trials of sub-maximal overhand throwing. Position data for each trial were acquired using a 3-d optical motion capture system and infrared reflective markers placed according to standard body segment parameter recommendations. From position data, segmental and whole-body CoM were computed for body mass positioned proximal and distal to the throwing elbow. Root Mean Squared Error (RMSE) values were computed using time-series position data between each segment CoM and whole-body CoM. Two one-way ANOVAs were performed on RMSE values in the x (direction of throw), y (perpendicular to the throw), and z (vertical) directions. To evaluate the movement of mass proximal to the throwing elbow, twelve body segments were included as levels within a single segment factor. To evaluate the movement of mass distal to the throwing elbow, two segments were included as levels within a single segment factor. **RESULTS:** Main effects of segment were observed for RMSE in the x, y, and z directions ( $p < 0.001 - 0.001$ ). Trunk RMSE in the x, y, and z directions ( $x: 40.5 \pm 7.4$  mm,  $y: 28.9 \pm 5.2$  mm,  $z: 9.5 \pm 4.0$  mm) was significantly

lower versus all other segments proximal to the throwing elbow ( $p < 0.001 - 0.028$ ). Right forearm RMSE in the x, y, and z directions (x:  $28.9 \pm 3.3$  mm, y:  $22.6 \pm 2.3$  mm, z:  $31.7 \pm 1.0$  mm) was significantly lower versus the right hand ( $p < 0.001 - 0.001$ ). **CONCLUSION:** During an overhand throwing task, the results suggest that CoM movement of the trunk and throwing forearm pattern closely with the movement of whole-body CoM located proximal and distal to the throwing elbow.

**264 Board #102 May 29 9:30 AM - 11:00 AM**  
**Ankle Bracing Effects on Contributions to the Support Moment during Hopping**

Carlos Santillan. *Illinois State University, Bloomington, IL.*  
 (Sponsor: Dale Brown, FACSM)  
 Email: Cksantil@gmail.com  
 (No relevant relationships reported)

Ankle Bracing Effects on Contributions to the Support Moment during Hopping  
 Carlos Santillan, Adam E. Jagodinsky, Mohammed Zaman, Christopher Wilburn, Wendi H. Weimar  
 Illinois State University, Normal, IL, Auburn University, Auburn, AL  
**INTRODUCTION:** Ankle bracing is commonly implemented to prevent ankle sprain injuries. However, research shows ankle bracing can alter joint kinetics during a variety of dynamic tasks. Analysis of the support moment (Ms) characteristics in response to bracing could provide insight into possible global motor strategies adopted when an ankle brace is applied. **PURPOSE:** Examine bracing effects on lower extremity contributions to the Ms during hopping. **METHODS:** 16 healthy individuals participated in the study. Participants performed 15 trials of single-leg hopping during no brace (NB) and brace (B) conditions. Position data were collected using a motion capture system, and reaction forces were obtained from force platforms. Joint kinetics were calculated using inverse dynamics, and the MS was calculated as the sum of ankle, knee, and hip moments in the sagittal plane. Data from the stance phase of hopping was extracted and time normalized to 0-100% of stance phase. The percentage contribution (%C) of ankle (A), knee (K), and hip (H) moment to Ms was calculated at 15, 30, 45, 60, and 75 percent of stance phase. Comparisons of percentage contribution between conditions were made at each time point using paired-samples t-tests. **RESULTS:** Analysis revealed that for K, %C was significantly lower during B ( $19.5 \pm 4.06\%$ ) compared to NB ( $21.76 \pm 4.42\%$ ) ( $t = 2.228, p = .041$ ). Additionally, for K, %C was significantly lower during B ( $34.025 \pm 9.14$ ) compared to NB ( $35.26 \pm 10.23$ ) ( $t = 2.306, p = .035$ ). No other significant differences for the study were observed. **CONCLUSION:** Bracing significantly decreased the contribution of the knee to the MS during single-leg hopping. Changes in the knee contribution to the Ms suggests that ankle bracing invokes adaptations to motor control strategies during the landing phase of single-leg hopping.

**265 Board #103 May 29 9:30 AM - 11:00 AM**  
**Support Moment Dynamics Are Similar In Individuals With and Without Chronic Ankle Instability During Hopping**

Umaiyaa Vasudevaraja<sup>1</sup>, Adam E. Jagodinsky<sup>1</sup>, Mohammed Zaman<sup>1</sup>, Christopher Wilburn<sup>2</sup>, Wendi H. Weimar<sup>2</sup>. *<sup>1</sup>Illinois State University, Normal, IL. <sup>2</sup>Auburn University, Auburn, AL.*  
 (Sponsor: Dr.Dale Brown, FACSM)  
 (No relevant relationships reported)

It has been proposed that the development of chronic ankle instability (CAI) is related to a maladaptive cascade stemming from mechanical and/or neuromotor impairments following an initial ankle sprain injury. Contrarily, individuals who do not exhibit recurring instability following initial ankle injury (copers) may benefit from adaptive movement strategies that allow for healthy functioning, yet the mechanisms surrounding this theory remain in question. Previous investigations have found that copers exhibit significantly greater variability in the support moment (Ms) and lower extremity joint moments compared to individuals with CAI during walking, which could indicate a mechanism by which copers adapt to both mechanical and/or neuromotor constraints relating to initial injury. However, these measures have not been explored in tasks that place greater demand on the previously injured limb. **PURPOSE:** The purpose of this study was to compare the Ms variability characteristics between healthy, coper and CAI individuals during a single-leg hopping task. **METHODS:** 48 individuals (16 per group) participated in the study. Participants performed 15 trials of continuous single-leg hopping. Position data were collected using a motion capture system, and reaction forces were obtained from force platforms. Joint kinetics were calculated using inverse dynamics, and the MS was calculated as the sum of ankle, knee, and hip moments in the sagittal plane. Variability of the MS was expressed as the percent coefficient of variation (%CV) across stance phase. A one-way ANOVA was conducted to compare %CV across groups. **RESULTS:** No differences in %CV were found between healthy ( $13.27 \pm 6.014\%$ ), Coper ( $16.14 \pm 10.6145\%$ ) and CAI ( $14 \pm 10.61\%$ ) groups. **DISCUSSION:** Individuals had no change in %CV compared with the previous study of walking. The contrast in findings may be attributed to the nature of task demands placed on subjects. Specifically, the

rapid and cyclic transition of loading-propulsion-loading, and low amplitude COM displacement associated with the hopping task performed in this study may not have placed an adequate constraint on the subjects to elicit adaptive strategies. Future studies investigating Ms variability characteristic should consider implementing tasks that will stress motor system adaptability.

**266 Board #104 May 29 9:30 AM - 11:00 AM**  
**Test-Retest Reliability of Performance Scores Using a Markerless Motion Capture System**

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 (No relevant relationships reported)

**PURPOSES:** This investigation examined the test-retest reliability of a markerless motion capture system (MCS) for six performance (PERF) scoring scales using a performance motion analysis protocol (PMA) across multiple visits. **METHODS:** Healthy, recreationally active men ( $n=11$ ;  $\pm$ SD; age= $23.0 \pm 2.6$  yrs, height= $180.3 \pm 4.8$  cm, weight= $80.4 \pm 7.3$  kg) and women ( $n=11$ ; age= $20.8 \pm 1.1$  yrs, height= $172.2 \pm 7.4$  cm, weight= $68.0 \pm 7.3$  kg) were screened once a week for 4 weeks using the PMA protocol, consisting of 19 motions. These include shoulder ranges of motions, trunk rotation, five types of squatting motions, single leg balances, and six types of vertical jumps and depth jumps. A three-dimensional markerless MCS using the DARI Motion Software (Scientific Analytics, Lincoln, NE) was used to analyze the kinetic and kinematic data, from which 192 variables were calculated to determine the PERF scores. The PERF scores evaluated included Composite, Power, Functional Strength, Dysfunction, Vulnerability, and Exercise Readiness. One-way repeated measures ANOVAs (performance scores x visit) ( $p \leq 0.05$ ), and intraclass correlation coefficients (ICCs) were determined to compare performance scores. **RESULTS:** Results are shown in the table. Excellent test-retest reliability was observed for composite, power, functional strength, and exercise readiness scores (ICCs  $> 0.8$ ) across all 4 visits. The vulnerability scores displayed fair test-retest reliability, while the dysfunction score exhibited poor reliability. No significant differences were observed for any performance scores on any visits. **CONCLUSION:** These results indicated excellent reliability for all PERF scores except vulnerability and dysfunction scores. It is possible that the vulnerability and dysfunction scales require several visits to establish a consistent baseline and may require 1-2 familiarization visits. Further study is needed to determine the magnitude of change for any score that is meaningful.

Table 1.

Visit	Composite	Power	Functional Strength	Dysfunction	Vulnerability	Exercise Readiness
1	1611.1 ± 307.3	836.6 ± 216.9	907.3 ± 114.9	132.8 ± 56.6	42.2 ± 12.3	15.7 ± 3.9
2	1611.9 ± 271.4	836.4 ± 196.5	900.8 ± 106.8	125.5 ± 45.4	40.5 ± 7.7	18.8 ± 3.6
3	1602.7 ± 270.9	825.7 ± 197.9	885.6 ± 117.9	108.6 ± 42.8	39.3 ± 9.4	18.6 ± 3.6
4	1601.6 ± 270.5	833.6 ± 207.6	879.8 ± 100.5	111.7 ± 46.6	30.0 ± 9.3	18.7 ± 3.4
p	0.96	0.91	0.16	0.17	0.07	0.98
ICC	0.92	0.93	0.83	0.27	0.54	0.89
95% CI	0.85 - 0.96	0.87 - 0.98	0.71 - 0.91	0.08 - 0.52	0.34 - 0.74	0.81 - 0.95
CV%	0.4	0.6	1.4	9.6	5.5	0.5

n=22; Performance Scores (X ± SD); Intraclass correlation coefficients (ICCs) were determined using the following criteria: two-way mixed model, absolute agreement, 95% confidence interval (CI), coefficient of variance (CV%)

**267 Board #105 May 29 9:30 AM - 11:00 AM**  
**Identification of Risk Factors Associated with Groin Injury in an Upright Standing Position**

Maria C. Herrera<sup>1</sup>, Tal Amasay<sup>1</sup>, Zacharias Papadakis<sup>1</sup>, Ana Castillo<sup>1</sup>, Samantha Day<sup>1</sup>, Noah Padgett<sup>2</sup>. *<sup>1</sup>Barry University, Miami, FL. <sup>2</sup>Baylor University, Waco, TX.*  
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 (No relevant relationships reported)

Groin injury is a common injury in sports such as soccer. This type of injury is associated with quick change of direction or acceleration, and kicking. Several studies have identified decrease in hip internal (Int) and external (Ext) rotations or decrease in hip adduction (Add) and abduction (Abd) torques ratio as risk factors for groin injury. However, it is still unclear what relationship exists between these variables, specifically performed in upright position which is more functional. **PURPOSE:** To explore the relation between low hip Add and Abd torque ratio and hip Int and Ext rotations, performed in upright position, in college students. **METHODS:** Fourteen college students participated in the study, Eight males ( $21 \pm 1$  yrs,  $81 \pm 11$  kg,  $176 \pm 6$  cm) and Six females ( $22 \pm 2$  yrs,  $62 \pm 5$  kg,  $163 \pm 6$  cm). Data were collected in two different sessions. Hip isokinetic maximal Add and Abd torques were captured using isokinetic dynamometer at two speeds, 30°/s and 60°/s. Participants performed five trials of continuous Add and Abd at each speed and the averages of the highest

three peaks and their corresponding angles were calculated. Add and Abd torques ratio were calculated and the data were categorized as high risk (HR), if ratio was <1, or low risk (LR), if ratio was >1. Hip 3D Int and Ext rotations were captured using 3D cameras at 240 Hz. Participants performed three separate trials of maximal Int and Ext rotations using sliding disk and highest lower leg Int and Ext rotations were analyzed. T-tests assuming unequal variance were performed. **RESULTS:** Mean Add and Abd torque ratios were  $0.72 \pm 0.13$  in HR group and  $1.30 \pm 0.19$  in LR group. Lower peak Add torque was observed in the HR group ( $48 \pm 15$  Nm vs.  $86 \pm 27$  Nm,  $p < 0.01$ ). No significant difference was observed in peak Abd torque between the groups ( $67 \pm 19$  Nm vs.  $66 \pm 18$  Nm,  $p > 0.05$ ). Hip Ext rotations were lower in the HR group, however not significant ( $17 \pm 7^\circ$  vs.  $20 \pm 9^\circ$ ,  $p = 0.07$ ), same was observed for hip Int rotations ( $13 \pm 5^\circ$  vs.  $15 \pm 4^\circ$ ,  $p = 0.08$ ). The total hip Int and Ext rotations range of motion was significantly lower in the HR group ( $30 \pm 9^\circ$  vs.  $34 \pm 10^\circ$ ,  $p < 0.05$ ). **CONCLUSION:** Decrease in hip Int and Ext range of motion was related to lower hip Add and Abd peak torque ratio. Future research should further investigate the association between these variables in athletes to better predict and prevent groin injuries.

#### A-44 Free Communication/Poster - Team Sports

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
Room: CC-Hall WA2

- 268** Board #106 May 29 9:30 AM - 11:00 AM  
**Effects Of Stroboscopic Vision On Reactive Strength Index Scores In Female Ncaa Division I Volleyball Players.**  
Talin Louder, Melissa Kroll, Jordan Preuss, Jake Rosburg, Lara Boman. *The University of South Dakota, Vermillion, SD.*  
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(No relevant relationships reported)

It is believed that ACL injury risk is multifaceted and includes structural, biomechanical, and cognitive factors. Recently, it is observed that overreliance on exteroception (visual stimuli) following ACL rehabilitation may increase the risk of re-rupture. There may be utility in using stroboscopic vision as an enhancement to plyometric movements and neuromuscular ACL-prevention programs. **PURPOSE:** To evaluate the effects of stroboscopic vision on Reactive Strength Index (RSI) scores in female NCAA Division I volleyball players. **METHODS:** Thirteen female NCAA Division I volleyball players performed three trials of depth jumping across five conditions: (1) 0.38 m - no visual restriction, (2) 0.53 m - no visual restriction, (3) 0.69 m - no visual restriction, (4) 0.38 m - high-frequency stroboscopic vision (H-f), and (5) 0.38 m - low-frequency stroboscopic vision (L-f). For all trials, the RSI, rebound jump height (RJH; m), and ground contact time (GCT; s) were computed from vertical ground reaction force data acquired via a tri-axial force platform. To evaluate the statistical significance of results, a Multivariate General Linear Model Analysis of Variance (GLM ANOVA) was performed using RSI, RJH (m), and GCT (s) as dependent measures. The five depth jump conditions were included as levels within a single condition factor. Statistical significance was set at an alpha level of 0.05. **RESULTS:** Main effects of depth jump condition were observed for RSI and GCT (s) ( $p = 0.001$ ), but not for RJH (m) ( $p = 0.101$ ). Post-hoc comparisons revealed that RSI scores were lower for stroboscopic conditions (H-f:  $0.75 \pm 0.16$ ; L-f:  $0.72 \pm 0.16$ ) versus no visual restriction (0.38 m:  $0.80 \pm 0.17$ ; 0.53 m:  $0.79 \pm 0.17$ ; 0.69 m:  $0.79 \pm 0.16$ ). Post-hoc comparisons revealed that GCT (s) was greater for stroboscopic conditions (H-f:  $0.47 \pm 0.07$  s; L-f:  $0.49 \pm 0.07$  s) versus no visual restriction (0.38 m:  $0.46 \pm 0.07$  s; 0.53 m:  $0.45 \pm 0.07$  s; 0.69 m:  $0.45 \pm 0.07$  s). **CONCLUSION:** Integrating stroboscopic vision into the depth jump movement reduced RSI scores in a sample of female NCAA Division I volleyball players, which was attributable to longer GCTs (s). The results suggest that adding stroboscopic vision to plyometric movements may increase the difficulty of the task from either a cognitive or biophysical perspective.

- 269** Board #107 May 29 9:30 AM - 11:00 AM  
**Women's Collegiate Volleyball Players Exhibit Kinetic Asymmetries during Sport-Specific Tasks**  
Jenna D. Smith, Kevin R. Ford, FACSM, Audrey E. Westbrook, Rachel A. Kordonow, Jeffrey B. Taylor. *High Point University, High Point, NC.* (Sponsor: Kevin R. Ford, FACSM)  
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(No relevant relationships reported)

Women's volleyball demands frequent lateral movements and vertical jumps. Repetitive lateral movements in the same direction could lead to biomechanical asymmetries and a potential increased risk of lower extremity injury. **PURPOSE:** To identify and analyze biomechanical asymmetries in collegiate women's volleyball players during sport-specific lateral and vertical jumping tasks.

**METHODS:** Nineteen female collegiate volleyball players were analyzed using standard 3D motion capture techniques during a drop vertical jump (DVJ) from a 30-cm box and a reactive jump (REACT) task. For the REACT, participants began in an athletic stance awaiting a directional cue on a screen placed in front of them. Once directed, participants were instructed to jump laterally and then vertically as high and fast as possible to mimic a volleyball block. Repeated measures MANOVA models were used to identify asymmetries in kinematic and kinetic measures in the DVJ and REACT task ( $\alpha = 0.05$ ). Paired t-tests identified asymmetries in reaction time during the REACT task. Limb symmetry indices (LSI) were calculated for significant findings. **RESULTS:** Significant kinetic asymmetries were identified for both the DVJ ( $p = 0.01$ ) and REACT ( $p = 0.003$ ) tasks, but no kinematic asymmetries were found in either task ( $p > 0.05$ ). During the DVJ, participants exhibited asymmetrical knee abduction (LSI=81%,  $p = 0.03$ ), ankle dorsiflexion (LSI=94%,  $p = 0.03$ ), and ankle inversion (LSI=30%,  $p = 0.001$ ) external joint moments and vertical ground reaction forces (LSI=93%,  $p = 0.04$ ). During the REACT task, participants exhibited asymmetrical ankle dorsiflexion (LSI=85%,  $p = 0.03$ ), and ankle inversion (LSI=73%,  $p = 0.001$ ) external joint moments. There were no differences in reaction times between the two limbs ( $p > 0.05$ ). **CONCLUSIONS:** Collegiate women's volleyball players exhibit significant asymmetry in the knee and ankle during jumping and landing tasks. Interestingly, asymmetries were identified in kinetic variables but not kinematic variables. These findings indicate that screening, injury prevention and rehabilitation practices cannot solely rely on visual observation to identify lower extremity asymmetry in this athletic population.

- 270** Board #108 May 29 9:30 AM - 11:00 AM  
**Differences in Lower-Extremity Kinematics Among Female Collegiate Soccer and Volleyball Players**  
Anjali Gairola, Dustin Malandra, Marisa J. Christensen. *Cabrini University, Radnor, PA.*  
(No relevant relationships reported)

Joint angles and leg stiffness play a role in an athlete's Reactive Strength Index (RSI). RSI is a variable that can quantify the elasticity and stiffness capacity of muscle during rapid changes from eccentric to concentric contraction. **PURPOSE:** To evaluate the differences in RSI, joint absorption strategies for knee joint displacement (KD), and ankle joint displacement (AD) among soccer and volleyball female athletes during a landing task. **METHODS:** A total of 30 (Soccer=21, Volleyball=9) healthy, NCAA Division III female athletes ( $19.76 \pm 1.24$  years) volunteered for this study. The subjects jumped over a hurdle with subsequent maximal vertical jump measured on EZE jump mat (swift performance). The maximal vertical jump landing was video recorded and joint angle displacements (KD and AD) analyzed using Hudl technique application on iPhone. Of three jump trials, highest ( $RSI_H$ ) and lowest RSI ( $RSI_L$ ) were recorded. A one-way ANOVA was used to determine differences among soccer and volleyball athletes for  $RSI_H$ . Further, two-way ANOVA with replication was used to examine the differences between joint angular displacements (KD and AD) at  $RSI_H$  and  $RSI_L$ . **RESULTS:** There was no significant difference ( $p = 0.178$ ) between soccer ( $1.9 \pm 0.44$ ) and volleyball ( $1.67 \pm 0.39$ ) athletes for  $RSI_H$ . There was a statistically significant interaction ( $p = 0.043$ ) between the effects of levels of RSI on joint angular displacements.

n=30	$RSI_H$ (mean $\pm$ SD)	$RSI_L$ (mean $\pm$ SD)
KD	$32.9 \pm 11.3^0$	$35.2 \pm 11.5^0$
AD	$36.5 \pm 10.4^0$	$33.9 \pm 8.6^0$

**CONCLUSION:** The power production and dynamic stability of leg during jump landing involves the coordination between the hip, knee, and ankle joints. In current study,  $RSI_H$  was associated with knee stiffness and elasticity of ankle joint. It was observed that there was no observable difference in ground force attenuation strategies by sport. Future studies should explore lower-extremity absorption strategies using bigger sample size, NCAA Division I or II athletes, and comparing genders during sport-specific tasks.

- 271** Board #109 May 29 9:30 AM - 11:00 AM  
**Age and Knee Confidence Effects on LESS and LESS-RMC Scores in Female Youth Soccer Players**  
Sean E. Higinbotham<sup>1</sup>, Ryan Wexler<sup>1</sup>, Ryan Colson<sup>2</sup>, Michael R. Torry<sup>3</sup>, Michael J. Decker<sup>3</sup>. <sup>1</sup>Illinois State University, Normal, IL. <sup>2</sup>Pacific University, Forest Grove, OR. <sup>3</sup>University of Denver, Denver, CO.  
(No relevant relationships reported)

**INTRODUCTION:** Anterior Crucial Ligament (ACL) injuries are common in female soccer players and can have serious, even lifelong consequences. The Landing Error Scoring System (LESS) and a modification of the LESS, the LESS-RMC, have been useful tools in screening athletes and identifying individuals at "high-risk" so appropriate interventions could be provided. However, it is unclear

how knee confidence and age influences these screening tools in female soccer athletes. **PURPOSE:** The aim of this study was to investigate the effects of age and knee confidence on ACL injury risk classification in female youth soccer players. **METHODS:** 178 healthy female youth soccer players (ht:  $1.63 \pm 0.07$  m, mass:  $48.8 \pm 4.9$  kg, age:  $14.1 \pm 1.5$  yrs) participated in this study. Participants were asked to jump from a 30cm box a distance 50% of their height where they immediately performed a maximum vertical jump and landing upon initial ground contact. Two HD cameras were used to record (60 Hz) this motion in the frontal and sagittal planes. The video of the task was then used to assess the participant's ACL injury risk by evaluating these landings using the LESS and LESS-RMC procedures. Knee confidence was evaluated by using a 5-point Likert scale in response to an item asking "How much do you trust your knee" from the knee-related quality of life subscale in the KOOS knee questionnaire. The participants were classified as confident if they answered "completely" and not confident for all other responses. Two-way ANOVAs were used to investigate the effects of age group (11-12, 13-14, 15-16 and 17-18 y) and knee confidence on the LESS and LESS-RMC scores. **RESULTS:** There was a statistically significant main effect of age on the LESS score, [F (3, 167) = 2.667,  $p = 0.049$ ]. Post-hoc tests revealed that the age group of 11-12 years displayed significantly higher LESS scores ( $6.43 \pm 2.14$ ) than the 17-18 group ( $4.49 \pm 2.11$ ) ( $p = 0.029$ ). There was no significant main effect for knee confidence ( $p = 0.501$ ). **CONCLUSION:** The results reveal that female soccer players in the 11-12 age range are at a greater risk of ACL injury than the 17-18 age range. Further research should be conducted to examine the mechanical contribution to this risk and methods to reduce injury risk across age ranges.

272 Board #110 May 29 9:30 AM - 11:00 AM

### Lower Extremity Force Production And Postural Stability Changes With Age In Young Male Soccer Players

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Optimizing lower extremity force production is key for elite soccer players (SP). Additionally, improved postural stability (PS) is generally associated with a decreased risk of injury. However, it is not well understood, in elite youth SP, how force production during explosive movements and PS during quiet stance differ among typical age categories.

**PURPOSE:** To compare lower extremity force production and PS performance in four different age categories in youth SP.

**METHODS:** A total of 73 elite youth SP from four age categories (U12:  $n = 18$ , U13:  $n = 20$ , U14:  $n = 16$ , U15:  $n = 19$ ) were tested using a force platform (KISTLER AG, Switzerland) during different types of jumps (countermovement jump free arms (CMJFA), countermovement jump (CMJ), squat (SJ) and depth jump (DJ)). PS was assessed on a pressure platform (RS SCAN, Belgium) during narrow standing, with (NSW) and without (NSN) visual control, and single limb stance on preferred (SLSP) and non-preferred leg (SLSN). We calculated: jump height (JH), maximum force, force asymmetry between legs (FA), absolute (FI) and relative force impulses and total center of pressure distance. Statistical analyses ( $p < 0.05$ ) consisted of MANOVA, Bonferroni post-hoc test and partial eta square ( $\eta_p^2$ ).

**RESULTS:** A significant age effect was found on JH in all jump tests (CMJFA:  $F_{3,69} = 13.92$ ,  $p = 0.00$ , CMJ:  $F_{3,69} = 14.44$ ,  $p = 0.00$ , SJ:  $F_{3,69} = 19.82$ ,  $p = 0.00$ , DJ:  $F_{3,69} = 19.04$ ,  $p = 0.00$ , ) and PS performance (NSN:  $F_{3,69} = 3.93$ ,  $p = 0.01$ , FLP:  $F_{3,69} = 7.88$ ,  $p = 0.00$ , FLN:  $F_{3,69} = 3.22$ ,  $p = 0.03$ , ). Older players (U15) had a higher performance in CMJFA (JH =  $37.59 \pm 5.32$  cm) and force impulse (FI =  $166.26 \pm 32.42$  N.s) compared to younger (U12: JH =  $30.36 \pm 2.63$  cm, FI =  $111.89 \pm 25.14$  N.s, U13: JH =  $30.15 \pm 3.31$  cm, FI =  $126.35 \pm 20.01$  N.s). Age had non-significant effects on FA ( $p > 0.05$ ). Decreased postural control (NSN) was found in U15 players ( $204.58 \pm 64.83$  mm) compared to U13 ( $140.25 \pm 35.01$  mm). Younger players (U12) had lower performance in SLSP ( $1956.06 \pm 822.70$  mm) compared to older players (U13 =  $1437.30 \pm 370.13$  mm, U14 =  $1157.94 \pm 316.85$  mm, U15 =  $1304.05 \pm 404.12$  mm). **CONCLUSIONS:** Explosiveness and PS are different by ages in youth elite SP. The results indicate that CMJFA and CMJ had different neuromuscular strategies compare to SJQ and DJ. Findings of this study are beneficial to develop age specific training program in youth SP.

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### Evaluation Of A Novel Acl Injury Prevention Technique:can Martial Arts Fall Training (break-falling And Rolling) Alter The Lower Extremity At-risk Biomechanics In Soccer Athletes?

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**Purpose** We propose that by introducing martial arts fall training (specifically break-falling and rolling), the neuropathways in these athletes will be trained to recognize and avoid at risk postures by having an alternative response. Given the absence of research utilizing martial arts falling techniques in other sports, this study aims to compare lower extremity biomechanics and risk factors in soccer athletes with fall training compared to those without. **Methods:** 5 youth premier soccer athletes between the ages of 9 and 16 were recruited for participation. Subjects were randomly divided into a control group and an intervention group. All subjects continued their usual soccer training. The intervention group completed a twice weekly 10-week training program in addition to their usual training, taught by a karate and aikido expert at the level of 3rd<sup>rd</sup> degree black belt. At baseline and after the 10 week program was completed, all subjects underwent a biomechanical evaluation that measured hip and knee movement/position in frontal, transverse, and sagittal planes at 4 different time points during a drop fall. A mixed factorial ANOVA model was used to determine the effects of the intervention training on the kinematic variables of interest. The between subjects' factor was treatment group (intervention and control) and the within subjects factor was time point (pre-intervention and post-intervention). The test of the interaction between group and time point was used to determine if the intervention produced change in the variables of interest. The alpha level of significance for this study is set at the 0.05 level. **Summary of Results:** There was a significant decrease in knee flexion in the sagittal plane at initial contact when comparing pre and post-intervention ( $-4.802$  degrees,  $P < 0.001$ ). There was also a significant decrease in knee flexion in the sagittal plane at heel strike 33ms ( $-7.384$  degrees,  $P < 0.001$ ). There was no significant change in any of the other motion points examined. **Conclusion:** There was a statistically significant change in body mechanics when comparing pre and post-break falling intervention. Prior research has shown that neuromuscular programs decrease ACL injury rates when they are started at an early age and continued with strong compliance.

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### Isokinetic Strength and Strength Asymmetries of Lower Extremities in Professional Soccer Players

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Muscle strength (MS) is an important component of physical fitness in soccer players (SP). Side-to-side differences may be developed due to the unilateral nature of certain soccer skills and movement patterns. Constant loading on one side of the body over time may lead to strength asymmetry and imbalances in tissue adaptation.

**PURPOSE:** To investigate isokinetic strength asymmetry (SA) and magnitude in professional male SP.

**METHODS:** Professional male SP from the first division of Czech Republic ( $n = 148$ , age  $25.1 \pm 4.8$  years) volunteered to participate in the study. SP performed isokinetic strength testing (Humac Norm, CYBEX, USA) concentrically at angular velocities of 60, 180 and 300°·s<sup>-1</sup>. The peak muscle torque of knee extensors (PT<sub>e</sub>) and flexors (PT<sub>f</sub>) in both legs, hamstrings and quadriceps strength ratio of muscle torque for both preferred and non-preferred extremities (H:Qp and H:Qn respectively), bilateral ratio between the exerted strength of knee extensors (Q:Q) and flexors (H:H) were calculated. Mixed-design RM ANOVA, Bonferroni's *post hoc* tests and partial eta square ( $\eta_p^2$ ) were used for statistical assessment.

**RESULTS:** Knee flexors showed significantly higher SA (H:H =  $9.77 \pm 0.40\%$ ) compared to the extensors (Q:Q =  $7.24 \pm 0.40\%$ ) ( $F_{1,294} = 20.49$ ,  $p = 0.00$ ,  $\eta^2 = 0.07$ ). Greater hamstrings and quadriceps strength ratio was found in preferred leg (H:Qp =  $59.89\%$ ) compare to non-preferred (H:Qn =  $58.10 \pm 0.63\%$ ) ( $F_{2,588} = 4.01$ ,  $p = 0.04$ ,  $\eta^2 = 0.01$ ). Contraction velocity speed did not have a significant difference on SA ( $p > 0.05$ ). MS of knee extensors reached the highest value at the lowest velocity for both legs (PT<sub>e60} =  $2.94 \pm 0.36$  N·m·kg<sup>-1</sup>). Exerted MS significantly decreased with</sub>

increasing velocity in both: extensors ( $F_{2,588}=4218.92, p=0.00, \eta^2=0.94$ ) and flexors ( $F_{2,588}=2932.69, p=0.00, \eta^2=0.91$ ). At the highest velocity ( $300^\circ \cdot s^{-1}$ ), MS achieved ~55% ( $PT_c$ ) respectively ~53% (PTF) of MS exerted at the lowest velocity ( $300^\circ \cdot s^{-1}$ ). **CONCLUSIONS:** Greater SA was found in knee flexion (H:H) rather than knee extension (Q:Q) in a group of professional male SP. Also, greater hamstrings and quadriceps strength ratio was found in preferred leg (H:Qp) compared to non-preferred leg (H:Qn). The findings of this study will be useful in the design of injury prevention and performance enhancement programs.

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**Effect of Previous Groin Pain on Sagittal Plane Joint Moments During Soccer Instep Kicks**

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Previous groin pain is common in male soccer players, often results in re-injury,<sup>1,2</sup> has been linked to maximal instep kicks.<sup>3,4</sup> Research has shown aberrant kinematics during the instep kick in players with previous groin pain.<sup>5</sup>

**PURPOSE:** To quantify differences in sagittal plane joint moments during maximal instep kicks between players with and without previous groin pain.

**METHODS:** Data were collected from 12 experienced male soccer players who reported nonspecific groin pain in the last 12 months, and 11 controls who each performed six maximal instep kicks. A 10-camera Qualisys motion capture system (500 Hz) and two Bertec force platforms (2000Hz.) collected data that were then processed using standard software (Visual 3D). Bilateral normalized joint moments of the hip, knee, and ankle were quantified at stance limb plant (PL), swing limb peak knee flexion (PKF) and at ball contact (BC). The foot speed of the swing limb at impact was considered an indication of kicking performance. The two-tailed alpha level was set to 0.05 and Cohen's *d* was used to quantify the magnitude of differences between groups.

**RESULTS:** A moderate difference in foot velocity existed between the groups (C: 15.5  $m \cdot s^{-1}$ , PGP 14.8  $m \cdot s^{-1}$ ,  $p=0.087, D=0.77$ ). Differences in stance limb joint moments were evident throughout the kick, while the swing limb only displayed differences at BC (Figure 1).

**CONCLUSION:** The PGP group often utilized lower sagittal plane joint moments about the hip, knee, and ankle of the stance limb but without evidence of a matching decrease in foot velocity at BC. This suggests that compensations occurred elsewhere in the kinetic chain to make up for the reduced joint moments. The stance hip flexion moment in the PGP group at PL is atypical and further supports the presence of aberrant motor patterns.

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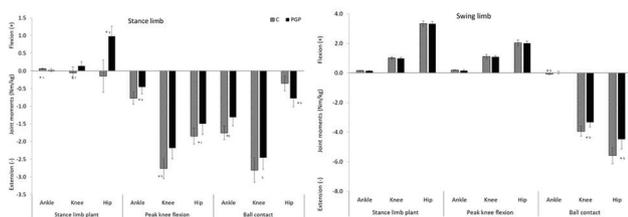


Figure 1. Graphs of joint moments of the limbs during the phases of the kick for C (black) and PGP (gray) groups. \* indicates  $P < 0.05$ , \*\* indicate  $D > 0.8$ , \*\*\* indicate  $0.5 > D > 0.5$ , and † indicate  $D > 0.5$ .

**276** Board #114 May 29 9:30 AM - 11:00 AM  
**Using Isokinetic Strength Assessment to Predict Performance and Prevent Injuries in Indian Cricket Fast Bowlers**

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 (No relevant relationships reported)

Cricket is the most commonly played & followed sport in India. It demands a high level of performance from the fast bowler. The fast bowling action involves a run up, leap and landing onto the lower limbs, followed by ball release. The large ground reaction forces generated during landing put fast bowlers at high risk of lower limb and lumbar spine injury. Precise dynamic coordination of lower body segments is needed to absorb these forces and transfer the energy via the core to the upper limb

to propel the ball at faster speeds. Thus, knowledge of lower quadrant strength can be very useful for injury prevention and better performance in fast bowlers. Dynamic Knee Strength in the front limb is critical during the leap phase of bowling for optimal performance. There is a lack of literature in this subject in Indian fast bowlers despite the popularity of the sport.

**PURPOSE:** To evaluate the Isokinetic knee strength, determine the relevant asymmetries and strength imbalances & their relationship with performance and injury risk in Cricket Fast Bowlers. **METHODS:** 42 male Indian State Level fast bowlers underwent Isokinetic knee strength testing. Quadriceps concentric (Qconc), Quadriceps eccentric (Qecc), Hamstring concentric (Hconc) & Hamstring eccentric (Hecc) Peak Torques normalized to body weight (PT/BW) were obtained. Bilateral Strength Asymmetries (BSA) and Dynamic Control Ratios (Hamstring DCR= Hecc/Qconc & Quadriceps DCR=Qecc/Hconc) were evaluated. Vertical Jump Height (VJ) & Standing Broad Jump (SBJ) distance were used as indicators of jump performance. Descriptive statistical analysis of data & Pearson correlation was done to obtain relationship between Isokinetic parameters & jump performance. **RESULTS:** A significant correlation was found between Qconc Strength and VJ ( $r=0.67, p=0.04$ ) & SBJ ( $r=0.39, p=0.04$ ). 67% of bowlers had significant Qecc strength asymmetry. 40% had poor Hamstrings DCR & 19% had poor Quadriceps DCR on the front limb. **CONCLUSION:** A significant proportion of fast bowlers have unfavorable strength asymmetry & DCR and thus are at risk of injury. Improving Dynamic Knee Strength through plyometric training could help optimize performance and reduce injury risk.

**277** Board #115 May 29 9:30 AM - 11:00 AM  
**Biceps and Triceps Contribute to Pitching Performance in College Baseball**

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Training for pitching traditionally focuses on core and leg work, but there may be justification for isolated arm muscle training to enhance performance. **PURPOSE:** To evaluate the influence of biceps and triceps function during pitching. **METHODS:** Pitchers ( $n=10$ ) from a Division-1 collegiate team were recruited. Throwing mechanics and isolated arm movements were assessed using Proteus technology (Boston Biomechanics Inc). A single set of biceps and triceps movements (with 12 and 10 lbs respective resistance) and biomechanical assessment of a throwing movement were collected. All movements completed on Proteus result in seven variables: power, explosiveness, braking, consistency, endurance, velocity, and range of motion (ROM). Pearson correlation coefficients were employed to analyze relationships between the Proteus variables for biceps curls and triceps extensions, throw mechanics, and statistics from in-game performances from the 2017 season. **RESULTS:** The strongest relationship among all comparisons was biceps curl endurance and ERA ( $r=-0.959; p=0.001$ ). The biceps curl ROM was also weakly related to throw power ( $r=0.429; p=0.076$ ). Throw endurance corresponded with positive trends for biceps curl power ( $r=0.419; p=0.089$ ), explosiveness ( $r=0.452; p=0.060$ ), velocity ( $r=0.417; p=0.085$ ), and ROM ( $r=0.429; p=0.075$ ). A strong positive relationship was observed between throw endurance and biceps curl braking ( $r=0.535; p=0.022$ ) and a positive trend between biceps curl ROM and throw velocity ( $r=0.429; p=0.075$ ). Triceps extensions corresponded closely with throwing mechanics and in-game statistics; trends were found between triceps explosiveness and strikeouts per nine innings ( $r=0.728; p=0.064$ ) and Proteus throw velocity ( $r=0.462; p=0.053$ ). Throw endurance was related to triceps extension braking ( $r=0.496; p=0.037$ ) and it displayed a trend with triceps extension endurance ( $r=0.435; p=0.071$ ). **CONCLUSIONS:** New technology permits advanced biomechanical analysis of baseball pitching. Preliminary testing reveals the importance of arm conditioning for a pitcher's ability to maintain power output. As more players are tested, we may further our understanding of the role of biceps and triceps function in throwing mechanics.

**278** Board #116 May 29 9:30 AM - 11:00 AM  
**Biomechanical Predictors of Fastball Velocity in Collegiate Pitching**

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Recent pitching analyses indicate development programs should emphasize ball speed to optimize performance on the mound. Proper training is likely to increase velocity, but pitch delivery involves complex motions in all cardinal planes. Until recently, accurate analyses were encumbered by technological limitations. For example, isokinetic torque assessment measures fundamentally different phenomena from isotonic pitch delivery. New technology permits more accurate analysis. **PURPOSE:** To evaluate kinematic predictors of fastball velocity in collegiate

pitchers. **METHODS:** We tested all pitchers (n=10) from a private D1 baseball team in the West Coast Conference. Velocity was recorded as the mean speed of the three fastest in-game pitches. We used Proteus (Boston Biomotion, USA) to conduct three-dimensional isotonic assessments of pitching form, dominant and non-dominant core rotation, dominant arm internal and external shoulder rotation, and anterior flexion and extension of the dominant shoulder. Proteus software calculated power, explosiveness, velocity, and endurance. Non-mechanical predictors of fastball velocity were class year, height, weight, and limb lengths. Simple linear regressions quantified mechanical predictors of fastball velocity and the effect of fastball velocity on in-game pitching performance. **RESULTS:** Pitchers with a higher fastball speed had more appearances (r=0.763; p=0.028), pitched more innings (r=0.715; p=0.046), had more wins per appearance (r=0.524; p=0.183), and more total strikeouts in the season (r=0.829; p=0.011) but not per appearance (r=0.566; p=0.143) or per inning (r=0.074; p=0.861). Anthropometric variables were unrelated to fastball velocity. Internal rotation explosiveness (p=0.031) and endurance (p=0.030) of the dominant arm predicted fastball velocity. For each additional point of endurance, fastball speed increased 0.7 mph (p=0.030); for each additional 10 points of explosiveness, fastball velocity increased 0.4 mph (p=0.031). There was a positive relationship associated with explosiveness in straight-arm anterior shoulder raises (r=0.898; p=0.015); trends were found in the non-dominant arm. **CONCLUSION:** Increased fastball velocity may be facilitated by training internal shoulder rotation and shoulder flexion.

**279** Board #117 May 29 9:30 AM - 11:00 AM  
**Match Acceleration and Deceleration Patterns in Female Collegiate Soccer Players**

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Non-contact anterior cruciate ligament (ACL) sprains are becoming increasingly problematic for athletes, especially females. Running performance factors like acceleration and deceleration are often underestimated when examining fatigue in soccer players, but may be useful for prophylactic training to counter dysfunctional lower body mechanics under fatigued conditions. Currently no study exists that characterizes these factors in match play in female collegiate soccer players. **PURPOSE:** To describe match acceleration and deceleration patterns in female collegiate soccer players and compare positional influence. **METHODS:** 24 female NCAA Division I soccer players (11 defenders, 5 midfielders, 8 strikers) underwent global positioning system (GPS, 10Hz) monitoring throughout a 16-game competitive season. A custom written Matlab script processed GPS data and computed the amount of low (<1 m/s<sup>2</sup>, <-1m/s<sup>2</sup>) and high (>2 m/s<sup>2</sup>, <-2 m/s<sup>2</sup>) acceleration-efforts (AE) and deceleration-efforts (DE), distance covered per effort, and starting speed of efforts. A Kruskal-Wallis H test and two separate paired t-tests were used to compare variables by position and by halves of matches, respectively. A significance level of p<.05 was used for all analyses. **RESULTS:** Strikers performed significantly more high-intensity AE (1<sup>st</sup> half: 0.97 efforts/min; 2<sup>nd</sup> half: 1.07 efforts/min) and DE (1<sup>st</sup> half: 1.15 efforts/min; 2<sup>nd</sup> half: 1.24 efforts/min) when compared to defenders (AE: 0.76 efforts/min; 0.75 efforts/min; DE: 0.90 efforts/min; 0.87 efforts/min) (p = 0.00, p = 0.00, p = 0.00, p = 0.00) and midfielders (AE: 0.73 efforts/min; 0.86 efforts/min; DE: 0.91 efforts/min; 0.80 efforts/min) (p = 0.00, p = 0.00, p = 0.00, p = 0.00). Significant decreases occurred in the second half across all matches in distance covered in low-intensity AE (1.9 ± 0.2 m, p = .01) and low-intensity DE (0.9 ± 0.1 m, p = .01), and starting speed in low-intensity AE (6.9 ± 0.3 m/s, p = .01) and DE (3.9 ± 0.2 m/s, p = 0.00). **CONCLUSION:** Strikers performed more high-intensity AE and DE than other positions, and may be at greater risk of lower body injury. Transient decreases in AE and DE occurred between halves of match play, and may relate to an increased risk of lower body injury in female soccer players.

**TOPICAL GROUP #103**  
**TOPICAL GROUP #402**  
**TOPICAL GROUP #404**

**280** Board #118 May 29 9:30 AM - 11:00 AM  
**The Kick Motion Analysis Of Adolescent Male Soccer Player With Osgood-schlatter Disease**

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Osgood-Schlatter disease(OSD) is an epiphyseal disease of tibial tubercle by repeated traction of patellar tendon, especially on epiphyseal or apophyseal stage. OSD is associated with sports that involve kicking, and running, but none have analyzed the kick motion of adolescent soccer players who experienced the OSD.

**PURPOSE:** The purpose of this study was to compare the kick motion in adolescent soccer players with and without OSD using three-dimensional motion analysis system. **METHODS:** We recruited 112 adolescent soccer players (13 ± 1 years old) All players went through the medical examination including the ultrasonography of tibial tubercle, and the muscle tightness test of lower limbs. We included only those tibial tubercle stage was epiphyseal or apophyseal stage for this study and made two groups: presence of OSD on kicking leg (OSD group; n = 10) and absence of OSD or any other injuries (NP group; n = 30).

We measured real-time kick motion using a three-dimensional motion analysis system (Qualisys track manager, Qualisys AB., Sweden). We placed 65 spherical markers on each anatomical landmark and calculated the angle of the lumbar spine, pelvis, hips, knees and ankles. We collected data for the following six events of kicking leg: foot contact (FC), toe off (TO), max hip extension (HE), max knee flexion (KF), ball impact (BI), and max hip flexion (HF). We used unpaired t-test to compare all the factors we measured between OSD group and NP group.

**RESULTS:** The anthropometric index, muscle tightness, ball speed of OSD group were not different from NP group. In HE, the supporting leg's ankle flexion angle in OSD group was smaller in OSD group(14.9±3.7 vs. 18.9±5.0 °, p=0.024). In KF ,the hip abduction angle of the kicking leg was smaller(24.5±5.9 vs. 28.6±5.1 °, p=0.041) in OSD group. In HF, the lateral bending angle of pelvis toward the supporting side was significantly smaller in OSD group (-2.6±16.4 vs. 7.4±11.3 °, p=0.037) In HF, supporting leg's ankle was more dorsal flexion(0.4±14.9 vs. -14.1±14.5 °, p=0.010), more valgus(26.3±12.4 vs. 11.5±11.1 °, p=0.001)compared to NP group.

**CONCLUSION:** OSD group had smaller dorsal flexion angle of supporting leg before and after BI. They also had smaller hip abduction angle of kicking leg before BI, and lateral bending angle of pelvis toward the supporting leg side was smaller after BI.

**281** Board #119 May 29 9:30 AM - 11:00 AM  
**Relationship Between Core Endurance and the Landing Error Scoring System in Youth Soccer Players**

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Lower extremity injuries in youth soccer players continue to rise and have been related to poor landing mechanics. Identifying modifiable factors that influence at-risk landing mechanics is crucial toward the development of effective injury prevention programs. Dynamic core stability is needed to control lower extremity motion and decrease the risk of lower extremity injury. However, there is limited research that has examined the relationship between core stability and landing mechanics in youth athletes. Furthermore, understanding this relationship using screening methods that are readily accessible to clinicians is necessary as participation and injuries in youth soccer programs continue to increase. **PURPOSE:** To investigate the relationship between core endurance and the Landing Error Scoring System (LESS). **METHODS:** One hundred and ninety-two youth soccer players (M 108, F 84, 11.9±1.0yrs, 153.2±11.1cm, 43.2±8.8kg) participated. Core endurance was assessed using a validated sport-specific endurance plank test. Two-dimensional kinematics were collected during three trials of a 30cm drop-jump landing task and scored using an automated LESS scoring system (PhysiMax Technologies Ltd. Tel Aviv, Israel). Separate Pearson correlations (r) examined the relationship between time to exhaustion during the plank test and total LESS scores for males and females. **RESULTS:** In males, core endurance time to exhaustion (73.6±15.1s) was negatively correlated (r=-0.210, P=0.030) to total LESS scores (5.6±1.8). In females, core endurance time to exhaustion (72.5±15.3s) was not correlated (r= -0.061, P=0.578) to total LESS scores (6.4±1.9). **DISCUSSION:** Decreased core endurance was related to increased landing errors in male, but not female, youth athletes. These data suggest that prevention programs should incorporate core endurance exercises to improve at-risk landing patterns known to increase the risk of lower extremity injuries in youth male soccer players. More work is needed to identify the modifiable factors that increase the risk of injury in youth female soccer players.

**282** Board #120 May 29 9:30 AM - 11:00 AM  
**Using Functional Movement Screento Predict Injuries in Soccer Players**

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**Purpose:** The aim of this study was to evaluate the predictive capacity of the Functional Movement Screen (FMS) to predict injuries in under 17 soccer players. In this study we tested the model in its original form, which will be called T7, with

an alternative model, proposed here, based on only 4 of the 7 evaluated in its original form. The choice of the four items considered the fact that they are movements that more directly evaluate balance and lower limb movement pattern, which are more related to musculoskeletal injuries in soccer.

**Methods:** The sample was selected from 33 under 17 players of a Brazilian soccer team. The evaluation of the functional movement pattern was performed by 2 evaluators and when there was conflict in the athletes' score, a third evaluator was called for the final decision. The evaluations were all made in the preseason. As predicted by the method, each one of the 7 analyzed items were rated with 1 (worst), 2 or 3 (best). The items evaluated were: deep squat (1), hurdle step (2), in-line lunge (3), active straight-leg raise (4), shoulder mobility stability (7). The complete index (T7) is what is normally used in this type of work. What we have suggested is T4, in which evaluations 1, 2, 3 and 4 come in.

**Summary of Results:** In 31 athletes selected, 7 had some type of skeletal muscle injury throughout the season (22.58% of the total). Through the analysis of effect size (Hedge's g) it can be verified that when the injured athletes are compared with the complete index T7 in relation to the proposed T4, the effect size is 0.854, which can be considered a significant difference, in a clinical way. Regarding those who were not injured, the power of explanation is even greater, with an ES of -1.104. The most relevant finding of the present study was when comparing the predictive power of T7 and T4 to predict injuries. While the T7 ES stood at 0.276, the T4 ES stood at 2.698.

Effect Size (ES)	ES (hedges g)	IC 95%	
ES T7Injury x ES T4Injury	<b>0,854</b>	<b>0,757</b>	<b>0,950</b>
ES T7Notinjury x ES T4Notinjury	<b>-1,104</b>	<b>-1,150</b>	<b>-1,059</b>
ES T7Injury x ES T7Notinjury	<b>0,276</b>	<b>0,214</b>	<b>0,338</b>
ES T4Injury X ES T4Notinjury	<b>2,698</b>	<b>2,632</b>	<b>2,764</b>

**Conclusion:** The present study showed that FMS can be used for the prediction of musculoskeletal injuries in soccer players.

#### A-45 Free Communication/Poster - Rehabilitation & Disability

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
Room: CC-Hall WA2

#### 283 Board #121 May 29 11:00 AM - 12:30 PM Different Exercise Regimens On Rehabilitation Of Patients With Stable Coronary Heart Disease

Chen Liang<sup>1</sup>, Can Gao<sup>1</sup>, Jianhong Zhang<sup>1</sup>, Qun Ye<sup>1</sup>, Lindan Zhai<sup>1</sup>, Fengrun Zhao<sup>2</sup>. <sup>1</sup>National Institute of Sports Medicine, Beijing, China. <sup>2</sup>Beijing University of Chinese Medicine, Beijing, China.  
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**PURPOSE:** To investigate the efficacy and safety of different exercise regimens in the rehabilitation of patients with stable coronary heart disease.

**METHODS:** This study was a randomized controlled trial to screen 112 patients with stable coronary heart disease who were admitted to General Administration of Sport of China Sports Medical Science Institute from March 2017 to June 2018. They were randomly divided into aerobic resistance training group for 12 weeks (ART group, 36 cases) and traditional Chinese medicine training group 12 weeks (TCMT group 2, 37 cases) and control group (CON group, 39 cases). We analyzed the baseline parameters of all participants and the 12-week exercise plate test parameters and related physical and body parameters.

**RESULTS:** After 12 weeks of intervention, VO<sub>2</sub>, VO<sub>2</sub>/Kg, METS, VO<sub>2</sub>/HR, SV, peaked grip strength and flexibility parameters of ART group and TCMT group were significantly higher than those of the control group (P<0.05). Resting heart rate (RHR) of TCMT Group was significantly lower than CON group, but there was no significant difference between groups ART and CON (P>0.05). VE/VO<sub>2</sub> of TCMT group was significantly higher than that of CON group. Body mass index (BMI) of ART group was significantly lower than that of TCMT group and CON group, and BMF of TCMT group was significantly smaller than that of ART group, but there was no difference between TCMT group and CON group for BMI and Body fat mass (BFM).

**CONCLUSIONS:** Both ART and TCMT can improve the cardiopulmonary aerobic exercise capacity and physical fitness of patients with stable coronary heart disease. Although the degree of improvement is different, they all have certain curative effect on the rehabilitation of patients with stable coronary heart disease and the application is safe.

#### 284 Board #122 May 29 11:00 AM - 12:30 PM Effect of Walking Exercise on Metabolic and Pulmonary Health in Non-ambulatory Stroke Survivors, Pilot Data

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(No relevant relationships reported)

**PURPOSE:** Most of rehabilitation interventions in stroke rehabilitation have focused on improving the impaired sensorimotor function. However, up to 75% of stroke survivors are prone to have cardiovascular disease, which is the main cause of death in people after stroke. Diabetes mellitus is one of the major risk factors for developing cardiovascular diseases. Stroke survivors are prone to have diabetes mellitus due to increased fat tissue in their affected limbs. In addition, lung function is compromised in stroke survivors, which may cause fatigue and exercise intolerance. Furthermore, past studies of aerobic exercise have involved only stroke survivors who could walk independently. Stroke survivors who were unable to walk were not included in previous research investigating changes in risk factors of cardiovascular diseases and lung function from walking exercise interventions. In this project, we examined the effect of aerobic walking exercise on blood glycemic control and lung function in non-ambulatory stroke survivors using a treadmill, body weight support system, and a gait training device.

**METHODS:** In this on-going project, we have completed a low intensity walking exercise program (30 minutes/session; three sessions/week for eight weeks) in 5 ischemic stroke survivors (4 males, mean age 63.8±14.8 years). Before and after the intervention, a glycated hemoglobin (HbA1c) was measured using A1CNow+™ Systems, and vital capacity (VC) and forced vital capacity (FVC) were measured using a spirometer according to the guideline from American Thoracic Society/European Respiratory Society.

**RESULTS:** HbA1c decreased from 5.7±0.2% to 5.4±0.2% from before to after the intervention. Pre- and post-intervention VC increased from 2.69±1.01 L to 2.85±0.82 L; FVC increased from 2.65±1.08 L to 2.72±0.97 L, respectively.

**CONCLUSIONS:** The results are promising and suggest that the low intensity aerobic walking exercise may improve blood glycemic control by decreasing HbA1c in non-ambulatory stroke survivors. Also, the results suggest that the low intensity aerobic walking exercise may improve lung function by increasing VC and FVC. This is an ongoing study; we anticipate recruiting 20 study participants for the study.

#### 285 Board #123 May 29 11:00 AM - 12:30 PM Effects Of Intra-dialytic Exercises On Physical Fitness And Health Related Quality Of Life (HRQOL).

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**PURPOSE:** Patients undergoing dialysis have low levels of physical activity compared to their age matched healthy sedentary adults (*Kidney International, Vol. 57 (2000), 2564-2570*). It is observed that there is continuous decline in physical function and associated increased mortality and morbidity, in these patients. In 2016, the *American College of Sports Medicine* stated that intradialytic exercise is medicine for haemodialysis patients. Exercise during haemodialysis has been shown to benefit muscle strength and bone demineralization, reducing cardiovascular risk dialysis related symptoms and improving physical fitness and HRQOL. Exercise during haemodialysis has higher adherence compared to out-patient exercise in a rehab center. Therefore, this study was conducted to see the effects of intra-dialytic exercises on fitness and quality of life. **METHODS:** Before enrolling the patients (N=50), a general history was taken. Physical fitness was assessed by 6-minute walk test with telemetry ECG monitoring and health-related quality of life assessment was done using DSI Scale (Dialysis symptom index). Patients were given breathing exercises, active movements of extremities, strengthening and specific therapies for other issues during each dialysis session (2-3 days/week). After completion of the dialysis, patients performed aerobic exercise on a stationary bicycle. At the end of 12 sessions, the 6-minute walk test (N=17) and DSI questionnaire (N=25) were repeated. **RESULTS:** There was an average 40 meters (13.88%) improvement in 6-minute walk test distance after 12 sessions of rehabilitation (p<0.0001, t=5.935). The number of symptoms patients suffered related to dialysis went down by 2.44 points (21.40%) after rehabilitation (p=0.0015, t=3.584). The Dialysis symptom Index score improved by 10 points (27.80%) (p<0.0001, t=4.798). **CONCLUSIONS:** An intradialytic aerobic and strengthening exercise program showed significant health benefits by reducing dialysis related symptoms, improved physical fitness and improved health related quality of life.

**286** Board #124 May 29 11:00 AM - 12:30 PM  
**Diabetes Impairs Walking Capacity And Autonomic Function In Patients With Peripheral Artery Disease**  
 Raphael M. Ritti-Dias<sup>1</sup>, Marilia Correia<sup>1</sup>, Paulo Longano<sup>2</sup>, Nelson Wolosker<sup>2</sup>, Gabriel Cucato<sup>2</sup>. <sup>1</sup>University Nove de Julho, São Paulo, Brazil. <sup>2</sup>Hospital Israelita Albert Einstein, São Paulo, Brazil.  
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Diabetes is a high prevalent comorbid condition in patients with peripheral arterial disease (PAD). Previous studies showed that diabetes impair physical function in PAD patients. However, whether cardiovascular function is also affected by diabetes is unknown.

**PURPOSE:** To compare walking capacity and cardiovascular function in PAD patients with and without diabetes. A total of 80 patients (n=41 non-diabetic and n=39 diabetic) with PAD were recruited. Six-minute walk test (total walking capacity), 4-meter test, walking impairment questionnaire (WIQ) and the walking estimated-limitation calculated by history (WELCH) were used to assess walking capacity. Cardiovascular function was assessed by blood pressure, arterial stiffness, heart rate variability and flow-mediated dilation. Mann-Whitney U test were performed, and data are presented in median and interquartile range. **RESULTS:** Diabetic PAD patients presented lower total walking capacity (308 ± 120 m vs. 370 ± 125m, p=0.025), WIQ distance score (10 ± 23 vs. 30 ± 46, p=0.002), WIQ speed score (17 ± 21 vs. 28 ± 27, p=0.001), WIQ stairs score (21 ± 42 vs. 42 ± 42, p=0.024), WELCH total score (20 ± 26 vs. 40 ± 42, p=0.006) compared to non-diabetic PAD patients. In addition, diabetic PAD patients had lower SDNN (22 ± 21 vs. 29 ± 36, p=0.030), and a trend to have lower RMSSD (13 ± 19 vs. 19 ± 32, p=0.061), and PNN50 (0.4 ± 3.7 vs. 1.6 ± 21.0, p=0.072). The remaining variables were similar between PAD patients with and without diabetes. **CONCLUSION:** Diabetes impairs walking capacity and cardiac autonomic modulation in patients with PAD. Therefore, interventions to improve these parameters should be emphasized in diabetic PAD patients. Supported by FAPESP (# 2016/16425-9) and CNPq (#310508/2017-7)

**287** Board #125 May 29 11:00 AM - 12:30 PM  
**High Intensity Interval Versus Moderate Intensity Training In Heart Failure Patients: Systematic Review And Meta-analysis**  
 José Trejos-Montoya<sup>1</sup>, Felipe Araya-Ramirez<sup>1</sup>, Braulio Sánchez-Ureña<sup>1</sup>, George A. Kelley, FACSM<sup>2</sup>. <sup>1</sup>Universidad Nacional, Heredia, Costa Rica. <sup>2</sup>West Virginia University, West Virginia, WV. (Sponsor: George A. Kelley, FACSM)  
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Studies examining high intensity interval training (HIIT) and moderate intensity continuous training (MICT) have yielded conflicting findings regarding changes in left ventricular ejection fraction (LVEF) in heart failure (HF) patients with reduced ejection fraction (EF). **Purpose:** Use the meta-analytic approach to compare the effects of HIIT versus MICT on LVEF in HF patients with reduced EF. **Methods:** A search for studies published up to July 2018 was conducted using four electronic databases: PubMed, Academic Search Complete, SportDiscus and ScienceDirect. Studies were included if they met the following criteria: (1) clinical trials, (2) studies that reported means and standard deviations for LVEF, (3) adult men and women 18 years of age and older with a previous diagnosis of HF and an ejection fraction <55%, and (4) studies published in English or Spanish. Change outcome effect sizes (ES) using the original metric were calculated from each study. Results were pooled using random-effects models. A two-tailed alpha value <0.05 was considered statistically significant. Heterogeneity was assessed using the Q statistic and inconsistency using I<sup>2</sup>. Small-study effects was examined using funnel plots and influence analysis was conducted with each study deleted once. **Results:** Of the 235 studies screened, 12 trials representing 418 HF patients met the criteria for inclusion. The number of sessions ranged from 24-48 and duration from 28-47 minutes per session. Overall, HIIT significantly increased LVEF (ES = 6.4%, 95% CI = 3.7% to 9.1%; p < 0.001). No statistically significant changes were found for either MICT (ES = 3.1%, 95% CI = -0.4% to 6.7%; p = 0.08) or Controls (ES = -0.8%, 95% CI = -1.8% to 0.2%; p = 0.11). Statistically significant heterogeneity and a moderate amount of inconsistency was found for HIIT (Q = 18.4, p=0.02; I<sup>2</sup> = 56.5%), statistically significant heterogeneity and a large amount of inconsistency for MICT (Q = 42.9, p < .001; I<sup>2</sup> = 79.0%), but no statistically significant heterogeneity or inconsistency for Controls (Q = 0.42, p = 0.81; I<sup>2</sup> = 0%). Small-study effects were observed for both HIIT and MICT but not Controls. With each study deleted from the models once, changes ranged from 5.5% to 7.9% for HIIT, 1.9% to 3.6% for MICT, and -3.0% to 0.4% for Controls. **Conclusion:** HIIT increases LVEF in HF patients with reduced EF.

**288** Board #126 May 29 11:00 AM - 12:30 PM  
**Evaluation of a Community Based Cardiac Rehabilitation Programme**  
 Joanne Regan-Moriarty<sup>1</sup>, Maire McCallion<sup>1</sup>, Azura Youell<sup>1</sup>, Eimear Donlon<sup>1</sup>, Audrey Coltery<sup>2</sup>, Brona Furlong<sup>2</sup>, Niall Moyna<sup>3</sup>. <sup>1</sup>Institute of Technology Sligo, Sligo, Ireland. <sup>2</sup>Sligo University Hospital, Sligo, Ireland. <sup>3</sup>Dublin City University, Dublin, Ireland.  
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The transition from hospital-based (phase II) to community-based (phase III) cardiac rehabilitation (CR) is an important step in the long-term maintenance of positive health behaviour change.

**PURPOSE:** To evaluate the effect of participation in a phase III, community-based CR (CBCR) programme on selected fitness indices in comparison to a control group that received usual care advice and to explore participant experiences and perceived benefits in transitioning from hospital-based phase II CR to CBCR. **METHODS:** Following completion of phase-II CR, 95 individuals were referred to a 10-week CBCR exercise programme (intervention). A total of 22 (73% male) participants were unable to attend CBCR classes and were assigned to the control group. The remaining 73 (67% male) were assigned to the CBCR exercise program. Aerobic fitness (6MWT), functional upper (hand grip) and lower (timed sit to stand) limb strength, flexibility (sit and reach test) and body composition (waist & hip girth and BMI) were measured pre and post the intervention. All participants from the intervention group were invited to attend a focus group on completion and a thematic analysis was conducted. **RESULTS:** A total of 51 participants (69% male) completed the 10-week program (70% compliance). There was a significant improvement (p<0.05) in the timed sit to stand (26.5±7.21 v 21.4±5.65sec), 6MWT (505±66.6 v 534±71.9m,) and waist circumference (100.9±13.09 v 98.5±13.37cm) in the intervention group. There was no significant change in any of the fitness indices in the control group. The focus groups were attended by 20 participants (60% male). The main themes identified included the strong sense of need for CBCR programmes and the reassurance provided by the link between the hospital and community provider. Physical, psychological and social benefits were described including moving from fear to confidence in their ability to exercise. **CONCLUSION:** Participation in a 10-week CBCR programme resulted in improved lower limb strength, aerobic fitness and waist circumference with maintenance of all other measured fitness components. Participants self-reported an increased ability and motivation to undertake exercise. This study provides an important insight into the experience and benefits, both perceived and actual, in the early transition to CBCR.

**289** Board #127 May 29 11:00 AM - 12:30 PM  
**Effect Of Supervised Physical Training In Patients With Univentricular Physiology After Fontan Operation**  
 Daniela Regina Agostinho, Aida Luiza Ribeiro Turquetto, Luciana Patrick Amato, Patricia Alves de Oliveira, Joao Bruno Dias Silveira, Milena Schiezzari Ru Barnabe, Fabiana Padilla Hodas, Luiz Fernando Caneo, Carlos Eduardo Negrão, Marcelo Bisegli Jatene. Heart Institute of University of São Paulo - Medical School, São Paulo, Brazil.  
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**PURPOSE:** The advances in the clinical and surgical management of patients with univentricular physiology after Fontan operation have allowed many patients to reach adulthood with a good quality of life. Nevertheless, most of these patients show a lower functional capacity compared to their healthy peers. Controlled data on supervised physical training in the Fontan patients are lacking, thus further studies are needed. The aim of this study was to evaluate the effect supervised exercise training on functional capacity (FC) in Fontan patients (FP).

**METHODS:** Randomized controlled trial with fifteen FP divided in two groups: supervised exercise training (ET) and no exercise training (NET). The ET group was submitted an incremental cardiopulmonary exercise test (CPX) before and after the intervention. The NET group was submitted to the CPX at baseline condition and after four months, maintaining their habitual activities. The training protocol consisted of three 60-minute exercise sessions per week for 4 months. The session was 40 minutes of aerobic exercise, 15 minutes of local strengthening exercises. The exercise intensity was monitored by heart rate between the anaerobic threshold and respiratory compensation point, obtained by a progressive maximal CPX.

**RESULTS:** There were no significant differences in baseline data between groups (age, gender, weight, medications, variables of CPX). There was an improvement in the FC as demonstrated by peak VO2 L/min, VO2 ml/kg/min and % predicted peak VO2 ml/kg/min in ETG [1,35 (1,27-1,95) vs 1,50 (1,40-2,55) L/min p=0,044; 26,9 (22,5-30,5) vs 30,6 (25,5-37,0) ml/kg/min p=0,021 and 69 (57-80) vs 79 (69-89) % p=0,018] respectively. In the NETG there was a mild decrease in FC and no significant. [1,57 (1,30-2,20) vs 1,55 (1,24-2,27) L/min p=0,753; 30,3 (25,9-38,6) vs 28,5 (23,8-

41.2) ml/kg/min,  $p=0.600$ ; 79 (61-89) vs 69 (61-91) %  $p=0.599$ ]. We also observed an improvement in peak ventilation and oxygen uptake efficiency slope (OUES) in ETG [54.7 (42.6-68.3) vs 67.6 (57.6-100.8) L/min  $p=0.028$ ; 1.80 (1.52-2.63) vs 2.11(1.65-2.88)  $p=0.028$ ] respectively.

**CONCLUSIONS:** Our results demonstrate that the supervised exercise training based on CPX was able to improve FC in patients with univentricular physiology after Fontan operation

**290 Board #128 May 29 11:00 AM - 12:30 PM**  
**Inertial Flywheel Resistance Exercise in Veterans with Chronic Kidney Disease Predialysis: A Case Series**

Jared M. Gollie, Michael O. Harris-Love, Samir S. Patel, Marc R. Blackman. *Veterans Affairs Medical Center; The George Washington University, Washington, DC.* (Sponsor: Peter F. Kokkinos, FACSM)

(No relevant relationships reported)

Chronic kidney disease (CKD) is associated with skeletal muscle loss and neuromuscular dysfunction, resulting in reduced physical performance. Inertial flywheel resistance exercise (RE) has been shown to be an effective training option for improving neuromuscular outcomes in healthy adults. However, evidence supporting its application in patients with CKD is limited. **PURPOSE:** To determine the effects of inertial flywheel RE on neuromuscular measures and physical function in Veterans with CKD predialysis. **METHODS:** Two adult men with stage 3 or 4 CKD (age: 70±7.1 yrs; eGFR: 41.5±19.5 mL/min/1.73 m<sup>2</sup>; weight: 111.3±16 kg; height: 178.2±9.9 cm) were enrolled to perform 12-weeks of inertial flywheel RE for the squat movement (3 sets x 12 repetitions). RE emphasized maximizing power output and was progressed by manipulating inertial load and contraction velocity. Knee extensor peak isometric and isokinetic torque (180°/s) and rate of torque development (RTD) were assessed using dynamometry. Muscle thickness (MT) and echo intensity (EI) of the rectus femoris and vastus lateralis muscles were determined via B-mode diagnostic ultrasound. Physical function was assessed as time to complete five chair stands (STS-5). **RESULTS:** Both subjects improved similarly after RE, thus data are presented as Mean ± SD. Peak isometric and isokinetic torque increased from 106.7±8.5 to 122.4±9.7 ft-lbs (+14.7%) and 67.5±3.2 to 80.9±8.4 ft-lbs (+19.9%). RTD at time intervals of 50, 100, 200, and 300 ms increased after RE from 0.14±0.13 to 0.49±0.46 ft-lbs/s (+255.4%), 0.19±0.17 to 0.41±0.34 ft-lbs/s (+119.7%), 0.19±0.13 to 0.27±0.27 ft-lbs/s (+44.3%), and 0.18±0.09 to 0.24±0.06 ft-lbs/s (+32.3%), respectively. STS-5 was reduced from 16.2±3.3 to 13.5±2.8 s (-16.4%). No changes were observed in MT or EI. **CONCLUSIONS:** Our initial findings support the notion that inertial flywheel RE was safe and feasible in these Veterans with CKD predialysis. Improvements were observed in peak isometric and isokinetic knee extensor torque, RTD, and STS-5. Lack of change in MT and EI suggest increases in torque generation may have, in part, been due to neurological adaptations. Larger-scale studies are required to determine the potential efficacy of inertial flywheel RE for enhancing neuromuscular health and physical function in persons with CKD.

**291 Board #129 May 29 11:00 AM - 12:30 PM**  
**Cardiovascular Rehabilitation: New Indications For Old Entities.**

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**Introduction:** The first Argentine Consensus of Cardiovascular rehabilitation (CR) is on the eve of publication. This adds new populations not included in other consensus, on pathologies that the Argentine Society of Cardiology (ASC) has updated through others published in recent years. **Purpose:** To highlight the interest to include pathologies that are increasingly underestimated and require greater focus. Although there are individual experiences that have not been published in Argentina so far. **Methods:** The consensus director, working together with two coordinators, and 35 editors, completed the task force of medical doctors with relevant experience in CR. In addition, had also participated an external evaluation committee comprised of four members, two of them international. The new candidate populations for CR programs are hypertrophic cardiomyopathy (HCM), pulmonary hypertension (PH) and chronic atrial fibrillation (CAF). **Results:** Individuals with these entities tend to over-demand what could trigger undesirable interferences. We focus on brief recommendations on each of them. Table. Synthesis of protocols in the considered pathologies

	PH	HCM	CAF
Inclusion criteria	Stable patient and with optimal pharmacological treatment.	Asymptomatic (finding).	1) isolated, or only episode 2) chronic stable.
Exclusion criteria		Symptomatic (intolerance to effort) or with demonstrable associated pathology.	paroxysmal, or repeated
Patient training	+	+	+
Elongation	yes	yes	Yes
Balance	yes	yes	Yes
Coordination	Yes	Yes	yes
Aerobic power	yes	no	Yes
Aerobic resistance	yes	yes	Yes
Strength	Yes	no	yes
Cool down	yes	yes	yes
Nutrition	+	+	+
Psychology	+	+	+

**Conclusion:** 1) The valuable contribution that will constitute the consensus on CR next to be published by the ASC stands out. 2) It focuses on the value it will have on three pathologies previously not sufficiently considered. 3) It also inferred the value it will generate when inducing the registry during its implementation, since there is not data enough in Argentina in this regard. 4) It proposes the integration and interaction of the different regions of the country in the same, which will stimulate the valuable integral contribution of the community of specialists in cardiology of Argentina. 5) It should be noted that at the last meeting of the ASC, in October 2018, 10,000 attendees were registered.

**292 Board #130 May 29 11:00 AM - 12:30 PM**  
**Low-health Literate Patients With Heart Failure Are At An Increased Risk Of Readmission**

James Kostra II<sup>1</sup>, Kelly Allsup<sup>2</sup>, Amanda Delligatti<sup>1</sup>, Gavid Hickey<sup>2</sup>, John Jakicic, FACSM<sup>3</sup>, Daniel E. Forman<sup>2</sup>. <sup>1</sup>University of Pittsburgh, Pittsburgh, PA. <sup>2</sup>VA Pittsburgh, Pittsburgh, PA. <sup>3</sup>Healthy Lifestyle Institute, University of Pittsburgh, Pittsburgh, PA. (Sponsor: John Jakicic, FACSM)

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**PURPOSE:** Health literacy (HL) is the degree to which individuals can obtain, process, and understand basic health information and services needed to make proper health decisions. Low-HL is associated with reduced adherence to exercise, medications, healthy nutrition, and low utilization of preventive health services. Cardiac Rehabilitation (CR) is a secondary prevention program that targets risk factor education and reduction, to associated improvements in health status. Heart failure (HF) has recently been added as an eligible diagnosis for CR, and it is associated with particularly high rates of readmission. We hypothesized that that low-HL may contribute to high hospital readmission among HF patients. To evaluate differences in hospital readmission rates for HF patients who did and did not attend CR. To compare rehospitalization in relation to low- versus (vs) high-HL in the HF patients who attended CR. **METHODS:** Retrospective quality improvement analysis. Comparison of matched HF patients who did versus did not attend CR. We then assessed HL in those who attended CR to compare 30-day and 90-day readmissions in patients with low-HL (less than 9<sup>th</sup> grade reading level) vs high-HL (greater than 9<sup>th</sup> grade reading level). HL was evaluated using the REALM-SF. **RESULTS:** Readmissions in 104 HF patients who attended CR were significantly lower than in the HF patients who did not attend CR (17.44% vs 21% at 30 days, and 22.62 vs. 39.3% at 90 days). Among the 104 HF patients who attended CR, 67 who categorized as high-HL had significantly lower readmission than the 37 who categorized as low-HL at both 30 (8.96% vs 29.73,  $p=0.0061$ ) and 90 days (22.39% vs. 40.54%,  $p=0.05$ ). **CONCLUSIONS:** CR enrollment was associated with reduced readmission in HF patients. Among HF patients who attend CR, low-HL was associated with relatively greater risks of rehospitalization compared to patients with high-HL, suggesting that refinements to address low-HL might improve the efficacy of CR.

Readmission rates in HF patients who participated in VA Pittsburgh Cardiac Rehab (N=109)							
	Low health literacy <9 <sup>th</sup> grade (N=37)		High Health literacy ≥9 <sup>th</sup> grade (N=67)				
	Frequency (n)	Percent	Frequency (n)	Percent	OR	95% CL	P-value
≥1 hospital readmission within 30 days	11	29.73	6	8.96	4.30	(1.44, 2.86)	0.0061
≥1 hospital readmission within 90 days	15	40.54	15	15	22.39	(0.98, 5.65)	.05

**293** Board #131 May 29 11:00 AM - 12:30 PM  
**Feasibility Of Overground High-intensity Interval Training (hit) In Persons With Chronic Stroke**  
 Daniel L. Carl, Victoria Scholl, Sarah Doren, Emily Staggs, Dustyn Whitesel, Kari Dunning, Hamza Sultan, Pierce Boyne. *University of Cincinnati, Cincinnati, OH.*  
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*(No relevant relationships reported)*

Evidence suggests that treadmill (TM) HIT can be safe and effective as a rehabilitation tool in persons with stroke. However, translation to overground walking can be limited and no studies have tested overground (OG) HIT. **PURPOSE:** To compare training speeds and HR responses for TM HIT and OG HIT in persons with chronic stroke. **METHODS:** Ten subjects (mean ± SD) 59.8 ± 6.8 years old and 2.4 ± 1.7 years post stroke with comfortable gait speed of 0.41 ± 0.35 m/s and fast gait speed of 0.56 ± 0.56 m/s participated and passed a symptom-limited GXT. Subjects performed 12 sessions of HIT over 4 weeks, alternating short and long interval HIT sessions. Both HIT protocols included 10 minutes of overground HIT (OG1), then 20 minutes of treadmill HIT, followed by another 10 minutes of overground HIT (OG2). Short interval HIT involved 30s bursts at maximum safe speed and 30-60s rest periods. Long interval HIT involved 4-min bursts at ~90% of peak heart rate (HR<sub>peak</sub>) from the GXT and 3-min recovery periods at ~70% HR<sub>peak</sub>. Variables recorded included gait training speeds and mean and max heart rate. OG1 and OG2 data were combined to control for warm up and cardiovascular drift effects. Mixed effects models were used to compare TM and OG exercise responses, while accounting for repeated measures from the same participant.

**RESULTS:** All participants completed 12 sessions and no serious adverse events occurred. With the short interval protocol, OG HIT elicited significantly slower gait training speeds than TM HIT (0.75 vs. 0.90 m/s, p<0.0001), with lower mean HR (78.4 vs 82.9 %HR<sub>peak</sub>, p<0.0001) and max HR (89.2 vs. 97.0 %HR<sub>peak</sub>, p<0.0001). With the long interval protocol, OG HIT elicited significantly faster gait training speeds than TM HIT (0.66 vs. 0.51 m/s, p<0.0001) with similar mean HR (81.2 vs 81.9 %HR<sub>peak</sub>, p=0.10) and lower max HR (92.7 vs. 95.8 %HR<sub>peak</sub>, p<0.0001).

**CONCLUSIONS:** OG HIT appears to be reasonably feasible and safe in chronic stroke. Mean OG HIT speeds were 34% and 18% faster than baseline fastest gait speed for short and long interval HIT, respectively. For short interval HIT, it may be optimal to combine the task specificity of overground training with the higher speeds and intensity of treadmill training. For long interval HIT, treadmill training does not appear to provide the same intensity benefit and overground training alone may be superior.

**294** Board #132 May 29 11:00 AM - 12:30 PM  
**Cardiorespiratory Differences Between Knee Scooter and Crutch Use for Mobility.**  
 Charles RC Marks, Caitlyn Heath. *Oakland University, Rochester, MI.* (Sponsor: Tamara Hew-Buttler, FACSM)  
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*(No relevant relationships reported)*

**PURPOSE:** In recent years, use of knee scooters (KS) has increased as a modality for moving around with a foot or ankle injury. There is a paucity of research examining the physiological demands of the knee scooter. Therefore, the purpose of this study was to compare moving on a knee scooter with moving using crutches (C). **METHODS:** Nineteen (13 females, 6 males) apparently healthy young adults were recruited. The participants had one day of practice then another day of testing. Participants completed a figure eight hallway route (196 m) under three conditions: first with walking, then (order randomized) using C and KS. The speed was self-paced with six minutes of sitting rest between conditions. Heart rate and oxygen consumption were monitored

with a mobile metabolic system. With alphas = 0.05, One-Way Repeated Measures ANOVA with paired t-Testing (Bonferroni with Holm’s sequential adjustment) for *post hoc* testing were done. **RESULTS:** The average VO<sub>2</sub> (1223 &#177; 321 mL/min) of C was significantly 27% higher than the average VO<sub>2</sub> (992 &#177; 221 mL/min) for the KS. In addition, the average heart rate (164 &#177; 17 bpm) for the C was significantly 12% higher than the average heart rate (146 &#177; 24 bpm) for C. Crutch use speed was on average non-significantly 4.2% (2.9 m/min) slower than the KS speed. **CONCLUSIONS:** The KS caused less cardiorespiratory stress than the C. This indicates that the KS be recommended over C especially for those with poor fitness levels. Supported in part by an Oakland University Honors College Grant.

**295** Board #133 May 29 11:00 AM - 12:30 PM  
**Feasibility of Stroke Volume Measurement during Treadmill Exercise in Adults with Down syndrome.**  
 Brooks A. Hibner, Thessa I.M. Hilgenkamp, Elizabeth C. Schroeder, Bo Fernhall, FACSM. *University of Illinois at Chicago, Chicago, IL.*  
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*(No relevant relationships reported)*

Individuals with Down syndrome (DS) exhibit reduced peak aerobic capacity (VO<sub>2peak</sub>) compared to those without DS. Lower VO<sub>2peak</sub> is partly due to impaired autonomic function, resulting in lower peak heart rate, thus altering cardiac output (CO). Autonomic dysfunction may also impact stroke volume (SV), further affecting CO. SV can be determined during exercise by measuring blood flow velocity in the ascending aorta with continuous wave (CW) Doppler echocardiography. It is unknown whether individuals with DS will tolerate the method or if it is feasible due to their specific physical features and gait abnormalities. **PURPOSE:** To determine the feasibility of SV measurement during exercise using CW Doppler in adults with and without DS. **METHODS:** Adults with DS (n= 6, 25 ± 2 yrs, 31.7 ± 4.6 kg/m<sup>2</sup>, 24.2 ± 4.2 ml/kg/min) and without DS (n= 5, 26 ± 4 yrs, 24.9 ± 4.8 kg/m<sup>2</sup>, 32.5 ± 6.4 ml/kg/min) performed a maximal incremental treadmill test to assess VO<sub>2peak</sub>. Images were obtained at rest and every 2 min, until 8 min, of the treadmill test. Success rate of CW Doppler was expressed as a percent of acquired images vs total potential images. The method was feasible if success rate was ≥80%, and if obtained values for SV indexed to body surface area (SVI) were physiologically plausible. **RESULTS:** Resting measures were equally feasible with both groups at 100% success rate. As exercise progressed, the ability to obtain clear images was compromised, however, feasibility remained ≥ 80% in both groups. Further, percent change of SVI from rest to 8 min was within expected range (DS: 24.4%, Control: 22.7%). **CONCLUSIONS:** This pilot data indicates that SV measures during exercise with CW Doppler are feasible in adults with DS similar to that in controls, even with the DS-specific physical characteristics and gait pattern. Future research with more subjects should compare the SVI and CO with increasing exercise intensity between groups to better understand what limits exercise capacity in persons with DS.

		DS (n=6)	Control (n=5)
Seated Rest	Success rate	100% (6)	100% (4)
	SVI	42.5 ± 6.5	34.3 ± 10.7
Standing Rest	Success rate	100% (6)	100% (4)
	SVI	36.9 ± 11.0	32.4 ± 12.8
2 minutes exercise	Success rate	83% (6)	100% (4)
	SVI	54.0 ± 8.8	43.6 ± 14.2
4 minutes exercise	Success rate	83% (6)	100% (5)
	SVI	56.2 ± 16.0	46.9 ± 16.4
6 minutes exercise	Success rate	100% (6)	80% (5)
	SVI	54.2 ± 18.4	45.8 ± 17.2
8 minutes exercise	Success rate	100% (6)	80% (5)
	SVI	52.9 ± 17.4	42.1 ± 18.8
Success rate in % (total potential measurements)			
SVI: Stroke volume index in mean ± SD			

WEDNESDAY, MAY 29, 2019

296 Board #134 May 29 11:00 AM - 12:30 PM  
**Exercise Preconditioning Reduces Brain Damage and Accelerates Physical Rehabilitation in Rats with Cerebral Ischemia**

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 (No relevant relationships reported)

Stroke has become one of the major causes of disability and mortality worldwide. There is increasing evidence that exercise training is associated with reduced risk of stroke. However, the effects of exercise training on protection of brain damage and subsequent motor and vestibular functions have not been fully understood.

**PURPOSE:** To determine the effects of exercise training prior to brain ischemia on protection against brain damage and subsequent motor and vestibular functions following transient cerebral ischemia/reperfusion injury in rats.

**METHODS:** Male Sprague-Dawley rats were either endurance exercise trained (N=10, ET, treadmill running at 16 m/min, 0° incline, 60 mins/day, 5 day/week, 4 weeks), resistance exercise trained (N=10, RT, climbing vertical ladder start load at 75% bodyweight with an additional 15% bodyweight added every 2 sets of climb until exhaustion, 10 sets/day, 5 day/week, 4 weeks) or remained sedentary (N=20) for 4 weeks. Brain ischemia induced by transient middle cerebral artery occlusion (MCAO) or sham surgery (sham) were then performed on these rats, which results in four groups: sham, MCAO, ET+MCAO, and RT+MCAO. 24 hours after the induction of brain ischemia, motor and vestibular functions were evaluated by various scoring methods. Ischemic infarct volume was measured by triphenyltetrazolium chloride (TTC) staining. One-way ANOVA followed by post-hoc Bonferroni test were used for data analysis.

**RESULTS:** Rats in both ET+MCAO and RT+MCAO group had significantly lower cerebral infarct volumes when compared to those in MCAO group (31.97±8.65% vs. 37.85±10.45% and 33.13±7.82% vs. 37.85±10.45%, respectively  $p < 0.05$ ). Consistently, the coordinated locomotor function and vestibular function were also significantly improved in ET+MCAO (2.33±0.52 vs. 3.40±0.89, 1.77±0.97 vs. 2.56±1.23) and RT+MCAO (2.40±0.55 vs. 3.40±0.89; 1.78±1.09 vs. 2.56±1.23) in comparison to MCAO group ( $p < 0.05$ ), while the rats in the sham group did not exhibit any cerebral injury and functional impairment. There were no difference between the two exercise training groups.

**CONCLUSIONS:** Exercise preconditioning prior to brain ischemia induction effectively reduced cerebral infarct volumes and protected against the decline in motor and vestibular functions in a rat model of brain ischemia.

**A-46 Free Communication/Poster - Renal**

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
 Room: CC-Hall WA2

297 Board #135 May 29 11:00 AM - 12:30 PM  
**The Effect of Physical Activity on Hemodynamic Response to Angiotensin Converting Enzyme Inhibition in Hypertension**

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 (No relevant relationships reported)

**PURPOSE:** Physical activity (PA) can reduce blood pressure (BP) in hypertensive populations. Although underlying mechanisms remain unclear, an interaction with the renin-angiotensin-aldosterone system (RAAS) is a logical focus of exploration. We conducted a nested cohort analysis to determine if reported level of PA was associated with vascular responsiveness to acute angiotensin converting enzyme inhibition (ACEi).

**METHODS:** Data were extracted from the HyperPATH dataset, which is an ongoing program to identify genetic mechanisms underlying cardiometabolic risk. Individuals with hypertension who completed a physical activity self-assessment and who had completed hormonal assessment (serum aldosterone [ALDO] and plasma renin activity [PRA]) and vascular response (BP) to a single dose of an ACEi (captopril 25mg) were included for analysis. All participants (n=144) were studied in a clinical research center after overnight, supine, fasting status and on a sodium, potassium, and calcium controlled diet for 7 days. PA was reported as 1) no additional PA, 2) little, 3) moderate, or 4) high amounts of exercise. The response to ACEi was evaluated by ANOVA or multivariate regression when appropriate, with all analyses adjusted for age, sex, race, and BMI.

**RESULTS:** As expected, both acute ACEi and increased PA levels were significantly associated with reduced systolic BP ( $p < 0.05$ ). However, individuals who reported

high amounts of exercise displayed a greater BP lowering effect from ACEi compared to those who reported moderate (-14.8 ± 8.1 mmHg vs -8.4 ± 9.9 mmHg,  $p < 0.01$ ) or no additional PA (-14.8 ± 8.1 mmHg vs -2.6 ± 9.9 mmHg,  $p < 0.001$ ). Exploratory analyses indicated high amounts of PA were associated with: a reduced heart rate when compared to no PA (54.2 ± 7.7 bpm vs 66.4 ± 9.8 bpm,  $p < 0.001$ ), reductions in PRA (0.42 ± 0.48 ng/ml/hr vs 0.59 ± 0.52 ng/ml/hr,  $p < 0.05$ ), and reductions in ALDO ( $\beta = -0.44$ , CI = 0.19-0.70,  $p = 0.001$ ).

**CONCLUSIONS:** Higher levels of self-reported PA are associated with decreased BP, and acute ACEi resulted in an augmented BP lowering effect in hypertensive subjects. PA is inversely correlated with RAAS activity. These data shed light on how physical activity interacts with vascular function in RAAS activity and suggest that PA and ACEi medications may act synergistically.

298 Board #136 May 29 11:00 AM - 12:30 PM  
**Previous Aerobic Exercise Increase Vo2 Peak And Improves Renal Protective Effects In Chronic Kidney Disease**

Wesley H. Silva, Rafael S. Luiz, Alexandre Saul, Natália R. Vaccas, Luciana Jorge, Samuel Trindade, Rodolfo Rampaso, Nestor Schor (in memoriam). *Universidade Federal de São Paulo, São Paulo - SP, Brazil.*  
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 (No relevant relationships reported)

**INTRODUCTION:** Patients with chronic kidney disease (CKD) have lower physical and when compared to the general population. It is common for patients with chronic diseases to be physically inactive, therefore patients with CKD in their different stages, present reduced physical capacity around 60% to 70% of the level expected for the age. **OBJECTIVE:** Evaluate the effects of previous aerobic exercise on oxygen consumption (peak VO<sub>2</sub>), renal function and glomerular sclerosis index in rats with CKD due to nephrectomy 5/6 (Nx5/6). **METHODS:** Adult Wistar rats were divided into groups (n = 8): Sedentary+Nx5/6+Sedentary (Sed), Sedentary + Nx5/6 + Exercise (Sed-Exe), Exercise + Nx5/6 + Sedentary (Exe-Sed) and Exercise + Nx5/6 + Exercise (Exe). The exercise was performed on treadmill, the intensity of 40 to 60% of the maximum load test, 60 minutes a day and 5 times a week, during the total period of 8 weeks of training. Nx5/6 was performed in the 4th week of the training protocol. Blood pressure (BP), oxygen consumption (Vo<sub>2</sub> peak), proteinuria, nitrogen urea base (BUN), and glomerular sclerosis index were evaluated in the hematoxylin-Eosin staining.

**RESULTS:** There was an increase in the Sed-Exe and Exe groups in relation to the Sed group (34.2 ± 2.1; and 37.9 ± 1.7 vs. 24.8 ± 0.6,  $p < 0.05$ , respectively). The Exe group presented a significant reduction in proteinuria when compared to the Sed-Exe group (176.6 ± 39.2 vs 61.1 ± 20.9,  $p < 0.05$ , respectively). The BUN of the Exe-Sed group was inferior to Sed group (31.7 ± 2.3 vs 65.6 ± 7.8,  $p < 0.05$ , respectively). There was a decrease in BP in the Sed-Exe and Exe groups when compared with the Sed group (215 ± 1 and 219 ± 2 vs 251 ± 2,  $p < 0.05$ , respectively), but the BP values still remained high. The glomerular sclerosis index was classified as follows: the Exe group presented the mild degree index (25%), the Sed-Exe and Exe-Sed groups moderate degree (50%), and the sedentary group presented degree high (over 75% injury).

**CONCLUSION:** The exercise minimizes the impact of Nx5/6, attenuating proteinuria, important analysis of progressive loss of renal function. Increasing physical capacity and VO<sub>2</sub>. Finally, previous exercise indicates protection for CKD, especially under this experimental protocol. Thus, it is reasonable to suggest that exercise may be an additional strategy to be employed in CKD.

299 Board #137 May 29 11:00 AM - 12:30 PM  
**Renal Function Responses To Steady-state Moderate-intensity And High-intensity Interval Exercise In Mid-spectrum Chronic Kidney Disease**

Jeffrey S. Forsse<sup>1</sup>, Matthew N. Peterson<sup>2</sup>, Zacharias Papadakis<sup>3</sup>, Nicholas Schwedock<sup>3</sup>, Burritt W. Hess<sup>3</sup>, Jackson O. Griggs<sup>3</sup>, D. Crawford Allison<sup>4</sup>, Ron L. Wilson<sup>4</sup>, J. Kyle Taylor<sup>5</sup>, Kathryn Dugan<sup>5</sup>, Kathy W. Jones<sup>5</sup>, Kathleen Adair<sup>2</sup>, Mitchell C. Cholewinski<sup>2</sup>, Peter W. Grandjean, FACSM<sup>2</sup>. <sup>1</sup>Stephen F. Austin State University, Nacogdoches, TX. <sup>2</sup>Baylor University, Waco, TX. <sup>3</sup>Family Health Center, Waco, TX. <sup>4</sup>Baylor Scott & White Health, Waco, TX. <sup>5</sup>Medical & Clinical Laboratory Sciences, Montgomery, AL. (Sponsor: Peter W. Grandjean, FACSM)  
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 (No relevant relationships reported)

Efficacy of exercise to improve renal function remains understudied in adults with mid-spectrum chronic kidney disease (CKD). In addition, a comparison of steady-state exercise (SSE) and high-intensity interval exercise (HIIE) may contribute clinically-relevant information for exercise-related augmentation of renal function in mid-spectrum CKD. **PURPOSE:** To determine the influence of SSE and a comparable amount of HIIE on indicators of post-exercise renal function in patients diagnosed

with secondary Stage 3 or 4 CKD. **METHODS:** Twenty participants (n = 6 men; n = 14 women; age  $62.0 \pm 9.9$  yr; weight  $80.9 \pm 16.2$  kg; body fat  $37.3 \pm 8.5\%$  of weight;  $VO_{2\max}$   $19.4 \pm 4.7$  ml/kg/min) completed 30 min of SSE at 65%  $VO_{2\text{reserve}}$  or HIIE by treadmill walking (90% and 20% of  $VO_{2\text{reserve}}$  in 3:2 min ratio) in a randomized crossover design. Both exercise conditions averaged ~ 65%  $VO_{2\text{reserve}}$ . Blood and urine samples were obtained by the same technician under standardized conditions just before, 1hr and 24hrs after exercise. Serum creatinine (sCR), urine epidermal growth factor ratio (uEGFr), cystatin C and estimates of glomerular filtration rate - modification of diet in renal disease (MDRD) and the CKD-EPI - responses were analyzed using 2 (condition) by 3 (sample point) repeated measures ANOVAs. **RESULTS:** sCR decreased from  $1.45 \pm 0.05$  pre-exercise to  $1.26 \pm 0.05$  mg/dl (-13%) 1hr after exercise and returned to pre-exercise levels by 24hr ( $p = 0.009$ ). Both MDRD and CKD-EPI estimates of glomerular filtration rate were 16 to 19% higher at 1hr, returning to pre-exercise values by 24hrs after exercise. The MDRD estimate increased from  $43.1 \pm 1.9$  pre-exercise to  $50.3 \pm 2.1$  ml/min/1.73m<sup>2</sup> 1hr after exercise ( $p = 0.007$ ) and CKD-EPI from  $45.2 \pm 2.1$  to  $53.8 \pm 2.4$  ml/min/1.73m<sup>2</sup> at 1hr post-exercise ( $p = 0.009$ ). Relative to pre-exercise measures, uEGFr remained stable with SSE but was 5.4% greater 24hr after HIIE ( $p = 0.052$ ). Cystatin C remained stable in the hours after exercise ( $p > 0.05$ ). **CONCLUSION:** By clinical estimates, renal function was not normalized but transiently improved with SSE and HIIE in mid-spectrum CKD.

## A-47 Free Communication/Poster - Age-Dependent Physiology

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
Room: CC-Hall WA2

### 300 Board #138 May 29 11:00 AM - 12:30 PM An Investigation Into Age-related Sarcopenia In Rodents

Shelby C. Osburn<sup>1</sup>, Petey W. Mumford<sup>1</sup>, Matthew A. Romero<sup>1</sup>, Paul A. Roberson<sup>1</sup>, Kaelin C. Young<sup>2</sup>, Michael D. Roberts<sup>1</sup>.  
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(No relevant relationships reported)

With aging, there is a decline in both skeletal muscle size and quality. This occurrence is known as sarcopenia and the implications due to this decline can be debilitating. Previous research has elucidated genes that are associated with muscle sarcopenia and how a change in expression can affect both muscle protein synthesis and degradation, which can affect skeletal muscle size and quality. **PURPOSE:** To investigate the expression of genes relating to skeletal muscle growth, collagen synthesis, and inflammation across the lifespan of rats. **METHODS:** Sedentary male Fischer 344 rats were fed ad libitum and were aged to 3 and 24 months (mo) (n=8 per age group) and then sacrificed. Body and gastrocnemius (gastroc) weights were collected and muscle was processed for RNA isolation and sent out for RNA sequencing. The following genes relating to muscle growth, collagen synthesis and inflammation were analyzed: Myostatin (MSTN), Insulin-like Growth Factor 1 (IGF-1), Insulin-like Growth Factor 2 (IGF-2), phosphorylated Mechanistic Target of Rapamycin (mTOR), Collagen Type I Alpha 1 Chain (COL1a1), Collagen Type I Alpha 2 Chain (COL1a2), Collagen Type IV Alpha 1 Chain (COL4a1), Lysyl Oxidase (LOX), Nuclear Factor Kappa B Subunit 1 (NFkB1), Tumor Necrosis Factor (TNF), Interleukin 6 (IL-6), and Interleukin 1 Beta (IL-1B). **RESULTS:** MSTN expression was significantly higher in 3 vs. 24 mo rats ( $p = 0.018$ ), and was positively correlated to relative gastroc weights ( $R = 0.663$ ,  $p = 0.005$ ). All genes related to collagen synthesis were significantly higher in 3 vs. 24 mo rats (COL1a1,  $p < 0.001$ ; COL1a2,  $p = 0.007$ ; COL4a1,  $p = 0.030$ ; LOX,  $p = 0.046$ ). Furthermore, COL1a1 and COL1a2 were positively correlated to relative gastroc weight ( $R = 0.649$ ,  $p = 0.007$ ;  $R = 0.730$ ,  $p = 0.001$ , respectively). However, no genes related to inflammation were significantly different between age groups, but there was a negative correlation between IL-6 gene expression and relative gastroc weights ( $R = -0.546$ ,  $p = 0.028$ ). **CONCLUSION:** We suspect 24-month old rodents may be too young to capture the sarcopenia symptoms that occur with aging. However, the relationship between inflammation and relative gastrocnemius muscle weight may warrant further investigations in rodents older than 24 months.

### 301 Board #139 May 29 11:00 AM - 12:30 PM Skeletal Muscle Phosphodiester Content is Related to Muscle Mass and Strength in Older Sarcopenic Adults

J. Matthew Hinkley, Heather H. Cornell, Robert A. Standley, Rick B. Vega, Bret H. Goodpaster, Paul M. Coen. *Translational Research Institute for Metabolism and Diabetes, Orlando, FL.*  
(No relevant relationships reported)

Age-associated loss of skeletal muscle mass and strength (sarcopenia) is a critical healthcare issue for older adults. Effective therapeutic options are limited in part because the underlying etiology is not well-defined. Studies utilizing magnetic resonance spectroscopy (MRS) revealed that resting phosphorus metabolites and maximal ATP production ( $ATP_{\max}$ ) are altered in muscle from older adults. However, it is unclear whether resting phosphorus metabolites and  $ATP_{\max}$  are related to muscle characteristics that define the sarcopenic phenotype. **PURPOSE:** To determine whether *in vivo* resting phosphorus metabolites and  $ATP_{\max}$  are associated with skeletal muscle mass, strength, and function in older adults. **METHODS:** *In vivo* metabolites and  $ATP_{\max}$  were measured by phosphorus-MRS during rest and following a brief bout of isometric leg contractions in 74 sedentary older adults (68.6  $\pm$  0.5 years; 23M/51F). Skeletal muscle mass was evaluated by DEXA and mid-thigh MRI. Quadriceps contractile function was assessed by Biodex. These variables were further explored in participants that were classified as sarcopenic (n=6) or non-sarcopenic (n=15). Muscle biopsies of the vastus lateralis were obtained to determine fiber type proportion and cross-sectional area by immunohistochemistry. **RESULTS:** Several resting phosphorus metabolites were related with muscle size and function in older adults. In particular, a phosphodiester peak (PDE2), considered a marker of membrane integrity, was negatively associated with skeletal muscle mass index ( $r = -0.38$ ,  $p < 0.01$ ), muscle volume ( $r = -0.37$ ,  $p < 0.01$ ), and peak power ( $r = -0.38$ ,  $p < 0.01$ ). PDE2 was elevated in sarcopenic patients in comparison to non-sarcopenic controls ( $2.48 \pm 0.11$  mM vs.  $1.92 \pm 0.08$  mM,  $p < 0.01$ ).  $ATP_{\max}$  was not different between sarcopenic and non-sarcopenic individuals. At the cellular level, PDE2 was negatively correlated to myofiber area ( $r = -0.51$ ,  $p = 0.03$ ) but not fiber type proportion. **CONCLUSION:** Elevated resting PDE2 levels in muscle were associated with lower muscle mass and strength in older sarcopenic adults. While  $ATP_{\max}$  was not related to the sarcopenic phenotype, our results reveal that resting *in vivo* phosphorus metabolite profiles may be a viable cellular marker of muscle quality in older adults. Supported by NIH Grants K01 AG04437 and R01 AG021961

### 302 Board #140 May 29 11:00 AM - 12:30 PM Amount and Variability of Adipose Tissue Content in Human Quadriceps Muscles of Older Adults

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(No relevant relationships reported)

**INTRODUCTION:** Obesity is a significant health problem that can compound health-related morbidities in aging adults. While substantial research has elucidated many of the metabolic consequences of obesity, much less is known about the effects of adipose tissue (fat) deposition on skeletal muscle function. Some evidence exists to suggest that obesity may interfere with muscle force production, but this is an understudied area of research. **PURPOSE:** To quantify *in vivo* the amount and distribution of fat and lean muscle tissue in the quadriceps muscles of healthy older adults. **METHODS:** The dominant legs of 8 healthy, sedentary adults (71  $\pm$  4 yrs, mean  $\pm$  SD; 4 men; BMI:  $25.1 \pm 3.3$  kg·m<sup>-2</sup>) were evaluated using a 6-point Dixon imaging technique in a 3 tesla magnetic resonance system. Axial slices (5 mm thick) were acquired for the entire thigh, and each image in which all 4 quadriceps muscles were visible was analyzed to determine fat and muscle volumes (cm<sup>3</sup>), and fat fractions (fat/total\*100; %). The location (% muscle length) of peak muscle volume and fat fraction, as well as the deviation from the line of best fit (2<sup>nd</sup> order polynomial) of these variables were calculated as measures of tissue distribution and heterogeneity. Differences in means were evaluated by paired t-tests. **RESULTS:** Fat-free muscle volume, fat volume, and fat fraction were  $821 \pm 287$  cm<sup>3</sup>,  $75 \pm 26$  cm<sup>3</sup> and  $8.6 \pm 1.1\%$ , respectively. Peak muscle volume and fat fraction occurred in different locations ( $70.7 \pm 7.7$  vs.  $19.3 \pm 23.2\%$  length,  $p=0.001$ ), with a 3-fold greater coefficient of variation for fat fraction than muscle volume. Likewise, slice-to-slice variability of fat fraction was greater than for muscle volume ( $4.7 \pm 1.5$  vs.  $1.2 \pm 0.3\%$ ,  $p<0.001$ ). **CONCLUSIONS:** These data show greater spatial variability of fat deposition in comparison to lean tissue in the quadriceps muscles of older adults. Combining these measures with traditional indices of muscle function may provide additional insight about the mechanical impact of intramuscular adipose tissue deposition *in vivo*.  
Support: NIH R01 AG047245

- 303** Board #141 May 29 11:00 AM - 12:30 PM  
**Age-related Changes In The Passive Properties Of The Plantarflexor Muscles**  
 Hayden K. Giuliani, Gena R. Gerstner, Jacob A. Mota, Eric D. Ryan. *University of North Carolina at Chapel Hill, Chapel Hill, NC.* (Sponsor: Abbie E. Smith-Ryan, FACSM)  
*(No relevant relationships reported)*

Limited data exists examining age-related changes in the passive mechanical properties of the musculotendon unit. **PURPOSE:** To examine the influence of age on maximum range of motion (MROM), peak passive torque ( $PT_{pass}$ ), and the dissipative coefficient (DC). **METHODS:** Twenty-one young ( $20.3 \pm 2.4$  yrs) and 14 older ( $69 \pm 3.1$  yrs) men completed MROM and isometric strength (for EMG normalization) assessments of the plantarflexors, following ultrasonography of the gastrocnemii. Muscle cross-sectional area (CSA) and subcutaneous fat corrected echo intensity (EI) of the gastrocnemii were determined as the sum and average of both muscles, respectively. Participants were seated in a calibrated dynamometer, with their leg fully extended and ankle and foot held in a custom steel foot plate. MROM assessments were performed by dorsiflexing the ankle at  $5^\circ s^{-1}$  from  $10^\circ$  of plantarflexion to the participants maximally tolerated ROM.  $PT_{pass}$ , loading, unloading, and the DC were calculated during the initial 80% of MROM. Independent samples *t*-tests were used to examine group differences. A Pearson's correlation coefficient was used to determine the relationship between  $PT_{pass}$  and MROM. Analyses of covariance (ANCOVAs) were used to determine age-related differences in loading and unloading, while controlling for MROM. Additional ANCOVAs were used to determine the age-related difference in DC, while controlling for CSA and EI, respectively. An alpha level of 0.05 was used to determine statistical significance. **RESULTS:** The  $PT_{pass}$ , MROM, loading, and unloading ( $P \leq 0.046$ ) were greater in the younger men, whereas the DC and EI ( $P \leq 0.024$ ) were greater in the older men. When accounting for MROM, unloading ( $P = 0.044$ ) remained significantly different between groups, while there was no difference between groups for loading ( $P = 0.223$ ). When accounting for CSA, differences between groups for the DC remained ( $P = 0.028$ ), while there were no longer differences between groups when accounting for EI ( $P = 0.120$ ).  $PT_{pass}$  was also strongly related to MROM ( $r = 0.755$ ,  $P < 0.001$ ). Mean EMG amplitude values across muscles was 1.61% MVC. **CONCLUSIONS:** Older men exhibited lower MROM and greater DC, which may be explained by an altered stretch tolerance and qualitative changes (i.e. non-contractile tissue accumulation) in aged skeletal muscle, respectively.

- 304** Board #142 May 29 11:00 AM - 12:30 PM  
**Longevity and Physical Vitality during Aging Altered by Adipose-derived Mesenchymal Stem Cell-Lysate Injection**  
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*(No relevant relationships reported)*

**Background:** Adipose-derived mesenchymal stem cell (MSC)-lysate injection effectively decreases body weight and improves glucose tolerance in mice on a high-fat diet. **Purpose:** To determine whether lifelong injection of MSC can minimize age-dependent decline in physical vitality and increase longevity in naturally aging rats. **Methods:** Rats were sex-balanced and randomly assigned into the vehicle-injected group ( $N = 46$ ) and the MSC lysate injected group ( $N = 46$ ). We measured body composition by dual energy X-ray absorptiometry (DEXA), spontaneous locomotor activity, and longevity in rats maintained on a normal diet and received an intermittent treatment of human adipose-derived MSC lysate (3 times a week, 11 times a month given every second month), starting at 12 months of age until natural death. Although our data agreed with previous observation on fat loss and marginally improved insulin resistance index subservient to long-term MSC lysate treatments, there was a shortened average lifespan, a longer inactive time, and a greater bone loss with a relative increase in lean mass compared with the vehicle-injected counterparts. **Conclusion:** Tissue renewal in multicellular systems requires regeneration after destruction. The results of the study implicate that simply enhancing regenerative signals from MSC does not beneficial and appear to be harmful for physical vitality and longevity.

- 305** Board #143 May 29 11:00 AM - 12:30 PM  
**Aging Alters NAD<sup>+</sup>, Sirtuins and Targeted Protein Levels and Acetylation in the Mouse**  
 Dongwook Yeo<sup>1</sup>, Chounghun Kang<sup>2</sup>, Li Li Ji, FACSM<sup>1</sup>.  
<sup>1</sup>University of Minnesota Twin Cities, Minneapolis, MN. <sup>2</sup>Inha University, Incheon, Korea, Republic of. (Sponsor: Li Li Ji, Ph.D., FACSM)  
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*(No relevant relationships reported)*

Sufficient intracellular NAD<sup>+</sup> is required for mitochondrial function and skeletal muscle health during aging. Sirtuins (SIRT), the major NAD<sup>+</sup>-consuming enzymes, regulate mitochondrial function via deacetylating transcription factors and enzymes such as PGC-1 $\alpha$  and GCN5, whereas Poly [ADP-ribose] polymerase 1 (PARP-1), the competing enzyme with SIRT for consuming NAD<sup>+</sup>, is activated by DNA damages during aging, leading to depletion of cellular NAD<sup>+</sup>. Lowered NAD<sup>+</sup> may dysregulate SIRT and induce hyperacetylation of its target proteins. Thus, it is important to know how aging impacts on NAD<sup>+</sup> pool and its consuming enzyme levels in the skeletal muscle. **PURPOSE:** To investigate the effect of aging on NAD<sup>+</sup> and protein levels of SIRT, PARP-1, GCN5, and PGC-1 $\alpha$  as well as protein acetylation (AC) in mouse muscles. **METHODS:** C57BL/6J mice at the age of 6 mo (young; Y; N=8), 12 mo (middle; M; N=8), and 24 mo (old; O; N=8) were used. Quadriceps (Q), gastrocnemius (G), and heart (H) muscles were collected for colorimetric assay and Western blotting to quantify NAD<sup>+</sup> and proteins levels of various enzymes. **RESULTS:** Aging decreased nuclear NAD<sup>+</sup> by 60 and 50% ( $p < .05$ ) in the G, and by 60 and 70% ( $p < .05$ ) in the Q of M and O, respectively. SIRT1 in G and Q increased by 3.1-fold ( $p < .01$ ) and 1.4-fold ( $p < .05$ ) with aging, whereas aging had no effect on SIRT1 in H. SIRT3 increased 1.3 ( $p < .05$ ), 2.2 ( $p < .01$ ), and 1.5-fold ( $p < .05$ ), respectively, in G, Q and H of O. SIRT5 was increased by ~4.8-fold ( $p < .01$ ) in G and Q of both M and O, but not in H. Aging increased SIRT6 by ~2.4-fold ( $p < .01$ ) in G and Q, whereas the level was decreased by 50% in H. PGC-1 $\alpha$  was increased in G of M (1.7-fold,  $p < .01$ ) and H of O (2.2-fold,  $p < .01$ ) vs. Y. GCN5 decreased 30% in the Q of O ( $p < .01$ ), but increased by 2.6 and 2.9-fold ( $p < .01$ ) in the H of M and O, respectively. Aging increased PARP-1 by 80% in G of M ( $p < .01$ ), and by 40 and 90% in H of M and O ( $p < .01$ ), respectively, but decreased by 40% in Q of O vs. Y. Cleaved-PARP-1 and AC were increased in all muscles with aging ( $p < .01$ ). **CONCLUSION:** Aging decreased NAD<sup>+</sup> pool, whereas SIRT, GCN5, PARP-1, and AC were increased with aging. Decreased level of NAD<sup>+</sup> and increased levels of NAD<sup>+</sup>-consuming enzymes in aged muscles may intensify the competition among enzymes for utilizing NAD<sup>+</sup>, which can contribute to age-associated mitochondrial dysfunction and muscle atrophy.

- 306** Board #144 May 29 11:00 AM - 12:30 PM  
**Comparison of Strength and Cognitive Performance in Elderly Individuals Aged 60 To 70 Years**  
 Andre de Camargo Smolarek<sup>1</sup>, Luis H. Ferreira<sup>2</sup>, Steven R. MacAnulty<sup>3</sup>, Alan C. Utter, FACSM<sup>4</sup>, Luis P. Mascarenhas<sup>1</sup>, Tacito P. Souza-Junior<sup>2</sup>. <sup>1</sup>UNICENTRO, Irati, Brazil. <sup>2</sup>UFPR, Curitiba, Brazil. <sup>3</sup>Appalachian State University, Boone, NC. <sup>4</sup>Texas Woman's University, Denton, TX. (Sponsor: Alan C Utter, FACSM)  
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*(No relevant relationships reported)*

Current literature indicates that positive results were obtained on strength, hypertrophy, power, and cognitive performance when strength training protocols were chronically applied in the elderly. Twelve weeks appears to be enough to improve strength and cognitive performance. On the other hand, the age range was large, starting with 60 years through 90 years old in the same study. **PURPOSE:** The purpose of this study was to examine if elderly individuals aged 60 years old to less than 70 years old presented different responses in strength and cognitive performance after 12 weeks of a strength training program. **METHODS:** Thirty elderly women were separated into a control group (CG) ( $n=7$ ), 60 years old group (G60) ( $n=14$ ) and 70 years old group (G70) ( $n=9$ ). The participants had body mass, height, upper lean limbs (ULL), lower lean limbs (LLL), and cognitive performance measured after answered the Montreal Cognitive Assessment (MoCA). The data was analyzed via a one-way ANOVA with  $p \leq 0.05$ . **RESULTS:** The CG indicated a difference between the G60 and G70 ( $p=0.05$ ) for ULS, LLS, and MoCA, while G60 and G70 had no significant differences in strength capacity and cognitive performance. **CONCLUSIONS:** After 12 weeks of a strength training program all groups improved strength capacity and cognitive performance compared to CG, however no differences were observed between G60 and G70.

- 307** Board #145 May 29 11:00 AM - 12:30 PM  
**Relationships Among Skeletal Muscle Satellite Cells, Capillarization, and VO<sub>2</sub>peak In Older Adults**  
 Nathan Serrano<sup>1</sup>, Andrew C. D'Lugos<sup>1</sup>, Jordan C. Ormsby<sup>1</sup>, Nicholas T. Thomas<sup>1</sup>, Chad C. Carroll<sup>2</sup>, Farshad F. Marvasti<sup>1</sup>, Glenn A. Gaesser, FACSM<sup>1</sup>, Jared M. Dickinson, FACSM<sup>1</sup>.  
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 (No relevant relationships reported)

**PURPOSE:** A reduction in satellite cells has been reported to contribute to muscle loss with aging. Exercise presents a powerful strategy to stimulate satellite cells, however, to what extent various forms of exercise stimulate skeletal muscle satellite cells in older adults is less understood. The purposes of this study were to 1) examine relationships of satellite cell density, capillary density, and VO<sub>2</sub>peak in older adults, and 2) identify changes in satellite cell density following two different intensities of aerobic exercise.  
**METHODS:** In a counter-balanced, cross-over design, six older adults (4M, 2F; 67±2yr; BMI: 26.6±2.0 kg·m<sup>-2</sup>) completed an acute bout of high-intensity interval (HIIE; ten, 1-min intervals, 85-95% heart rate max, 1-min rest between intervals) and moderate intensity continuous cycling (MOD; 30-min, 60-65% VO<sub>2peak</sub>), separated by ~1 week. Muscle biopsies (*vastus lateralis*) were obtained before exercise and 24h after each exercise bout. Immunofluorescence was used to identify myosin heavy chain (MHC), satellite cells, and capillaries. **RESULTS:** A significant relationship between capillary density and satellite cell density (P=0.018; R<sup>2</sup>=0.789) was observed. Significant correlations were also found between satellite cell density and VO<sub>2</sub>peak (P<0.001; R<sup>2</sup>=0.99), capillary density and VO<sub>2</sub>peak (P=0.019; R<sup>2</sup>=0.785), satellite cells/MHC I fiber and VO<sub>2</sub>peak (P=0.026; R<sup>2</sup>=0.750), and satellite cells/MHC II fiber and VO<sub>2</sub>peak (P=0.002; R<sup>2</sup>=0.93) at baseline. Total satellite cells/fiber and fiber type-specific satellite cells/fiber were unchanged in response to acute MOD or HIIE (P>0.05) and no differences were observed between exercise trials (P>0.05). **CONCLUSIONS:** These data reveal positive relationships between capillaries and satellite cell density in skeletal muscle of older adults. Further, while no changes in satellite cell density were observed 24h following acute MOD or HIIE, our preliminary findings suggest an association between satellite cell density and VO<sub>2</sub>peak in older adults. Thus, future research is needed to examine whether these exercise strategies differentially impact changes in proliferation or differentiation of satellite cells in older adults, and to what extent capillary density may be related to chronic adaptations in satellite cell density and VO<sub>2</sub>peak.

- 308** Board #146 May 29 11:00 AM - 12:30 PM  
**Predicting Prevalence and Mortality in Female Mice Using The Mouse Frailty Phenotype**  
 Dongmin Kwak<sup>1</sup>, Cory W. Baumann<sup>2</sup>, LaDora V. Thompson<sup>1</sup>.  
<sup>1</sup>Boston University, Boston, MA. <sup>2</sup>University of Minnesota, Minneapolis, MN.  
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 (No relevant relationships reported)

Frailty is a clinical syndrome associated with adverse health outcomes. Preclinical studies are important in the identification of the underlying mechanisms contributing to frailty. Interestingly, previous preclinical studies focused on male rodents with minimal attention to female rodents.  
**PURPOSE:** The two purposes of this study were to identify the prevalence of frailty across the lifespan in female mice, and to determine if frailty status at a younger age predicts mortality. **METHODS:** Female C57BL/6J (n=29) were used. Starting at 17 months of age, mice were assessed using a frailty phenotype that consisted of 5 criteria, including body weight, walking speed (Rotarod), strength (grip strength), endurance (treadmill) and physical activity (voluntary wheel running). Mice were tested every three months across their lifespan using the frailty phenotype. The designated cut-off points for each frailty criterion, using 20 months of age characteristics, were set using the top 20% for body weight and bottom 20% for the other 4 criteria. Mice with 3 or more positive frailty markers were identified as frail, mice with 2 markers were identified as pre-frail and mice with 1 or no positive marker were identified as non-frail. **RESULTS:** The mean survival age was 28.1 months, with the first and last mouse dying at 21.1 and 34.3 months, respectively. Prevalence of frailty increased across the lifespan. At 17 months of age, there is evidence of pre-frail and frail mice. Frail mice steadily increased up to 66.7% at 32 months. Non-frail mice steadily decreased to 18.2% at 29 months. Beyond 29 months, no mouse was identified as non-frail. The percentage of pre-frail mice increased and peaked at 26 months (36.8%). Following 29 months this percentage declined, with 18.2 and 33.3% of mice being identified as pre-frail at 29 and 32 months. Frail/pre-frail and non-frail mice had mean survival ages of 26.9 months and 29.0 months, respectively. Frailty status predicted mortality with the non-frail mice living longer than the frail/pre-frail mice (P=0.037). **CONCLUSIONS:** Using a mouse frailty phenotype, we are able to identify

that the prevalence of frailty in female mice increases across the lifespan. In addition to predicting mortality, this frailty phenotype has potential to yield information about underlying mechanisms contributing to frailty.

- A-48** Free Communication/Poster - Joint Health and Arthritis  
 Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
 Room: CC-Hall WA2

- 309** Board #147 May 29 11:00 AM - 12:30 PM  
**Bone Health of Patients Diagnosed With Rheumatoid Arthritis**  
 Sebastien Beaugard, Adriana De la Parra-Solomon, Nathan Chiarlitti, Alexe Sirois, Susan Bartlett, Ross Andersen, FACSM.  
 McGill University, montreal, QC, Canada.  
 (No relevant relationships reported)

Rheumatoid arthritis (RA) is the most common type of chronic inflammatory disease in adults and often is associated with bone health problems. It is estimated that poor bone health may occur in 50% of patients. **PURPOSE:** First, to explore bone health among sedentary patients diagnosed with RA. Secondly, to explore the relationship among regional bone mineral density (BMD) with age, weight, and height. **METHOD:** Twenty-one sedentary participants with diagnosed RA whose mean age was 39.43± 18.3yrs, height was 162.56± 7.452 cm, and weight averaged 66.67± 9.07 kg. Dual energy x-ray absorptiometry (DXA) was used to measure bone health. Linear regression was used to explore relationships among age, height, weight, and BMD in RA patients. **RESULTS:** BMD of the FN and L1-L4 averaged 0.12± 1.29 SD and 0.38±1.57 SD, respectively. Mean Z-scores were 0.72± 1.43 for TB, 0.38± 1.57 for LV, and 0.12± 1.29 for the FN. In the FN region 25% of patients had Z-scores below -1 SD and 5% were below -2 SD. In the LS 20% has Z-scores below -1 SD and 45% were below 0 SD. Additionally, no significant relationships were observed among BMD, age, weight, and height. **CONCLUSION:** These findings suggest that a great range of variability in bone health exists in RA patients. Furthermore, healthcare professionals should monitor bone health in the RA population and future interventions should explore the effects of tailored exercise programming to simultaneously improve bone health and well-being.

- 310** Board #148 May 29 11:00 AM - 12:30 PM  
**Cells Progenitors Potential In Cartilage: Changes From Moderate To Severe OA**  
 Marija Mazor<sup>1</sup>, Annabelle Cesaro<sup>1</sup>, Thomas M. Best, FACSM<sup>2</sup>, Mazen Ali<sup>1</sup>, Eric Lespessailles<sup>3</sup>, Hechmi Toumi<sup>3</sup>.  
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 (No relevant relationships reported)

Cells progenitors potential in Cartilage: Changes from moderate to severe OA  
**PURPOSE:** Recent data suggests that osteoarthritic (OA) cartilage contains mesenchymal progenitor cells (MPC) with multi-differentiation potential. Yet, there is limited information concerning how their prevalence changes with disease stages. Herein, we explore presence, prevalence and differentiation potential of MPC cells isolated from different OA grades. **METHODS:** Human osteoarthritic tibial plateaus were obtained from 25 patients undergoing total knee replacement. Each sample was classified as mild, moderate or severe OA according to OARSI scoring. The mRNA expression levels of CD105, CD166, Notch 1, Sox9, Acan, Col II A1 and Col I A1 were measured at day 0, day 14 (2 weeks in vitro) and day 35 (after chondrogenesis). At D35, the pellets matrix composition was tested on formation of proteoglycan, collagen II and I by HES and Immunofluorescence. **RESULTS:** Cells from all OA grades significantly increased MPC markers mRNA in vitro expression. Proliferated cells expressed MPC specific antigens: CD105, CD166, CD73, CD90, Notch-1 and Nucleostemin. The chondrogenesis induced decrease in CD105, Notch 1 and Sox9 mRNA only in mild and moderate OA. Yet, only moderate OA-derived pellets revealed significantly high levels of proteoglycans and hyaline cartilage marker - collagen II and low expression of fibrocartilage marker - Collagen I at both mRNA and protein level. **CONCLUSION:** A novel finding emerges from our data confirms differences in MPC potential between OA grades. Only moderate OA-derived cells were able to form hyaline-like matrix.

- 311** Board #149 May 29 11:00 AM - 12:30 PM  
**Correlation between Generalized Joint Hypermobility and Chronic Musculoskeletal Pain in College Students**  
 Kaylee R. Fichthorn, Peter R. Reuter. *Florida Gulf Coast University, Fort Myers, FL*  
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 (No relevant relationships reported)

The main complaint of patients with benign joint hypermobility syndrome (BJHS) is chronic musculoskeletal pain (MSP) that may affect their daily activities, leading to a decreased quality of life. While some studies support an association between generalized joint hypermobility (GJH) and MSP in children and adolescents, there is no published study yet looking into a correlation of GJH and MSP in a college-aged population in the US. **PURPOSE:** To determine whether young adults with generalized joint hypermobility are more likely to suffer from chronic musculoskeletal pain. **METHODS:** Undergraduate students studied the general structure of joints and range of motion, including joint hypermobility, before completing a survey that included questions about chronic musculoskeletal pain and the severity of pain. They worked in groups to evaluate each other's joints for hypermobility under supervision by the research team. **RESULTS:** Overall, 20.8% of 654 participants showed GJH based on a cutoff Beighton score of  $\geq 4$ . Women had statistically significant higher rates of GJH (23.9%) than men (12.2%) (Wald Test,  $DF = 1$ , Chi-square = 10.049,  $P = 0.0015$ ; odds ratio female to male: 0.44). Ninety four of 650 participants (14.4%) recalled chronic joint pain. The most commonly named joints were knee ( $n = 59$ ), shoulder ( $n = 17$ ), hip ( $n = 14$ ), ankle ( $n = 9$ ), and elbow ( $n = 7$ ). Male and female participants with GJH reported higher rates of chronic joint pain than participants without GJH. There was, however, no significant difference (Pearson Chi-square Test, Chi-square = 1.386,  $p = 0.5001$ ,  $n = 650$ ). The prevalence of chronic neck/back pain in our study was 20.8%. Participants with GJH reported higher rates of chronic back/neck pain, yet, the difference was not statistically significant (Pearson Chi-square Test, Chi-square = 3.850,  $p = 0.1459$ ,  $n = 650$ ). The average pain intensity on a scale from 0 to 10 was more or less the same for both types of chronic pain (4.5 for chronic joint pain, 4.2 for chronic neck/back pain) and for respondents with and without GJH. The ranges for the reported pain intensity as well as the standard deviations for all averages were also very similar. **CONCLUSION:** Young adults with GJH are not reporting higher rates of chronic pain in joints, the neck or the back nor do they suffer from more severe pain than their peers without GJH.

#### A-49 Free Communication/Poster - Physiologic Applications in Skeletal Muscle

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
 Room: CC-Hall WA2

- 312** Board #150 May 29 11:00 AM - 12:30 PM  
**Association between Muscle Carnosine Content and Changes in Muscle Cytokines following Lower-Body Resistance Exercise**  
 David D. Church<sup>1</sup>, Adam R. Jajtner<sup>2</sup>, Jeremy R. Townsend<sup>3</sup>, Kyle S. Beyer<sup>4</sup>, Michael B. La Monica<sup>5</sup>, Leonardo P. Oliveira<sup>6</sup>, Jay R. Hoffman, FACSM<sup>7</sup>. <sup>1</sup>University of Arkansas for Medical Sciences, Little Rock, AR. <sup>2</sup>Kent State University, Kent, OH. <sup>3</sup>Lipscomb University, Nashville, TN. <sup>4</sup>Bloomsburg University, Bloomsburg, PA. <sup>5</sup>Missouri State University, Springfield, MO. <sup>6</sup>The University of Chicago, Chicago, IL. <sup>7</sup>University of Central Florida, Orlando, FL. (Sponsor: Jay R. Hoffman, FACSM)  
 (No relevant relationships reported)

**PURPOSE:** Carnosine has a pluripotent role in skeletal muscle (SkM) physiology, enhancing intracellular buffering and acting as an antioxidant, antiglycating and ion-chelating agent. Carnosine also acts as a diffusible Ca<sup>2+</sup>/H<sup>+</sup> exchanger. Cytokines mediate the inflammatory response to exercise-induced muscle damage. Carnosine's role as a physiochemical buffer and antioxidant may affect SkM cytokine production. Therefore, the purpose of this study was to assess the association between SkM carnosine content and cytokine production following a lower body resistance exercise session.

**METHODS:** Ten recreationally active men completed a lower body resistance exercise protocol consisting of the squat, leg press, and leg extension exercises. SkM biopsies were obtained from the vastus lateralis at baseline (BL), one hour (1H), and five hours (5H) post-resistance exercise. SkM Carnosine content was assessed via high performance liquid chromatography. Multiplex signaling assay kits were used to quantify SkM cytokines (GCSF, GMCSF, IL-1ra, IL-6, IL-8, MCP-1, TNF- $\alpha$ ), and fold changes from BL were calculated. Associations were assessed with Pearson bivariate correlations, with significance set at  $\alpha \leq 0.05$ .

**RESULTS:** Carnosine content was not significantly associated with 1H and 5H changes of GCSF ( $r = 0.257$ ,  $p = 0.473$ ;  $r = 0.254$ ,  $p = 0.479$ , respectively), GMCSF ( $r = -0.285$ ,  $p = 0.426$ ;  $r = -0.431$ ,  $p = 0.214$ , respectively), IL-1ra ( $r = -0.019$ ,  $p = 0.962$ ;  $r = 0.126$ ,  $p = 0.747$ , respectively), IL-6 ( $r = -0.192$ ,  $p = 0.596$ ;  $r = -0.011$ ,  $p = 0.977$ , respectively), MCP-1 ( $r = -0.491$ ,  $p = 0.150$ ;  $r = 0.147$ ,  $p = 0.685$ , respectively), or TNF- $\alpha$  ( $r = -0.050$ ,  $p = 0.899$ ;  $r = -0.239$ ,  $p = 0.537$ , respectively). However, a trend for a significant positive correlation was noted for IL-8 at 5H ( $r = 0.705$ ,  $p = 0.051$ ), but not at 1H ( $r = 0.044$ ,  $p = 0.918$ ).

**CONCLUSIONS:** SkM Carnosine content was not associated with the change in GCSF, GMCSF, IL-1ra, IL-6, MCP-1, or TNF- $\alpha$  following resistance exercise. However, a trend for a significant positive association was observed for IL-8 at 5H and carnosine content. IL-8 and carnosine are involved in the histamine response to stress and intracellular Ca<sup>2+</sup> handling, which may explain the observed relationship. Further research is required to discern the observed correlation.

- 313** Board #151 May 29 11:00 AM - 12:30 PM  
**Redefining Physiologic Predictors of Endurance Performance with Measures of Skeletal Muscle Oxygenation: E pluribus unum**

Philip M. Batterson, Michael R. Norton, Sarah E. Hetz, Sachi Rohilla, Keston Lindsay, Andrew W. Subudhi, FACSM, Robert A. Jacobs. *University of Colorado Colorado Springs, Colorado Springs, CO*. (Sponsor: Andrew W. Subudhi, FACSM)  
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Reported Relationships: P.M. Batterson: Consulting Fee; Moxy Monitor, Fortiori Design, LLC.

**PURPOSE:** To scrutinize the ability of classic measures of endurance performance vs. NIRS-derived measures of skeletal muscle oxygenation to predict 25 km cycling time trial performance. **METHODS:** 14 participants (4 f / 10 m) underwent 3 sequential exercise bouts on a cycle ergometer while fitted with NIRS devices over each vastus lateralis: 1) A warmup consisting of 2 sequential 7.5-min bouts of 50 and 100 W at 80 rpm to determine gross efficiency (GE), exercise economy (EC), and delta efficiency (DE) across the same absolute workloads followed by an incremental max test to volitional fatigue (VF) used to discern 3 separate measures of ventilatory threshold (VT), maximal rates of whole-body oxygen consumption ( $VO_{2max}$ ) and maximal aerobic power ( $W_{max}$ ); 2) A warmup consisting of 2 sequential 7.5-min bouts at 80 rpm corresponding to 15% and 30%  $W_{max}$  for GE, EC, and DE across the same relative workloads followed by a 60 sec ramp to a sustained 110%  $W_{max}$  until VF to verify  $VO_{2max}$ ; and 3) A 25 km TT. Ventilatory measures were sampled throughout bouts 1 and 2. **RESULTS:** Stepwise and multiple linear regression analyses revealed that from the classic variables only mean  $VT_{VO2}$  ( $2.59 \pm 0.53$  l O<sub>2</sub>·min<sup>-1</sup>,  $p = 0.019$ ) and EC at 15%  $W_{max}$  ( $47 \pm 10$  W,  $p = 0.030$ ) explained (adj R<sup>2</sup> = 0.463;  $p = 0.013$ ) 25 km TT performance ( $46:40 \pm 04:36$  min:sec) variance whereas the change in skeletal muscle oxygenation ( $\Delta SmO_2$ ;  $-6.9 \pm 6.1\%$ ;  $p = 0.001$ ) from 50 to 100 W and the deoxygenated hemoglobin and myoglobin index (HHb) at  $W_{max}$  ( $9.57 \pm 1.56$ ;  $p = 0.044$ ) were the best NIRS-derived variables to describe TT performance (adj R<sup>2</sup> = 0.751;  $p < 0.001$ ). When combining all variables, skeletal muscle measures provided a superior physiologic explanation of 25 km TT performance versus those classically used to describe endurance performance ( $VT_{VO2}$ , EC @ 15%  $W_{max}$ , HHb<sub>max</sub>, and  $\Delta SmO_2$  at  $p = 0.083$ , 0.056, 0.008, and 0.005, respectively). **CONCLUSION:** These results demonstrate that measures reflecting the balance of skeletal muscle O<sub>2</sub> delivery and utilization during exercise are superior to classic measures of whole-body aerobic capacity, ventilatory threshold, and/or the efficiency of exercise at predicting 25 km time trial (TT) cycling performance.

- 314** Board #152 May 29 11:00 AM - 12:30 PM  
**Western Diet-Induced Obesity Does Not Cause Diaphragm Muscle Abnormalities**

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(No relevant relationships reported)

**Purpose:** Obese individuals demonstrate ventilatory abnormalities at rest and during exercise, which may reflect inspiratory (diaphragm) muscle weakness. Several studies have shown diaphragm abnormalities in genetically obese animal models. However, the effects of an obesogenic diet on the diaphragm are not well defined. The purpose of this study was to determine if a Western diet (high-saturated fat, high-sugar: HFHS) causes diaphragm muscle pathology, perhaps related to oxidative stress.

**Methods:** Adult male Wistar rats were randomly allocated to one of two ad libitum diets for 24 weeks: healthy control ( $n=8$ ) or HFHS diet ( $n=8$ ). Diaphragm muscle then underwent i) in vitro contractile function assessment, ii) histology and immunohistochemistry for determination of fibrosis and fiber cross-sectional area (CSA) and iii) analysis of mitochondrial reactive oxygen species (ROS) emission. Data are mean  $\pm$  SE.

**Results:** We previously reported that HFHS diet did not impair diaphragm maximal specific force or peak power. Alongside this maintenance of contractile function, HFHS-fed rats did not differ in diaphragm muscle interstitial fibrosis (in %: lean  $3.4 \pm 0.8$ , HFHS  $2.7 \pm 1.7$ ), type I fiber CSA (in  $\mu\text{m}^2$ : lean  $1954 \pm 121$ , HFHS  $2174 \pm 103$ ), type IIa fiber CSA (in  $\mu\text{m}^2$ : lean  $2062 \pm 329$ , HFHS  $2412 \pm 155$ ), or type IIb/x fiber CSA (in  $\mu\text{m}^2$ : lean  $4165 \pm 1232$ , HFHS  $4523 \pm 526$ ). Additionally, no shifts in fiber type occurred. Interestingly, HFHS diaphragm demonstrated a trend toward a lower succinate-induced increase in ROS emission (in  $\text{pmol}/\text{min}$ : lean  $1.313 \pm 0.2$ , HFHS  $0.73 \pm 0.2$ ,  $p = 0.09$ ). Analyses of glutathione and antioxidant enzymes are ongoing. **Conclusion:** A high-saturated fat, high-sugar diet did not induce diaphragm muscle dysfunction or morphological changes. These results, combined with our previous findings of normal contractile function, suggest that intrinsic diaphragm muscle abnormalities do not contribute to breathing difficulties in obesity.

**315 Board #153 May 29 11:00 AM - 12:30 PM**  
**Anabolic Signaling Phosphorylation Does Not Explain Differential Muscle Protein Synthesis with Intra-Set Rest Manipulation**

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 (No relevant relationships reported)

Power development is imperative for dynamic sport athletes. Cluster sets (CLU) are an effective method to allay the progressive decrement in power output normally observed in a traditional (TRD) resistance exercise strategy. CLU configurations incorporate a brief intra-set rest period to preserve velocity and power. Despite favorable performance, we previously established that TRD configurations elicit higher myofibrillar protein synthesis (MPS) rates when compared to CLU. However, it remains unclear if hallmark readouts related to mTORC1-signaling underlie this observation.

**PURPOSE:** To elucidate anabolic signaling mechanisms driving differential MPS rates observed between CLU and TRD paradigms of the barbell back squat in trained men and women.

**METHODS:** In randomized crossover design, 8 resistance-trained adults (7M, 1F;  $23 \pm 4$  y; LBM,  $63 \pm 9$  kg; back squat 1RM,  $150 \pm 26$  kg) performed an acute bout of either CLU (4 sets  $\times$  (2  $\times$  5) repetitions, 30s intra-set rest, 90s inter-set rest) or TRD (4 sets  $\times$  10 repetitions, 120s inter-set rest) barbell back squats at  $\sim 70\%$  1RM. Volume load and total rest were matched between bouts. Participants ingested 20g of whey protein immediately before and after exercise. Muscle biopsies were collected at rest and at 0, 2, and 5 h post-exercise during primed-continuous L-[ring-<sup>13</sup>C]<sub>6</sub>phenylalanine infusions. Total and phosphorylated states of targeted proteins were assessed through immunoblotting. Data was normalized to an internal loading control.

**RESULTS:** The phosphorylation of focal adhesion kinase (FAK) was doubled with TRD, but not significantly different, from CLU (TRD  $2.1 \pm 0.9$ -fold increase from baseline; CLU  $1.3 \pm 0.9$ -fold;  $p > 0.05$ ). Downstream targets of mTORC1 also showed no differences in phosphorylation between paradigms (4E-BP1: TRD  $1.6 \pm 0.3$ -fold, CLU  $0.4 \pm 0.2$ -fold; p70S6K: TRD  $1.5 \pm 0.4$ -fold, CLU  $0.9 \pm 0.4$ -fold). Similarly, there was no difference in AMPK phosphorylation between conditions (TRD  $1.3 \pm 0.9$ -fold; CLU  $0.9 \pm 0.7$ -fold).

**CONCLUSION:** Our data demonstrated that changes in protein phosphorylation as noted by various readouts within the mTORC1 pathway do not underpin the greater post-exercise muscle protein synthetic response with TRD versus CLU-style in resistance trained men and women.

**316 Board #154 May 29 11:00 AM - 12:30 PM**  
**Resistance Exercise-Induced Hormonal Response Promotes Satellite Cell Proliferation in Untrained Men**

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 (No relevant relationships reported)

Evidence suggests that resistance exercise (RE)-induced transient release of anabolic hormones can be beneficial for muscle adaptation (e.g. muscle size, strength); however, no prior research appears to have investigated the effect of the RE-induced hormonal response on satellite cell (SC) proliferation and differentiation, an important step in any such muscle adaptations. **Purpose:** To determine the effect of transient resistance exercise (RE)-induced hormonal changes on satellite cell myogenic state following eccentric exercise. **Methods:** Untrained men ( $n=10$ ,  $22 \pm 3$ y) and women ( $n=9$ ,  $21 \pm 4$ y) completed 2 sessions of 80 unilateral maximal eccentric knee extensions followed by either an upper body RE protocol (EXE) or a 20-min rest (CON). Muscle samples were collected and analyzed for protein content of Pax7, MyoD, myogenin, cyclin D1, and

p21 before exercise (PRE), and 12 hours (+12h) and 24 hours after the session (+24h). Serum testosterone, growth hormone, cortisol, and myoglobin concentrations were measured at PRE, immediately after eccentric knee extension (IMD), immediately after (IP), 15, 30, and 60 min after the session. **Results:** Testosterone was significantly ( $p < 0.05$ ) higher immediately after the session in EXE ( $6.34 \pm 0.48$  ng·ml<sup>-1</sup>) than CON ( $4.87 \pm 0.26$  ng·ml<sup>-1</sup>) for men. A significant time  $\times$  gender  $\times$  condition interaction was found for MyoD with  $20.1 \pm 10.8$ -fold increase for EXE in men and  $21.9 \pm 7.6$ -fold increase for CON in women at +12h compared to PRE. A significant time  $\times$  condition interaction was found for Pax7 with  $0.8 \pm 0.1$ -fold decrease for EXE and  $1.6 \pm 0.3$ -fold increase for CON at +24h compared to PRE. A significant time effect was found for myogenin, p21, and cyclin D1. Myogenin (+12h:  $5.9 \pm 1.5$ -fold; +24h:  $5.0 \pm 1.1$ -fold) and p21 (+12h:  $25.4 \pm 4.5$ -fold; +24h:  $12.4 \pm 1.9$ -fold) were increased at +12h and +24h and Cyclin D1 was  $6.6 \pm 1.9$ -fold increased at +12h compared to PRE. **Conclusion:** These results suggest that the RE-induced hormonal response can be important to promote SC proliferation for men but not women. In addition, markers of SC differentiation appeared to be unaffected by the hormonal response but were increased in response to the knee eccentric exercise protocol. Supported in part by a grant from the National Strength and Conditioning Association Foundation

**317 Board #155 May 29 11:00 AM - 12:30 PM**  
**Contralateral Repeated Bout Effect of Elbow Flexors Not Observed in Young Women**

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 (No relevant relationships reported)

Previous studies have reported that a prior bout of damaging exercise with one limb attenuated the magnitude of muscle damage in the subsequent damaging exercise with the contralateral limb, a phenomenon called contralateral repeated bout effect (CL-RBE). To our knowledge, these studies involved either exclusively men or a mixture of both sexes.

**PURPOSE:** To determine whether contralateral repeated bout effect of elbow flexors exists in women. **METHODS:** Twelve healthy women ( $20.9 \pm 2.5$  yrs) performed two bouts of 45 maximal eccentric contractions (ECC) of elbow flexors separated by 14 days. The isokinetic muscle strength (60°/sec) was measured pre-exercise, immediately post-exercise, and at 24 and 48 h post-exercise. Limb girth, range of motion (ROM), and muscle soreness were measured pre-exercise, and at 24 and 48 h post-exercise. Surface Electromyography (EMG) was recorded during both exercise bouts from the biceps brachii muscle. Data of all variables were analyzed using two-way repeated measures ANOVA (Bout  $\times$  Time) except that of median frequency of EMG which was analyzed via paired t-test.

**RESULTS:** The isokinetic strength was significantly reduced after the eccentric exercise for both bout 1 ( $-19.3 \pm 17.4\%$ ,  $P < 0.01$ ) and bout 2 ( $-15.3 \pm 15.2\%$ ,  $P < 0.01$ ). Significant main effects of time were also observed for muscle soreness and ROM. Limb girth did not change significantly after either exercise bout. There were no significant differences between bouts for all the measured variables.

**CONCLUSION:** The CL-RBE of elbow flexors was not evident in healthy young women, which is probably because the magnitude of the muscle damage induced by the first exercise bout was not sufficient to induce protective adaptation for the contralateral arm in the second bout.

**318 Board #156 May 29 11:00 AM - 12:30 PM**  
**Tissue Hemodynamics of Skeletal Muscle and Prefrontal Cortex is Related to Rowing Time Trial Performance**

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Near-infrared spectroscopy (NIRS) is a non-invasive method for measuring tissue concentrations of oxy- (HbO<sub>2</sub>) and deoxyhemoglobin (Hb) providing information about local metabolism, tissue-specific oxygen availability, and blood flow. Time-resolved NIRS can quantitatively measure absolute hemoglobin concentrations in tissue. Its ability to separate light absorption from scattering makes it an ideal tool for measuring tissue hemoglobin levels where there may be large changes in blood volume such as with exercise. Furthermore, it has been hypothesized that blood flow and oxygenation to the prefrontal cortex (PFC) may be related to fatigue. **PURPOSE:** To quantify tissue oxy- and deoxyhemoglobin (Hb) concentrations in the vastus lateralis (VL) and (PFC) during a 2,000 m ergometer time trial test with collegiate rowers. **METHODS:** Eighteen collegiate club rowers (11 males and 7 females,  $20.33 \pm 1.65$  years,  $\text{VO}_2\text{max}$   $42.77 \pm 7.62$  ml/kg/min.) performed a maximum 2,000 m test on a Concept 2 ergometer. A two-channel time-resolved NIRS instrument (TRS-21, Hamamatsu) was used to assess tissue HbO<sub>2</sub>, Hb, and total hemoglobin (tHb) of the right VL and PFC. **RESULTS:** Average time to complete the 2,000 m time trial was  $475.4 \pm 44.37$  seconds. A significant correlation was observed for

the 2,000 m ergometer test and VO<sub>2</sub>max (Pearson  $r = -0.523$ ;  $p = 0.045$ ). Exercise reduced HbO<sub>2</sub> ( $p = 0.0063$ ) and increased Hb ( $p = 0.0038$ ) compared to baseline in the VL with tHb remaining unchanged ( $p = 0.0677$ ). No changes were observed during exercise in the PFC except for an increase in tHb ( $p < 0.0001$ ). The magnitude of change in VL tissue oxygenation (HbO<sub>2</sub>) was correlated with the time to complete the time trial with a faster time relating to a greater reduction in VL HbO<sub>2</sub>. Similarly, the magnitude of change in VL deoxygenated hemoglobin (Hb) trended towards a greater increase in concentration with a faster time trial (Pearson  $r = -0.4422$ ,  $p = 0.0661$ ). **CONCLUSION:** Exercise during a 2,000 m rowing time trial test resulted in decreased HbO<sub>2</sub> and increased Hb levels in the VL compared to baseline which was correlated with performance on the time trial. Total hemoglobin was found to increase in the PFC which may represent increased fatigue that occurs due to the maximal nature of the time trial.

319 Board #157 May 29 11:00 AM - 12:30 PM

### Calf Muscle Endurance and Gait Variability among Older Adults

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Declines in skeletal muscle functions are associated with aging which affects daily activities and quality of life. Fall risk and fall-related injuries are related to muscle fatigability among older adults. **Purpose:** Measure calf muscle endurance and gait function in older adults. We hypothesize that gait abnormalities will be associated with reduced calf muscle endurance. **Methods:** Ten participants ages 55-80 years volunteered for the study. Skeletal muscle endurance was measured on the calf muscle of the participant's right leg at 2Hz, 4Hz and 6Hz using previously established protocol. Selected gait measurements (stride length, left/right ratio step length, %CV of step length, stride width) were recorded on three trials at self-selected speed on a 20foot gait mat (Protokinetics Zeno walkway). Pearson's  $r$  was used to test the relationship between the selected gait variables and endurance index at 6Hz. ANOVA Levene's test of covariance was used to test the difference in the variance in step length of both legs. Significance was accepted at 0.05 alpha level **Results:** Muscle endurance at 6Hz ( $0.75 \pm 0.21\%$ ) varied from 0.3% to 1.0%. Stride length ( $145\text{cm} \pm 11\text{cm}$ ) varied from 127.4cm to 168.5cm and step length ( $1.0\text{cm} \pm 0.06\text{cm}$ ) varied from 64.6cm to 82.7cm. There was a positive correlation between endurance index and stride length ( $r = 0.68$ ,  $p = 0.02$ ), and the right/left ratio step length ( $r = 0.72$ ,  $p = 0.01$ ) but there was no significant relationship between endurance index and step width ( $r = -0.43$ ,  $p = 0.11$ ). A Levene's test verified equality of variances in step length %CV of both legs ( $p = 0.84$ ). **Conclusions:** Muscle endurance in the calf was associated with some selected gait parameters which have been shown to predict increase fall risk among older adults.

320 Board #158 May 29 11:00 AM - 12:30 PM

### Effects Of Rate Of Force Production On Vastus Lateralis Pennation Angle During Isometric Squats And Knee Extensions

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Previous literature has shown that force exerted by muscle is closely related to its size, length (i.e. joint angle) and pennation angle (PA). For a mono-articular muscle such as the vastus lateralis (VL), its ability to produce maximal force is dependent on the joint angle of the knee. However, since the VL shares a joint action with a bi-articular muscle, the rectus femoris (RF), it's possible that its performance may also be affected by the angle of the hip (i.e. the RF contribution to knee extension is hip angle dependent, which may influence VL performance as well). It is unknown how the pennation angle of the VL during contraction differs between maximal multi- and single-joint exercises, such as the isometric squat (SQ) and knee extension (KE), and whether those changes are dependent on the rate of the force production. **PURPOSE:** To examine the pennation angle of the VL during slow and rapid maximal force production of the isometric SQ and KE exercises. **METHODS:** Fifteen lower-body resistance trained males (mean  $\pm$  SD age =  $24 \pm 3$  yrs) performed two separate maximal voluntary contractions (MVC) for both SQ and KE exercises. The first MVC (MVC1) cue was used to elicit peak force, with no instructions on the rate, while the 2nd (MVCR) was used to elicit rapid force production. Knee joint angles were set at  $110^\circ$  during both exercises, while hip angle was  $\sim 110^\circ$  and  $\sim 105^\circ$  during the SQ and KE, respectively. During all MVCs, ultrasonography was used to measure pennation angle of the VL muscle at peak force production. **RESULTS:** A two-way [MVC speed (slow vs. rapid)  $\times$  exercise (SQ vs. KE)] repeated measures ANOVA indicated no significant differences in pennation angle of the VL between slow vs. rapid MVCs of the squat (mean MVC1 =  $16.19 \pm 3.18^\circ$ , MVCR =  $16.13 \pm 3.26^\circ$ ) and knee extension

exercises (mean MVC1 =  $16.21 \pm 2.23^\circ$ , MVCR =  $16.08 \pm 2.34^\circ$ ), nor were there any differences between the exercises ( $p > 0.05$  for all analyses). **CONCLUSION:** When knee angle is controlled for, the pennation angle of the VL during isometric squats and knee extensions do not differ. Furthermore, neither the rate of force, nor the slightly different hip angles had an effect.

321 Board #159 May 29 11:00 AM - 12:30 PM  
**Electrical Pulse Stimulation Induced Increase In Lipid And Mitochondria Depends On Donor's Physical Activity Level**

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(No relevant relationships reported)

We have previously shown that human primary myotubes retain *in vivo* characteristics of their donors. Electrical pulse stimulation (EPS) has recently been used as an exercise mimetic in a cell culture model, and could be beneficial to understanding underlying molecular mechanisms of exercise.

**Purpose:** To determine if EPS induced adaptations on mitochondria and lipid content is dependent on the donor population and the duration of EPS applied.

**Methods:** Human primary skeletal muscle myotubes were cultured from four endurance trained athletes ( $23 \pm 1$  yrs and BMI  $24.4 \pm 0.9$  kg/m<sup>2</sup>) and five lean healthy Caucasian donors ( $23 \pm 1.9$  yrs and BMI  $24.2 \pm 0.6$  kg/m<sup>2</sup>). EPS was applied to pooled cells from athlete and lean donor groups for either 24 hours or 48 hours (single bipolar pulses of 1 Hz for 2 ms; 30V) and were harvested after stimulation. Control cells were maintained simultaneously and harvested alongside EPS treated cells. Lipid and Mitochondrial content were measured by fluorescent histochemical techniques, and quantified using Image J software.

**Results:** Myotubes cultured from athletes had a significantly greater lipid ( $35.68 \pm 5.78$  vs  $0.51 \pm 0.08$  AU;  $p < 0.0001$ ) and mitochondrial ( $108.3 \pm 18.9$  vs  $6.9 \pm 0.87$  AU;  $p = 0.03$ ) content compared to lean donors at baseline. Lipid and mitochondrial content were significantly greater in lean after 24 hours (both  $p < 0.05$ ), but not after 48 hours (both  $p > 0.05$ ) of EPS compared to control of EPS (Lipid: control  $0.51 \pm 0.08$  AU, 24hr.  $10.15 \pm 0.79$  AU, 48 hr.  $6.06 \pm 1.1$  AU; Mitochondria: Control  $6.9 \pm 0.87$ , 24hr.  $116.9 \pm 14.4$ , 48 hr.  $89.57 \pm 12.4$  AU). Lipid content did not change in myotubes cultured from athletes with EPS after 24 hours ( $p = 0.8$ ) or 48 hours ( $p = 0.4$ ) (Control  $35.68 \pm 0.51$  AU, 24 hr.  $35.43 \pm 5.12$  AU, 48 hr.  $25.9 \pm 2.6$  AU) whereas mitochondrial content was significantly greater after 24 hours EPS ( $p = 0.0004$ ) but not after 48 hours ( $p = 0.8$ ) of EPS (control  $108.3 \pm 18.9$  AU, 24 hr.  $239.1 \pm 25$  AU, 48 hr.  $125.1 \pm 15.3$  AU).

**Conclusion:** Primary human skeletal muscle cells cultured from athlete donors have a higher lipid and mitochondrial content compared to lean, healthy donors. EPS induced increases in lipid and mitochondrial content depends on the physical fitness of the population being studied. 24 hours of EPS stimulation seems to result in greater mitochondrial content compared to 48 hours of stimulation.

322 Board #160 May 29 11:00 AM - 12:30 PM  
**Whole-body Heat Shock Accelerates Recovery from a Single Blunt Trauma Contusion in Mice**

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(No relevant relationships reported)

Contusions are a common sports injury, often resulting in acute skeletal muscle contractile dysfunction. Whole-body heat shock is reported to attenuate skeletal muscle atrophy in animal models. **PURPOSE:** The purpose of this study was to test the hypothesis that whole-body heat shock attenuates contusion induced-skeletal muscle contractile dysfunction. **METHODS:** Male mice ( $14.4 \pm 1.4$  mo) were randomized to either the heat shock contusion group (HSC  $n = 5$ ), the normal body temperature contusion group (NTC  $n = 4$ ), or sham ( $n = 3$ ). Under anesthesia, the *in vivo* torque-frequency relationship (1hz-300hz) of the anterior crural muscle group was measured in all mice. Body temperature was then raised to  $41^\circ\text{C}$  (HSC) or maintained at  $37^\circ\text{C}$  (NTC and sham) for 30 min and then all mice were allowed to recover consciousness. Twenty-four hours later all mice were anesthetized again and a single contusion (HSC and NTC) was delivered via the instrumented mass-drop technique (14.1 g steel ball was dropped through a tube from 115 cm onto an impactor directly striking the tibialis anterior) or no contusion (sham); all mice were then allowed to recover. Following 5 days of normal cage activity (5-d recovery), *in vivo* torque-frequency relationships were measured in all mice. Data were analyzed using a factorial ANOVA with an *a priori* level of significance of 0.05. Fisher's LSD pair-wise comparisons were made *post hoc*. **RESULTS:** There was a significant group-time-frequency interaction ( $F = 1.791$ ,  $p = 0.034$ ). Within group pairwise comparison pre to 5-d recovery revealed sham did not differ ( $p = 0.529$ ), HSC fully recovered ( $p = 0.899$ ), and NTC did not recover ( $p = 0.001$ ) muscle contractile function. Within group comparison pre to 5-d

at 40hz (submaximal stimulation) and 250hz (maximal stimulation) found sham did not differ ( $p=0.765$ ;  $p=0.912$ , respectively), HSC recovered ( $p=0.786$ ;  $p=0.602$ , respectively), and NTC did not recover at either frequency ( $p=0.001$ ;  $p=0.006$ , respectively). **CONCLUSION:** Whole body heat shock treatment prior to a single blunt trauma contusion accelerates the rate of recovery of *in-vivo* skeletal muscle contractile function within the 5-d recovery period. Funding: This work was partially supported by an Appalachian State University GRAM award.

**323** Board #161 May 29 11:00 AM - 12:30 PM

**The Effect of 10%O<sub>2</sub> Microenvironment and Electric Pulse Stimulation on Glucose and Lipid Metabolism**

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(No relevant relationships reported)

**PURPOSE:** There is currently no successful cell contraction model *in vitro*. Electrical pulse stimulation (EPS) can induce muscle cell contraction. 10%O<sub>2</sub> microenvironment is closer to the human skeletal muscle environment. In this study, EPS was applied to myotubes to test the changes of the metabolism of glucose and lipid, and to establish successful cell contraction model in a 10%O<sub>2</sub> microenvironment *in vitro*.

**METHODS:** After seven days of differentiation in 5% CO<sub>2</sub>(20%O<sub>2</sub>) incubator, the mouse myoblast cell line C2C12 were transferred into the 10%O<sub>2</sub> incubator. After adaptation to the hypoxia for 12h, the myotubes were subjected to EPS. The EPS stimulation was performed for 120min each, total 4 consecutive days. And cell extracts obtained from each were prepared 3h after EPS. The content of PGC-1 $\alpha$ , MyHCl, MyHClIa, MyHClIb and MyHClIc were determined by ELISA. And RT-PCR analysis was applied to determine mRNA expression of PGC-1 $\alpha$ , MCAD, Cpt1B, GLUT1, GLUT4, PDH, LDH and GAPDH.

**RESULTS:** Both 10%O<sub>2</sub> microenvironment and EPS significantly increased the protein level of PGC-1 $\alpha$ , and the synergistic effect of hypoxia and EPS was more significantly. 10%O<sub>2</sub> microenvironment significantly decreased the content of MyHCl, MyHClIc and MyHClIa in myotubes. EPS significantly decreased the content of MyHCl and MyHClIc but significantly increased the content of MyHClIa in myotubes. 10%O<sub>2</sub> microenvironment significant decreased the mRNA level of GLUT1 and GLUT4. However, in stimulated myotubes, the mRNA level of GLUT1 was significantly elevated, but the RNA level of GLUT4 was decreased. Meanwhile, 10%O<sub>2</sub> microenvironment significantly decreases the mRNA level of MCAD, CPT1B and PDH, and EPS increased the mRNA level of MCAD.

**CONCLUSIONS:** 4 days of 10%O<sub>2</sub> microenvironment combined with EPS successfully established myotubes cell contraction model. 10%O<sub>2</sub> microenvironment inhibited the proliferation and glycolipid metabolism in myotubes. The usage energy of EPS-induced contraction is based on aerobic oxidation of glucose and fatty. The pulse frequency increases from 1 Hz to 2 Hz in the EPS protocol, were association with substrate from fat to glucose.

**324** Board #162 May 29 11:00 AM - 12:30 PM

**Assessment Of Quadricep Femoris Pennation Angle And Force Production Asymmetry In College-Aged Males**

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(No relevant relationships reported)

Muscular architecture is a valuable tool for quantifying muscle function. The arrangement of muscle fibers, commonly referred to as pennation angle (PA), influences the amount of force that a muscle can produce. Levels of leg asymmetry (PA, strength, ROM, etc.) is a growing topic of interest due to its link to functional disorders, injuries, and fall risk. Hence, a better understanding of the amount of asymmetry present can serve as a guide for future researchers and practitioners when examining lower limb function and performance. **PURPOSE:** The current study examined asymmetry in pennation angle (PA) and force production (FP) in the quadriceps femoris (QF) muscle group in college aged males. **METHODS:** Thirty-eight college-aged males (22.97 $\pm$ 2.58 yrs., 180.22 $\pm$ 6.90 cm, 88.62 $\pm$ 14.88 kg) were recruited to participate in this study. All measurements were taken in random order on both legs. PA's were measured using B-mode ultrasound. Three images were captured and analyzed for each muscle of the QF: the vastus medialis (VM), vastus lateralis (VL), rectus femoris (RF) and vastus intermedius (VI). QF FP was measured on two separate visits by performing 3 knee extension maximal voluntary isometric contractions (MVICs). The mean MVIC was used in data analysis. **RESULTS:** FP was significantly different between legs (31.64 $\pm$ 103.43N,  $p<0.05$ ) which equated to one leg being 7% stronger than the other leg. However, there was no difference in PA in any of the muscles between legs (VM, VL, RF, and VI,  $p>0.05$ ). **CONCLUSION:** The current study revealed a significant strength asymmetry in the absence of differences in PA for

the QF muscles. These data suggest that the strength asymmetry was not due to muscle architecture differences as measured by PA. However, further research is needed in other musculature of the legs as it relates to PA and FP differences.

**325** Board #163 May 29 11:00 AM - 12:30 PM  
**Comparison Of Effects Of Different Exercise Modes On Gastrocnemius Of Obese Rats**

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(No relevant relationships reported)

**Purpose:** To explore the effects of different exercise patterns on gastrocnemius in obese rats.

**Methods:** Forty-eight SD rats were randomly divided into 4 groups, 12 in each group, which were quiet control group(Con), continuous exercise group (CE), high-intensity intermittent exercise group (HIIT) and ladder exercise group (LE). After 8 weeks of exercise training, each exercise group was anesthetized including quiet control group and samples were collected for testing. The body weight and gastrocnemius weight of each group were recorded. The cross-sectional area of gastrocnemius muscle was observed by HE staining. The levels of MSTN and insulin in serum were detected by ELISA. The expressions of MSTN, IGF1 and p70S6K in rat gastrocnemius muscle were detected by Western blot.

**RESULTS:** Compared with the group Con, the body weights of group CE, HIIT, LE were reduced by 13.8%,14%,10%, and the weight of the gastrocnemius muscles in group HIIT was decreased by 22%. Compared with the group Con, the gastrocnemius mass index of group CE and group LE was increased by 10.7%. Morphological observation of the gastrocnemius showed that compared with the group Con, the gastrocnemius muscle cross-section of the group LE was increased by 17%. The serum GDF8 level in the group CE was reduced by 32% than that in the group Con, and the serum insulin level in the group CE and group HIIT was decreased by 42% and 35%. Compared with the group Con, the expression of GDF8 and P70S6K protein in the gastrocnemius muscle of the group CE and group HIIT was reduced by 31%, 26%,13% and 21% respectively, while the expression of IGF1 protein in the three exercise groups was increased by 6%,40% and 190% respectively.

**Conclusion:** Although the three exercise modes may significantly reduce the body weight of rats, only continuous exercise and ladder exercise improve the gastrocnemius muscle mass index. Continuous exercise and high-intensity intermittent exercise had similar effects on serum GDF8, insulin, and similar effects on the proteins of MSTN, IGF1 and P70S6K in the gastrocnemius muscle, but the effects of three exercise modes on serum GDF8 and insulin and gastrocnemius MSTN, IGF1 and P70S6K proteins, laddering exercise is different from sustained exercise and High intensity intermittent exercise.

**326** Board #164 May 29 11:00 AM - 12:30 PM  
**Pennation Angle of the Quadricep Femoris Muscles in Resistance Trained Males vs. Non-Resistance Trained Males**

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(No relevant relationships reported)

Pennation angle (PA) is the orientation at which muscle fibers attach to the deep aponeurosis within a muscle. PA is measured using *in-vivo* methods (ultrasound) which allows researchers to observe any angle discrepancies throughout different locations in the muscle. The quadriceps femoris (QF) is a muscle group used on a daily basis. Understanding the architecture of the QF is helpful for understanding and improving performance in sports or activities which relies on running, jumping, or explosive movements. Another reason to pursue our understanding of muscle architecture is examining potential for injury. Furthermore, asymmetrical strength of the quadriceps can lead to increased risk of injuries. However, limited research has looked at muscle architecture asymmetry as it relates to injury and function. **PURPOSE:** The aim of this study was to determine the magnitude of bilateral asymmetry for PA in the QF in resistance trained (RT) and non-resistance trained (NRT) males. **METHODS:** Thirty-eight males (22.97 $\pm$ 2.58 yrs., 180.22 $\pm$ 6.90cm, and 88.62 $\pm$ 14.88 kg) were recruited to participate in this study (25 were lower body RT and 13 were NRT). The first visit consisted of protocol explanation and familiarization. The following visit consisted of PA assessment of the QF muscles using B-mode ultrasound. All PA measurements were taken in random order on both legs. Three images were taken and analyzed from the vastus medialis (VM), vastus lateralis (VL), rectus femoris (RF) and vastus intermedius (VI). **RESULTS:** There was no significant group x leg effect for PA of the QF, [VM ( $p=0.470$ ), VL ( $p=0.795$ ), RF ( $p=0.431$ ), VI ( $p=0.563$ )]. Collapsing across groups revealed a non-significant effect on asymmetry as well (all  $p>0.05$ ). The between leg percent differences were; VM 6.08% $\pm$ 3.65%, VL 4.84% $\pm$ 4.1%, RF 3.87% $\pm$ 4.0% and VI 3.53% $\pm$ 5.87%. **CONCLUSION:** This study revealed that PA angle in the QF muscles was not significantly different between RT and NRT in males.

327 Board #165 May 29 11:00 AM - 12:30 PM  
**Field-based Simplified Methods For Predicting Skeletal Muscle Index In Japanese University Women**

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(No relevant relationships reported)

**PURPOSE:** A recent study reported that the rate of 'presarcopenia' (low SMI without impact on muscle strength or physical capability) was over 30% for healthy young women in Japan. This means that the SMI assessment is particularly attentive for the healthy young women in early prevention of mobility problems and frailty. Thus, we examined if the field-based simplified methods for predicting skeletal muscle index (SMI) in Japanese university women.

**METHODS:** A total of 193 Japanese university freshmen women (ages 18-25 years) volunteered to participate in this study. A stepwise multiple-regression analysis (method of increasing and decreasing the variables, criterion was set at  $p < 0.05$ ) was performed to SMI and 17 variable factors (body mass index, % body fat, waist-hip ratio, girth (mid-thigh and lower-leg), muscle thickness (anterior and posterior mid-thigh and posterior lower-leg), handgrip, knee extension, standing long jump, vertical jump, sit-to-stand test, side step test, multi-stage 20-m shuttle run test, two-step test, sit and reach).

**RESULTS:** Twelve of 17 variables was correlated ( $P < 0.05$ ) with SMI. There was excellent relationship between mid-thigh girth and SMI ( $r = 0.81$ ,  $P < 0.001$ ). The prediction equations were highly correlated with SMI ( $R^2 = 0.64$  for step 1 [ $SMI = 0.11 \times \text{thigh girth (cm)} + 0.71$ ] and  $R^2 = 0.90$  for step 7 [ $SMI = 0.02 \times \text{thigh girth (cm)} - 0.07 \times \text{body fat (\%)} + 0.22 \times \text{BMI (kg/m}^2) + 0.02 \times \text{handgrip (kg)} + 0.04 \times \text{lower leg girth} + 0.01 \times \text{side step} + 0.14$ ],  $P < 0.05$ ).

**CONCLUSIONS:** Our results indicated that the SMI could be evaluated by the field-based simplified methods, especially for the mid-thigh girth measurement, which may be a major determinant to maintain an active life for healthy young women.

328 Board #166 May 29 11:00 AM - 12:30 PM  
**Muscular Activation Differences during Daily Activities in a Unilateral Trans-Femoral Amputee**

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(No relevant relationships reported)

Lower-limb amputees often exhibit an increased atrophy of remaining skeletal musculature as compared to the non-amputated side. This difference in lean mass may present variations in the contribution of physical effort between the affected and unaffected musculature. While most literature has focused mainly on microprocessor-controlled prosthetics, few investigations have examined mechanical (i.e., un-powered) prosthetics during daily activity tasks. **PURPOSE:** The purpose was to examine the electromyographical activity of the lower limb musculature of the amputated versus non-amputated side in a unilateral trans-femoral amputee. **METHODS:** The participant ( $n=1$ , age=26) performed four activities of daily living (i.e., sit-to-stand, 10-meter walk, and stair ascent and descent without support) with an above-knee mechanical prosthetic. The participant completed each task three times with 1-minute rest in between each trial. EMG was recorded, on both sides of the body, at the following sites and compared to a percentage of maximal voluntary contraction (%MVC): gluteus maximus (GM), gluteus medius (GMed), rectus femoris (RF), and biceps femoris (BF). Ratios (affected:unaffected) and percent differences between the affected and unaffected sides of the body were calculated. **RESULTS:** Results demonstrated large mean muscular activation differences of 34% for RF and 20% for GMed throughout overall movement patterns. Small mean activation differences were seen within the GM (2%) and BF (1%). The largest observed imbalance ratios for the sit-to-stand trials were in the RF (1:1.8) and GM (4:1). For the 10-meter walk, the largest differences were seen in the GM (3:1) and GMed (4.5:1). During the stair ascent without support, only the RF and GMed showed large imbalances between limbs (i.e., 1:3.5 and 3:1, respectively). Lastly, for the stair descent, the GM (4:1) and GMed (2:1) demonstrated a large imbalance; while BF and RF exhibited small differences. **CONCLUSIONS:** Results indicate that performing daily tasks for amputees may provide large imbalances in muscular effort between limbs. While some imbalances (increased motor unit recruitment) favored the unaffected limb, the affected limb did display increased recruitment in the gluteal musculature during walking, stair climbing, and sit-to-stand tasks.

329 Board #167 May 29 11:00 AM - 12:30 PM  
**Skeletal Muscle Mass And Bone Mineral Density Of Japanese alpinist Mr. Yuichiro Miura.**

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(No relevant relationships reported)

**Purpose:** In this study, we report on the skeletal muscle mass and bone mineral density of Japanese alpinist Mr. Yuichiro Miura who is the oldest person to climb to the summit of Mount Everest (8,848m) at the age of 80 years compared with Japanese community-dwelling middle-aged and older men. **Method:** The appendicular skeletal muscle mass index (SMI), total bone mineral density (tBMD), whole body fat free mass index (FFMI) and fat mass index (FMI) in Mr. Miura (84.6 yr) and 209 community-dwelling middle-aged and older men (50-79 yr, mean age: 68.1 yr) were obtained by dual X-ray absorptiometry. **Results:** The SMI, tBMD, FFMI and FMI in Mr. Miura were 8.79 kg/m<sup>2</sup>, 1.075 g/cm<sup>2</sup>, 22.3 kg/m<sup>2</sup> and 9.8 kg/m<sup>2</sup>, respectively, and in the community-dwelling middle-aged and older men 7.46 ± 0.81 kg/m<sup>2</sup>, 1.020 ± 0.100 g/cm<sup>2</sup>, 18.1 ± 1.9 kg/m<sup>2</sup> and 5.5 ± 1.7 kg/m<sup>2</sup>, respectively. The values were higher in Mr. Miura than the community-dwelling middle-aged and older men, with z-scores for the SMI and tBMD of 1.63 and 0.55, respectively. **Conclusion:** Mr. Miura maintained total body bone mineral density and skeletal muscle mass at a high level even at the age of 84 years which may in part be due to his long-term training for mountain climbing.

330 Board #168 May 29 11:00 AM - 12:30 PM  
**Motor Nerve Conduction Velocity with Eccentric Contractions of Flexor Pollicis Brevis Muscle**

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(No relevant relationships reported)

Eccentric contractions (ECCs) cause muscle damage indicated by loss of muscle strength, limited range of motion (ROM), and development of delayed-onset muscle soreness (DOMS). Previously, we showed that ECCs induce nerve dysfunction and damage in rats and humans. In a human study, the M-wave latency of the biceps brachii increased by 12-24% at 1-2 days after eccentric exercise of the elbow flexors in women. However, whether ECCs cause a decrease in motor nerve conduction velocity (MCV) is unknown. **PURPOSE:** In the present study, we aimed to establish a new ECC model for the flexor pollicis brevis muscle (FPBM) and evaluate MCV. **METHODS:** Twelve men (age, 19.8 ± 1.7 y; height, 172.4 ± 7.0 cm; weight, 64.0 ± 8.6 kg) performed 100 maximal ECCs at 60 deg/sec with the FPBM of the non-dominant arm (ECC) with a custom-made torque dynamometer. The dominant arms were the controls (CON). Maximal voluntary contraction (MVC), ROM, DOMS, and MCV were assessed before, immediately after, and 1, 2, and 5 days after the ECCs. MCV was calculated as the distance by stimulation divided by the latencies of the waveforms generated. Values were statistically analyzed, and the significance level was set at  $p$  values of  $< 0.05$ . **RESULTS:** MVC, ROM, and DOMS of the ECCs significantly increased as compared with their values before the ECCs (MVC: post, 67.1%; day 1, 73.8%; ROM: post, 83.4%; day 1, 92.1%; DOMS: day 1, 178.8%; day 2, 181.0%;  $p < 0.05$ ) and as compared with those of the CON (MVC: post, 67.1%; day 1, 73.8%; ROM: post, 83.4%; day 1, 92.1%; DOMS: day 1, 178.8%; day 2, 181.0%;  $p < 0.05$ ). The MCV of the ECCs decreased significantly immediately after exercise (63.6%,  $p < 0.05$ ) and as compared with that of time-matched CON. The M-wave latency of the ECCs delayed significantly immediately after exercise (127.3%,  $p < 0.05$ ) and as compared with before exercise. **CONCLUSIONS:** Our new ECC model leads to muscle damage similar to those reported in previous studies that used other muscles and motor nerve dysfunction.

**331** Board #169 May 29 11:00 AM - 12:30 PM  
**Combined Exercise and Leucine Supplementation Promotes Skeletal Muscle Protein Deposition in Tumor Bearing Mice**  
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 (No relevant relationships reported)

**PURPOSE:** To investigate the effect of concurrent exercise training and leucine supplementation on skeletal muscle protein deposition in Colon 26 tumor bearing mice.

**METHODS:** Male BALB/c mice were divided into a control group (C, n=8), a C26 tumor bearing group (T, n=8) and a tumor bearing plus exercise and leucine supplementation group (TEL, n=8). Mice in the C and T groups were fed with normal chow diet, while mice in the TEL group were fed with formulated diet contained 5% leucine and received 30-min swimming training 3 days per week (Monday, Wednesday and Friday) and resistance training 3 days per week (Tuesday, Thursday and Saturday) for 2 weeks. At 24 hours after the last training session, blood and gastrocnemius muscle samples were collected under full anesthesia. The contents of TNF- $\alpha$  and IL-6 in gastrocnemius muscle and serum were determined by ELISA. Maximal grip strength was measured with a commercial grip strength meter. Two-way ANOVAs and post-hoc tests were used for data analysis.

**RESULTS:** After tumor bearing, cumulative food intake appeared to decrease, whereas body weight (20.7 g vs. 26.1 g), wet gastrocnemius muscle weight (97.3 mg vs. 128.9 mg), total protein content (35.7 mg/g vs. 51.2 mg/g), sarcoplasmic protein content (26.5 mg/g vs. 38.3 mg/g), myofibrillar protein content (28.6 mg/g vs. 43.3 mg/g) and muscle strength (82.7 g vs. 156.5 g) were significantly lower in the T group than in the C group (all  $p < 0.01$ ). TNF- $\alpha$  and IL-6 contents in serum and gastrocnemius were obviously higher in the T group than in the C group ( $p < 0.01$ ). After exercise and leucine supplementation, cumulative food intake and the TNF- $\alpha$  and IL-6 content were significantly lower in the TEL group than in the T group ( $p < 0.05$ ), while body weight (21.8 g), wet gastrocnemius muscle weight (111.1 mg), total protein content (40.3 mg/g), sarcoplasmic protein content (30.7 mg/g), myofibrillar protein content (34.0 mg/g) and muscle strength (112.2 g) were significantly higher in the TEL group than in the T group ( $p < 0.05$  to  $p < 0.01$ ).

**CONCLUSIONS:** Combined exercise and leucine supplementation significantly ameliorated skeletal muscular protein deposition in C26 tumor bearing mice, which may be through down-regulating the inflammatory response. (Supported by Research Foundation of Sichuan Provincial Department of Education grant #18ZB0106).

**332** Board #170 May 29 11:00 AM - 12:30 PM  
**Environmental Enrichment Increases Spontaneous Locomotor Activity In Rats**  
 Mizuki SUDO<sup>1</sup>, Soichi ANDO<sup>2</sup>. <sup>1</sup>Meiji Yasuda Life Foundation of Health and Welfare, Hachioji, Tokyo, Japan. <sup>2</sup>University of Electro-Communications, Chofu, Tokyo, Japan.  
 (No relevant relationships reported)

[Purpose] Environmental enrichment (EE) involves housing conditions that facilitate enhanced sensory, cognitive and motor stimulation. EE is beneficial to brain functions, probably due to increases in spontaneous locomotor activity. However, actual spontaneous locomotor activity has not been directly measured because of the technical difficulties involved in housing rats in groups. The purpose of this study was to assess spontaneous locomotor activity in the EE using a recently developed three-axis accelerometer. We also examined whether wheel running is the key to increase spontaneous locomotor activity housed in the EE. [Methods] Thirty-two Wistar rats were divided into four different housing groups (standard environment; SE; only running wheel group; W; EE without running wheel group; EE-S and EE). The present EE contained running wheel, slope, three tunnels, and small hut. Locomotor activity of each was continuously recorded using a three-axis accelerometer, which was embedded in the back. After exposure to each environment for 6 weeks, the tibialis anterior (TA), extensor digitorum longus (EDL) and soleus (Sol) muscles were removed and immediately weighted. [Results] Locomotor activity was higher during the dark period in the W (23,182  $\pm$  9,730, frequency/day) and EE (28,260  $\pm$  12,705) groups compared with EE-S (15,703  $\pm$  6,510) and SE (19,757  $\pm$  9,964) groups ( $p < 0.05$ , respectively). In contrast, locomotor activity during the light period was not different between groups. All hindlimb muscles except for EDL muscle were greater in the W (TA: 1.60  $\pm$  0.23, Sol: 0.42  $\pm$  0.49 mg/g) and EE (TA: 1.60  $\pm$  0.24, Sol: 0.41  $\pm$  0.51) groups compared with EE-S (TA: 1.52  $\pm$  0.23, Sol: 0.39  $\pm$  0.50) and SE (TA: 1.49  $\pm$  0.21, Sol: 0.37  $\pm$  0.52) groups ( $P < 0.05$ , respectively). [Conclusions] The present study suggests that environmental enrichment increase spontaneous locomotor activity housed in groups, which was accompanied by muscle hypertrophy. Wheel running appears to play a key role in increased spontaneous locomotor activity in the EE.

**333** Board #171 May 29 11:00 AM - 12:30 PM  
**Investigating The Repeated-bout Effect To Eccentric Contractions For Females And Males**  
 Christina D. Bruce, Luca Ruggiero, Gabriel U. Dix, Paul D. Cotton, Chris J. McNeil. *The University of British Columbia, Kelowna, BC, Canada.* (Sponsor: Charles L. Rice, FACSM)  
 (No relevant relationships reported)

Performing unaccustomed eccentric (ECC) exercise leads to temporary muscle damage, initiating a prophylactic response to minimize injury from a subsequent bout (i.e., the repeated-bout effect; RBE). Few studies have investigated sex-related differences to ECC maximal voluntary contractions (MVCs). There is indirect evidence to suggest females may have greater muscle damage following ECC MVCs. If true, this could induce a larger RBE for females than males; however, the RBE has not been compared between the sexes. **PURPOSE:** To compare the magnitude of the RBE for females and males. **METHODS:** To date, data from two bouts of ECC MVCs have been collected from 15 healthy young participants (22.7  $\pm$  2.8y; 6 females). The fatigue/damage protocol involved 200 ECC MVCs of the dorsiflexors (60°/s from a neutral ankle position to 30° of plantar flexion; 4 sets of 50 reps; 2s rest between reps and 1min rest between sets). Isometric (ISO) MVC torque and the ratio of ISO torque responses to low vs. high frequencies of electrical stimulation (10:100Hz) were compared before and after (2, 3, and 5min, as well as 2, 4, and 7d) the fatigue/damage protocol. The fatigue/damage protocol and recovery visits were repeated four weeks later. **RESULTS:** After bout 1, ISO MVC torque decreased 27.2  $\pm$  10.9% (females) and 25.1  $\pm$  14% (males) at 2min post-fatigue. At 2d, ISO MVC torque was 91.0  $\pm$  8.3% and 90.0  $\pm$  11.9% control for females and males, respectively. The 10:100Hz ratio decreased markedly in acute recovery (5min: 53.5  $\pm$  13.6% and 40.4  $\pm$  10.4% for females and males, respectively) but returned to 94.7  $\pm$  16.3% and 88.8  $\pm$  10.6% control at 2d. After bout 2, ISO MVC torque was impaired by 19.4  $\pm$  13.3% (females) and 23.1  $\pm$  13.7% (males) at 2min post-fatigue, and restored to 91.3  $\pm$  8.1% and 96.3  $\pm$  6.0% control (females and males, respectively) at 2d. The decrease in the 10:100Hz ratio at 5min post-fatigue was 41.8  $\pm$  15.0% and 35.7  $\pm$  12.3% for females and males, respectively. At 2d, the ratio was 92.1  $\pm$  12.5% (females) and 94.7  $\pm$  8.8% (males) of control. **CONCLUSIONS:** Our preliminary results suggest that an initial bout of ECC MVCs may cause greater fatigue or transient damage for females than males. After bout 2, acute decreases in ISO MVC torque and 10:100Hz ratio appear to be attenuated more for females than males, which may suggest a greater RBE for females. Supported by NSERC, CFI, and BCKDF

## A-50 Free Communication/Poster - Supplements and Nutritional Ergogenic Aids

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
 Room: CC-Hall WA2

**334** Board #172 May 29 9:30 AM - 11:00 AM  
**Effect of Red Spinach Extract Supplementation on Cycle Time Trial Performance in Recreationally Active Individuals**

Adam M. Gonzalez<sup>1</sup>, Matthew R. Accetta<sup>1</sup>, Robert W. Spitz<sup>1</sup>, Gerald T. Mangine<sup>2</sup>, Jamie J. Ghigiarelli<sup>1</sup>, Katie M. Sell<sup>1</sup>.  
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 (No relevant relationships reported)

Red spinach extract (RSE) offers a rich source of dietary nitrates and evidence suggests that it may positively impact exercise performance. **PURPOSE:** The purpose of this investigation was to examine the effects of short-term red RSE supplementation on cycling time trial performance. **METHODS:** Seventeen recreationally active men (n=9, 22.2  $\pm$  3.8 y) and women (n=8, 22.8  $\pm$  3.5 y) underwent two testing sessions administered in a randomized, counterbalanced, double-blind fashion. Participants were assigned to supplement daily with 1 gram of RSE or placebo (PL) for seven days prior to each testing session. During each testing session, an additional serving was provided 1 hour prior to completing a 4-km cycling time trial test. Performance variables (time-to-completion, average power, relative power, cadence, and average speed) and subjective measures (perceived exertion and muscle fatigue) were assessed during each testing session. Heart rate, systolic blood pressure, and diastolic blood pressure (DBP) were also assessed around exercise. **RESULTS:** Compared to PL, RSE supplementation significantly improved ( $p < 0.05$ ,  $\eta_p^2 = 0.24$ ) 4-km completion time (404.6  $\pm$  24.6 vs. 410.6  $\pm$  31.3 s), relative power (2.53  $\pm$  0.44 vs. 2.46  $\pm$  0.40 W  $\cdot$  kg<sup>-1</sup>), and average speed (35.7  $\pm$  2.2 vs. 35.3  $\pm$  2.5 km  $\cdot$  hr<sup>-1</sup>). Additionally, a trial  $\times$  time interaction was observed for DBP ( $F = 4.5$ ,  $p = 0.020$ ,  $\eta_p^2 = 0.22$ ) where DBP was lower following the RSE trial compared to the PL trial (66.1  $\pm$  6.1 vs. 70.1  $\pm$  5.0 mmHg). No other differences were observed between trials. **CONCLUSION:** In conclusion, RSE

supplementation significantly reduced time-to-completion and increased measures of power and speed during a 4-km cycling time trial. RSE also appeared to lower DBP following the cycling time trial, without altering participants' perceived exertion or subjective measures of muscle fatigue. Supported by a grant from American Health Foods, Inc.

**335** Board #173 May 29 9:30 AM - 11:00 AM  
**The Probiotic *Streptococcus Salivarius* M18 Increases Plasma Nitrite But Does Not Alter Blood Pressure**

Mia C. Burleigh. *University of the West of Scotland, West Kilbride, United Kingdom.* (Sponsor: Jason David Allen, FACSM)  
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 (No relevant relationships reported)

The probiotic *Streptococcus salivarius* M18 increases plasma nitrite but does not alter blood pressure

Mia C Burleigh<sup>1</sup>, Nicholas Sculthorpe<sup>1</sup>, Fiona Henriquez<sup>1</sup>, John Butcher<sup>2</sup>, Chris Easton<sup>1</sup>

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Some species of bacteria in the mouth can reduce nitrate (NO<sub>3</sub><sup>-</sup>) from the diet to nitrite (NO<sub>2</sub><sup>-</sup>) which can be later converted to nitric oxide (NO). Increased levels of NO can reduce blood pressure (BP) and improve exercise performance. The bacteriocin-producing probiotic *Streptococcus salivarius* M18 (*S.salivarius* M18) can inhibit pathogenic oral bacteria but it is unclear whether an alteration to the oral microbiome will influence circulating levels of NO metabolites and BP. **Purpose:** To determine the effects of *S.salivarius* M18 supplementation on BP, plasma and saliva [NO<sub>2</sub><sup>-</sup>], and [NO<sub>3</sub><sup>-</sup>]. **Methods:** Eight healthy males (age 32 ± 8 y, body mass 80 ± 11 kg) completed 2 x 14 day supplementation phases in a randomized order at least 14 days apart. In one phase, participants consumed *S.salivarius* M18 probiotic lozenges (2.5 billion colony-forming units/dose) once per day and in the other they ingested water (placebo). Samples of unstimulated saliva and venous blood were collected, and BP was measured before and after each phase. Samples of saliva were later analysed for [NO<sub>2</sub><sup>-</sup>] and [NO<sub>3</sub><sup>-</sup>] using chemiluminescence. The change (Δ) in each outcome from pre- to post-supplementation was compared between phases using paired t-tests.

**Results:** Plasma NO<sub>2</sub><sup>-</sup> increased from baseline (173 ± 38 nM) following probiotic supplementation (Δ50.24 ± 51.23 nM, *P* = 0.04) in comparison to the placebo phase (Δ8.77 ± 61.51 nM). There were no significant changes in systolic BP (probiotic Δ0 ± 3 mmHg; placebo Δ1 ± 4 mmHg, *P* = 0.51). Diastolic BP and salivary NO metabolites were also unaffected (all *P* > 0.05). **Conclusions:** Supplementation with *S.salivarius* M18 increased plasma NO<sub>2</sub><sup>-</sup>, a key marker of NO availability, potentially by altering the abundance or activity of NO<sub>3</sub><sup>-</sup>-reducing bacteria in the mouth. Despite this, *S.salivarius* M18 did not lower BP in healthy participants. Further research is therefore required to determine the therapeutic and ergogenic potential of probiotic supplementation.

Supported by a grant from the Hannah Dairy Research Foundation

**336** Board #174 May 29 9:30 AM - 11:00 AM  
**Effect of Beetroot Juice Supplementation on Thermoregulation and Running in a Hot Environment**

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 (No relevant relationships reported)

Beetroot juice (BRJ) is a rich source of dietary nitrate (NO<sub>3</sub><sup>-</sup>), and has become increasingly popular as a dietary supplement due to its positive effects on exercise performance. However, the effect of BRJ supplementation on thermoregulation and/or exercise performance in the heat is uncertain.

**PURPOSE:** To examine the effects of BRJ supplementation on thermoregulation and running performance and physiology in a hot/humid environment. **METHODS:** Using a double-blind, placebo-controlled, crossover design, 13 male runners (age, 35.8 years ± 6.1 yr; V<sub>O<sub>2max</sub></sub>, 57.4 ± 6.5 mL·kg<sup>-1</sup>·min<sup>-1</sup>) were randomly selected to receive either nitrate-rich BRJ or a nitrate-depleted placebo (PLA) (2 x 70 mL) for 6 days, separated by a washout period of at least 10 days. On Day 6 of BRJ or PLA supplementation, subjects performed a 10 km time trial in an environmental chamber (26.6 °C, 50 % RH) after consuming their last supplement dosage. The first 8 km of each trial were run on a motorized treadmill (fixed speed for each subject), while the final 2 km were run on a non-motorized treadmill, allowing subjects to select their own pace. We examined core body temperature (T<sub>re</sub>), heart rate (HR), ratings of perceived exertion (RPE) and thermal stress ratings (TSR) during each trial (every 2 min), as well as time trial performance (every 500 m). **RESULTS:** Only 4 out of 13 participants completed a full 10 km trial in both (BRJ and PLA) conditions. Participants who did not finish both trials had their session(s) terminated when their T<sub>re</sub> reached 39.5°C (safety precautions), and one trial ended early due to the participant not feeling well. A time to event

analysis revealed that a higher proportion of runners from the PLA group remained in the trial compared to the BRJ group for any given distance, although these differences were not statistically significant (*P* = 0.221). For the first 5.5 km (a distance every participant completed in both conditions), there were no significant differences in T<sub>re</sub> (*P* = 0.092), HR (*P* = 0.437), or RPE (*P* = 0.5013) between trials. TSR was significantly greater in PLA vs. BRJ (*P* < 0.001) during the first 5.5 km. **CONCLUSION:** There is weak evidence that BRJ supplementation may be associated with elevated T<sub>re</sub> when running in the heat, even though thermal perceptions of heat stress are lower. It is unclear if these differences have health or performance implications.

**337** Board #175 May 29 9:30 AM - 11:00 AM  
**Ergogenic Effect of Citrulline Malate Supplementation on Total Training Load and Muscle Thickness in Trained Women.**

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 (No relevant relationships reported)

Practitioners of physical activity, to improve performance in training sessions, commonly use pre-workout supplements. Recently, Citrulline Malate (CM) has attracted attention for its potential to improve performance in resistance training (RT). However, there is still a need to understand the ergogenic effect of CM in some populations with different levels of training. **PURPOSE:** To evaluate the acute effects of CM supplementation on the total training load and muscle thickness (MT) in recreationally resistance-trained women. **METHODS:** Six women (27.8±3.5 y; 67.8±6.6 kg; 164.5±3.1 cm) experienced in RT (36.1±19.5 months) underwent three RT sessions (RTS) in a randomized, double blind fashion. Participants were submitted to the maximum strength test (1RM) for the Arm Curl (AC) and Leg Extension (LE) exercises 120h before experimental trials (ET). Then, each participant performed a RTS in three randomized ET with 96h of interval among them: i) Control (CON): without consumption of any supplement; ii) Placebo (PLA): with 8g of synthetic magnesium silicate and; iii) Supplemented (SUP): with 8g of CM. PLA and SUP consumed their supplements 60min before the RTS that consisted in 3 sets until concentric muscle failure with 80%1RM and 90sec interval-rest among sets in AC and LE exercises. The total number of repetitions and the total training load was recorded for each series and the muscle thickness of the extensor muscles of the thigh and arm flexor muscles was obtained, immediately, before and after each exercise (Bodymetrix PRO-BX2000®). One-way ANOVA with Tukey's post-hoc was utilized to compare differences among ET, Wilcoxon test was utilized to within groups analyzes and effect size (ES) was calculated by using Cohen d. **RESULTS:** There were no significant differences in total training load among the ET (CON: 4714±1269kg; PLA: 4758±922.4kg; SUP:4826±940.7kg). Significant differences were observed in MT pre and post RTS in all ET in the arm flexors (CON: *p*=0.01, ES:1.2; PLA: *p*=0.007, ES:1.8; SUP: *p*=0.005, ES:1.4) and in the thigh extensors (CON: *p*=0.048, ES:0.6; PLA: *p*=0.01, ES:1.2; SUP: *p*=0.01, ES:1.4), however, no significant differences were observed when compared to the ET. **CONCLUSION:** The supplementation with 8g of CM 60min before a RTS has no ergogenic effect on total training load or MT in resistance-trained women.

**338** Board #176 May 29 9:30 AM - 11:00 AM  
**Oral Creatine Supplementation On Physically Active Elderly Women Cognition Improvement**

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**PURPOSE:** The aim of this study was to verify if creatine supplementation in conjunction with a community-based exercise program improved cognition in elderly women.

**METHODS:** Twenty elderly women were randomized into 2 groups: creatine (CRE, n=10, age = 71± 6 y; body mass = 67.4± 6.0 kg; height = 166±2 cm) or control (CON, n=10, age = 73±6 y; body mass = 67.4±5.7 kg; height = 164±4 cm). All subjects were active and did not use CM or pro-cognitive drugs before the experiment. CRE group received 2.0 g.kg body mass<sup>-1</sup>.d<sup>-1</sup> of CM for 28 days. CON group received 2,0 g.kg body mass<sup>-1</sup>.day<sup>-1</sup> of dextrosol. Community-based exercises (walking, dancing, calisthenics, stretching) were performed 3x a week with 1 h per session. Cognition was assessed using a battery of five tests: a Visual Reaction Time (VRT) test, a visual GO/NO GO reaction time (GNG) test; a Differentiation task test (DTT), an Eriksen flanker test (EFT), and a Corsi block test (CBT). Subjects completed a familiarization, taking the testing battery on two sessions over nonconsecutive days the week prior to the experiment. The week after familiarization, subjects completed the test battery and initiated supplementation (CRE or CON). After 28 days, they repeated the test battery.

Chi-square tests were used to compare groups and sessions for DTT, EFT, and CBT. Repeated measures ANOVA were used to compare VRT and GNG. Significance level was set  $p \leq 0.05$ .

**RESULTS:** Significant ( $p \leq 0.05$ ) pre-post performance increases in GNG, EFT, and CBT were observed in CRE vs. CON (table 1). We did not find difference between moments or groups in VRT ( $p > 0.05$ ) nor DTT ( $p > 0.05$ ).

Table 1 - Cognitive tests results \* $p \leq 0.05$  difference from other means according to ANOVA. Differing superscripts (<sup>a,b</sup>) indicate  $p \leq 0.05$  difference according to Chi-Square

Test (units)	Group	Pre	Post	p-value
GNG (ms)	CRE	1140.2 ± 520.7	590.3 ± 134.1*	0.0235
	COM	967.6 ± 386.6	997.9 ± 517.7	
EFT (%)	CRE	76 <sup>a</sup>	94 <sup>b</sup>	0.0104
	COM	74 <sup>a</sup>	76 <sup>a</sup>	
CBT (%)	CRE	56 <sup>a</sup>	84 <sup>b</sup>	0.0298
	COM	62 <sup>a</sup>	70 <sup>a</sup>	
VRT (ms)	CRE	952.1 ± 442.5	578.2 ± 219.9	0.0915
	COM	543.4 ± 448.7	611.4 ± 418.3	
DTT (%)	CRE	66	68	0.6304
	COM	62	74	

**CONCLUSIONS:** We conclude that  $2g \cdot kg^{-1} \cdot day^{-1}$  during 28 days of oral CM supplementation improved results in some cognitions tasks in elderly woman.

**339 Board #177 May 29 9:30 AM - 11:00 AM**  
**Creatine Supplementation And Repeated Sprint Ability - A Systematic Review And Meta-analysis**

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*(No relevant relationships reported)*

**PURPOSE:** The aim of this study was to conduct a systematic review and meta-analysis of the effects of creatine supplementation on repeated sprint ability. **METHODS:** Sixteen studies met the inclusion criteria of adopting double-blind randomized placebo-controlled designs (crossover or between-subject) in which adult participants (age  $\geq 18$  years) completed a repeated sprint test (number of sprints:  $4 < n \leq 20$ ; sprint duration:  $\leq 10$  s; recovery duration:  $\leq 90$  s) before and after supplementing with creatine or placebo for  $\geq 3$  days in a dose of  $\sim 20$  g per day. No exclusion restrictions were placed on the mode of exercise. Meta-analyses were completed using random-effects models, with effects on measures of peak sprint performance (peak power or fastest sprint) and fatigue during each repeated sprint test presented as standardized mean difference ( $\delta$ ) and with effects on body mass and post-test blood lactate concentration presented as raw mean difference ( $D$ ). Analyses were completed using pre-post supplementation differences, with standard deviations imputed, where necessary. 95% confidence limits ( $CL_{95}$ ) were calculated for all estimates. **RESULTS:** Relative to placebo, creatine supplementation resulted in a significant increase in body mass ( $D = 0.67$  kg;  $CL_{95}$  [0.47, 0.88];  $p < 0.00001$ ). However, there was no corresponding effect of creatine supplementation on measures of peak sprint performance ( $\delta = 0.25$ ;  $CL_{95}$  [-0.19, 0.69];  $p = 0.27$ ), fatigue ( $\delta = 0.19$ ;  $CL_{95}$  [-0.14, 0.53];  $p = 0.26$ ), or post-test blood lactate concentration ( $D = 0.36$  mmol·L<sup>-1</sup>;  $CL_{95}$  [-0.13, 0.85];  $p = 0.15$ ). **CONCLUSION:** Although the increase in body mass following creatine supplementation supports an increase in creatine retention; the results of this meta-analysis show that there is no corresponding effect on measures of repeated sprint ability.

**340 Board #178 May 29 9:30 AM - 11:00 AM**  
**The Effect of Creatine Supplementation on Muscle Oxygen Saturation and Arterial Stiffness**

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There is a void in our knowledge on the impact of exercise, in particular creatine monohydrate supplementation, on arterial stiffness (AS) in the major elastic arteries. This study also examined the effects of creatine supplementation on skeletal muscle oxygen saturation ( $SmO_2$ ) in the lower leg. Data have indicated that creatine supplementation can result in an increase in lower leg anterior compartment pressure at rest and post exercise. Although the increased pressures seen during these studies were not pathological, this and additional factors associated with creatine supplementation could possibly effect  $SmO_2$  during exercise and recovery. **PURPOSE:** To determine the effects of acute creatine monohydrate supplementation on AS and  $SmO_2$ .

**METHODS:** 12 male, physically active participants were randomized in a double-blind fashion to placebo (PL) ( $n=6$ ,  $23 \pm 2$  yrs) or creatine (CM) ( $n=6$ ,  $21 \pm 2$  yrs) groups. Subjects received 0.3 g/kg/day creatine monohydrate or placebo in gelatin capsules for 7 days. Ultrasonography of the carotid artery, applanation tonometry, submaximal exercise tests (10 minute treadmill activity at 3.7 mph and 9% incline), and lower leg pain (analog visual scale and pain test algometer) assessments were conducted at baseline and on day 7 of the study period. **RESULTS:** There were no significant differences between PL and CM in carotid-femoral pulse wave velocity (CF PWV) ( $4.60 \pm 10.42$  vs.  $-2.71 \pm 21.20$  % change),  $\beta$ -stiffness index ( $5.81 \pm 26.3$  vs.  $1.65 \pm 41.35$  % change), central pulse pressure (CPP) ( $-17.38 \pm 16.31$  vs.  $6.05 \pm 24.61$  % change), and arterial compliance (AC) ( $19.79 \pm 37.50$  vs.  $12.48 \pm 53.89$  % change) (all  $P > 0.05$ ). There were no significant changes in  $SmO_2$  ( $-7.95 \pm 10.24$  vs.  $29.94 \pm 36.13$  % change) and peak pain ( $-6.55 \pm 29.87$  vs.  $-12.5 \pm 30.62$ ) between PL and CM, respectively (all  $P > 0.05$ ). Finally, there were also no significant differences in body weight ( $0.53 \pm 0.79$  vs.  $0.20 \pm 0.87$  % change), fat mass ( $-3.40 \pm 3.49$  vs.  $-0.23 \pm 8.17$  % change), and fat free mass ( $1.12 \pm 0.98$  vs.  $0.23 \pm 0.80$  % change) between PL and CM, respectively (all  $P > 0.05$ ). **CONCLUSIONS:** Using a randomly controlled, double-blind trial with validated measurements of AS and  $SmO_2$ , acute creatine supplementation does not appear to impact vascular compliance or oxygen saturation in skeletal muscle in young, otherwise healthy males.

**341 Board #179 May 29 9:30 AM - 11:00 AM**  
**Exhaustive Resistance Exercise Alters Serum Creatine and Guanidinoacetic Acid in Active Men**

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*(No relevant relationships reported)*

Exhaustive exercise adversely affects biomarkers of creatine metabolism yet it remains unknown when the values back toward pre-disturbance conditions. **PURPOSE:** To evaluate a 24-hour post-exercise response in serum guanidinoacetic acid (GAA), creatine and creatinine in young active men subjected to a single session of exhaustive resistance exercise and matched it with exercise-induced changes in serum cortisol, interleukin 6 (IL-6), creatine kinase (CK), and lactate dehydrogenase (LDH). **METHODS:** Twelve healthy active men (age  $22.7 \pm 0.8$  years; weight  $79.8 \pm 7.3$  kg; height  $182.4 \pm 4.9$  cm; weekly exercise  $5.1 \pm 1.6$  hours) were subjected to a single session of bench press exercise until volitional exhaustion, with venous blood sampled before, immediately after exercise ( $\sim 2$  min), and after 15 min, 60 min and 24 h after the end of exercise. **RESULTS:** Baseline values for serum GAA, creatine and creatinine were  $2.2 \pm 0.5$   $\mu$ mol/L,  $18.9 \pm 3.6$   $\mu$ mol/L, and  $72.4 \pm 6.0$   $\mu$ mol/L, respectively. Serum GAA significantly dropped for  $9.6 \pm 7.3\%$  immediately after bench press exercise (95% CI, 5.0 to 14.2;  $P < 0.001$ ), while both creatine and creatinine increased immediately after the test for  $5.0 \pm 2.5\%$  (95% CI, 3.4 to 6.6;  $P < 0.001$ ) and  $11.9 \pm 4.3\%$  (95% CI, 9.2 to 14.6;  $P < 0.001$ ), respectively. GAA and creatine levels recovered to the baseline values after 24 hours post-exercise, yet creatinine remained significantly higher at 24-hour period as compared to the baseline values for  $2.5 \pm 2.3\%$  (95% CI, 1.0 to 4.0;  $P = 0.002$ ). **CONCLUSIONS:** A single session of exhaustive resistance exercise induces transient alterations in biomarkers of creatine metabolism, with serum creatinine outlined as a most persistent marker of exhaustion. Exercise-induced changes in creatine metabolism poorly corresponded to perturbations in inflammation and muscle fatigue biomarkers following exercise. This project was partly supported by the Serbian Ministry of Education, Science and Technological Development (175037 and 179011), the Provincial Secretariat for Higher Education and Scientific Research (142-451-2473 and 114-451-710) and the Faculty of Sport and Physical Education, University of Novi Sad (2018 Annual Award).

**342 Board #180 May 29 9:30 AM - 11:00 AM**  
**Fish Oil Intake and Exercise Improve Physical Function and Resting Metabolic Rate in Older Adults**

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Omega-3 polyunsaturated fatty acids (n-3) have received great attention due to their health-enhancing benefits; however, effects of chronic n-3 administration combined with resistance training (RT) in physical function and resting metabolic rate (RMR) in older adults are not well established. **PURPOSE:** To investigate the effects of 12-wk n-3 administration with programmed RT on muscular strength, physical function, and RMR in older adults. **METHODS:** Healthy older adults (62 - 77 years) were randomly assigned to the fish oil plus RT group (FRT;  $n=8$ ) or control group (CON;  $n=5$ ). The FRT group consumed fish oil supplements enriched with n-3 polyunsaturated fatty acids [3 capsules per day - 2100 mg of eicosapentaenoic acid (EPA) and 720 mg of

docosahexaenoic acid (DHA)] and performed progressive RT including lat pull-down, seated row, biceps curl, leg press, and calf raise (2 sets of 10 repetitions; 2x/week for 12 weeks). Muscular strength, physical function, and RMR were evaluated pre- and post-intervention. Data were analyzed using  $2 \times 2$  (group  $\times$  time) repeated-measures ANOVA. **RESULTS:** There were significant group  $\times$  time interactions for muscular strength ( $p < 0.01$ ), physical function ( $p < 0.05$ ), and RMR ( $p < 0.01$ ). There were significant increases in muscular strength; lat pull-down (+22%), seated row (+45%), biceps curl (+36%), leg press (+54%), and calf raise (+43%) ( $p < 0.01$ ) in FRT with no detectable changes in CON. In addition, there were great improvements in physical function; five-stand chair (+22%) and 30-sec chair stand (+22%) in FRT ( $p < 0.05$ ) with no changes observed in CON. RMR significantly increased in FRT (+6%,  $p < 0.05$ ), while remarkably decreased in CON (-6%,  $p < 0.05$ ). **CONCLUSION:** Twelve-weeks of n-3 administration with progressive RT greatly improved muscular strength and physical function as well as appears to reverse the aging-induced decline in RMR in healthy older adults.

Supported by New Mexico State University.

**343** Board #181 May 29 9:30 AM - 11:00 AM  
**Effects Of A Single Dose Multi-ingredient Pre-workout Supplement On Aerobic And Anaerobic Performance In Men**

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(No relevant relationships reported)

**PURPOSE:** To assess the effects of a single dose of a multi-ingredient pre-workout supplement (MIPS) on aerobic and repeated anaerobic performance tests. **METHODS:** Eight college-aged men were recruited to participate in a randomized, double-blind, placebo-controlled, crossover study. All participants were tested within the same week separated by 48 hours and were provided either the placebo (PLA) or the MIPS on each day. As per the manufacturer's instructions, the participants waited 25 minutes to begin the tests, following consumption of the drink. Aerobic exercise performance was assessed using the Modified Astrand Treadmill Protocol, during which maximal oxygen consumption (VO<sub>2</sub>max) and maximal aerobic exercise time were determined. Following this test, participants were provided a 20-minute seated rest period. After the rest period, participants completed a short warm-up which consisted of 2 minutes of cycling at 50 RPMs against a light resistance, followed by 3, 10-second sprints, to determine the max RPMs. After the warm-up, participants completed the repeated anaerobic power test, which consisted of 10, 6-second sprints, with 45 seconds of active rest in between each sprint. For each sprint, a resistance of 7.5% of the participant's body mass was applied at 90% of their max RPM. Peak power (PP) was determined for each sprint and the percent decline in PP from the first to the last sprint was calculated. VO<sub>2</sub>max, exercise time and the percent decline in PP for the sprints were analyzed using a dependent t-test. The peak power of the 10 sprints were analyzed using 2x10 ANOVA. The alpha level was set a priori to  $p < 0.05$ . **RESULTS:** There was no significant difference between the PLA and MIPS for VO<sub>2</sub>max. However, there was a significant difference in treadmill time ( $p = 0.005$ ) with MIPS (10.4 ± 1.6 min) performing better than PLA (10.0 ± 1.6 min). There were no significant differences between the PLA and MIPS when analyzing peak power during the 10 sprints or percent decline in PP. **CONCLUSIONS:** A single dose of this MIPS improved maximal aerobic exercise time despite no changes in VO<sub>2</sub>max. However, this MIPS did not improve performance during a repeated anaerobic power test. Study supported by Cenegenics®

**344** Board #182 May 29 9:30 AM - 11:00 AM  
**Antioxidants Supplementation Hamper Muscle Growth after 10 Weeks Strength Training**

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Strength Training (ST) is recommended for increased muscular mass. It has been suggested that reactive oxygen species (ROS) produced by a ST session may play a positive role in the hypertrophic process. However, there is some evidence that chronic antioxidant supplementation may indeed reduce ROS and play a negative role in protein synthesis. Few studies have investigated the effects of ST combined with antioxidant supplementation on muscle hypertrophy. However, results are still controversial. **PURPOSE:** To investigate the effects of ST combined with Vitamin C and E supplementation on muscle thickness (MT). **METHODS:** Thirty-three untrained

women (22.9 ± 2.5 years, 57.7 ± 8.4 kg, 1.6 ± 0.6 m) were allocated into three groups: Vitamins (VG, n=12), Placebo (PG, n=11) and Control (CG, n=10). Participants of VG and PG underwent lower-body (lunge and deadlift exercises) periodized ST, two-times a week, for 10 weeks. VG group was supplemented with vitamins C (1g/day) and E (400IU/day) during the training period, PG ingested placebo pills and CG did not perform training or supplementation. Muscle thickness (MT) of the quadriceps femoris of the dominant limb was analyzed by ultrasonography. **RESULTS:** Both VG (+11.6%;  $P < .05$ ) and PG groups (+17.1%;  $P < .05$ ) presented increased values of MT after 10 weeks of ST. However, there was no difference between the VG and PG groups, only the PG presented a significant gain of MT when compared to CG (17.1% vs 2.0%;  $p < .05$ ). **CONCLUSIONS:** The results of this investigation suggest that chronic antioxidants supplementation may mitigate improvements in muscle hypertrophy, after 10 weeks of ST in untrained young women.

**345** Board #183 May 29 9:30 AM - 11:00 AM  
**Combination Polyphenol and MSM Supplementation Alters Post Half Marathon Systemic Inflammatory Response**

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(No relevant relationships reported)

Individuals participating in prolonged endurance performances and associated training experience regular inflammation and muscle soreness. Natural products with known anti-inflammatory and/or oxidative stress blocking effects represent attractive options to traditional NSAID treatments. **PURPOSE:** To investigate the effect of combined curcumin (500-1000 mg/d; Longvida), pomegranate extract (500-1000 mg/d; Pomella), and methylsulphmethane (500-1000 mg/d; OptiMSM) supplementation for 30-days on inflammation-associated RNA, protein inflammatory biomarkers, and biomarkers of oxidative stress. **METHODS:** All protocols were approved by the University IRB committee and participants gave written informed consent. Subjects supplemented with the combination supplement (N=5) or placebo (N=5) for 30-d prior to the half marathon race. Venous blood samples were collected for RNA (PAXgene tube) or serum (evacuated serum separator tube) 24-h pre-race, 4-h, and 24-h after a half marathon race. PAXgene treated blood was analyzed in duplicate using a custom, bead-based RNA assay (Quantigene; ThermoFisher). Serum samples were analyzed in duplicate using separate bead-based protein assays to measure cytokines, soluble cytokine receptors, and myokines (Milliplex; Millipore-Sigma). Bead-based analysis was conducted using an automated analyzer (Luminex FM3D). Oxidative stress (TAC, AGE) was measured using enzymatic assays (Cell Biolabs, Aviva Systems Biology). Fold change from pre was calculated for the various outcome variables to allow for better comparison and model creation. **RESULTS:** Fold changes in RNA and proteins exhibited a trend toward reduced inflammation while showcasing an increased ability of soluble cytokine receptors to tolerate inflammation with supplementation post-race. Reduced oxidative stress (via TAC and AGE) was observed post-race with the supplement compared to placebo. **CONCLUSIONS:** These data support the notion that the combined use of curcumin, pomegranate and MSM prior to and after a half marathon race may result in reduced systemic inflammation and oxidative stress. More research is needed in order to understand how to use these effects to improve the effectiveness of a long-term training program.

**346** Board #184 May 29 9:30 AM - 11:00 AM  
**Acute Fermented Soy Supplementation Improves 20-km Time Trial Performance through Improvements in Power and Speed**

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(No relevant relationships reported)

**INTRODUCTION:** Isoflavones, a chemical class of phytoestrogens, are found in soybeans and soy products and may have biological functions similar to estradiol. After binding with ER<sub>β</sub> or perhaps independently of estrogen receptors, isoflavones may augment vascular endothelial relaxation, contributing to improved skeletal muscle blood flow. **PURPOSE:** To determine if acute fermented soy extract supplementation influences 20-km time trial cycling performance and cardiac hemodynamics compared to a placebo. **METHODS:** Subjects included twenty-five recreationally trained cyclists and triathletes (31 ± 8 y, 177.3 ± 5.9 cm, 78.3 ± 8.5 kg, VO<sub>2peak</sub>: 55.1 ± 8.4 mL·kg<sup>-1</sup>·min<sup>-1</sup> (4.3 ± 0.7 L·min<sup>-1</sup>) at 315 ± 42 W). Each subject completed a VO<sub>2peak</sub> assessment, familiarization, and two 20-km time trials in randomized order following ingestion of a fermented soy extract supplement or placebo. The fermented soy extract consisted of 30 g powdered supplement in 16 fl. ounces of water. The placebo consisted of the same quantities of organic cocoa powder and water. Each trial

consisted of 60 min of rest, 30 min of steady-state exercise at 55%  $W_{peak}$ , and a self-paced 20-km time trial. Heart rate, stroke volume, and cardiac output were measured continuously using impedance cardiography. Ergometer software continuously recorded power output, speed, cadence, and time to completion. **RESULTS:** Soy supplementation elicited a faster time to completion ( $-0.22 \pm 0.10$  min;  $-37$  s), lower average heart rate ( $-5 \pm 1$  bpm), and significantly greater power ( $6.8 \pm 2.5$  W) and speed ( $0.42 \pm 0.16$  km $\cdot$ hr $^{-1}$ ) during the last 5 km of the time trial compared to placebo. Analysis of the results by relative fitness level ( $< 60$  vs.  $\geq 60$  mL $\cdot$ kg $^{-1}\cdot$ min $^{-1}$ ) indicated that soy supplementation resulted in lower values of cardiac output ( $-1.6 \pm 0.8$  L $\cdot$ min $^{-1}$ ), stroke volume ( $-5.4 \pm 3.1$  ml $\cdot$ beat $^{-1}$ ), and heart rate ( $-5 \pm 3$  bpm) in those with higher levels of fitness. **CONCLUSIONS:** Ingestion of a fermented soy extract supplement improved sprint-distance performance through improvements in both power and speed. For those with great aerobic fitness, soy supplementation may help to decrease cardiac demand alongside performance improvement.

**347** Board #185 May 29 9:30 AM - 11:00 AM  
**Effects of Short-Term Spirulina Supplementation on Oxidative Stress Markers in Mountaineers at High Altitude**

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**PURPOSE:** To investigate effects of 14 days of spirulina supplementation on oxidative stress responses of climbers at high altitude. Spirulina is a source of antioxidants, which can protect against oxidative damage.

**METHODS:** Eighteen apparently healthy men and women mountaineers (age 24.87 $\pm$ 5yr, height 170.7 $\pm$ 15.34cm, weight 75.92 $\pm$ 17.21kg) volunteered to participate in a one group pretest-posttest study design. All participants completed two winter ascents to the summit (4,000meters) a week before as well as 14 days after spirulina supplementation (3g/day). Blood samples (4cc) were collected at pre-climbing and summit prior to and following supplementation under the same conditions. Participants were instructed to maintain their diet and avoid using antioxidant-containing products throughout the study. Blood samples were analyzed to measure oxidative stress markers such as malondialdehyde (MDA), superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), and total antioxidant capacity (TAC). All data were expressed as the mean  $\pm$  SEM. Statistical comparisons were performed using t-test ( $p$  values  $< 0.05$  were considered to be statistically significant).

**RESULTS:** Results indicated that resting MDA at pre-climb were significantly reduced following supplementation (3.37 $\pm$ 0.017U vs. 2.89 $\pm$ 0.14 U;  $p=0.036$ ); however, significant increases occurred in SOD resting values (132.8 $\pm$ 6.39U vs. 147.8 $\pm$ 3.37U;  $p=0.042$ ) and TAC (10.52 $\pm$ 0.32U vs. 12.98 $\pm$ 0.48U;  $p=0.001$ ) after supplementation. The TAC values were significantly higher at the summit compared to pre-climb values in pre-supplementation (10.87 $\pm$ 0.30U vs. 10.52 $\pm$ 0.32U); conversely, TAC values were significantly lower at the summit compared to pre-climb values after the supplementation (12.09 $\pm$ 0.36U vs. 12.98 $\pm$ 0.48U) ( $p=0.047$ ). Spirulina Supplementation did not significantly change resting GPx and CAT levels as well as the responses of MDA, SOD, GPx and CAT in high altitude ( $p>0.05$ ).

**CONCLUSION:** Spirulina supplementation for a 14-day period reduced the oxidative stress in participants during pre-climbing phase and increased the total antioxidant capacity. However, there were no significant changes in the variables at high altitude. It appears that 3g/day of spirulina cannot completely cope with oxidative stress in hypoxic condition.

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**Effect of Huperzine A on Cognitive Function and Perception of Effort During Exercise**

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**PURPOSE:** Huperzine-A has shown the ability to acutely improve cognitive function in certain populations, and therefore is commonly added to pre-workout supplements.

However, its effects have not been studied in exercise-trained individuals. We hypothesized that acute consumption of huperzine-A would improve cognitive function during exercise, which may be beneficial for exercise performance.

**METHODS:** From January to April, 2018, 15 exercise-trained individuals (women and men, BMI 23.5 $\pm$ 1.4 kg/m $^2$ , age 30.4 $\pm$ 3.6 years) were studied in a double blind randomized-sequence cross-over study, in which they underwent tests for cognitive function (digit span, verbal/word fluency, and Stroop), neuromuscular performance (sharpened Romberg and dart throwing), and exercise performance (estimated aerobic capacity, hand-grip strength, vertical jump, and push-up) after acute ingestion of huperzine-A (200 mcg) or placebo. A 7- to 10-day washout period separated the subsequent trials.

**RESULTS:** No measures of cognitive function differed between placebo or huperzine-A trials (all  $p\geq 0.296$ ). Heart rates (157 $\pm$ 4 vs. 158 $\pm$ 4 bpm;  $p=0.518$ ) and ratings of perceived exertion (13.7 $\pm$ 0.56 vs. 13.9 $\pm$ 0.61;  $p=0.582$ ) did not differ between placebo and huperzine-A trials, respectively. Ratings of subjective difficulty post-exercise (0-10 scale) were significantly higher (5.7 $\pm$ 0.38 vs. 6.8 $\pm$ 0.38;  $p=0.002$ ) in the huperzine A trial than the placebo trial. No differences were observed for neuromuscular or exercise performance measures between both groups (all  $p\geq 0.497$ ). **CONCLUSION:** Huperzine-A does not enhance cognitive function during exercise despite it being marketed as a cognitive enhancer. Because of its inability to enhance cognitive function, its inclusion in pre-workout supplements warrants reconsideration. Other more practical and effective strategies should be considered.

**349** Board #187 May 29 9:30 AM - 11:00 AM  
**No Recovery Differences with Acute vs. Pre-load Montmorency Tart Cherry Juice Supplementation Following Strenuous Exercise**

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 (No relevant relationships reported)

Montmorency tart cherry juice (MC) has been shown to enhance exercise recovery following high intensity exercise by decreasing inflammation and oxidative stress. Methodologies for previous studies involving MC consumption as a recovery aid utilize a pre-load dosage strategy involving a 3-7 day loading phase prior to strenuous exercise. No consistent rationale has been provided for dosage strategies, therefore a pre-load strategy may be unnecessary for proposed benefits. **PURPOSE:**

To investigate whether acute consumption of MC following a bout of strenuous exercise is equally as effective as consuming MC pre and post exercise on markers of recovery. **METHODS:** Healthy resistance-trained males ( $n=10$ , age, height, mass: 25.30 $\pm$ 8.08 years, 179.81 $\pm$ 10.84 cm, 90.95 $\pm$ 18.04 kg) and females ( $n=8$ , age, height, mass: 25.63 $\pm$ 3.85 years, 165.89 $\pm$ 3.46 cm, 70.98 $\pm$ 8.54 kg) were randomized into two groups that consumed 30 mL of MC twice per day for three days following exercise (no-preload; NPL) or six consecutive days beginning three days prior to strenuous exercise (pre-load; PL). Participants completed a squatting exercise protocol designed to induce muscle damage and reported to the lab immediately post-exercise, 24, 48 and 72-h later to assess recovery indices including: serum creatine kinase (CK), the Adapted Brief Assessment of Mood (BAM+) survey, pressure-pain threshold (PPT), countermovement jump height (CMJ) and the Wingate anaerobic test (WANt).

**RESULTS:** Serum CK peaked at 24-h in the NPL and PL group as compared to baseline (410.56 $\pm$ 253.90, 778.17 $\pm$ 780.95 U/L, respectively) ( $p<0.05$ ). Perceived recovery (BAM+) was lowest at 48-h in the NPL and PL group (45.16 $\pm$ 25.59, 35.96 $\pm$ 29.67 mm, respectively) ( $p<0.05$ ). PPT of the vastus medialis muscle was lowest at 48-h in the NPL and PL group (5.99 $\pm$ 1.34, 5.36 $\pm$ 0.84 kg-force, respectively) ( $p<0.05$ ). CMJ performance was lowest at 24-h in the NPL and PL group as compared to baseline (94.28 $\pm$ 5.29, 88.94 $\pm$ 11.74%, respectively) ( $p<0.05$ ). No differences were found between the NPL and PL groups for all recovery indices. **CONCLUSIONS:** These results suggest no additional benefits of a pre-load strategy when using MC as a post-exercise recovery aid following high-intensity, muscle-damaging exercise. These findings could have implications for dosage strategies currently used by athletes.

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**Performance Enhancing Effects Of Ecdysterone- A Human Intervention Study**

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(No relevant relationships reported)

**PURPOSE:** Recent studies suggest that the anabolic effect of ecdysterone (a naturally occurring steroid hormone present in some supplements claimed to enhance physical performance) is mediated by estrogen receptor (ER) binding. In comparison to the prohibited anabolic agents (e.g. metandienone and others) ecdysterone revealed to be even more effective in a recent study performed in rats. However, scientific studies in humans are very rarely accessible. Thus, our project aimed at investigating the effects of ecdysterone containing products on human athletic performance

**METHODS:** A ten weeks intervention study in young man has been conducted including regular resistance training for all volunteers. Different doses of ecdysterone containing supplements have been administered during the study to evaluate the performance enhancing effect. Analysis of blood and urine samples for ecdysterone and potential biomarkers of performance enhancement have been conducted. To ensure the specificity of the measured effects a comprehensive screening for prohibited compounds was also performed. Furthermore, the administered supplements have been tested for the absence of anabolic steroid contaminations prior to administration.

**RESULTS:** Used ecdysterone supplements displayed anabolic activity in C2C12 cells. Dose dependent administration of Ecdysterone supplements to human volunteers results in detectable ecdysterone concentrations in serum. Effects on endocrine parameters were detectable. Serum IGF1 concentrations increased in comparison to the control group while thyroxin (T4) concentrations decreased. Significantly higher increases in muscle mass were observed in those volunteers that were dosed with the ecdysterone supplements. Even more relevant with respect to sports performance, also significantly more pronounced increases in one-repetition bench press performance were observed.

**CONCLUSIONS:** These data underline the effectivity of an ecdysterone supplementation with respect to sports performance. Our results strongly suggest to include ecdysterone in the list of prohibited substances and methods, in the class S1.2 "other anabolic agents".

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**Citrus Active Substances Improve Elite Weightlifters' Aerobic Exercise And Resilience**

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**PURPOSE:** Citrus active substances can extend aerobic exercise time in mice. The objective of this study was to determine whether citrus bioactive substances could improve aerobic exercise and resilience of athletes.

**METHODS:** Weightlifters (male = 6; female = 5) Took citrus bioactive substance (200mg/d) orally for 5 weeks, blood sampling before intervention, and then collected once every 6 days, and the fasting sampling was proceeding from 7:00 to 8:00 am. Athlete-related biochemical indicators were detected and analyzed.

**RESULTS:** Citrus active substances could maintain the number of athletes leucocytes. After 5 weeks, the testosterone contents of male and female athletes decreased and then increased during intervention time, increasing the testosterone content (more than 1.5 times) of male athletes with low initial testosterone levels. The cortisol concentrations of all athletes significantly lower than that before non intervention. Serum ferritin content rose during intervention time. The erythrocytes number of male athletes decreased and the amount of increased compared the initial state, while hemoglobin/red blood cells showed an increasing trend. In terms of fatigue index, the

male athlete's blood urea level fell, while that of the female athlete escalated; male athletes' uric acid content decreased, female athletes increased gently in the early stage.

**CONCLUSION:** Our findings showed that the citrus bioactive substance diminished serum cortisol levels and increased the testosterone/cortisol ratio, thus helping the recovery of the athlete's body. The increase in the amount of hemoglobin carried by athletes in red blood cells increases the rate of oxygen transport. In general, athletes can use citrus

bioactive substances as a supplement to enhance physical recovery and exercise capacity.

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**7-Day Hydrogen Inhalation Affects Exercise Performance and Hormonal Profiles in Young Volunteers**

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(No relevant relationships reported)

The use of medical gasses has been recently displayed as an emerging exotic strategy in exercise physiology and sports medicine community, with few unconventional medical gasses put forward as performance-enhancing agents. Among others, molecular hydrogen (H<sub>2</sub>) pops up as an innovative compound that might be applicable among athletes. **PURPOSE:** To examine the effects of 7-day H<sub>2</sub> inhalation on exercise performance outcomes and serum hormonal and inflammation profiles in a cohort of young men and women. **METHODS:** Twenty healthy volunteers (10 men and 10 women; age 22.9 ± 1.5 years; body mass index 23.4 ± 2.5 kg/m<sup>2</sup>) participated in this randomized, double-blind, placebo-controlled, crossover pilot trial. All participants were allocated to receive either gaseous hydrogen (4%) or placebo (room air) by 20-min once-per-day inhalation for 7 days, with wash-out period of 7 days to prevent the residual effects of interventions across study periods. Gaseous hydrogen was provided by biological gas supplying apparatus (MIZ Company Ltd, Kanagawa, Japan), with day-to-day H<sub>2</sub> inhalation supervised by study investigators throughout the trial. The primary treatment outcome was the change in running time-to-exhaustion from baseline to day 7. Secondary outcomes included change from baseline to end of treatment in other exercise performance endpoints and clinical chemistry biomarkers.

**RESULTS:** Breathing H<sub>2</sub> was superior to placebo to increase peak running velocity during a maximal incremental running test (for up to 4.2%;  $P \leq 0.05$ ), also to attenuate a drop in maximal voluntary isometric strength at 7-day follow-up ( $P = 0.04$ ). Hydrogen inhalation resulted in a notable drop in serum IGF-1 for 48.2 ng/mL at follow-up, while IGF-1 levels were elevated by 59.3 ng/mL after placebo intervention ( $P = 0.04$ ). Baseline CRP levels were decreased by 1.0 mg/L and 0.7 mg/L after H<sub>2</sub> and placebo inhalation at 7-day follow up, respectively. **CONCLUSION:** Inhalational hydrogen appears to show ergogenic properties in young volunteers. Gaseous H<sub>2</sub> should be further evaluated for its efficacy and safety in athletic environment. Supported by the Serbian Ministry of Education, Science and Technological Development (175037), the Provincial Secretariat for Higher Education and Scientific Research (114-451-710) and the Faculty of Sport and Physical Education.

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Supported by the Serbian Ministry of Education, Science and Technological Development (175037), the Provincial Secretariat for Higher Education and Scientific Research (114-451-710) and the Faculty of Sport and Physical Education.

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**Using Combined Curcumin and Boswellia Serrata Supplementation to Alter Inflammatory Response to Consecutive Exercise Days**

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(No relevant relationships reported)

Repetitive exercise on consecutive days is a key component of many long-term training plans. This type of training results in muscle inflammation and soreness that limits the capacity to sustain exercise at a high intensity. Several dietary polyphenols have the capacity to manage inflammation and thus supplementation may be an effective component of a long-term training plan. **PURPOSE:** The purpose of this study was to investigate the effect of combined oral supplementation with curcumin and boswellia serrata prior to and following three consecutive days of intense interval exercise. **METHODS:** All protocols were approved by the University IRB committee and participants gave written informed consent. Participants were supplemented with either combined active (N=10; 95% full spectrum curcumin=400 mg/d and 90% boswellia serrata extract standardized for AKBA=100 mg/d) or placebo (rice flour; N=7) for 7-d prior to and immediately following each exercise session. Each exercise day consisted of 45-min of interval exercise (ladder climbing, cycling, and downhill running). Subjective muscle soreness and muscle strength were evaluated using a visual analog scale and isokinetic dynamometer respectively. Venous blood samples were collected for serum prior to and 1-h after each of the three exercise days and 24-h after the final exercise day. Samples were analyzed in duplicate using separate bead-

based assays to measure cytokines and myokines (Milliplex; Millipore-Sigma). Sample analysis was performed on a multiplex analyzer (Luminex LX200). **RESULTS:** Active resulted in trends toward reduced muscle soreness and improved muscle strength compared to placebo. Active was also associated with transient reductions in serum creatine kinase, MIP-1 $\beta$ , and IL-6. **CONCLUSIONS:** These data support the notion that combined supplementation with curcumin and boswellia serrata may represent an effective means to manage systemic inflammation during consecutive days of training. More research is needed to understand how curcumin and boswellia serrata may be able to manage inflammation in other exercise models.

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### Curcumin Supplementation Alters Inflammatory Cytokines Following Exercise

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*Reported Relationships: B.K. McFarlin: Industry contracted research; Research Grant to UNT.*

Nutritional supplementation is often misused as a component of a holistic approach to muscle recovery following exercise. Supplementation that reduces post exercise inflammation or muscle soreness might improve recovery time. **Purpose:** The phase 1 purpose was to evaluate different doses of a curcumin supplement following a bout of eccentric leg press. The phase 2 purpose was to determine if the effective curcumin dose from phase 1, could alter inflammation in an open-label, field-based model. **Methods:** We consented self-reported healthy men and women to participate in the two phases of the study. In phase one, we tested a dose response for curcumin (Longvida) by comparing three doses (200, 400, & 1000 mg/d) to a placebo. In phase two, we evaluated a single dose of curcumin (1000 mg/d) combined with another polyphenol (pomegranate extract; Pomella; 1000 mg/d) endurance exercise model (half-marathon performance). Venous blood samples and analyzed for inflammatory cytokines (IL-1 $\beta$ , IL-6, IL-8, and TNF- $\alpha$ ) using a bead-based multiplex assay and an automated analyzer. Creatine kinase was analyzed using an enzymatic assay on a biochemistry analyzer (ChemWell T). **Results:** The 400 and 1000 mg doses were associated with a reduction in inflammatory cytokines and CK at 24 & 48-h after injury. Only the 1000 mg dose was associated with a reduction in subjective muscle soreness. The 200 mg dose responded in a similar manner as placebo (i.e. no reduction in muscle soreness or inflammation). When curcumin (1000 mg) was combined with pomegranate (1000 mg) in half-marathon runners, we found a significant reduction in inflammatory cytokines at 24-h post-race compared to pre-race. **Conclusions:** The key findings of this study suggest that the effectiveness of an oral curcumin supplement is dose-dependent and also activity-dependent. The combination of curcumin with pomegranate extract appeared to be more effective than curcumin alone at altering inflammation. More research is needed to identify how to incorporate curcumin and pomegranate supplementation into long-term exercise program.

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### Effect Of New Zealand Blackcurrant Extract On Recovery From Exercise Induced Muscle Damage Following Half Marathon Running

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*(No relevant relationships reported)*

New Zealand blackcurrant (NZBC) is a rich source of polyphenols, namely anthocyanins, which improve blood flow and display anti-inflammatory and anti-oxidant properties that may improve recovery from exercise-induced muscle damage (EIMD). Limited evidence is available as to whether a polyphenol supplement can aid recovery in the days following a half-marathon event. **Purpose:** To examine whether NZBC extract would accelerate recovery after a half-marathon race. **Methods:** Following a double blind, independent groups design, 20 (8 women) recreational runners (mean  $\pm$  SD: age 30  $\pm$  6 years, height 1.73  $\pm$  0.74 m, body mass 68.5  $\pm$  7.8 kg, previous half-marathons 7  $\pm$  2, finishing time 1:56:33  $\pm$  0:18:08 h:min:s) ingested either 2 x 300 mg day<sup>-1</sup> capsules of a NZBC supplement (CurraNZ™; each containing 105 mg anthocyanin) or a visually matched placebo (PLA) 7-days prior to and 2-days following a half-marathon. Force plates sampling at 1000 Hz recorded countermovement jumps (CMJ) performance variables: jump height (JH), time to take off (TTT) and reactive strength index modified (RSImod) and visual analogue scales for perceived muscle soreness and fatigue were measured pre-, immediately post-, and at 24 h and 48 h after the half-marathon. The CMJ performance variables, muscle soreness and fatigue were analysed using a mixed model ANOVA. **Results:** CMJ variables were reduced immediately after the half marathon ( $P < 0.05$ ) (NZBC; JH 0.19  $\pm$  0.06 and PLA 0.18  $\pm$  0.05 m, NZBC; TTT 0.98  $\pm$  0.16 and PLA 1.03  $\pm$  0.20

s, NZBC; RSImod 0.20  $\pm$  0.08 and PLA 0.18  $\pm$  0.06 ratio) and had returned to baseline by 48 h, with no difference between NZBC and PLA for any variables ( $P > 0.05$ ). Perceived muscle soreness was increased immediately post (NZBC; 6  $\pm$  2 and PLA; 6  $\pm$  2) and had returned to baseline by 48 h, with no difference between NZBC and PLA ( $P = 0.404$ ). Perceived muscle fatigue was increased immediately post (NZBC; 7  $\pm$  2 vs. PLA; 6  $\pm$  2) and had returned to baseline by 48 h, with no difference between NZBC and PLA ( $P = 0.170$ ). **Conclusion:** NZBC extract did not accelerate recovery of CMJ variables or perceptions of muscle soreness or fatigue following a half-marathon in recreational runners, possibly because the event only induced modest changes in the indices of EIMD in the days after the event. **Acknowledgement:** We thank Health Currency Ltd (UK) and CurraNZ (NZ) for supplements.

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### New Zealand Blackcurrant Extract Increases Circulating Hsp32 And Hsp90 $\alpha$ But Doesn'T Affect Circulating Hsp72

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*(No relevant relationships reported)*

Extracellular heat shock protein 72 (eHSP72) acts as an inflammatory molecule, inducing cytokine production in immune cells, whereas HSP90 $\alpha$  is implicit in recovery and adaptation to cellular stress. Heme oxygenase-1 (eHSP32) protects the vasculature and suppresses inflammation. Each are elevated following exertional heat stress. Polyphenols are proposed to have anti-inflammatory properties, so may affect eHSP responses to exercise. **Purpose:** To determine the effects of 7-days supplementation with New Zealand blackcurrant (NZBC) extract on eHSP72, eHSP90 $\alpha$ , and eHSP32 before and after exertional heat stress. **Methods:** In a randomized double-blind design, 12 men (Age: 28 $\pm$ 6 years, stature: 1.81 $\pm$ 0.07 m, mass: 80.5 $\pm$ 9.8 kg, VO<sub>2max</sub>: 55.6 $\pm$ 6.0 mL kg<sup>-1</sup> min<sup>-1</sup>) completed 2 trials. Participants ingested 2x300 mg day<sup>-1</sup> capsules of CurraNZ™ (each containing 105 mg anthocyanin) or a visually matched placebo for 7 days (washout 14 days). On day 7, participants ran 60 minutes at 65%VO<sub>2max</sub> in hot ambient conditions (34°C and 40% relative humidity). eHSP72, eHSP90 $\alpha$ , and eHSP32 were measured in EDTA plasma at rest and 20 and 60 minutes after exercise. **Results:** Post exercise eHSP72 concentrations were elevated after the placebo [by 1.98 ng mL<sup>-1</sup> (95% CI: 0.65 - 3.33 ng mL<sup>-1</sup>)] and NZBC trials [by 1.59 ng mL<sup>-1</sup> (95% CI: 0.03 - 3.15 ng mL<sup>-1</sup>)] and remained elevated 60 minutes after exercise [Placebo: by 0.68 ng mL<sup>-1</sup> (95% CI: -0.07 - 1.46 ng mL<sup>-1</sup>); NZBC by 0.51 ng mL<sup>-1</sup> (95% CI: -0.37 - 1.40 ng mL<sup>-1</sup>)]. Basal eHSP90 $\alpha$  concentration was increased following NZBC supplementation [by 5.60 ng mL<sup>-1</sup> (1.85 - 9.51 ng mL<sup>-1</sup>), trial x time interaction, F = 3.57, p = 0.046, np<sup>2</sup> = 0.25], and were elevated at 20 and 60 minutes post exercise in both conditions. Similarly, basal eHSP32 was elevated after NZBC supplementation [by 3.9 ng mL<sup>-1</sup> (95% CI: 0.37 - 7.42 ng mL<sup>-1</sup>), trial x time interaction F = 5.62, p = 0.01, np<sup>2</sup> = 0.34], but were not altered at 20 or 60 minutes after heat stress in either condition. **Conclusion:** We present moderate evidence to support that 7 days of NZBC extract supplementation increases basal eHSP32 and eHSP90 $\alpha$ , with no effect on eHSP72 before or after exercise. Further research is required to determine the functional relevance of these increases. **Acknowledgement:** We thank Health Currency Ltd (UK) and CurraNZ (NZ) for supplements.

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### Does Supplementation With Pedicoccus Acidilactici Probiotics Alter Inflammatory Response To Exercise On Consecutive Days?

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*(No relevant relationships reported)*

Oral supplementation with probiotics has been reported to treat a variety of common gastrointestinal conditions (i.e. IBS, IBD, etc.); however, probiotics have not been studied for potential sport nutrition applications. Management of post-exercise inflammation, particularly on consecutive days poses a unique challenge to the body and effects future training and performance. **Purpose:** The purpose of this study was to investigate if a novel plant based, non-spore forming high temperature (up to 85°C) and acid resistant probiotic strain (*Pedicoccus acidilactici*; NRRL B-50517, 8 billion cfu per day; N=6) or placebo condition (maltodextrin; N=5) for 14-d prior to two consecutive days of 45-min of intense, interval exercise (intervals of ladder climbing, cycling, and downhill running). Subjective muscle soreness and muscle strength were

evaluated using a visual analog scale and isokinetic dynamometer respectively. Venous blood samples were collected prior to exercise and 48-h after the final exercise day. Samples were analyzed in duplicate using separate bead-based assays to measure cytokines and myokines (Milliplex®; Millipore-Sigma). Sample preps were analyzed using a multiplex analyzer (Luminex LX200). **RESULTS:** There were trends toward reduced MIP-1 $\alpha$ , MIP-1 $\beta$ , and IL-8 in probiotic compared to placebo during recovery from exercise. There were no obvious trends in any additional outcome measures. **CONCLUSIONS:** These data support the concept that probiotics may be useful for managing the trafficking of monocytes and other phagocytes during exercise-induced inflammatory responses. More research is needed to determine if a more extensive exercise model may be capable of eliciting probiotic associated improvements in post-exercise inflammation.

**358** Board #196 May 29 9:30 AM - 11:00 AM  
**Combined Dietary Polyphenol Supplementation Reduces Inflammation Associated Gene Expression Following a Half Marathon Race**

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 (No relevant relationships reported)

Prolonged endurance exercise provides a unique model for investigating skeletal muscle damage through the combined effects of oxidative stress and eccentric muscle contraction on differential gene expression with nutritional interventions known to blunt inflammation. Dietary polyphenols (i.e. curcumin, pomegranate, etc.) have been shown to reduce exercise-induced inflammation associated mRNA and protein expression with fewer side effects than NSAIDs. **PURPOSE:** To investigate the effect of a combined curcumin (500-1000 mg/d; Longvida) and pomegranate extract (500-1000 mg/d; Pomella) supplement for 30-days on mRNA expression following a half marathon race. **METHODS:** All protocols were approved by the University IRB committee and participants gave written informed consent. Participants supplemented for 30-days prior to running a half marathon race with either the active (N=6) or no supplement (N=6). Venous blood samples were collected in PAXgene RNA tubes 24-h before (PRE) and 4-h after completing a half marathon. After collection, tubes were stored frozen at -80°C until RNA isolation. PAXgene whole blood was thawed and isolated using a PAXgene Blood miRNA sample processing system (PreAnalytiX) along with a QIAcube automation system (Qiagen). Isolated RNA was analyzed using a 594-plex Human Immunology Panel on a NanoString nCounter platform. Data were normalized to housekeeper genes and reported as log<sub>2</sub> fold change. Detailed pathway and interaction analysis was conducted using Nanostring nSolver software to identify RNA that were significantly affected by the supplement. **RESULTS:** Analysis revealed significant down regulation of nine pro-inflammatory associated mRNA at 4-h post-race with supplementation compared to control. **CONCLUSIONS:** Combined curcumin and pomegranate extract supplementation altered expression of inflammation associated mRNA prior to and following a half marathon race. Based on these findings, it appears that curcumin and pomegranate extract supplementation may positively affect short-term inflammatory response and recovery in endurance athletes and recreationally active individuals participating in half marathon races. More research is needed to determine how to best use these dietary polyphenols as part of a long-term training plan.

**359** Board #197 May 29 9:30 AM - 11:00 AM  
**Mood: There Are Some Connection Between Probiotics Supplementation On Marathon Runners? A Double Blind Study**

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Prolonged exercise may cause Gastrointestinal Symptoms (GIS) as well as rise some negative affects, which may be mitigated by probiotics according to evidences. **PURPOSE:** Investigate the probiotic effect on mood and GIS after a marathon race. **METHODS:** Twenty seven marathonists were double-blind randomly assigned to either a probiotic group (PR) (35.96  $\pm$  5.81 years, 79.30  $\pm$  10.99 Kg) or placebo (PL) (PL=13 40.46  $\pm$  7.79 years, 72.67  $\pm$  10.20 Kg). PR consumed during 30 days a sachet containing *Lactobacillus Acidophilus* and *Bifidobacterium Lactis* (10x10<sup>9</sup>UFC + maltodextrin 5g/day) while PL received a sachet with maltodextrin (5g/day). GIS were evaluated before the supplementation period (B) and one day before the race (1D) by questionnaires. Brunel Mood Scale (BRUMS) was applied at the B, immediately after the race (AR) and one hour after the race (1H). The data were analyzed in SPSS version25® using ANOVA two way with repeated measures, "group" and "time"

as factors, and Tukey's post-hoc test ( $p < 0.05$ ). Results were expressed as means  $\pm$  standard deviation (SD). **RESULTS:** GIS were not different after the supplementation period or between groups. According to BRUMS, PL group showed significant increase of depression (B: 0.23  $\pm$  0.43; AR: 1.30  $\pm$  2.01; 1H: 1  $\pm$  0), anger (B: 0  $\pm$  0; AR: 6.61  $\pm$  1.51; 1H: 5.53  $\pm$  1.33), fatigue (B: 0.69  $\pm$  1.54; AR: 12.15  $\pm$  0.98; 1H: 7.30  $\pm$  0.75), tension (B: 1.46  $\pm$  2.06; AR: 6.38  $\pm$  0.65; 1H: 3.84  $\pm$  0.37) and mental confusion (B: 0.53  $\pm$  0.77; AR: 4.46  $\pm$  0.51; 1H: 2.92  $\pm$  0.27) and decrease of vigor (B: 10.30  $\pm$  2.25; AR: 2  $\pm$  0.91; 1H: 6.76  $\pm$  1.30) when compared with B, AR and 1H. Probiotic group shown significant increase of anger (B: 0.21  $\pm$  0.42; AR: 1.21  $\pm$  0.89; H: 0.14  $\pm$  0.36), fatigue (B: 1  $\pm$  0.87; AR: 4.28  $\pm$  1.43; 1H: 0.71  $\pm$  0.72), tension (B: 0.92  $\pm$  1.20; AR: 1.42  $\pm$  0.64; 1H: 0.71  $\pm$  1.13) and mental confusion (B: 0.28  $\pm$  0.46; AR: 0.42  $\pm$  0.51; 1H: 0.42  $\pm$  0.64) when compared B, AR and 1H. Between groups, for all mood parameters, PR showed significant increase at AR and 1H compared to PR ( $p < 0.05$ ). **CONCLUSION:** *Lactobacillus Acidophilus* and *Bifidobacterium Lactis* (10x10<sup>9</sup>UFC/day) consumption did not seem to have effect on GIS, but it plays a positive role on mood affects in order to attenuating the increase of negative affects and maintaining the vigor state which may influence sport performance. **Financial Support:** CNPq, CAPES/PROEX.

**360** Board #198 May 29 9:30 AM - 11:00 AM  
**No Acute Effects of Placebo or Open-Label Placebo Supplementation on Strength and Neuromuscular Fatigue**

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 (No relevant relationships reported)

**PURPOSE:** We utilized a repeated measures design to examine the acute effects of placebo, open-label placebo, and control treatments on muscle strength and voluntary activation (Experiment #1), as well as neuromuscular fatigue (Experiment #2). **METHODS:** Following a familiarization session, 21 untrained males ( $n = 11$ ) and females ( $n = 10$ ) visited the laboratory on three occasions to receive placebo, open-label placebo, and control treatments in a randomized, counter-balanced manner. All visits involved a pretest, 15-minute intervention period, and posttest. All visits were at the same time of day. The time between sessions was  $\geq 48$  hours but  $< 1$  week. Laboratory conditions were constant throughout the study, and participants were asked to keep their physical activity levels, dietary habits, and caffeine consumption consistent. In Experiment #1, knee extensor maximal voluntary isometric contraction (MVIC) peak torque and percent voluntary activation were evaluated. In Experiment #2, participants performed 20, six-second MVICs while surface electromyographic signals were detected from the vastus lateralis. Subjective assessments of energy and perceived exertion were also examined. **RESULTS:** In Experiment #1, there were no differences among interventions for peak torque or voluntary activation, but a main effect revealed that energy levels increased following all treatments ( $p = .016$ ,  $\eta^2 = .257$ ). Experiment #2 demonstrated that placebo and open-label placebo treatments had no influence on neuromuscular fatigue, but there were main effects for declines in absolute ( $p = .001$ ,  $\eta^2 = .675$ ) and normalized peak torque ( $p = .001$ ,  $\eta^2 = .765$ ), normalized electromyographic mean frequency ( $p = .001$ ,  $\eta^2 = .565$ ), neuromuscular efficiency ( $p = .001$ ,  $\eta^2 = .585$ ), and energy levels ( $p = .006$ ,  $\eta^2 = .317$ ). **CONCLUSIONS:** Compared to a control condition, placebo and open-label placebo treatments had minimal influence on muscle strength, voluntary activation, and fatigue resistance in untrained participants.

**361** Board #199 May 29 9:30 AM - 11:00 AM  
**Evaluation of the Placebo Effect in Elite and Amateur Athletes**

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 (No relevant relationships reported)

**Purpose:** The aim of the present study was to test the placebo effect effect. This was made possible by the research design. In this way the impact of the placebo effect could be effectively measured. **Methods:** 22 athletes were selected for the experiment. Out of this total 16 recreational and 6 elite. The test was performed on a cycle ergometer. The tests were performed in 2 days, with a 72-hour interval between one and the other. All tests were performed at the same time of the day. The load of the test was adjusted by the weight of the athlete to work with the same load relative to the weight (watt / kg). The load was kept fixed throughout the test and the test ended after exhaustion and voluntary request of the athlete. During the evaluation, the heart rate was continuously measured and the subjective perception of effort (Borg scale) was measured minute by minute. On the first day the athletes received 30 minutes before the test a supplement. This supplement was placebo. There was no ergogenic feature in the capsule, but they received the information that it was a new, very powerful supplement.

In the second encounter, the athlete did the test without any capsule. He was informed that the goal was to compare how much the supplement, offered in the first encounter, would lead to a better performance.

**Summary of Results:** Overall, in the supplement test (which was placebo) there was an average increase of 9.66% in performance, measured by a longer time to exhaustion. This result was obtained with all 22 athletes. In the case of elite athletes, the result was lower, showing an increase of 4.39%, on average. In the case of amateur athletes, the increase was 22.87%.

The fact that the increased impact of the placebo effect was greater in amateur athletes seems quite reasonable and may be explained by their greater susceptibility to placebo. In the case of elite athletes, the impact of the placebo effect was smaller, but can be considered as important from a practical point of view, since a performance increase of 4.39% a professional athlete, seems to be something fantastic.

**Conclusion:** The present study showed that the placebo effect is important to be considered even in the case of elite athletes. The way the study was designed allowed a more reliable measurement of the real dimension of the placebo effect.

**362 Board #200 May 29 9:30 AM - 11:00 AM**  
**Effects of Nutritional Supplementation on Body Composition and Bio-markers during Army Initial Entry Training**

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**Purpose:** Previous research has reported that military training can result in reductions in fat free mass (FFM) and serum testosterone while increasing cortisol and interleukin-6 (IL-6). This can be due to inadequate nutrition combined with rigorous training. The purpose of this study was to investigate whether once daily whey protein (WP) or carbohydrate (CHO) supplementation positively impacts the physiologic response to Initial Entry Training (IET).

**Methods:** Eighty-one male soldiers (WP: n = 39, Ht. = 173 ± 8 cm, Wt. = 76.8 ± 12.8 kg, Age = 21 ± 3yrs; CHO: n = 42, Ht. = 175 ± 8 cm, Wt. = 77.8 ± 15.3 kg, Age = 23 ± 4yrs) participating in Army IET were supplemented with one 38.6 g protein (from WP hydrolysate; WP, n = 45) or one energy, fat and taste matched CHO (n = 51) serving per day, for seven weeks. Physical performance, body composition and serum markers were collected during weeks one and eight of training. Testosterone, cortisol and IL-6 were measured using enzyme-linked immunosorbent assays. All measures were collected in the morning after an overnight fast, in a hydrated state, and prior to physical activity. Repeated measures ANOVA with one within subjects' factor (time) and one between subjects factor (group) were used to evaluate biomarker response to training. Regression analysis was used to determine if change in biomarkers were related to changes in FFM.

**Results:** There was a significant increase in testosterone (F = 14.06, p < 0.01) and the testosterone to cortisol ratio (F = 10.08, p < 0.01) and a significant decrease in IL-6 across military training (F = 7.63, p = 0.01). There was no significant change in cortisol (F = 3.64, p = 0.06). There were no group by time interactions for testosterone, cortisol or testosterone to cortisol ratio or IL-6. Change in Testosterone to cortisol ratio was a significant predictor of change in FFM (P = 0.04). FFM increased 1.2 kg (95% CI: 0.4, 2.0 kg) in the WP group; whereas FFM increased only 0.1 kg (95% CI: -0.9, 1) in the CHO group during IET.

**Conclusion:** We found no differential effects of once daily supplementation with WP or CHO on testosterone, cortisol or IL-6. However, our results in light of previous research in military training, suggests that supplementation in general may benefit the physiologic response to training. Additionally, there may be a clinical benefit of WP on FFM during Army IET.

**363 Board #201 May 29 9:30 AM - 11:00 AM**  
**Adverse Reactions and Perceived Benefits of Dietary Supplements used by SEAL Qualification Training Students**

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Sea, Air, and Land (SEAL) Qualification Training (SQT) students must successfully complete several months of advanced tactical training in order to become a NAVY SEAL Operator. During SQT training students are discouraged from consuming any dietary supplements (DSs). **PURPOSE:** Evaluate the DS habits of SQT Students. **METHODS:** 282 male Students (Age 24 ± 2.7 y) completed a detailed DS questionnaire. **RESULTS:** Ninety percent of SQT students reported consuming at least one DS on a consistent basis during the previous 12 months. Of these, 59% consumed

whey protein supplements (WP), 47% multivitamin and mineral supplements (MVM) and 31% energy drinks (EDs) (Table 1). Table 1: Common dietary supplements, purpose for use, perceived benefits and adverse reactions among SQT students (top 3 responses reported as % Students)

Supplement Category	Purpose of Use*	Adverse Reactions	Perceived Benefits*	Impact*
Whey	Increase muscle mass, strength, recovery 88% Supplement diet Improve health 23% Improve performance 23%	None 98% Bloating, gas, lactose intolerance 2%	No benefit 40% Improved recovery 41% Increase muscle mass/strength 34%	Beneficial 85% Neither harmful or beneficial 15%
Multivitamin & Mineral Supplement	Supplement diet/ Improve Health 97% Improve performance 15% Increase muscle mass, strength, recovery 6%	None 99% Upset stomach 1%	No benefit 74% Stayed healthy/ Improved immunity 14% Better energy/ feel better 8%	Beneficial 63% Neither harmful or beneficial 36% N/A 1%
Energy Drinks	Improve cognitive function 50% Improve performance 35% Tastes Good 8%	None 85% Jittery/ Shaky 7% Increased heart rate 3%	Awake/Alert 48% More energy 31% No benefit 23%	Beneficial 62% Neither Harmful/ Beneficial 19% Harmful 17%

\*Subjects were allowed to select more than 1 response. **CONCLUSION:** SQT students reported taking WP was beneficial (75%) in increasing muscle mass/strength and improving recovery. MVM supplements had the lowest reported adverse reactions and was beneficial in maintaining/improving health. EDs had the highest response for adverse reactions including jitters, shakiness and increased heart rate, with 17% of Students indicating taking EDs was harmful. Whey protein and MVM are safe and effective DSs that aid in muscle hypertrophy/strength (WP) and supplementing the diet (MVM). **Supported by ONR N00014-11-1-0929.**

**364 Board #202 May 29 9:30 AM - 11:00 AM**  
**Dark Chocolate Supplementation Elevates Resting Energy Expenditure In Exercise Trained Females**

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 (No relevant relationships reported)

**PURPOSE:** To investigate the influence of dark chocolate supplementation on resting and exercise metabolism.

**METHODS:** Using a randomized, double-blind design 18 exercise trained female subjects were assigned to a 30 day supplementation with either 20-g per day of 70% dark chocolate (DC) (n=9) or a calorically matched white chocolate (WC) (n=9). Prior to supplementation (PRE), subjects underwent indirect calorimetry assessment for resting energy expenditure (REE) followed by an assessment of exercise energy expenditure consisting of cycling for 20 min, 10 min at 50 watts (EEE-50) and 10 min at 100 watts (EEE-100). Upon completion of the 30 day supplementation, subjects repeated the assessment for REE, EEE-50, and EEE-100. All data are presented as mean (SE).

**RESULTS:** Pre supplementation REE (DC 1454 (51), WC 1565 (48) kcal per day), EEE-50 (DC 4.86 (0.11), WC 4.61 (0.18) kcal/min), and EEE-100 (DC 7.07 (0.15), WC 6.77 (0.18) kcal/min) were not significantly different between groups (p > 0.05). Post supplementation REE was significantly increased by 9.4% in the DC group (DC 138 (39), WC -29 (18) kcal per day, p=0.001). Neither EEE-50 (DC 4.49 (0.19), WC 4.48 (0.11) kcal/min), nor EEE-100 (DC 6.50 (0.20), WC 6.65 (0.14) kcal/min) were significantly different between groups (p > 0.05).

**CONCLUSIONS:** These results indicate that in athletic female subjects, DC supplementation significantly increases REE by 9.4%, but doesn't significantly influence exercise energy expenditure.

\* Product was provided by The Hershey Company, Hershey, Pennsylvania.

365 Board #203 May 29 9:30 AM - 11:00 AM

**Amelioration Of Capillary Regression Of Skeletal Muscle Under Disuse Condition By Enterococcus Faecium Strain R30 Supplementation**

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(No relevant relationships reported)

**PURPOSE:** Disuse condition results in impaired capillary network of skeletal muscle. Capillary regression appears to be an adaptation to a reduction in blood flow to the skeletal muscles caused by a decrease in oxidative demand. Increased blood flow leads angiogenesis via increases in angiogenic factors in skeletal muscles. A probiotic strain of lactobacillus affects autonomic nerve activity has been reported. The purpose of the present study was to investigate the amelioration of enterococcus faecium strain R30 (R30) supplementation on the capillary regression and fatigue of skeletal muscle under disuse condition. **METHODS:** Thirty-six male Sprague-Dawley rats were assigned randomly either to a control, control with R30 supplementation, hindlimb unloaded or hindlimb unloaded with R30 supplementation group for 14 days. The three-dimensional capillary network of soleus muscle was visualized using a confocal laser scanning technique, and the capillary volume and diameter were measured. The angiogenic factors, VEGF and eNOS, were also determined. Furthermore, the tensions during muscle isometric contraction in plantar muscles was generated by successive electrical stimulations were measure in vivo. **RESULTS:** The capillary volume and diameter in disuse muscle were lower than those in control. R30 supplementation attenuated the decrease of capillary volume and diameter in disuse muscle. In addition, the decreased expression levels of VEGF and eNOS in R30 supplemented muscle were attenuated. In addition, the resistance to fatigue (isometric tension expressed relative to the initial value) was significantly higher in the R30 supplementation group than the hindlimb unloaded group **CONCLUSION:** These data suggest that R30 supplementation may be an effective treatment to counter the detrimental effects of a chronic decrease in muscle activities on the microcirculation and endurance in skeletal muscle.

366 Board #204 May 29 9:30 AM - 11:00 AM

**Circulating Levels of Select Micro-RNA Are Not Impacted by Manipulating Nutrient Intake Following High-Intensity Cycling**

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(Sponsor: Michael Saunders, FACSM)

(No relevant relationships reported)

Circulating microRNAs (ci-miRNA) may facilitate intercellular communication as well as fine-tune phenotype adaptations to exercise through post-transcriptional regulation. Ci-miRNA levels are sensitive to acute aerobic exercise, yet much less is known about the influence of high-intensity interval type exercise. Further, almost nothing is known about the impact of post-exercise nutrition (carbohydrate and/or protein) on ci-miRNA levels. **Purpose:** To examine the effects of high-intensity interval cycling and different post-exercise nutrition treatments on select ci-miRNA levels. **Methods:** Eight recreationally active males (age 22 ± 2 yrs; VO<sub>2max</sub> 50 ± 4 mL/kg/min) completed 3 trials, each consisting of 4 sets of 3-min intervals (90% W<sub>max</sub>) flanked by 30-sec Wingate intervals. Placebo (PLA; water), carbohydrate (CHO; 65 g), and carbohydrate (65 g) + protein (20 g) (PRO) beverages (600 mL) were consumed immediately following exercise. Serum levels of 9 miRNA (miR-1, -21, -126, -146a, -150, -210, -221, -222, and -486) were measured pre-exercise (Pre), immediately post (Post-0), Post-1hr, and Post-4hr. miRNA levels were expressed as fold changes relative to baseline and analyzed with repeated measures ANOVAs. **Results:** With the exception of a 1.3-fold increase (p<0.05) in ci-miRNA-486 there was no main effect of time for any of the target ci-miRNA from Pre to Post-0 (i.e. prior to any nutritional intervention). There was a main effect of time for Ci-miRNA-150 from Pre to Post-1hr (0.6 fold-change, p<0.05) and from Pre to Post-4hr (0.7 fold-change, p<0.05), but there were no detectable nutritional effects. Further, ci-miRNA-1 increased from Pre to Post-4hr (3.1-fold-change, p<0.05) but again with no nutrition effect. No other differences, across time or between treatments, were detected. **Conclusion:** In general, high-intensity cycling had a subtle impact on serum levels of miRNA. However, miRNA associated with skeletal muscle (miRNA-1 and -486) and cardiac physiology (miRNA-1 and -150) were affected by exercise. Post-exercise nutrition had no consequences on any of the targets of interest. However, the extent to which ci-miRNA reflects intracellular miRNA activity is poorly understood and future work should investigate how nutrition may influence intracellular mi-RNA levels.

A-51 Free Communication/Poster - Immunology I

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
Room: CC-Hall WA2

367 Board #205 May 29 9:30 AM - 11:00 AM

**Can a Dynamic Warm-up Reduce the Magnitude of Immune Perturbation Following Vigorous Aerobic Exercise?**

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(No relevant relationships reported)

Exercise transiently increases several leukocyte populations in peripheral blood in an intensity-dependent manner, with numbers returning to baseline or lower during recovery. This mobilization of immune cells is explained in part by sympathetic activity and the release of stress hormones (catecholamines and cortisol). The literature examining immune responses to exercise has by and large failed to control for the presence of a warm-up prior to the experimental bout. Gradually increasing exercise intensity over a period of minutes may reduce the stress of the exercise bout and thus may influence the immune response to a given exercise protocol.

**PURPOSE:** To compare the mobilization of leukocyte subpopulations following a bout of high intensity aerobic exercise with and without a dynamic pre-exercise warm-up.

**METHODS:** 8 physically active adults (4 women, 27±4 years) cycled 30 minutes at 80% heart rate maximum with and without warm-up in a randomized, counter-balanced order. Warm-up was provided immediately prior to the exercise, and involved increasing wattage by 10% each minute for 10 minutes starting at 10% of desired exercise intensity. Blood collected pre-, post- and 1-hour post-exercise was analyzed by flow cytometry to characterize cell populations. Differences in cell concentrations across time points and conditions were assessed by maximum likelihood linear mixed models.

**RESULTS:** Exercise transiently increased lymphocyte concentration in blood, and the number and proportion of late differentiated CD8 T cells (main effects of time; p<0.001). Inclusion of warm-up diminished these post-exercise increases in lymphocytes (pre- to post- change with warm-up: 45±19 cells/microliter, representing a 17% increase; change with no warm-up: 93± 11 cells/microliter, a 42% increase; p<0.05) and in late differentiated CD8 T cells (pre- to post- change with warm-up: 1±5 cells/microliter representing a 2% increase; change with no warm-up: 10±4 cells/microliter, a 46% increase; p<0.05).

**CONCLUSIONS:** Inclusion of a dynamic warm-up prior to vigorous aerobic exercise lessens the exercise-induced mobilization of lymphocytes and late differentiated T cells. Athletes should include a dynamic warm-up to reduce immune perturbations during high intensity exercise.

368 Board #206 May 29 9:30 AM - 11:00 AM  
**Mobilization and Fc -Receptor Expression of Six NK Cell Subsets During and After Acute Exercise**

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Natural killer (NK) cells are the most responsive lymphocytes during acute exercise, with increased concentrations. After exercise, NK cell levels drop below their resting level if the exercise intensity was high, but values usually recover within 1-3 hours. NK cells may be divided into CD56<sup>dim</sup> and CD56<sup>bright</sup> subsets. The CD56<sup>dim</sup> subset is the major population, representing about 80% of NK cells. Smaller subpopulations were recently studied for cell developments and diseases. We previously reported that exercise decreased the expression of Fcγ-receptor III (CD16); however, it is not yet understood how exercise affects these small subsets.

**PURPOSE:** To clarify the effect of acute exercise on the mobilization and expression of CD16 on the six different NK cell subsets.

**METHODS:** Healthy male students (n=6, 22.8±0.8 years old) exercised on a cycle ergometer for 30 min at intensities corresponding to the individual's onset of blood lactate accumulation (70-85% maximum oxygen consumption). Venous blood samples were collected at rest (PRE), just before the end of exercise (END), 30 (POST 30), 60 (POST 60), 120 (POST 120), and 180 (POST 180) min after exercise. Cell counts and proportions of total lymphocytes expressing CD16<sup>CD56<sup>bright</sup></sup> (R1), CD16<sup>CD56<sup>bright</sup></sup> (R2), CD16<sup>CD56<sup>dim</sup></sup> (R3), CD16<sup>CD56<sup>dim</sup></sup> (R4), CD16<sup>bright</sup>CD56<sup>dim</sup> (R5) and CD16<sup>bright</sup>CD56<sup>dim</sup> (R6) subsets were determined. CD16 expressions of these subsets were also examined by flow cytometry. ANOVA was used for statistical analyses.

**RESULTS:** Exercise induced changes in NK cell concentration in CD56<sup>dim</sup> (R3,  $p=0.04$ ; R4,  $p<0.01$ ; R5,  $p<0.01$ ) and CD56<sup>bright</sup> (R6,  $p<0.01$ ) subsets. However significant changes between time points were only found in R5. In this subset, NK cell counts increased from PRE ( $356\pm 151$  cells/ $\mu$ L) to END ( $1182\pm 159$  cells/ $\mu$ L,  $p<0.01$ ) and decreased under the PRE-level at POST 30 ( $108\pm 27$  cells/ $\mu$ L,  $p<0.01$ ) and POST 60 ( $106\pm 70$  cells/ $\mu$ L,  $p<0.01$ ). There were no changes in CD56<sup>bright</sup> (R1, R2) subsets. These cell mobilizations were reflected in proportions to the total lymphocyte count. Expressions of CD16 were down-regulated at END in R5 ( $-502\pm 135$ ,  $p<0.01$ ) and R6 ( $-416\pm 99$ ,  $p<0.01$ ) then recovered at POST 30.

**CONCLUSIONS:** These results suggest that the influence of acute exercise on NK cell mobilization and CD16 expression are clear in subset R5, but not in R1 and R2.

**369 Board #207 May 29 9:30 AM - 11:00 AM**  
**Tumor Necrosis Factor-alpha, TNFR, And STNFR Relationships to Body Temperature**

Elliott Arroyo<sup>1</sup>, Brittany N. Followay<sup>2</sup>, Jeremiah A. Vaughan<sup>3</sup>, Joseph A. Laudato<sup>1</sup>, Brandon M. Gibson<sup>1</sup>, Ellen L. Glickman, FACSM<sup>1</sup>, Adam R. Jajtner<sup>1</sup>, <sup>1</sup>Kent State University, Kent, OH, <sup>2</sup>Ripon College, Ripon, WI, <sup>3</sup>Bemidji State University, Bemidji, MN. (Sponsor: Ellen L. Glickman, FACSM)  
 (No relevant relationships reported)

**PURPOSE:** To examine the TNF- $\alpha$ , TNFR, and STNFR relationships to body temperature in response to the heat. **METHODS:** 12 recreationally active men ( $24.4 \pm 3.1$  yrs;  $181.0 \pm 6.8$  cm;  $81.5 \pm 8.0$  kg;  $47.2 \pm 4.8$  ml $\cdot$ kg<sup>-1</sup> $\cdot$ min<sup>-1</sup>) completed an exercise protocol under four conditions: 23°C/45%RH; 23°C/70%RH; 35°C/20%; and 35°C/45% RH. The protocol consisted of a 60-minute cycling trial at 60% VO<sub>2</sub>max, a 15-minute rest, and a time-to-exhaustion trial at 90% VO<sub>2</sub>max (TTE). Blood was collected before (T1) and after (T2) the 60-minute trial, and immediately after TTE (T3). Plasma concentrations of TNF- $\alpha$ , STNFR1, and STNFR2 were measured via ELISA. Surface expression of TNFR1 and TNFR2 on human classical (CD14<sup>+</sup>CD16<sup>-</sup>) monocytes was measured via flow cytometry (n=8). Participant's rectal (T<sub>re</sub>) and skin temperatures at 5 locations: Chest, Triceps, Forearm, Thigh and Calf were monitored continuously. Total skin temperature (T<sub>sk</sub>) and whole body temperature (T<sub>wb</sub>) were calculated using weighted averages. The Area Under the Curve with respect to increase (AUC<sub>i</sub>) was then calculated for T<sub>re</sub>, T<sub>sk</sub> and T<sub>wb</sub>. Data were analyzed as Pearson Product Moment Correlations between AUC<sub>i</sub> for T<sub>re</sub>, T<sub>sk</sub> and T<sub>wb</sub> with TNF- $\alpha$ , TNFR, and STNFR. The time spent above specific critical temperatures for T<sub>re</sub> (37.5, 38.0, 38.5 and 39.0°C) and T<sub>wb</sub> (35.0, 36.0, 37.0 and 38.0°C) were related to TNF- $\alpha$ , TNFR, and STNFR using stepwise linear regression. **RESULTS:** T<sub>re</sub> was correlated with the change in STNFR1 from T1 to T3 ( $r=0.307$ ;  $p=0.048$ ) and with the change in STNFR2 from T1 to T3 ( $r=0.340$ ;  $p=0.028$ ). T<sub>sk</sub> was correlated with both the change in STNFR1 from T1 to T2 ( $r=0.321$ ;  $p=0.038$ ) and from T1 to T3 ( $r=0.320$ ;  $p=0.039$ ); with the change in STNFR2 from T1 to T3 ( $r=0.430$ ;  $p=0.004$ ); and with the change in TNF- $\alpha$  from T1 to T2 ( $r=0.357$ ;  $p=0.020$ ). Time spent with a T<sub>re</sub> above 38.5°C was related to the change in STNFR1 from both T1 to T2 ( $r=0.837$ ;  $p<0.001$ ) and from T1 to T3 ( $r=0.773$ ;  $p<0.001$ ); and to the change in TNF- $\alpha$  from T1 to T2 ( $r=0.426$ ;  $p=0.005$ ) and from T1 to T3 ( $r=0.415$ ;  $p=0.006$ ). **CONCLUSION:** Changes in circulating levels of TNF- $\alpha$ , STNFR1, and STNFR2 are influenced by rectal and whole body temperature. Classical monocyte expression of TNFR1 and TNFR2 do not appear to be influenced by rectal or whole body temperature.

This investigation was partially funded by Kent State University Research Council.

**370 Board #208 May 29 9:30 AM - 11:00 AM**  
**Monocyte Adhesion Molecule Expression Following an Acute Bout of Moderate Intensity Cycling**

Natalie J. Bohmke, Lindsay M. LaFratta, Lauren N. Pedersen, Anson M. Blanks, Virginia L. Mihalick, Morgan B. Senter, R. Lee Franco. Virginia Commonwealth University, Richmond, VA.  
 (No relevant relationships reported)

Monocyte adhesion to the endothelium is a key step in the development of atherosclerosis. It is well established that higher CV fitness is associated with a reduced risk for CV disease. **PURPOSE:** To investigate the impact of fitness on monocyte surface receptor expression of CD11c and VLA4 following an acute bout of exercise. **METHODS:** 9 fit (VO<sub>2</sub> peak; males:  $\geq 45$  mL $\cdot$ O<sub>2</sub>/kg/min, females:  $\geq 35$  mL $\cdot$ O<sub>2</sub>/kg/min) and 13 unfit (VO<sub>2</sub> peak; males:  $< 40$  mL $\cdot$ O<sub>2</sub>/kg/min, females:  $< 30$  mL $\cdot$ O<sub>2</sub>/kg/min) subjects performed 30 min of moderate intensity (60% VO<sub>2</sub> peak) cycling. Blood samples were obtained pre-exercise, immediately, and 1 h post-exercise. Monocytes were stained with antibodies against CD14, CD16, VLA4, and CD11c and were analyzed via flow cytometry. A mixed between-within repeated measures ANOVA was used to determine the impact of fitness on VLA4 and CD11c following a submaximal bout of exercise. **RESULTS:** There were no significant between-subjects main effect for groups in either of the monocyte subsets ( $p>0.083$ ). A main effect for time was significant in VLA4 ( $p=0.004$ ) and CD11c ( $p=0.014$ ) expression in non-classical and classical monocytes, respectively. A profile plot suggested that VLA4 was increased 1 h post-exercise and CD11c was reduced immediately post-exercise. **CONCLUSIONS:**

Monocyte receptor expression does not appear to be impacted by physical fitness in young, apparently healthy adults. Nevertheless, an acute bout of cycling altered the expression level of monocyte adhesion molecules to varying degrees depending on the specific monocyte subset.

**371 Board #209 May 29 9:30 AM - 11:00 AM**  
**Aerobic Capacity And LPS-induced iNOS mRNA Expression In Leukocytes Of Healthy College-aged Males**

Tiffany M. Zuniga<sup>1</sup>, Aaron L. Slusher<sup>2</sup>, Ryan S. Garten<sup>3</sup>, Edmund O. Acevedo, FACSM<sup>3</sup>. <sup>1</sup>The University of Arizona, Tucson, AZ. <sup>2</sup>University of Michigan, Ann Arbor, MI. <sup>3</sup>Virginia Commonwealth University, Richmond, VA. (Sponsor: Dr. Edmund O. Acevedo, FACSM)  
 (No relevant relationships reported)

**PURPOSE:** Inducible nitric oxide synthase (iNOS) is an enzyme expressed in leukocytes that supports innate immune function. While iNOS expression is low-to-undetectable in leukocytes under normal resting conditions, LPS-stimulated overexpression of iNOS increases indices of pro-inflammation, oxidative stress, and apoptosis. Aerobic exercise is a known anti-inflammatory mechanism shown to regulate iNOS expression. Therefore, this study examined the relationship between LPS-induced iNOS mRNA expression and indices of pro-inflammation, oxidative stress, and apoptosis in isolated leukocytes of aerobically fit (AF) and unfit (UF) males. **METHODS:** iNOS mRNA expression and TNF- $\alpha$ , MDA, and p53 concentrations were quantified from 3-hour LPS stimulated and unstimulated whole blood. **RESULTS:** iNOS mRNA expression remained unaltered following LPS stimulation in AF and UF subjects ( $p=0.146$ ). However, LPS stimulation significantly lowered MDA concentrations to a greater extent in UF compared to AF subjects ( $p=0.001$ ), whereas LPS stimulation increased TNF- $\alpha$  and lowered p53 to a similar extent in both groups ( $p=0.002$ ,  $p=0.022$ , respectively). Interestingly, change in relative iNOS mRNA expression was not associated with the percent change (control vs. LPS stimulation) in the concentrations of MDA, TNF- $\alpha$ , and p53. **CONCLUSIONS:** Findings suggest that although aerobic fitness did not alter iNOS mRNA expression following LPS stimulation and may not directly impact indices of pro-inflammation or the pro-apoptotic marker p53 in healthy, young males, fitness may impact LPS-induced oxidative stress.

**372 Board #210 May 29 9:30 AM - 11:00 AM**  
**Monocyte Chemoattractant Protein-1 and C-C Chemokine Receptor Type 2 Expression related to Body Temperature Changes**

Joseph A. Laudato. Kent State University, Kent, OH. (Sponsor: Dr. Ellen Glickman, FACSM)  
 (No relevant relationships reported)

**Purpose:** To examine the relationship between Monocyte Chemoattractant Protein-1 (MCP-1) and its receptor C-C Chemokine Receptor Type 2 (CCR2) and the time spent above critical body temperatures while cycling. **Methods:** 12 recreationally active men ( $24.4 \pm 3.1$  yrs;  $1.81 \pm 0.07$  m;  $81.5 \pm 8.0$  kg;  $47.2 \pm 4.8$  ml/kg/min) completed five experimental visits: a VO<sub>2</sub> max test and cycling trials in 23°C/45%RH, 23°C/70%RH, 34°C/20%RH and 34°C/45%RH. Within each trial, participants completed a 60-minute bout of cycling at 60% VO<sub>2</sub>max, 15min rest, and a time to exhaustion (TTE) at 90% VO<sub>2</sub>max. Blood samples were taken prior to cycling (PRE), immediately after (60), and after TTE. Rectal temperature (T<sub>re</sub>) and skin temperatures (chest, triceps, forearm, thigh and calf) were monitored continuously during trials. Total skin (T<sub>sk</sub>) and whole body (T<sub>wb</sub>) temperatures were calculated using weighted averages. The Area Under the Curve with respect to increase from baseline (AUC<sub>i</sub>) was then calculated for T<sub>re</sub>, T<sub>sk</sub> and T<sub>wb</sub> at 60 and TTE. Data were analyzed as Pearson Product Moment Correlations between AUC<sub>i</sub> for T<sub>re</sub>, T<sub>sk</sub> and T<sub>wb</sub> with changes in MCP-1 and CCR2 from PRE to 60 (P<sub>60</sub>) and PRE to TTE (P<sub>TTE</sub>). Additionally, the time spent above critical temperatures for T<sub>re</sub> (37.5, 38.0, 38.5, 39.0°C) and T<sub>wb</sub> (34.5, 35.5, 36.5, 37.5°C) were related to MCP-1 and CCR2. **Results:** No significant correlations were observed between MCP-1<sub>P60</sub> or MCP-1<sub>P-TTE</sub> and AUC<sub>i</sub> of T<sub>re</sub> and T<sub>wb</sub> ( $p \geq 0.260$ ). There were no significant correlations observed between CCR2<sub>P60</sub> or CCR2<sub>P-TTE</sub> and AUC<sub>i</sub> of T<sub>re</sub> and T<sub>wb</sub> ( $p \geq 0.156$ ). MCP-1<sub>P60</sub> was significantly correlated to time spent with a T<sub>wb</sub> above 35.5°C ( $r=0.292$ ;  $p=0.047$ ), however no correlations were observed between MCP-1<sub>P60</sub> or MCP-1<sub>P-TTE</sub> and any other critical T<sub>re</sub> and T<sub>wb</sub> ( $p \geq 0.112$ ). CCR2<sub>P60</sub> and CCR2<sub>P-TTE</sub> were not significantly correlated to time spent above critical T<sub>re</sub> and T<sub>wb</sub>. Of note was a non-significant negative correlation ( $r=-0.312$ ) observed between CCR2<sub>P-TTE</sub> and T<sub>re</sub> above 37.5°C ( $p=0.053$ ). **Conclusion:** These data suggest that the duration of time spent at T<sub>wb</sub> above 35.5°C influences MCP-1<sub>P60</sub> concentrations, while not being affected by time spent above other critical T<sub>re</sub> and T<sub>wb</sub>. CCR2 expression was not influenced by time spent above critical T<sub>re</sub> and T<sub>wb</sub>.

373 Board #211 May 29 9:30 AM - 11:00 AM

**Changes In Salivary Antimicrobial Protein Concentrations In Response To Maximal Exercise In Collegiate Swimmers**

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(No relevant relationships reported)

Salivary Antimicrobial Proteins (sAMPs) play a central role in innate immune responses by exerting their antibacterial and antiviral properties. Acute psychological and physiological stressors reduce sAMPs concentrations, and increase the risk of upper respiratory tract infections (URTI). However, the impact of sustained stressors on sAMPs and their relation to URTI symptoms is unknown. **Purpose:** To characterize the impact of acute bouts of exercise on sAMPs and symptoms of URTI in collegiate swimmers over a 6-month period. **Methods:** Salivary samples were collected from sixteen NCAA D1 swimmers (8 M, 8 F: 19.8 ± 0.7 yrs) before and after exhaustive in-pool swims at 2 timepoints (V<sub>1</sub>: immediately post-season 1 and V<sub>2</sub>: early season 2). An additional V<sub>3</sub> mid-off season 1 timepoint was collected in a subset of 10 swimmers. Azurocidin and secretory leukocyte protease inhibitor (SLPI) sAMPs were measured by ELISA, and self-reported measures of stress were collected to assess sleep quality (PSQI) and symptoms of URTI (WURRS-21). Linear mixed models were used to determine the effects of exercise, season timepoint, and their interaction on sAMP concentrations and secretion rates ( $\alpha=0.05$ ). Pearson's correlation coefficients were used to determine linear correlations between resting sAMP concentrations and secretion rates with stress measures. **Results:** Post-exercise SLPI levels were elevated 8 fold at V<sub>2</sub> and 3 fold at V<sub>3</sub> when compared to resting values ( $p<0.05$ ); however, resting SLPI concentrations and secretion rates remained unchanged during the season ( $p>0.05$ ). Acute exercise was associated with increased Azurocidin concentrations, with the greatest post-exercise increase seen at V<sub>2</sub> ( $p=0.03$ ). Resting salivary Azurocidin concentrations and secretion rates were positively associated with sleep quality ( $r=0.42$ ,  $p=0.04$  and  $r=0.49$ ,  $p=0.02$  respectively), while salivary SLPI concentrations were not. Furthermore, resting Azurocidin concentrations were associated with self-reported symptoms of URTI ( $r=0.52$ ,  $p=0.03$ ) during all 3 visits. **Conclusion:** Oral innate immunity in collegiate swimmers is differently impacted by acute maximal exercise over a season. Greater sleep quality appears to promote salivary Azurocidin concentration and oral innate immune health, which could in turn protect athletes against URTIs.

374 Board #212 May 29 9:30 AM - 11:00 AM

**Acute And Chronic Anti-inflammatory Responses During A Season Training in Young Swimmers**

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(No relevant relationships reported)

It is well established that prolonged intense exercise training suppresses aspects of immune function and a perturbation in balance between pro- and anti-inflammatory cytokines may induce chronic, low-level systemic inflammation. Although swimming exercise training is demanding, however it is not clear whether it can promote changes in inflammatory responses. **Purpose:** This study investigated the acute and chronic effects of a full season swimming training on serum interleukin (IL)-4 and IL-1 receptor antagonist (IL-1ra), both at rest and after a maximal exercise bout. **Methods:** Twelve well-trained male swimmers (14.08±1.0 yrs) were recruited. Measurements were carried out at the beginning of the training season (T1) and pre- and post the taper of each of the two competitive periods (i.e., T2, T3 for the first macrocycle, and T4, T5 for the second macrocycle, respectively). At each of the above time points, blood samples were collected pre- and 1 hour post a maximal, 400m swimming testing. Serum IL-1ra and IL-4 levels were measured by ELISA. Adjustment for exercise-induced plasma volume changes was performed before all data analyses. Two-way ANOVA with repeated measures was used for statistics. **Results:** Significant pre-post testing differences for IL-1ra ( $p=0.000$ ), but not for IL-4 ( $p>0.05$ ), were found throughout the experimental period. Pre-post testing difference was greater at T5 for IL-1ra and at T1 for IL-4 (165.95±36.16 pg/ml and 0.06±0.04 pg/ml, respectively). Both IL-1ra and IL-4 had similar, no significant ( $p>0.05$ ) pre-testing responses, exhibiting an increase from T1 to T2 (IL-1ra:

200.04±14.73 vs 250.76±73.56 pg/ml and IL-4: 0.08±0.02 vs. 0.11±0.03 pg/ml) and from T3 to T5 (IL-1ra: 171.15±11.85 vs 187.66±19.89 pg/ml, IL-4: 0.08±0.03 vs 0.9±0.3 pg/ml) and a decrease from T2 to T3 (IL-1ra: 250.76±73.56 vs 171.15±11.85 pg/ml, IL-4: 0.11±0.03 vs 0.08±0.03 pg/ml). Post-testing, IL-4 response exhibited a 59% decline from T1 to T4 (0.14±0.05 vs 0.08±0.03 pg/ml.) and a 157% increase from T4 to T5 (0.08±0.03 vs 0.13±0.03 pg/ml), however those responses failed to reach statistical significance throughout the experimental period ( $p>0.05$ ). **CONCLUSION:** These findings indicate that long-term swimming training can affect the resting and acute (pre-post testing) anti-inflammatory profile in young swimmers.

375 Board #213 May 29 9:30 AM - 11:00 AM

**Fitness-related Differences In The Polarization Of Lipid-exposed Macrophages Following Acute Exercise**

Lauren Pedersen, Lindsay Lafratta, Natalie Bohmke, Anton Blanks, Virginia Mihalick, Morgan Senter, Robert Lee Franco. Virginia Commonwealth University, Richmond, VA.  
(No relevant relationships reported)

Compared to anti-inflammatory M2 (CD206<sup>+</sup>) macrophages, pro-inflammatory M1 (CD86<sup>+</sup>) macrophages are considered to be highly atherogenic. Increased cardiovascular fitness is linked to attenuated atherosclerotic plaque formation as well as anti-inflammatory alterations in the immune cells that mediate this process. Therefore, macrophage polarization in unfit individuals may differ from that of fit individuals following exposure to physical stress and elevated lipids. **Purpose:** To determine fitness-related differences in the polarization of lipid-exposed macrophages following acute, moderate-intensity exercise. **Methods:** 8 fit (VO<sub>2</sub> peak; M: ≥ 45 mL O<sub>2</sub>/kg/min, F: ≥ 35 mL O<sub>2</sub>/kg/min) and 12 unfit (VO<sub>2</sub> peak; M: < 40 mL O<sub>2</sub>/kg/min, F: < 30 mL O<sub>2</sub>/kg/min) male and female subjects performed 30 minutes of moderate-intensity (60% VO<sub>2</sub> peak) cycling. Blood samples were collected pre-exercise (PRE) and immediately- (POST), 1 hour- (1HR), and 2-hours (2HR) post-exercise. Peripheral blood mononuclear cells (PBMCs) were isolated by density gradient centrifugation, and adherent monocytes were cultured with LDL (150 mg/dL) and palmitate (10ug/mL) for 4 hours. Cells were washed and cultured with 20% autologous serum for 7 days. The resulting macrophages were subsequently stained with antibodies against CD86 and CD206 for flow cytometric analysis. A mixed between-within ANOVA was performed to determine differences in receptor expression between groups (fitness) and within subjects (time). **Results:** A mixed between-within ANOVA found no significant between-subjects main effects for CD86 ( $p=0.667$ ) and CD206 ( $p=0.675$ ) macrophage expression. A main effect of time was significant for the expression of CD206 ( $p=0.033$ ). A profile plot suggests that CD206 expression was different between fitness groups PRE, POST, and 1HR. **Conclusion:** Macrophage expression of CD206 was observed to be different between fit and unfit individuals immediately before and following an acute bout of moderate-intensity exercise and lipid exposure. Alterations in "M2" macrophage polarization may contribute to cardiovascular risk in unfit individuals.

**A-52 Free Communication/Poster - Exercise and Children**

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
Room: CC-Hall WA2

376 Board #214 May 29 9:30 AM - 11:00 AM

**Associations Among Obesity, Physical Activity, Nutrition, And Family Environment In Adolescents**

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(No relevant relationships reported)

Previous research has shown that the Family Nutrition and Physical Activity (FNPA) Screening Tool is related to obesity risk in children. However, there is limited research on the utility of the FNPA among adolescent populations and its association with health behaviors. **Purpose:** To examine the association of the FNPA Screening Tool with physical activity, dietary quality, screen time behaviors, and obesity risk in ninth grade students. **Methods:** Data were collected from ninth grade students ( $n=175$ , 51% boys, 72% Caucasian) from a Midwestern high school. Physical activity, dietary quality, and screen time behavior were measured using the Physical Activity Questionnaire (PAQ-A; 8 items, scored 1-5), Healthy Eating Index-2010 (HEI-2010; scored 0-100), and self-reported total screen time (television, video game, and computer usage), respectively. Trained research assistants measured height and weight to calculate body mass index (BMI). Percent body fat (BF) was measured using a foot-to-foot bioelectrical impedance scale. The FNPA Screening Tool was mailed

home to parents of the students to be completed. Upon completion, parents returned the FNPA to researchers, and it was scored (range 20-80). Multiple linear regression, with and without controlling for age, sex, and race (Caucasian or non-Caucasian), was used to examine associations between the FNPA and PAQ-A, HEI-2010, and total screen time. Logistic regression was used to determine differences in FNPA score by weight categories. **RESULTS:** Mean BMI ( $22.3 \pm 4.6 \text{ kg/m}^2$ ) approximated the 65<sup>th</sup> percentile, with 18.3% of the sample being overweight and 11.4% being obese. No significant relationships were found in the linear regression analyses between the FNPA, PAQ-A, HEI-2010, or total screen time ( $F=0.49$ ,  $p=0.83$ , Adjusted  $R^2 = 0.018$ ). When controlling for age, sex, and race, these relationships remained non-significant. Logistic regression analyses showed no significant associations between the FNPA and weight status (OR = 1.21, CI = 0.62-2.36) or overfatness (OR = 1.91, CI = 0.92-3.95). **CONCLUSION:** This study highlights that the FNPA Screening Tool may not be associated with health behaviors or obesity risk in an adolescent population. Further research is needed to explore the utility of the FNPA Screening Tool in adolescents.

**377** Board #215 May 29 9:30 AM - 11:00 AM  
**Factors Associated to Mechanical Efficiency among Adolescent Boys Performing a Graded Maximal Exercise**  
 Georges Jabbour, Lina Majed. *Qatar University, Doha, Qatar.*  
 Email: georgesjabbour1980@hotmail.com  
*(No relevant relationships reported)*

**Factors Associated to Mechanical Efficiency among Adolescent Boys Performing a Graded Maximal Exercise**

Georges Jabbour<sup>1</sup>, Lina Majed<sup>1</sup>  
<sup>1</sup>Qatar University, Doha, Qatar.  
**PURPOSE:** To determine the mechanical efficiency (ME) and associated factors among adolescent boys at different stages of graded maximal exercise. **METHODS:** 45 sedentary adolescent boys were separated into three groups according to their percentage of fat mass as follows: 15 normal-weight (NW) (body fat:  $16.0 \pm 1.9\%$ ), 15 overweight (OW) (body fat:  $24.0 \pm 1.6\%$ ) and 15 obese (OB) (body fat:  $31.0 \pm 3.0\%$ ). Each of them completed a maximal graded test in which energy consumption in watt (E), ME (expressed as a %), plasma epinephrine, and norepinephrine concentrations were determined consecutively through three stages corresponding to ~50% and 75% of each participant's maximal heart rate (50%HRmax and 75%HRmax) and at peak oxygen consumption ( $VO_{2peak}$ ) level. **RESULTS:** During the maximal graded test, plasma epinephrine, and norepinephrine as well as ME determined at 50%HRmax, 75%HRmax and at  $VO_{2peak}$  stages were significantly lower in OB compared to NW and OW individuals ( $ps < 0.01$ ). ME correlated negatively to body weight ( $r = -0.80$ ;  $p < 0.01$ ) at 50%HRmax level. However, at 75%HRmax and at  $VO_{2peak}$  stages, ME correlated significantly to power output ( $r = 0.88$  and  $r = 0.91$ ,  $ps < 0.01$ ) as well as with epinephrine ( $r = 0.82$ ,  $p < 0.01$ ) and norepinephrine concentrations ( $r = 0.88$ ,  $p < 0.01$ ) for entire group. **CONCLUSION:** These findings suggest that the body's weight excess exerts a negative effect on ME values at a low intensity, while at higher intensities (75%HRmax and  $VO_{2peak}$ ) the lower ME could be better explained by the reduced catecholamine responses as observed in obese adolescent boys.

**378** Board #216 May 29 9:30 AM - 11:00 AM  
**Weight Trajectories Are Associated With Exercise Capacity Among Children With Complex Congenital Heart Defects**  
 Tyler Kung<sup>1</sup>, Kenneth Tang<sup>1</sup>, Warsame Yusuf<sup>1</sup>, Jane Lougheed<sup>2</sup>, Patricia E. Longmuir<sup>1</sup>. <sup>1</sup>Children's Hospital of Eastern Ontario Research Institute, Ottawa, ON, Canada. <sup>2</sup>Children's Hospital of Eastern Ontario, Ottawa, ON, Canada.  
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Children with complex congenital heart defects (CHD) are often short/lightweight relative to peers, and may require supplementary feeding to meet energy demands. It was hypothesized that CHD patients with limited growth would also have decreased energy for exercise. **PURPOSE:** To investigate the impact of chronic energy deficit, as evidenced by negative growth trajectory, on submaximal exercise capacity. **METHODS:** Retrospective chart review of Bruce treadmill exercise test results, weight/height at each visit for 5 years prior to the exercise test, age at exercise test, sex and CHD diagnosis among CHD patients 8 to 14 years of age. Submaximal energy consumption ( $VO_{150}$  = estimated ml O<sub>2</sub>/kg/min at heart rate of 150 bpm) and growth trajectory (slope of the body weight z-score over 5 years) were calculated per child. A linear regression model examined energy consumption by growth trajectory, adjusting for age, sex, CHD severity and initial body weight z-score. **RESULTS:** Participants were 90 children with CHD (34 females (38%)), mean age 10.5 (SD=2.3) years. CHD diagnoses were simple (n=19, 21.1%), moderate (n=33, 36.7%) or complex (n=38, 42.4%). Mean  $VO_{2@150bpm}$  was 28.7 (SD=7.4). Initial height (median 0.36, IQR: -0.65, 1.04) and weight (median 0.21, IQR: -0.69, 1.12) z-scores indicated most participants were taller/heavier than expected for age.

Submaximal energy consumption was significantly higher (model  $R^2 = 0.29$ ) with lower initial weight z-score ( $b = -1.4$  [0.2, 2.5] per 1 unit increase,  $p = .02$ ), a decreasing slope of the weight z-score ( $b = 7.9$  [1.8, 14.0],  $p = .01$ ), male sex ( $b = 3.8$  [1.2, 6.3],  $p = .004$ ) and severe CHD ( $b = 4.0$  [0.7, 7.4],  $p = .02$ ), but not by age ( $b = 0.4$ ,  $p = 0.15$ ). **CONCLUSIONS:** Children with CHD who were underweight or had a negative growth trajectory had significantly higher energy consumption during submaximal exercise. The relationship between a negative growth trajectory and daily physical activity should be examined to assess whether the higher energy demands for submaximal exercise are also associated with an inactive lifestyle, and therefore the known increase in risk for sedentary lifestyle morbidities. Prospective studies are required to understand the mechanisms linking growth limitations to reduced exercise capacity.

**379** Board #217 May 29 9:30 AM - 11:00 AM  
**Boys with Obesity have Attenuated Cardiorespiratory Fitness Independent of Fat Mass**  
 Julianna J. Kilpatrick<sup>1</sup>, Kyleigh Allie<sup>1</sup>, Oscar E. Suman, FACSM<sup>2</sup>, Eric Rivas<sup>1</sup>. <sup>1</sup>Texas Tech University, Lubbock, TX. <sup>2</sup>University of Texas Medical Branch, Galveston, TX. (Sponsor: Oscar E. Suman, FACSM)  
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*(No relevant relationships reported)*

**Purpose:** The assessment of cardiorespiratory fitness using ratio scaling to total body mass (TBM) is confounded by fat mass in obese populations because fat tissue does not contribute to oxygen utilization during exercise. Our objective was to isolate the independent effects of obesity on fitness when normalized to total lean body mass (TLM) and leg lean mass (LLM). We tested the hypothesis that boys with obesity would have attenuated cardiorespiratory fitness compared to age-matched non-obese boys. **Methods:** Values are expressed as means  $\pm$  SD with significance set at  $P < 0.05$ . Seventeen non-obese boys ( $10.6 \pm 0.9$  y,  $141.8 \pm 6.5$  cm,  $35.5 \pm 7.0$  kg,  $24 \pm 5\%$  body fat) and thirteen age-matched obese boys ( $10.6 \pm 1.4$  y,  $146.3 \pm 10.6$  cm,  $60.25 \pm 13.0$  kg,  $44 \pm 2\%$  body fat) completed a cardiorespiratory fitness test ( $VO_{2peak}$ ) and body composition scan (DXA). **Results:** Utilizing a 2-tailed independent T-test, both groups had comparable  $VO_{2peak}$  test times ( $9.1 \pm 1.4$  min;  $P = 0.80$ ), and peak heart rates ( $187 \pm 12$  bpm;  $P = 0.50$ ). Boys with obesity had a reduction in  $VO_{2peak}$  when normalized to TBM (54% of age-matched boys without obesity); however, this effect was reduced less when compared to LBM (76%) and LLM (68%). Further, simple linear regression found that total body fat accounted for 69% variance for mL/kgTBM/min, 49% variance for mL/kgLBM/min, and 40% variance for mL/kgLLM/min. **Conclusions:** These data indicate that obesity in young boys impairs cardiovascular fitness which supports the concept that obesity in pediatrics reduces aerobic capacity, which may have later life consequences in regards to cardiorespiratory fitness and all-cause mortality. Lastly, we show that the normalization of  $VO_{2}$  to LBM and LLM can provide an independent measure of fitness.

**A-53** Free Communication/Poster - Exercise & Neuroscience  
 Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
 Room: CC-Hall WA2

**380** Board #218 May 29 9:30 AM - 11:00 AM  
**Social Media-Based Physical Activity Promotion by Craft Brewing Establishments Located in Knoxville, Tennessee**  
 Paula-Marie M. Ferrara, Eugene C. Fitzhugh, Cory T. Beaumont, Kelley Strohacker, FACSM. *University of Tennessee, Knoxville, TN.*  
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*(No relevant relationships reported)*

Researchers have consistently observed a positive relationship between physical activity (PA) and alcohol consumption (AC). Anecdotally, craft breweries (CBs) appear to capitalize on this relationship by marketing to active populations (e.g. sponsorship of athletic associations, post-competition product donation, hosting of PA-related events). To date, empirical analysis of PA promotion by CBs has not been conducted. **PURPOSE:** Preliminarily assess PA promotion by CBs located in a single community. **METHODS:** Facebook posts by 15 CBs located in Knoxville, TN were screened between November 2016-October 2017, with PA-related posts coded by activity type. Non-parametric correlations assessed associations between CBs' total PA posts and built environment factors via Geographic Information System (e.g. walk score, transit score, culture score). Chi-square tests were also used to assess the distribution of PA-posts across each season (Winter, Spring, Summer, Fall).

**RESULTS:** Of 3845 Facebook posts, 147 (3.82%) referred to PA. PA posts made by individual CBs ranged from 0-47 (median=4.50; IQR=9; mean=10±13) over one year, and pertained to fitness classes (29.25%), biking (24.49%), running, (21.77%), outdoor activities (12.24%), sports (4.08%), and miscellaneous PA (8.16%). PA posts were not equally distributed across seasons ( $\chi^2(2, N=3)=14.68, p=0.002$ ); Summer contained the highest percentage of posts (34.51%), followed by Spring (28.87%), Fall (23.94%), and Winter (12.68%). PA posts were significantly and inversely correlated with scores regarding culture ( $r=-0.67, p=0.01$ ) and shopping ( $r=-0.62, p=0.01$ ). Moderate, but statistically insignificant correlations were observed between PA posts and scores for walkability ( $r=-0.36, p=0.18$ ), dining and drinking ( $r=-0.46, p=0.08$ ), and errands ( $r=-0.38, p=0.16$ ). **CONCLUSIONS:** Although PA posts represent a minimal portion of social media advertising in this local sample of CBs, a wide variety of activities is promoted. Additionally, promotion volume fluctuates seasonally, and CBs that promote PA more frequently tend to be located in areas that are less walkable, with fewer desired amenities.

**381 Board #219 May 29 9:30 AM - 11:00 AM**  
**Pre- and Post-Season Electroencephalography Measures of Brain Vital Signs in Youth Football Players**

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 (No relevant relationships reported)

Amid growing concern of potential brain trauma caused by repetitive head impacts (RHI) in youth football, there is an emerging need to develop objective, physiologic assessments of brain function that can identify sub-concussive impairment. Electroencephalography (EEG) may be a viable tool to evaluate neurologic dysfunction associated with RHI. **PURPOSE:** To evaluate the neurophysiologic activity of youth football players in association with RHI. **METHODS:** EEG data were captured from nine middle school football players (13.1 ± 0.5 yr) before (PRE) and after (POST) one season using a portable 8-channel EEG cap with three electrodes (Fz, Cz and Pz) while subjects listened to an auditory stimulus sequence (~5 min). Amplitudes (A) and latencies (L) of event-related potentials (ERP) corresponding to auditory sensation (N100A, N100L), basic attention (P300A, P300L), and cognitive processing (N400A, N400L) were converted to normalized brain vital signs scores (0-100 scale). Larger ERP amplitudes equate to higher scores and delayed latencies equate to lower scores. RHI were measured during the season via accelerometry (Head Impact Telemetry System). EEG data from three subjects were of insufficient quality for analysis; thus, results were limited to the six remaining subjects. **RESULTS:** Scores for N400L decreased significantly ( $P = 0.031$ ) from PRE (63.9 ± 7.6) to POST (38.2 ± 16.8). There were no significant changes in N100A ( $P = 0.971$ ), N100L ( $P = 0.308$ ), P300A ( $P = 0.562$ ), P300L ( $P = 0.183$ ), or N400A ( $P = 0.685$ ) scores. On average, players sustained 134 ± 66 head impacts during the season. Head impact frequency was not significantly associated with any brain vital signs score ( $P = 0.169-0.783$ ). **CONCLUSION:** In this small sample of youth football players, cognitive processing was delayed following a single season as measured by the significant reduction in N400 latency scores. However, this change was not associated with RHI incurred by the players. While these data should be interpreted with caution, they provide preliminary evidence for the potential value of using the brain vital signs framework to evaluate brain function and sub-concussive impairment in collision-sport athletes.

This work was supported by a grant from the T. Denny Sanford Pediatric Collaborative Research Fund between Mayo Clinic and Sanford Health.

**382 Board #220 May 29 9:30 AM - 11:00 AM**  
**Aerobic Exercise Regulates Gamma Oscillation in Hippocampal CA1 of APP/PS1/Tau Mice**

Yan Li<sup>1</sup>, Cui Li<sup>1</sup>, Lianwei Mu<sup>1</sup>, Ziqi Zhao<sup>2</sup>, Li Zhao<sup>1</sup>. <sup>1</sup>Beijing Sport University, Beijing, China. <sup>2</sup>Institute of Genetics and Developmental Biology, Chinese Academy of Sciences, Beijing, China.  
 (No relevant relationships reported)

**PURPOSE:** Changes in gamma oscillations have been observed in multiple brain regions in mouse models of Alzheimer's disease. This study aimed to investigate the effect of aerobic exercise on gamma activity in hippocampal CA1 of APP/PS1/Tau transgenic (3×Tg) mice during awake state when theta oscillation occurs, and the effect on slow gamma activity in CA1 during sleep state when SWRs occur.

**METHODS:** 3×Tg mice (6 months old) and C57BL/6J mice were randomly divided into exercise groups and sedentary groups respectively. The exercise groups were made to run on the treadmill for 1 hour per one day, five times a week, for 12 weeks. The exercise workload consisted of running at a speed of 12 m/min for the first 10 min, 15 m/min for the last 50 min, with 0% grade of inclination. Radial arm maze was used to evaluate the memory function of the mice. Multichannel recording technology was

used to record electrical activity of hippocampal CA1 in vivo. Theta oscillation and sharp waves and ripples (SWRs) were detected by MATLAB programs, and spectral analysis was computed using multi-taper methods. Immunofluorescence was used to detect the Aβ deposits in CA1.

**RESULTS:** 12 weeks of treadmill exercise ameliorated working memory (2.00±0.35 vs. 1.20±0.38,  $p<0.05$ ) and reference memory (5.47±0.36 vs. 3.70±0.45,  $p<0.05$ ) deterioration of 3×Tg mice. The 9-month-old 3×Tg mice exhibited a reduction of both gamma power (0.33±0.05 vs. 0.51±0.02,  $p<0.01$ ) during the theta rhythms awaking and slow gamma power (0.50±0.03 vs. 0.55±0.04,  $p<0.01$ ) during SWRs sleeping in the hippocampal CA1 compared to control mice, respectively. 12 weeks of treadmill exercise could increase gamma power either being awake (0.50±0.06,  $p<0.01$ ) or being asleep (0.54±0.03,  $p<0.05$ ) in 3×Tg mice. Furthermore, these disturbances were observed to be consistent with Aβ pathological deposits (AS, 1.42±0.21,  $p<0.01$  vs. CS; AE, 0.53±0.09,  $p<0.01$  vs. AS).

**CONCLUSIONS:** Consistencies between these alteration in gamma power and Aβ deposits suggest that disturbances in rhythmic organization of theta and gamma may contribute to spatial memory deficits in 9-month-old 3×Tg mice. Given these data, aerobic exercise could improve spatial performance by regulating gamma power when theta oscillations or SWR occur.

Supported by the National Natural Science Foundation of China (31571229).

**383 Board #221 May 29 9:30 AM - 11:00 AM**  
**Aerobic Exercise Differential Alters Intrinsic Neuronal Properties In The 3xtg Mouse Model Of Alzheimer's Disease**

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**PURPOSE:** Alterations in network activities in Alzheimer's disease (AD) are accompanied by an early imbalance of excitation and inhibition that related to cognitive function. Although that aerobic exercise could enhance synaptic plasticity from various AD mouse models have been found, the properties of neurons firing in specific conditions remain poorly understood. This study was to investigate the neurophysiological signals underlying the effects of aerobic exercise on the brains of APP/PS1/Tau transgenic (3×Tg) mice and 129 mice as wild type (Wt) control at 9 months of age.

**METHODS:** 3×Tg mice (6 months old) were randomly divided into exercise groups and sedentary groups (AS, AE), and Wt mice as cohort control. The exercise groups would run on the treadmill for 12 weeks. Multichannel recording technology was used to record population spikes in cortical and hippocampal region at 9 months of age in vivo during awake or sleep state. Spike sorting was performed using offline sorter software. Pyramidal cells (PNs) were distinguished from putative interneurons (INs) on the basis of average firing rate, bursting properties, and spike width.

**RESULTS:** Recordings took place across 5-7 consecutive days while mice were awake exploring or asleep, and the number of spikes was calculated every 10 sec as a session. During awake, in three AS, AE and Wt mice, we recorded 15 PNs, 48 PNs and 10 PNs, while 9, 23 and 11 INs in cortex (with a total of 192 place fields); 36 PNs, 77 PNs and 35 PNs, while 10, 37 and 15 INs in hippocampus (with a total of 330 place fields). During sleep state, with a total of 138 place fields, we recorded 22 PNs, 19 PNs and 13 PNs, while 7, 15 and 14 INs in cortex; 29 PNs, 58 PNs and 21 PNs, while 9, 24 and 11 INs in hippocampus (with a total of 270 place fields). In both awake and sleep state, IN firing rates were differential changed in AS compared to the control, and the ratio of IN/PN was lower in both cortex (0.6±0.02, 0.31±0.00) and hippocampus (0.28±0.00, 0.31±0.01) of AS compared to Wt mice (1.1±0.02, 0.43±0.01/ 1.08±0.02, 0.52±0.01,  $P<0.01$ ). Exercise attenuated the phenomena (0.48±0.01, 0.48±0.01/0.79±0.02, 0.41±0.02,  $p<0.01$ ).

**CONCLUSIONS:** Aerobic exercise could regulate aberrant cellular neurophysiology related to cognitive impairments dependent network function.

**384 Board #222 May 29 9:30 AM - 11:00 AM**  
**Aerobic Exercise Regulates GSK3β Activity to Attenuate the Neuropathology In APP/PS1 Transgenic Mice**

Peng HAN, Boya GU, Li ZHAO. Beijing Sport University, Beijing, China.  
 (No relevant relationships reported)

**PURPOSE:** Glycogen synthase kinase 3 beta (GSK3β) is involved in hyperphosphorylated Tau, one of the hallmarks of Alzheimer's disease (AD). This study was to evaluate the possible effect of aerobic exercise on GSK3β and the phosphorylating Tau protein in APP/PS1 transgenic mice. **METHODS:** C57BL/6J (6-month-old) and APP/PS1 transgenic mice (6-month-old) were randomly divided into exercise group (CE/AE) and sedentary group (CS/AS) respectively. Animals

were subjected to treadmill exercise for 12 weeks. The changes of behavior were detected by eight arm maze. The phosphorylation levels of AKT, GSK3 $\beta$  and Tau were measured by using Western Blotting. **RESULTS:** The eight arm maze showed that working and reference memory errors and time to complete testing in AE decreased significantly compared with the mice of AS ( $3.67 \pm 0.41$  vs  $4.83 \pm 0.24$ ,  $p < 0.05$ ;  $6 \pm 0.73$  vs  $8.40 \pm 0.59$ ,  $p < 0.01$ ;  $109 \pm 35$  vs  $256 \pm 45.26$ ,  $p < 0.05$ ), indicating that aerobic exercise improved behavioral and cognitive response ability. The levels of pTau ser262 and pTau ser396 were severely increase at hippocampus in AS compared with those of control cohorts (CS) ( $0.98 \pm 0.09$  vs  $0.82 \pm 0.09$ ,  $p < 0.05$ ;  $0.89 \pm 0.06$  vs  $0.73 \pm 0.11$ ,  $p < 0.05$ ). Aerobic exercise could decrease pTau ser262 and pTau ser396 ( $0.69 \pm 0.08$  vs  $0.98 \pm 0.09$ ,  $p < 0.01$ ;  $0.67 \pm 0.02$  vs  $0.89 \pm 0.06$ ,  $p < 0.05$ ). As in case of GSK3 $\beta$ , the levels of pGSK3 $\beta$  ser9 were significantly decreased, while pGSK3 $\beta$  tyr216 were significantly increased in hippocampus of AS compared with those of CS ( $0.51 \pm 0.08$  vs  $0.69 \pm 0.08$ ,  $p < 0.05$ ;  $0.90 \pm 0.07$  vs  $0.67 \pm 0.02$ ,  $p < 0.01$ ). The levels of pGSK3 $\beta$  ser9 were increased ( $0.79 \pm 0.09$  vs  $0.51 \pm 0.08$ ,  $p < 0.01$ ), and the levels of GSK3 $\beta$  tyr216 were decreased after aerobic exercise training in the hippocampus ( $0.69 \pm 0.06$  vs  $0.90 \pm 0.07$ ,  $p < 0.05$ ). The levels of pAKT (GSK3 upstream regulator) ser473 were significantly decreased in hippocampus of AS compared with those of CS ( $0.49 \pm 0.07$  vs  $0.73 \pm 0.13$ ,  $p < 0.05$ ). Aerobic exercise induced to increase the activity of pAKT ser473 ( $0.74 \pm 0.13$  vs  $0.49 \pm 0.07$ ,  $p < 0.05$ ). **CONCLUSION:** Aerobic exercise regulates GSK3 $\beta$  activity to attenuate the neuropathology of hyperphosphorylated Tau in APP/PS1 transgenic mice. Supported by the National Natural Science Foundation of China (NSFC) (No. 31571229)

**385** Board #223 May 29 9:30 AM - 11:00 AM  
**Aerobic Exercise Attenuates The A $\beta$  Oligomer-induced Mitochondrial Permeability Transition Pore Opening In App/ps1 Transgenic Mice**  
 Lianwei MU, Cui Li, Boya Gu, Yuanyuan LV, Li Zhao. *Beijing Sport University, Beijing, China.*  
 (No relevant relationships reported)

**PURPOSE:** The mitochondrial permeability transition pore (mPTP) plays a role in the onset and the progression of Alzheimer's disease (AD). This study was to analyze the effects of 12 weeks aerobic exercises on mPTP activation in AD models mice.

**METHODS:** 6-month-old of APP/PS1 transgenic mice and C57BL/6J mice were randomly divided into exercise group (CE, AE) and sedentary group (AS, CS) respectively. The exercised mice were subjected to a treadmill exercise for 12 weeks, then the experimental age was at 9-month-old. The behavioral changes were detected by eight arm maze. Immunofluorescence, histochemistry and Dot blot were to analyze mPTP opening, the level of amyloid- $\beta$  (A $\beta$ ) and soluble oligomers (oA $\beta$ ). ELISA and Western Blotting were used to detect the activity of COXIV, ABAD, and the levels of COXIV, ABAD, Cyp-D, ANTI1, ANTI2, VDAC-1. **RESULTS:** Both working memory errors and reference memory errors were significantly increased in AS compared with those in the CS ( $40 \pm 4$  vs  $30 \pm 4\%$ ;  $71 \pm 2$  vs  $54 \pm 1\%$ ,  $p < 0.01$ ). The AE performed better than AS ( $22 \pm 1$  vs  $39 \pm 3\%$ ;  $55 \pm 3$  vs  $71 \pm 2\%$ ,  $p < 0.05$ ). A $\beta$  was aggregated at hippocampus in AS, accompanied with an increase of oA $\beta$  ( $1$  vs  $1.1 \pm 0.1$ ,  $p < 0.05$ ). A decline was detected in A $\beta$  plaque and oA $\beta$  content in AE than AS ( $0.6 \pm 0.1$  vs  $1.5 \pm 0.1$ ;  $0.9 \pm 0.1$  vs  $1.1 \pm 0.1$ ,  $p < 0.05$ ). There was an increase in AS compared with CS in the mPTP opening ( $0.07 \pm 0.002$  vs  $0.08 \pm 0.002$ ,  $p < 0.01$ ), and which was decreased after aerobic exercise ( $0.07 \pm 0.002$  vs  $0.08 \pm 0.003$ ,  $p < 0.01$ ). AS displayed an increase in Cyp-D, ANTI1, VDAC-1, ABAD of the hippocampus compared with the CS ( $1.1 \pm 0.1$  vs  $1$ ,  $p < 0.05$ ), but a decrease in ANTI2, COXIV protein ( $0.9 \pm 0.1$  vs  $1$ ,  $p < 0.01$ ). Aerobic exercise decreased the expression of Cyp-D, ANTI1, VDAC-1, ABAD in AS ( $1.1 \pm 0.1$  vs  $1$ ,  $p < 0.05$ ) and increased ANTI2, COXIV ( $0.9 \pm 0.1$  vs  $1$ ,  $p < 0.05$ ). The activity of COXIV and ABAD in the hippocampus of AS were decreased compared with those of the CS ( $3.3 \pm 0.1$  vs  $3.7 \pm 0.2$ ;  $0.5 \pm 0.1$  vs  $1 \pm 0.2$ ,  $p < 0.01$ ), and aerobic exercise caused an increase of their activities ( $3.3 \pm 0.1$  vs  $5.6 \pm 0.2$ ;  $0.5 \pm 0.1$  vs  $0.8 \pm 0.1$ ,  $p < 0.01$ ). **CONCLUSIONS:** Aerobic exercise attenuates the oA $\beta$  deposition and the opening of mPTP, then regulates the mitochondrial oxidative phosphorylation for energy production in AD models. Supported by the National Natural Science Foundation of China (NSFC) (No. 31571229)

**386** Board #224 May 29 9:30 AM - 11:00 AM  
**Effects Of Aerobic Exercise On Learning And Memory Ability And Hippocampal Tgf-1 In Depressed Rats**  
 Xue Li, Lu Wang, Yu Jin, Xiang Hu, Qi Ye. *Chengdu Sport Institute, Chengdu, China.*  
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 (No relevant relationships reported)

**OBJECTIVE:** To investigate the effects of different periods of aerobic exercise intervention on hippocampal TGF- $\beta$ 1 expression and spatial learning and memory ability in depressive model rats.

**METHODS:** 36 male SPF grade Sprague Dawley (SD) rats were randomly allocated into 4 groups (n=9): Control group (C group), Pre-model exercise group (EC group), Model group (M group), Motion group (ce group). Except for group C, all other groups

used CUMS stress stimulation to establish an animal model. Morris water maze test was used to detect spatial learning and memory ability of rats. Nissl staining was used to observe the morphology of rat hippocampal neurons. Real-time PCR, Western Blotting were used to detect the expression of TGF- $\beta$ 1.

**RESULTS:** There was no significant difference in time-consumption of escaping the incubation period between the 1st and the 2nd day in each group ( $P > 0.05$ ). On the fourth day, the escape latency of M group was significantly longer than that of rats in the C and ce groups ( $P < 0.05$ ). On the 5th day, the escape latency in M group was significantly longer than that in C and ce groups ( $P < 0.05$ ), and EC group was significantly longer than that in C group ( $P < 0.05$ ). Results of the number of crossing platforms: The number of crossing in the M and EC groups were significantly lower than those in the C and ce groups ( $P < 0.01$ ). Compared with EC and M group, the morphological structure of neurons in ce group was better. The expression of TGF- $\beta$ 1 mRNA in hippocampus of EC and ce group was significantly lower than that of C and M groups ( $P < 0.01$ ). The expression levels of TGF- $\beta$ 1 protein in C and M groups were significantly higher than those in ce group ( $P < 0.01$ ). The expression of TGF- $\beta$ 1 protein in M rats was significantly higher than that in EC and ce groups ( $P < 0.01$ ). **CONCLUSION:** Aerobic exercise intervention can improve the morphological structure of hippocampal CA3 neurons, and decrease the expression of TGF- $\beta$ 1. It indicated that aerobic exercise can improve the depression.

**387** Board #225 May 29 9:30 AM - 11:00 AM  
**Aerobic Exercise Inhibits Tau Hyperphosphorylation Through Activation Of The P13k/akt Pathway In The Hippocampus Of App/ps1 Mice**  
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 (No relevant relationships reported)

**PURPOSE:**

Many studies suggest that regular physical exercise can reduce the risk of Alzheimer's disease and slow its onset and progression. However, the exact mechanism is still unclear. Clinically, Alzheimer's disease is characterized by the presence of extracellular amyloid plaques and intraneuronal neurofibrillary tangles, which are associated with amyloid- $\beta$  and tau hyperphosphorylation respectively. The PI3K/Akt signaling pathway regulates tau phosphorylation and plays a pivotal role in the development of pathology in Alzheimer's disease. Therefore, we try to investigate the effects of aerobic exercise on tau phosphorylation and examined whether these effects were mediated by the PI3K/Akt pathway in the hippocampus of APP/PS1 and C57BL/6J mice.

**METHODS:** 40 male APP/PS1 mice and 40 male C57BL/6J mice were randomly divided into four groups respectively: sedentary group, exercise group, sedentary with GNE-317 treatment group and exercise with GNE-317 treatment group. The mice in the exercise group and exercise with GNE-317 treatment group were given exercise training on a treadmill for 8 weeks. After 8 weeks of treadmill exercise, the morris water maze, immunohistochemistry and western blot analysis were performed.

**RESULTS:** We found out that 8 weeks of aerobic exercise enhanced PI3K expression and increased phosphorylation of Akt at Thr308 and Ser473 and of GSK3 $\beta$  at Ser9. Furthermore, 8 weeks of aerobic exercise reduced tau phosphorylation at multiple sites including Ser202, Thr231 and Ser396. In the morris water maze test, the exercise group showed a reduced escape time and distance compared with those of the sedentary group, suggesting that aerobic exercise improved the cognitive ability in mouse. While the above-mentioned results were attenuated in the PI3K/Akt inhibitor GNE-317 treatment groups.

**CONCLUSIONS:**

Our study demonstrated that 8 weeks of aerobic exercise could inhibit tau hyperphosphorylation and improve cognitive function through activation of the PI3K/Akt pathway in the hippocampus of APP/PS1 and C57BL/6J mice.

**388** Board #226 May 29 9:30 AM - 11:00 AM  
**Cutaneous Sensitivity Increases During an Ultra-Marathon**  
 Domenica A. Rivera, Sharon C. Thompson, Amina Rahmoune, Steven B. Hammer, James W. Agnew. *Indian River State College, Fort Pierce, FL.*  
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 (No relevant relationships reported)

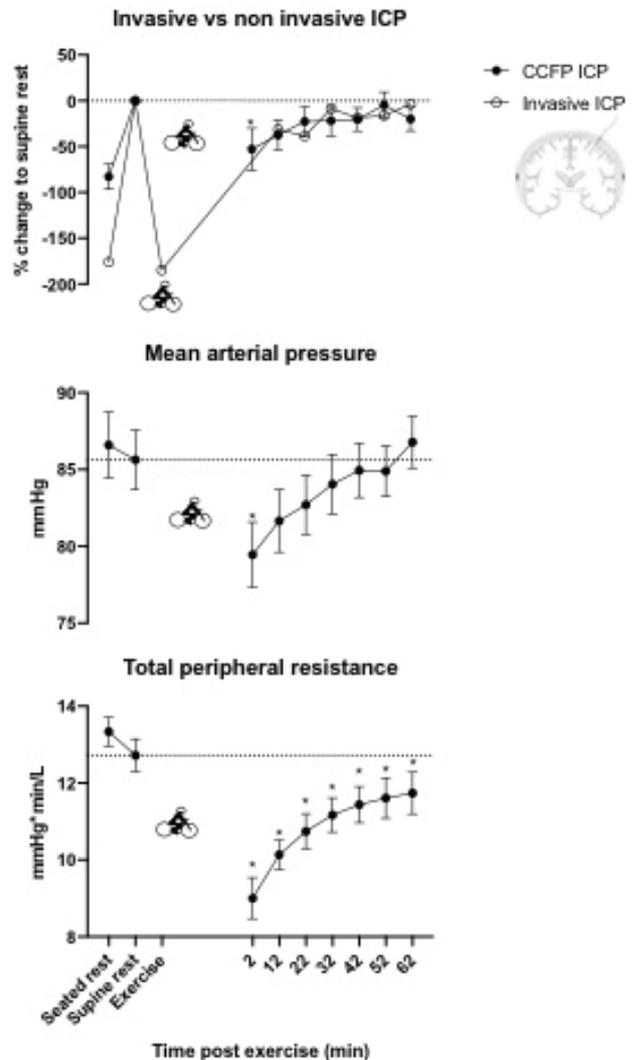
Very little data is available on variation in cutaneous sensation that occurs during an ultra-marathon competition. Decreased sensory activity may be a factor in gait deterioration that may lead to injury during ultra-endurance activities. **PURPOSE:** We hypothesized that cutaneous sensation, assessed with two-point discrimination tests (2PD), may be altered by running in an ultra-marathon. **METHODS:** Twenty-one male and female ultra-marathoners who completed the Keys-100 ultra-marathon on a flat course in hot, humid conditions, gave informed consent and volunteered for this study that was previously approved by Indian River State College Institute Review Board. To measure 2PD calipers were set at 5mm, 10mm, 15mm, 20mm,

and 25mm apart. Calipers were placed on the calcaneal plantar surface of the foot before the ultra-marathon and again immediately after the runners completed their ultra-marathon distance. The different width calipers were placed randomly either in a horizontal or vertical position. Subjects were in a prone position and were unable to observe caliper placement. Subjects were asked to indicate caliper placement position. Technicians used hand signals to indicate to the recorder: 1. caliper position and 2. the subject's response either correct or incorrect. This was repeated 5 times randomly for each caliper setting and their respective answers were recorded as: correct=1 and incorrect=0. Two-Way ANOVA was used to analyze the overall Pre vs. Post accuracy difference ( $p<.05$ ). Pre vs. post accuracy differences between each specific caliper distance were analyzed with a paired t-test ( $p<.05$ ). **RESULTS:** A significant increase in 2PD was observed after completing the ultra-marathon across all caliper distances ( $p<.05$ ). While the 2PD across all caliper distances increased in accuracy only the two widest caliper settings 20mm and 25mm were significantly more accurate ( $p<.05$ ). **CONCLUSION:** The increased 2PD suggests an increase in cutaneous sensitivity after an ultra-marathon. We have previously found increased sensitivity in pain threshold after an ultra-marathon. There, and in this present study, it is likely that the inflammatory response from ultra-endurance activity has a sensitizing effect on nociceptors and cutaneous receptors, respectively, thus increasing pain and cutaneous sensitivity.

389 Board #227 May 29 9:30 AM - 11:00 AM  
**Postexercise Intracranial Hypotension**

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Arterial hypotension, minutes to hours after exercise, is a well described phenomenon. The drop in mean arterial blood pressure (MAP) likely results from a combination of sustained vasodilation of the previously active muscles, centrally mediated reduction in sympathetic nervous activity and resetting of thermo-, chemo-, and baroreceptors. Despite decreased MAP, cerebral blood flow is generally well maintained. **PURPOSE:** To characterize effects of moderate aerobic exercise on intracranial pressure (ICP) as a mechanism for maintaining cerebral perfusion pressure during and following exercise. **METHODS:** Sixteen healthy volunteers completed 30-min exercise at 70% estimated  $VO_2$ -max on an upright ergonomic bicycle followed by a one-hour recovery phase in supine position. MAP, heart rate, stroke volume, and total peripheral resistance (TPR) were recorded continuously (Nexfin). In 15 subjects (8 female,  $20\pm 2$  years, height  $169\pm 10$  cm, weight  $64\pm 12$  kg) ICP was estimated non-invasively by evoked tympanic membrane displacement (Cerebral Cochlea Fluid Pressure device). Invasive parenchymal ICP recordings were performed in one, cerebrally intact, former patient (male, 74 years, 176 cm, 80 kg) via a permanently implanted tip-transducer telemetric ICP-sensor (Neurovent-P-tele). **RESULTS:** 30 min moderate exercise did not increase ICP ( $-6.1$  mmHg during seated rest vs  $-6.8$  mmHg during exercise). Invasive ( $N=1$ ) and non-invasive ( $N=15$ ) ICP recordings followed the same trend, demonstrating a  $52.8\pm 22.9\%$  ( $P<0.005$ ) decrease immediately postexercise and gradually returned to baseline (fig). ICP was correlated to MAP ( $r^2=0.8$ ,  $P<0.05$ ) and TPR ( $r^2=0.9$ ,  $P<0.005$ ) **DISCUSSION:** Postexercise decrease in ICP is a potential factor for maintaining cerebral perfusion pressure during arterial hypotension. Future analysis and ongoing trials are stratifying these responses according to responsiveness, gender and age. Supported by Novo Nordic Foundation (NNF150C0019196)



390 Board #228 May 29 9:30 AM - 11:00 AM

**Concussion History Does Not Predict Pupillary Light Reflex or Visual Sensory Performance in Young Adults**

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Visual sensory performance (VSP) tasks may dynamically assess deficits following concussion, as these tasks reflect visual and cognitive function and motor response. The pupillary light reflex (PLR) represents autonomic nervous system activity, and is inexpensive and noninvasive to assess. This activity may be compromised following concussion; however, deficits in young adults are currently unknown. The relationships among PLR and VSP outcomes are interesting given these metrics may reflect different but overlapping visual domains.

**PURPOSE:** To investigate the effects of concussion history on the relationships between PLR and VSP outcomes in young adults. **METHODS:** Participants [ $n = 89$ , age =  $21.0 \pm 1.5$  years, concussion history = 19 (21.3%)] completed a test battery including PLR and VSP. Seven PLR parameters included initial and final pupil diameters, constriction and dilation velocities, constriction latency, time to 75% initial diameter recovery (T75), and average maximum constriction velocity. VSP tasks included visual clarity, contrast sensitivity, depth perception, near-far quickness, perception span, multiple object tracking, reaction time, target capture, eye-hand coordination, and go/no-go. Regression models tested concussion history effects on PLR controlling for age; and whether history moderated relationships between

PLR and VSP outcomes. **RESULTS:** The PLR and VSP outcomes did not differ by concussion history ( $P > 0.05$ ). We found a negative relationship between reaction time and T75 ( $r_{88} = -0.30$ ,  $p = 0.005$ ) which was not moderated by concussion history ( $t = -0.97$ ,  $p = 0.33$ ), indicating that people with faster PLR recovery times also had faster reaction times. No other significant relationships were observed ( $P > 0.01$ ). **CONCLUSION:** Our PLR and VSP measures did not differ by concussion history. These measures may be insensitive to long-term physiological and behavioral deficits due to prior concussion injury, or no such long-term deficits exist in young adults. It is worth further studying the inverse relationship between reaction time and time to diameter recovery, providing a possible link between an involuntary process supporting vision with visual-sensory task performance.

**391** Board #229 May 29 9:30 AM - 11:00 AM  
**Working Memory Differences Between Fallers and Non Fallers**

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Falls are a major concern for older adults and their quality of life. Cognitive impairment is associated with falls in older adults; however, the electrophysiology while performing a working memory task has not been investigated. Working memory is a necessity for everyday function (walking, postural control, conversing), and the processing of a stimulus to elicit the appropriate response might lead to important insights into potential causes for falls and help us identify older adults at risk or develop future intervention strategies. **PURPOSE:** To examine differences between Non-Fallers and Fallers in performance on a working memory task and corresponding electrophysiology. **METHODS:** Older adults ( $n=38$ , female= $23$ ) aged 60 - 80 years ( $m=68.8$ ,  $SD=4.7$ ) completed two separate sessions on two separate days. The first session incorporated general demographic questionnaires and mobility and neuropsychological assessments. Participants were classified as Non-Fallers or Fallers based on their self-reported falls history over the past 12 months. In the second session we assessed working memory using the n-back (0-, 1-, 2-), while behavioural and electroencephalograms (EEG) results were recorded. **RESULTS:** In the 2-Back test, the EEG results showed that Fallers were more impaired in processing the stimuli, with earlier latencies for the N2 ( $p<0.001$ ) and P3 ( $p<0.001$ ) components in comparison to Non-Fallers. As well, delayed peak latencies in the N2 ( $r=0.507$ ,  $p=0.01$ ) and P3 ( $r=0.451$ ,  $p=0.024$ ) components were associated with increased accuracy in the working memory task. **CONCLUSIONS:** Fallers show processing impairments in working memory compared to Non-Fallers. Future studies should consider incorporating working memory as a component of falls risk screening for older adults.

**392** Board #230 May 29 9:30 AM - 11:00 AM  
**Effects Of Different Load Forced Swimming On The Expression Of Psd-95 And Ncam In Hippocampus Of Rats**

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**OBJECTIVE:**To investigate effects of different load forced swimming exercise on the spatial learning and memory ability of rats and to detect the expression of hippocampus PSD-95 and NCAM. **METHODS:**Thirty male 2-monthes old Sprague-Dawley rats were divided randomly into three groups: Control group (C), moderate load exercise group (M), overloading exercise group (O), 10 in each group. Group C rats were fed naturally for 8 weeks, and Group M rats were involved in 8 weeks of moderate load swimming intervention, and Group O rats were involved in 8 weeks of overload swimming intervention. Then, the Morris Water Maze (MWM) test was performed to estimate rats' learning and memory abilities and the Western Blot and Real-time PCR were used to determine the expression levels of PSD-95 mRNA, NCAM mRNA, PSD-95 and NCAM in the hippocampus. **RESULTS:**(1)In the process of navigation training, all animals' escape latencies gradually shortened. On the third day, the average escape latency of Group M was significantly lower than that of Group C and Group O ( $p < 0.05$ ), there were no significant difference in other days; in the navigation experiment, for the time of through the area of the original platform, Group M was significantly higher than Group C and Group O ( $p < 0.05$ ,  $p < 0.01$ ). (2)The expression of PSD-95 mRNA and PSD-95 protein in Group M was significantly higher than that in Group C ( $P < 0.05$ ), as well as the expression of PSD-95 mRNA in Group O was significantly lower than that in Group C and Group M ( $P < 0.05$ ); the expression of NCAM mRNA and NCAM protein in Group M was significantly higher than Group C ( $P < 0.05$ ), as well as the expression of NCAM protein in group O was significantly lower than Group M ( $P < 0.05$ ), but there was no significant difference with Group C ( $p > 0.05$ ). **CONCLUSION:**Moderate load swimming can improve the expression of

PSD-95 and NCAM in the rat hippocampus, as well as improve the spatial learning and memory ability of rats; overload swimming has little influence on PSD-95 and NCAM expression.

**393** Board #231 May 29 9:30 AM - 11:00 AM  
**Protective Effects Of Treadmill Exercise On  $\alpha\beta_{1-42}$ -induced Inflammation And Cognitive Impairment In Rat**

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(No relevant relationships reported)

Many studies suggest that regular exercise could reduce memory impairment, the main symptoms of Alzheimer's disease (AD), but the underlying mechanisms has not been elucidated. Inflammation induced by  $\beta$ -amyloid ( $A\beta$ ) deposition has been shown to play an critical role in AD pathogenesis. Increasing evidence show that aerobic exercise has anti-inflammatory and neuroprotective effects. We hypothesized that aerobic exercise could attenuates memory deficits by regulating inflammatory status. **PURPOSE:** To investigate whether regular aerobic exercise regulate inflammation and attenuate memory deficits induced by  $A\beta_{1-42}$  in rat. **METHODS:** Sprague-Dawley rats were divided into 3 groups: control group (C),  $A\beta_{1-42}$  infusion group (A),  $A\beta_{1-42}$  infusion with exercise group (E). Rats in group A and E were injected 10 $\mu$ g  $A\beta_{1-42}$  oligomer (1 $\mu$ g/ $\mu$ l saline) into their hippocampus, and rats from group C were injected with an same volume of saline. The rats in group E underwent aerobic exercise training on a leveled motorized treadmill at a moderate speed for consecutive 5 weeks (once a day, 6 days/week) starting at the 2nd day after  $A\beta_{1-42}$  injection. The memory ability was evaluated by Morris Water Maze (MWM) and the inflammatory status was analyzed by expressions levels of proinflammatory cytokines (TNF- $\alpha$ , IL-1 $\beta$ ) and anti-inflammatory cytokine (TGF- $\beta$ , IL-10) in hippocampus using Western Blot. **RESULTS:** MWM test showed that memory functions of rats were impaired by  $A\beta_{1-42}$  infusion, but this impairment was ameliorated by aerobic treadmill exercise. Compared with group C, both pro-inflammatory and anti-inflammatory cytokines in group A increased by different degrees (TNF- $\alpha$ : 306.9%, IL-1 $\beta$ : 255.6%, TGF- $\beta$ : 78.3%, IL-10: 80.0%). Compared with group A, the expression of TNF- $\alpha$  and IL-1 $\beta$  in group AE decreased by 31.4% and 25.0%, whereas TGF- $\beta$  and IL-10 increased by 68.5% and 39.0% respectively. **CONCLUSIONS:** The findings demonstrated that treadmill exercise could adjust inflammation status in hippocampus and attenuate the cognitive impairment of rats induced by  $A\beta_{1-42}$ . Supported by the Fundamental Research Funds for the Central Universities, Southwest University for Nationalities (2018NQ19) and the Sichuan Science and Technology University (18YYJC1355).

**394** Board #232 May 29 9:30 AM - 11:00 AM  
**Treadmill Exercise Alters Microglia Phenotype via Inhibiting NF- $\kappa$ B Signaling in Rats Hippocampally Injected With  $A\beta_{1-42}$**

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Microglia has been shown to play a pivotal role in the pathogenesis and prognosis of Alzheimer's disease (AD) for its' distinct activation phenotype, including pro-inflammatory, neurotoxic M1 and anti-inflammatory, neuroprotective M2. Previous studies have showed that regular exercise has anti-inflammatory effect and can reduce the memory deficit of AD rats induced by  $\beta$ -amyloid ( $A\beta$ ), but whether exercise modulates microglial phenotype remain unclear.

**PURPOSE:** To evaluate the impact of a moderate treadmill exercise program on activation of microglial M1/M2 phenotype in the hippocampus of rats injected with  $A\beta_{1-42}$  and to probe the underlying molecular mechanism. **METHODS:** Health Sprague-Dawley rats were randomly separated into sham (S),  $A\beta_{1-42}$  (A) and  $A\beta_{1-42}$ /exercise (AE) groups. Rats in group A and AE were bilateral hippocampally injected with 10 $\mu$ l  $A\beta_{1-42}$  solution (1 $\mu$ g/ $\mu$ l), and rats in group S were injected with 10 $\mu$ l saline. Rats in group AE performed running on a treadmill for 5 weeks (6 days/week, once a day, 8-10 min/min for 10-20 min at a time in the first week, 15 min/min for 30 min at a time in the next 4 weeks) starting 1 day after  $A\beta_{1-42}$  injection. The microglial M1/M2 phenotype in the hippocampus were determined by flow cytometry (FC) and immunofluorescence (IF). The expression of nuclear factor-kappa B (NF- $\kappa$ B/p65), which has been shown to be involved in the regulation of microglial phenotype, was measured using western blotting (WB) and quantitative real-time PCR (qRT-PCR). **RESULTS:** Both FC and IF showed that the number of M1 microglia (CD11b+CD86+ cell, Iba-1+iNOS+ cell) increased markedly in comparison with group C ( $P < 0.01$ ), but no significant change was observed in M2 microglia (CD11b+CD206+ cell, Iba-1+Arg-1+ cell), and that the number of M1 microglia in group AE was significantly lower than group A ( $P < 0.01$ ), whereas that of M2 microglia was increased ( $P < 0.01$ ). WB and qRT-PCR analysis suggested that the expression of NF- $\kappa$ B/p65 in the hippocampus was significantly increased after  $A\beta_{1-42}$  injection ( $P < 0.01$ ), which was

down-regulated by exercise ( $P < 0.05$ ). **CONCLUSIONS:** These results indicated that the treadmill exercise could suppress the M1 phenotype activation of microglia following A $\beta$ 1-42 insult and effectively promote microglia toward M2 polarization, which may relate with inhibition of NF- $\kappa$ B pathway.

**395** Board #233 May 29 9:30 AM - 11:00 AM  
**Brain Modulation For Perceived Exertion Processing After Different Cycling Exercise Intensities: An fMRI Study**

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Ratings of perceived exertion (RPE) during exercise is processed in the brain, however, the modulation of the associated areas at different intensities levels remains unclear. **PURPOSE:** To verify the brain modulation while RPE processing immediately after cycling exercise performed at different intensities.

**METHODS:** 24 healthy adults (77.6 $\pm$ 9.4 kg; 176 $\pm$ 7.2 cm; 25.9 $\pm$ 5.9 years old) performed an incremental load test on an adapted cycling ergometer attached to a MRI scanner. The workload started at 25 W and increased 25W after every four blocks of 30 s of cycling and 30 s rest. At the end of each block, participants had four seconds to report their RPE based on the 6-20 Borg scale presented on a screen. The RPE processing periods for RPE responses from 6 to 12 were labeled as LOW intensity while those from 13 to 18 were considered as HIGH intensity. To identify the common areas associated to RPE processing, the one sample t-test was used for each condition (all RPE, LOW and HIGH intensities). The statistical threshold established was family-wise error corrected (FWE $<$ 0.05).

**RESULTS:** When grouping all RPE responses throughout exercise intensities, we found an activation of several areas related to motor control (primary motor cortex, primary somatosensory cortex and cerebellum), homeostatic regulation (insular cortex) and cognition for executive functions (dorsolateral and anterior prefrontal cortex), spatial cognition (superior parietal lobule), reflective self-awareness (precuneus), and others (T=5.33; FWE $<$ 0.05). For the inhibited areas, we observed brain structures located in occipital lobe, prefrontal cortex, and thalamus, angular gyrus, Wernicke's area, associative visual cortex, premotor cortex and supplementary motor cortex (T=5.44; FWE $<$ 0.05). At LOW, the somatosensory cortex and cerebellum (T=6.46; FWE $<$ 0.05) were activated and at HIGH, only the cingulate gyrus was activated (T=6.53; FWE $<$ 0.05). **CONCLUSIONS:** By using a gold standard technique to analyze brain activity, we described here the modulation of brain areas to the RPE processing immediately after exercise cessation performed at different intensities. The integration of motor control, homeostatic regulation and cognitive related areas seems to, together, process the RPE responses after exercise.

**396** Board #234 May 29 9:30 AM - 11:00 AM  
**Different Characteristics Of Brain Function Between Endurance And Sprinting Athletes: A Resting State fMRI Study**

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Long-term motor training has been shown to create adaptations in regional brain plasticity, including brain structure and function, and this has been demonstrated by a number of studies. However, different influences on brain characteristics caused by different specific physical ability like endurance or sprinting still remain unknown. **PURPOSE:** To investigate spontaneous brain activity characteristics of national level endurance and sprinting athletes, as well as different pattern of brain functional connectivity between these two groups.

**METHODS:** Fifty-seven Chinese national level athletes were recruited and assigned to the endurance group (n=29) and the sprinting group (n=28) according to their physical fitness. Their resting functional magnetic resonance imaging data were acquired by Philips Achieva 3.0T Trio scanner with a standard 32 channel head coil for all subjects. Amplitude of low frequency fluctuation (ALFF) was used to evaluate the intensity of regional spontaneous brain activity. Based on the ALFF results and previous studies, six region of interests (ROIs) were defined, including the cingulate gyrus (6, -21, 27) and right SMA (4, -12, 74). Then whole-brain seed based-functional connectivity analysis was conducted to examine characteristics of brain activation

pattern. SPM8 was used for preprocessing and statistical analysis of the images, and DPARSF was used to acquire the ALFF and FC maps for each individual. Two-sample t-tests were used to analyze differences between the groups.

**RESULTS:** 1. Compared to the sprinting group, the endurance group demonstrated higher ALFF in the right cingulate gyrus (peak t= 4.20) and lower ALFF (peak t= 4.5) in the left precuneus ( $p < 0.001$ , cluster size $>$ 6). 2. The sprinting group showed higher functional connectivity between right cingulate gyrus and left Temporal Lobe (peak t=3.83), as well as right SMA and lateral prefrontal cortex (peak t= 4.06) ( $p < 0.001$ , cluster size $>$ 25).

**CONCLUSIONS:** Long time specialized training seems associated with the changes in athletes' regional spontaneous brain activity and patterns of brain functional connectivity.

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**397** Board #235 May 29 9:30 AM - 11:00 AM  
**Changes in Inhibitory Markers of Neuronal Plasticity Following Exercise and Intermittent Hypoxia**

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Studies exploring the effects of exercise in the brain mainly focus on exercise induced modulation of growth factors, whereas research regarding inhibitory factors of plasticity in the brain such as Nogo-A and chondroitin sulfate proteoglycans (CSPGs) is limited. **PURPOSE:** To determine the expression of CSPGs and Nogo-A in selected brain areas after treadmill exercise training or intermittent hypoxia.

**METHODS:** Male Wistar rats (228g  $\pm$  12.63) underwent six weeks of moderate intensity continuous training (MICT), high intensity interval training (HIIT), intermittent hypoxia (IH), IH and HIIT simultaneously (IH+HIIT), or remained sedentary (CON). MICT animals trained for 3 minutes at 25 cm.s<sup>-1</sup> followed by 30 minutes at 32 cm.s<sup>-1</sup>. HIIT animals trained for 3 minutes at 25 cm.s<sup>-1</sup> followed by five cycles of 3 minutes at 50 cm.s<sup>-1</sup> and 3 minutes at 15 cm.s<sup>-1</sup>. MICT and HIIT protocols were matched for duration and distance. IH animals were exposed to five cycles of 3 minutes of hypoxia (FiO<sub>2</sub> 15%) and 3 minutes of normoxia (FiO<sub>2</sub> 20.95%). The IH+HIIT animals were exposed to the IH and HIIT protocols simultaneously, training at the higher speeds during the hypoxic intervals. Hindlimb muscles were snap frozen and citrate synthase activity was measured. Brains were harvested following transcardial perfusions and fixation in 4% paraformaldehyde. 25  $\mu$ m coronal brain sections were immunohistochemically stained for Nogo-A and CSPGs. **RESULTS:** Preliminary results show that MICT reduced the average staining intensity of Nogo-A in the dentate gyrus (DG) (99%), CA1 (51%) and CA3 (98%) regions of the hippocampus compared to the CON group. HIIT reduced the intensity of Nogo-A to a larger extent than MICT in the CA1 region (62%). However, HIIT only slightly reduced the intensity of Nogo-A in the DG (22%) and CA3 (9%) regions. MICT increased the expression of CSPGs in the CA1 (300%) and CA3 (27%) regions and reduced the expression of CSPGs in the DG (77%) compared to CON. HIIT reduced the intensity of CSPGs in the DG (73%), CA1 (62%) and CA3 (61%) regions compared to the CON group. **CONCLUSIONS:**

These results show that MICT and HIIT have the capacity to reduce inhibitory molecules within the brain which may contribute to enhancing plasticity.

**398** Board #236 May 29 9:30 AM - 11:00 AM  
**Age-Related Variation of Pressure Pain Threshold and Condition Pain Modulation During an Ultra-Marathon**

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There is insufficient data available on age related variation in pain mechanisms during ultra-marathon competitions.

**PURPOSE:** We examine pressure pain threshold (PPT) and condition pain modulation (CPM) in older versus younger age groups during an ultra-marathon. **METHODS:** Informed consent was obtained from all subjects prior to their participation. Age groups were formed from the mean age of 41 years-old in our subject population: n=21 for  $<$ 40 years and n=23 for  $>$ 40 years. PPT was measured using a Baseline© Dolorimeter. The dolorimeter was placed equidistant to the radial and the ulna styloid processes. A trained technician applied consistent, gradual pressure until the subject indicated that they felt a change from pressure to pain. This was repeated three times and the mean score was used for statistical analysis. CPM was measured with the same technique while subjects placed the opposite hand in cold water (20°C). During this process neither the technician nor the subjects were able to see the dolorimeter. Another technician recorded the results to maintain double blinding of data collection. To investigate any differences between the pre versus post changes during the ultra-marathon "Delta" PPT and CPM values were calculated by subtracting the Post PPT

and CPM from the Pre PPT and CPM, respectively. Independent sample t-tests were used to assess differences in Delta values for PPT and CPM between the two age groups. **RESULTS:** The Post PPT and CPM were significantly decreased ( $p < 0.05$ ) for both age groups, indicating greater pain sensitivity. The age group analysis ( $< 40$  versus  $> 40$ ) showed a decrease in Delta PPT in the older age group: (Mean Delta  $< 40$  years = 149.40 kPa, Mean Delta  $> 40$  years = 48.38 kPa  $t(42) = 2.69$ ;  $p < .05$ . A similar decrease was found in Delta CPM: (Mean Delta  $< 40$  years = 31.75 kPa, Mean Delta  $> 40$  years = 11.69 kPa  $t(42) = 2.03$ ;  $p < .05$ . **CONCLUSION:** Previous research from our group has shown a decreased PPT and CPM, indicating greater pain sensitivity, across all ages during an ultra-marathon. In this present study we have seen similar decreases in PPT and CPM but clearly a difference between age groups in the degree of these changes. Further research is required to determine how factors of immunosenescence, directly or indirectly, may affect the age group variations in pain during an ultra-marathon.

**399** Board #237 May 29 9:30 AM - 11:00 AM  
**Impact of a Carbohydrate Mouth Rinse on Corticomotor Excitability after Mental Fatigue.**

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Mental Fatigue (MF) has been associated with reduced physical performance. Carbohydrate (CHO) mouth rinse (MR) has been shown to be effective at increasing corticomotor excitability. **PURPOSE:** The purpose of this study was to determine if CHO MR positively impacts corticomotor excitability and cognitive function after MF. **METHODS:** Nine subjects (6 females, 3 males; Age =  $23 \pm 1$  years; Height =  $170 \pm 3$  cm; Weight =  $68 \pm 4$  kg) completed 2 experimental sessions under different MR conditions (Placebo (PLAC), 6.4% glucose (CHO)) each separated by at least 48 hours and applied in a random fashion. Motor-evoked potential (MEP) of the left first dorsal interosseous (FDI) was determined at rest by transcranial magnetic stimulation (TMS) before and immediately after completion of a task designed to cause MF. The MF task required the subjects to complete six blocks (448 trials each) of the Stroop Color Word Test (SCWT). MR was applied between each SCWT block and held in the mouth for 20 sec. Perceived MF was recorded before and after the MF task using a 100 mm VAS. **RESULTS:** Perceived MF increased from pre (PLAC =  $16 \pm 6$  mm; CHO =  $19 \pm 7$  mm) to post (PLAC =  $41 \pm 5$  mm; CHO =  $46 \pm 4$  mm) in both conditions ( $p < 0.001$ ) but no differences were seen between the groups. Overall reaction time during SCWT was better ( $p = 0.03$ ) in CHO ( $698 \pm 10$  ms) compared to PLAC ( $738 \pm 16$  ms), but correct response rate was not different between the groups (PLAC =  $97.5 \pm 0.4$ ; CHO =  $98.1 \pm 0.2$ ). MEP improved ( $33 \pm 9\%$ ) ( $p = 0.03$ ) after the MF task in CHO (Pre =  $2241 \pm 633$   $\mu$ V; Post =  $2704 \pm 606$   $\mu$ V) and declined ( $-28 \pm 6\%$ ) ( $p = 0.02$ ) after the MF task in PLAC (Pre =  $1810 \pm 389$   $\mu$ V; Post =  $1208 \pm 244$   $\mu$ V). **CONCLUSIONS:** CHO MR was successful at preventing a reduction in corticomotor excitability subsequent to MF. CHO MR also had a positive impact on some measures of cognitive performance during the MF task. CHO MR did not impact perceived MF. These results suggest that CHO MR may be a valuable tool at combating the negative consequences of MF.

**400** Board #238 May 29 9:30 AM - 11:00 AM  
**The Influence Of Transcranial Direct Current Stimulation On Skill Acquisition In A Complex Motor Task.**

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 (No relevant relationships reported)

**INTRODUCTION:** A single application of transcranial direct current stimulation (tDCS) delivered to motor cortex improves skill acquisition in relatively simple motor tasks performed unilaterally with the hand and arm. **PURPOSE:** The purpose of this study was to examine the acute effects of tDCS on skill acquisition in a complex, multi-joint arm movement in healthy young adults. **METHODS:** The study employed a double-blind, SHAM-controlled, between-subjects experimental design. Twenty-two right-handed adults were randomly assigned to either a tDCS or a SHAM group. Subjects participated in one experimental session that involved overhead throws to a target in a baseline-test block, 5 practice blocks, and a post-test block (10 trials per block). After the baseline-test block, transcranial magnetic stimulation (TMS) was used to locate the first dorsal interosseus muscle (FDI) motor representation area (motor hot spot) of the left hemisphere. Subsequently, motor evoked potentials (MEP) were obtained in the resting FDI muscle prior to and after 5 minutes of tDCS (current: 1 mA). After a 20 minute rest period, tDCS was applied again for 20 minutes to the FDI hot spot while subjects performed the 5 practice blocks of overhead throws. Finally, subjects performed a post-test block of overhead throws

5 minutes after the tDCS/practice session ended. Motor performance was quantified as the endpoint error, whereas MEP amplitude was used to quantify cortical excitability. Percent change in endpoint error between the baseline-test block and the post-test block for the two groups was compared with an unpaired t-test. Similarly, percent change in MEP amplitude before and after the 5 minutes of tDCS for the two groups was compared with an unpaired t-test.

**RESULTS:** The percent change in endpoint error (decrease) was greater for the tDCS group compared to the SHAM group, but this difference just failed statistical significance ( $-16.9$  vs.  $-5.2\%$ ;  $P = 0.127$ ), whereas the percent change in MEP amplitude was significantly greater for the tDCS group compared to the SHAM group ( $49.7$  vs.  $-13.5\%$ ;  $P = 0.012$ ).

**CONCLUSION:** These findings indicate that a single-session of tDCS enhances cortical excitability and appears to improve motor skill, although there was high inter-individual response variability to tDCS for this difficult motor task.

**401** Board #239 May 29 9:30 AM - 11:00 AM  
**Impact of Acute Aerobic Exercise on Cue Reactivity in Heavy Episodic Drinkers**

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 (No relevant relationships reported)

Physical exercise has been shown to reduce craving for alcohol in alcoholics. There is a high prevalence of heavy episodic drinking in college-aged adults (18-29 years of age). This can be predictive of an alcohol or other substance use disorder developing later in life. **PURPOSE:** The purpose of this investigation is to examine the impact of acute aerobic exercise on cue reactivity to alcohol in heavy episodic drinkers. **METHODS:** Seven participants (6 females, 1 male) (Age =  $20 \pm 0.44$  years, BMI =  $22.6 \pm 0.59$ ,  $VO_{2Max} = 32.014 \pm 2.14$  ml $\cdot$ kg $^{-1}$  $\cdot$ min $^{-1}$ ) completed 2 experimental sessions. Heavy episodic drinking was identified using an adapted version of the CAGE questionnaire. During one session subjects rested for 30 minutes and during the other session subjects exercised for 30 minutes at a moderate exercise intensity ( $77 \pm 1\%$  of Peak HR). Sessions were randomized for each participant. Prior to and immediately following each session, EEG data were collected using a 64-channel system while subjects were exposed to 180 images (90 alcoholic drinks (ALC), 90 non-alcoholic drinks (NON)). Images were presented in a random order and preceded by a fixation stimulus using a variable time span (0.5 to 1.5 sec). Mean amplitude and peak latency was calculated for P300 (300-380 ms post stimulus) in parietal-occipital electrodes. **RESULTS:** Before exercise, subjects had a greater response ( $p = 0.002$ ) to ALC ( $1.85 \pm 0.20$   $\mu$ V) as compared to NON ( $1.47 \pm 0.21$   $\mu$ V). After exercise the response to ALC ( $1.62 \pm 0.37$   $\mu$ V) was similar to that seen for NON ( $1.72 \pm 0.31$   $\mu$ V). Before exercise the peak latency was shorter ( $p = 0.025$ ) for ALC ( $325 \pm 32$  ms) compared to NON ( $366 \pm 25$  ms). After exercise, the peak latency was similar for ALC ( $313 \pm 26$  ms) and NON ( $323 \pm 27$  ms). **CONCLUSION:** These findings suggest that acute aerobic exercise of moderate intensity attenuates cue reactivity to images of alcoholic beverages in heavy episodic drinkers.

**402** Board #240 May 29 9:30 AM - 11:00 AM  
**Effect of High Intensity Aerobic Training on Fitness and Health in Individuals with Parkinson's Disease**

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 (No relevant relationships reported)

Parkinson's disease (PD) is a neurodegenerative disorder characterized by motor dysfunction. Impaired mitochondrial capacity, as well as glucose and lipid toxicity, have been linked to neuronal dysfunction and apoptosis. Although aerobic exercise impacts these outcomes, few data exist in PD. **PURPOSE:** We tested the hypothesis that high intensity aerobic exercise (AEX) would improve aerobic fitness and metabolic outcomes. **METHODS:** Nineteen subjects (11 female, age:  $67.5 \pm 1.4$  yrs) with idiopathic PD (Hoehn and Yahr stage 2 or 3) were enrolled in a 16-week supervised aerobic exercise program. Subjects exercised 3d/wk at a rating of perceived exertion (RPE) of 15-17 for 30 min. They also performed 30 min. of unsupervised exercise 2d/wk at an RPE of 10-12. Paired sample t-tests were used to assess maximal oxygen consumption, 6 min. walk, body weight (kg), body fat % (BIA), respiratory exchange ratio (RER; indirect calorimetry), blood pressure (BP), heart rate (HR), as well as fasting glucose and free fatty acids (FFA) pre/post intervention. **RESULTS:** AEX increased  $VO_{2peak}$  (PRE:  $22.6 \pm 1.6$  vs. POST:  $25.1 \pm 1.4$  ml/kg/min.,  $p = 0.004$ ) and distance covered during the 6 min. walk (PRE:  $470 \pm 19.3$  vs. POST:  $539.7 \pm 24.3$  m,  $p = 0.0001$ ). AEX also reduced systolic BP (PRE:  $119 \pm 3.1$  vs. POST:  $106.7 \pm 2.6$  mmHg,  $p = 0.007$ ) and fasting FFA (PRE:  $0.40 \pm 0.07$  vs. POST:  $0.3 \pm 0.07$ ,  $p = 0.03$ ). There were no statistical change in body weight, body fat %, diastolic BP, HR, RER or fasting glucose. **CONCLUSIONS:** An AEX intervention improves fitness and

metabolic health independent of weight loss in PD. Whether AEX improves metabolic health and PD related clinical outcomes more than other exercise prescriptions awaits further investigation. Supported by a grant provided by The Manning Foundation.

**403** Board #241 May 29 9:30 AM - 11:00 AM  
**Dopaminergic Receptor and Transporter Densities in Nucleus Accumbens Are Not Altered by a Western Diet**

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 (No relevant relationships reported)

Multiple studies have indicated that physical activity regulation may be largely controlled by central neural factors, such as dopamine (DA) signaling in the nucleus accumbens (NAc). DA signaling has been shown to be altered by nutritional interventions. The key identified proteins involved with DA signaling are DA receptors one and two (DRD1, DRD2), tyrosine hydroxylase (TH), vesicular monoamine transporter (VMAT), and DA transporter (DAT).

**PURPOSE:** To determine if a high fat/high sugar (HFHS) diet alters DA signaling in the NAc of male and female C57Bl/6J mice. **METHODS:** Mice were randomly assigned to either a HFHS diet or a standard CHOW diet (C) at three weeks of age for a total of nine weeks. The C diet consisted of 4% fat, 25.2% protein, 39.5% carbohydrate, and 23.2% fiber, while the HFHS diet consisted of 45% fat, 20% protein, and 35% carbohydrate along with a 20% fructose solution replacing drinking water. Physical activity was measured using a running wheel for three days during the last week. Mice were sacrificed at 12 weeks, the NAc was dissected on ice, and flash frozen in liquid nitrogen. Immunoblotting was performed using NAc lysate probed with the following antibodies; DRD1, DRD2, TH, VMAT, DAT. Bands were analyzed after normalization using Welch's t-tests to compare target protein densitometries between the HFHS and C diet conditions. **RESULTS:** There were no significant differences in protein densitometries in male mice for DRD1, TH, VMAT, DAT, or DRD2 ( $p = 0.85; 0.46; 0.38; 0.38; 0.36$  respectively) or in female mice ( $p = 0.16; 0.39; 0.31; 0.33; 0.83$  respectively). **CONCLUSION:** A HFHS diet did not alter dopaminergic receptor or transporter densities in the NAc. Previous analyses revealed the HFHS group had greater kcal consumption and decreased physical activity while the C diet group had lower kcal consumption and higher physical activity. Thus, we conclude that each group mediated DA activity via separate mechanisms; the HFHS through diet and the C through physical activity.

**404** Board #242 May 29 9:30 AM - 11:00 AM  
**Changes in Cue Reactivity to Fatty Foods After Exercise**

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 (No relevant relationships reported)

Acute aerobic exercise has been shown to reduce craving for various addictive substances like cigarettes and alcohol. A similar effect has been seen in children when examining brain fMRI responses to fatty foods. **PURPOSE:** The purpose of this investigation is to examine the impact of acute aerobic exercise on cue reactivity to fatty and healthy foods in college-aged women. **METHODS:** Sixteen women (Age=21±1 years, BMI=22.1±0.5,  $VO_{2peak}=39.1\pm 1.5$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) completed 2 experimental sessions. During one session subjects rested for 30 minutes and during the other session subjects exercised for 30 minutes at a moderate exercise intensity (77±2% of Peak HR). Treatments were applied in a counter-balanced fashion and subjects fasted for 4 hours prior to each session. Prior to and immediately following each session, EEG was collected using a 64-channel system while subjects were exposed to 280 images (40 Distractor (DIS), 120 Fatty Foods (FAT), 120 Healthy Foods (HEALTHY)). Images were presented in a random order and proceeded by a fixation stimulus using a variable time span (0.5 to 1.5 sec). Adaptive mean and peak latency for N100 (100-130 ms post stimulus) and P300 (240-300 ms post stimulus) were determined in parietal-occipital electrodes. **RESULTS:** Before exercise, subjects had a greater P300 response ( $p=0.001$ ) to FAT (5.68±0.46 μV) as compared to HEALTHY (5.23±0.48 μV). After exercise the response to FAT (4.92±0.45 μV) was similar to that seen for HEALTHY (4.94±0.54 μV). The N100 response to FAT (Pre=3.48±0.24 μV; Post=2.96±0.28 μV) was greater than the response to HEALTHY (Pre=3.20±0.22 μV; Post=1.96±0.42 μV) before ( $p=0.001$ ) and after ( $p=0.005$ ) exercise. No differences in peak latency were seen for N100 or P300 at either time point. **CONCLUSION:** These findings suggest that acute aerobic exercise of moderate intensity can influence cue reactivity to images of fatty and healthy foods in college-aged women.

**405** Board #243 May 29 9:30 AM - 11:00 AM  
**Changes in Analgesia, Hyperphagia and Depression are Mediated by Endogenous Opioids Following Forced Swimming Exercise**

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 (No relevant relationships reported)

Exercise is specifically linked to at least three phenomena that are likely to involve opioid release; the 'athlete's high', increased pain tolerance, and addiction to exercise. Exercise studies that have examined the effects of the opiate receptor blocker naltrexone, found that its administration prior to exercise alter these before mentioned phenomena. **PURPOSE:** The purpose of this study was twofold: 1) to establish an exercise modality that is sufficient to stimulate the release of endogenous opioids and 2) to examine the role endogenous opioids play in post-exercise pain tolerance and depression. **METHODS:** Following a week of familiarization, mice underwent a 50-minute (min) bout of forced swimming (FS). Mice were injected with either saline (S; 0.9%) or the opioid blocker naltrexone (NTX; 4g/kg) 15 mins prior to exercise. Following exercise mice were challenged with a tail suspension test (TST), pain tolerance test or monitored for post exercise food consumption for 2 hours. **RESULTS:** NXT injection decreased total FS time (46 ± 1.2 mins. vs. 35 ± 1.6 mins;  $p<0.05$ ). Forced swimming increased food consumption by 88% ± 11 ( $p<0.05$ ) two hours following exercise but was abolished by NXT ( $p<0.05$ ), verifying an increase in opioid mediated hyperphagia. An increase in hot water tail immersion time following exercise ( $S = 2.72 \pm 0.13$  vs.  $FS = 4.28 \pm 0.19$ ;  $p<0.05$ ) demonstrated an improvement in pain tolerance. Pain tolerance decreased by 20% ± 0.05 with the addition of NXT ( $P<0.05$ ). Finally, a TST demonstrated that following a bout of exercise, mice spent 49 ± 3.1% less time immobile ( $p<0.05$ ), signifying lower depression levels. This effect was reversed with the opioid blockade ( $p<0.05$ ). **CONCLUSIONS:** Fifty minutes of forced swimming is an effective stimulus for the release of endogenous opioids and modulates behavioral changes specific to the release endogenous opioids in mice.

**406** Board #244 May 29 9:30 AM - 11:00 AM  
**Endurance Exercise-induced Autophagy Coincides With Anabolic Activation And Neurogenesis In The Hippocampus Of The Mouse Brain**

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 (No relevant relationships reported)

**PURPOSE:** Autophagy and neurogenesis play a pivotal role in maintaining cellular homeostasis of neurons in the brain. Endurance exercise (EXE) serves as a potent activator of both autophagy and neurogenesis in the hippocampus of the brain; however, the molecular mechanisms of the dual activation remains unclear. We investigated EXE-induced molecular signaling nexus of autophagy and neurogenesis pathways in the hippocampus.

**METHODS:** C57BL/6 mice (8 weeks old, male, n=24) were randomly divided into two groups: control (CON, n=12) and endurance exercise (EXE, n=12). Animals performed treadmill running exercise at 13 m/min (65-70%  $VO_{2max}$ ) for 60 min/day for 6 weeks. 24 hours after the last session of EXE, whole brains were excised, and the hippocampi were isolated for Western blot analysis. For immunofluorescence microscopy, the excised whole brains were frozen. A student t-test was used for statistical analysis ( $p<0.05$ ).

**RESULTS:** EXE significantly increased autophagy evidenced by an increase in LC3II, ATG7, BECLIN1, and phosphorylation of BCL-X<sub>L</sub> by JNK activation along with an increase in lysosomal proteins (LAMP2, CATHEPSIN L and TEEB,  $p<0.05$ ). Intriguingly, EXE-induced autophagy coincided with activation of anabolic signaling cascades (AKT-mTOR-p70s6k,  $p<0.05$ ), known to interfere in autophagy. This autophagy promotion was associated with activation of endoplasmic reticulum stress adaptors (p-PERK, ATF6, and p-IRE1,  $p<0.05$ ). Interestingly, EXE-mediated neurogenesis was induced, despite the downregulation of canonical neurotrophic factors (BDNF, GDNF, and NGF,  $p<0.05$ ). Instead, EXE promoted neuroglin-mediated neurotrophic signaling (p-ERK, p-RSK, and p-CREB,  $p<0.05$ ).

**CONCLUSIONS:** EXE-induced coactivation of autophagy and anabolism suggest that enhanced recycling of damaged molecules along with increased anabolism in the hippocampus may confer neuroprotective phenotypes of the brain. Furthermore, EXE-mediated improvement in neurogenesis devoid of canonical neurotrophic factors suggests that there exists a potential modulatory mechanism regulating the optimal levels of neurogenesis, which prevents undesired excessive chronic neurogenesis. Our results suggest that coactivation of autophagy and neurogenesis via EXE is critical for maintaining optimal neuronal homeostasis.

**A-54 Free Communication/Poster - Mental Health through the Lifespan**

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
Room: CC-Hall WA2

**407 Board #245 May 29 11:00 AM - 12:30 PM Suicidality, Physical Activity and Sport Participation in US Middle and High School Students**

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(No relevant relationships reported)

**PURPOSE:** Exercise is inversely related to both sadness and suicidality in developing adolescents. To date, the literature has addressed neither the contextual factors nor the dynamic fluctuations of these relationships in middle and high school children over time. The purpose of this study is to examine the temporal changes in the relationship between physical activity, sport participation, sadness, and suicidality in students in grades 6-12 in the U.S.

**METHODS:** Using the 2015 National Youth Risk Behavior Survey (N=199,194), regression models adjusted for age, sex, and race estimated the odds ratios between sadness, suicidal ideation, and suicidal attempts, stratified by exercise and sports participation.

**RESULTS:** Overall, 19.7% of students in grades 6-12 reported suicidal ideation or attempt. Only 68.4% of students reported  $\geq 60$  minutes of physical activity on four or more days of the week, and 55.2% reported sport team participation. Physical activity on four or more days per week was associated with a 27% reduction in the odds of suicidality, and sport team participation was associated with 17% reduction in suicidality.

**CONCLUSIONS:** Exercise and sport team participation are inversely related to sadness and suicidality in adolescents and this relationship persists throughout adolescence. Future research should examine the influence of exercise and sport participation on a longitudinal basis and identify other biopsychosocial factors that may be contributing to these results in developing adolescents.

**408 Board #246 May 29 11:00 AM - 12:30 PM Device-based Sedentary Time And Executive Function Among African-american Children With Behavior Disorders**

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(No relevant relationships reported)

Screen time in children with ADHD can exacerbate symptoms and affect self-regulation and attention. **PURPOSE:** To test relationships between device-based ST and children's executive function (EF) with behavior disorders. **METHODS:** Eleven African-American girls and 12 boys (mean age =  $9.3 \pm 1.9$ -years) wore a triaxial accelerometer for 5-consecutive-days at the beginning of an intervention trial. Evenson (2008) cut-points were used to determine ST (min/day), sedentary breaks (min/day), and ST% (% per day) during weekdays and a filter to remove intervention time and non-wear time during the night was applied. Data was included if a participants wore the accelerometer  $\geq 3$  weekdays for  $\geq 8$  hrs/day. EF was assessed through parental-report of behavioral manifestation of EF (BRIEF-GEC score) and children underwent neuropsychological tests of verbal and visuospatial working memory (AWMA verbal and AWMA visuospatial scores). ST (min/day) was reciprocal by 100 transformed to achieve normality. Bivariate correlations and multiple regression analyses tested relationships between EF and ST, controlling for wear-time and moderate-to-vigorous physical activity. **RESULTS:** On average, children spent  $295.60 \pm 67.17$  min/day in ST,  $417.60 \pm 120.78$  min/day in sedentary breaks, and  $49.31 \pm 7.11\%$  of the day in ST. Children obtained an average score of  $59.21 \pm 10.42$  points in BRIEF-GEC,  $32.70 \pm 25.68$  points in AWMA verbal score, and  $38.05 \pm 23.31$  points in AWMA visuospatial score. BRIEF-GEC, AWMA verbal, and AWMA visuospatial scores were low. In this case, BRIEF-GEC scores indicate a better EF, while AWMA verbal and visuospatial scores represent a less fewer difficulties in working memory and a less problematic behavior in the classroom. In bivariate correlations, a significant relationship was observed between ST% and AWMA visuospatial score ( $r(17) = -0.49$ ,  $p = 0.04$ ). None of the regression analyses, controlling for wear-time and moderate-to-vigorous physical activity, showed significant results, though there was a trend for all ST variables to explain  $\geq 15\%$  of the variance in AWMA visuospatial scores after controlling for wear-time. **CONCLUSIONS:** Few significant relationships were evident between objectively-measured ST and assessments of African-American children's EF with behavior disorders.

**409 Board #247 May 29 11:00 AM - 12:30 PM****Exercise Group In a Geriatric Psychiatry Clinic - Improving Physical Strength and Mental Health**

Sivan Klil-Drori<sup>1</sup>, Sophia Escobar<sup>1</sup>, Allana Goodman<sup>2</sup>, Marylin Segal<sup>3</sup>, Karl Looper<sup>1</sup>, Soham Rej<sup>1</sup>. *<sup>1</sup>McGill University, Montreal, QC, Canada. <sup>2</sup>Jewish General Hospital, Montreal, QC, Canada. (No relevant relationships reported)*

**Introduction:** Exercise has wide range of health benefits, more than any other single intervention. It improves depression and anxiety symptoms, attention and other cognitive functions. Exercise is recommended for common chronic diseases, such as diabetes, hypertension, coronary heart disease, osteoporosis, insomnia and more. Benefits to exercise include low cost, social interactions, no drug interactions or drug metabolism, improved physical health, and positive stigma.

**Methods:** We designed an exercise group for patients followed at our geriatric-psychiatry clinic. We recruited older adults age  $\geq 60$  with any type of major mental disorder, followed at the tertiary-care geriatric psychiatry clinic, Jewish General Hospital, Montreal.

**Intervention of Exercise Group:** Aerobic and anaerobic exercise, for 50 minutes, twice a week, total of 12 weeks, at medium intensity which gradually increased. Groups included 6-12 participants every 3 months and led by an exercise instructor. We ran four groups during 2017-2018.

**Results:** We had 24 individual participants in 4 groups, among them we had 9 patients who joined the group during the first 4 weeks of the 12-week session, completed at least 75% of the exercise sessions, and completed both pre- and post questionnaire (PHQ-9) were included in the final analysis.

**Quantitative results:**

We used the PHQ-9 to examine depressive symptoms, analysis by Wilcoxon signed rank test.

Pre and post intervention analysis showed improvement in depressive symptoms with a significant  $P = 0.03$

**Qualitative results:**

We conducted a focus group at the end of the fourth group. Repeated themes were: feeling more confident, stronger, more energetic, and more calm. Most patients described the exercise environment as positive, non-judgmental, and supportive. Quality of sleep during the night was not improved, though most patients mentioned feeling much less sleepy during the daytime.

**Conclusions:** Exercise could potentially help number of outcomes for older adults with mental illness. It has been shown to significantly improve depressive symptoms, and qualitative results show improvement in general well-being. Our results and future research in this field will help establish an evidence base to tailor this promising intervention to this vulnerable population of older adults with mental illness.

**410 Board #248 May 29 11:00 AM - 12:30 PM Functional Capacity, Cognition And Spatial Navigation In Older Adults With Mild Cognitive Impairment**

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(No relevant relationships reported)

Spatial navigation is a complex and fundamental cognitive ability that allows an individual to maintain independence and, combined with episodic memory, emerges as one of the first deficits in patients with Alzheimer's disease (AD). A successful spatial navigation depends on an interaction between physical (mobility, balance and aerobic capacity) and cognitive ability (memory and executive function). However, although Mild Cognitive Impairment (MCI) typically precedes AD, the mechanisms of spatial navigation in real environment in this population are still not well understood, especially the influence of physical variables.

**Purpose:** To compare spatial navigation performance through use of the Floor Maze test (FMT) - an easy-to-apply two-dimensional maze - on healthy elderly individuals and those with MCI. A secondary objective we examined which cognitive and functional functions were associated with performance in this task.

**Methods:** We evaluated 62 older adults ( $> 60$  years) (healthy=39; MCI=23). Spatial navigation was evaluated through the FMT (Planning (PMT), Immediate (IMT) and Delayed Maze Time (DMT)). Functional capacity was evaluated through the Sit to Stand, 8 Foot up and go and STEP (Senior Fitness Test battery). Cognitive functions were evaluated through MMSE, clock-drawing test, Verbal Fluency, RAVLT, Digit Span and Trail Test (A and B). The relationship and possible association between FMT performance and independent variables were analyzed using multiple and logistic regression models.

**Results:** The group with MCI was significantly slower in all stages of the FMT. PMT performance was associated with clock drawing test ( $R^2 = 0.26$   $p < 0.001$ ). Performance in the IMT was associated with STEP ( $R^2 = 0.15$   $p = 0.02$ ), while DMT was influenced by the STEP and clock drawing test ( $R^2 = 0.33$   $p < 0.001$ ). Logistic regression analysis

showed that older adults with low aerobic capacity are 18 times more likely to have a worse performance in the DMT ( $O.R=18.76$   $p=0.04$ ).  
 Conclusion: Older adults with MCI presented significant spatial navigation deficits. Their performance on the FMT is mainly influenced by spatial orientation and aerobic capacity. Elderly people should be encouraged to practice physical exercises, aiming to maintain cardiorespiratory levels and spatial navigation.

**411** Board #249 May 29 11:00 AM - 12:30 PM  
**Do Aerobic Exercise And Mindfulness Act Synergistically To Mitigate Psychological Distress In High-stress College Students?**

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 (No relevant relationships reported)

Mindfulness meditation (MM) and aerobic exercise (AE) decrease stress, but the combined effects are unknown. **Purpose:** Assess effects of AE plus MM, compared to effects of MM alone, on stress in young adults. **Methods:** High-stress, sedentary ( $N=32$ , 27 F,  $20.5 \pm 2.7$  years,  $23.9 \pm 5.0$  kg/m<sup>2</sup>) individuals were randomized to a 4-week MM, AE+MM, or control group. MM and AE+MM groups participated in 200 minutes/week of guided MM or AE+MM. MM consisted of present moment, non-judgmental awareness. AE consisted of moderate-intensity ( $\approx 40$ -60% heart rate reserve) exercise. Stress (PSS) and anxiety/depression symptoms (DASS) were measured at baseline, and after weeks 1 and 4. An analysis of variance assessed effects of group and time on PSS and DASS. **Results:** There were no group x time interactions for PSS ( $p = 0.12$ ) or DASS ( $p = 0.21$ ). There were main effects of time in which PSS and DASS were significantly lower after week 1 (PSS:  $p = 0.04$ ; DASS:  $p = 0.01$ ) and at post-intervention (PSS:  $p < 0.001$ ; DASS:  $p = 0.004$ ) compared to baseline. There were large effect size (ES; Cohen's  $d$ ) changes in the pre to post PSS and DASS scores for the MM (PSS: -1.33; DASS: -1.03) and AE+MM (PSS: -1.24; DASS: -0.97) groups, and small ES changes in the PSS and DASS scores for the control group (PSS: -0.45; DASS: -0.13). **Conclusion:** MM may be as effective as AE+MM in combatting psychological distress in high-stress young adults. Further research should compare AE-only to AE+MM.

**412** Board #250 May 29 11:00 AM - 12:30 PM  
**The Feasibility Of Pilates To Improve Mental Health Outcomes Among People With Multiple Sclerosis: An 8-week Randomized Controlled Pilot Trial**

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 (No relevant relationships reported)

Evidence supports positive effects of exercise on mental health outcomes among people with Multiple Sclerosis (PwMS). However, non-traditional exercise modes like yoga, tai chi, and Pilates remain understudied. **Purpose:** Thus, this 8-week feasibility trial examined the effects of supervised or home-based Pilates compared to a wait-list control on mental health outcomes among PwMS. **Methods:** Nineteen PwMS were recruited; one refused randomization and the one male was omitted from analyses. Seventeen females (49.8±8.4 y) were randomised to two weekly sessions of supervised Pilates ( $n=5$ ), two weekly home-based Pilates sessions guided by a DVD ( $n=6$ ), or wait-list control ( $n=6$ ). Pilates sessions involved 60min sessions of 14 mat-based beginners' level exercises; repetitions progressed from 4-10 for each exercise across eight weeks. Feasibility was assessed relative to recruitment, retention, compliance with the Pilates intervention, and the presence/absence of adverse events. Well-validated questionnaires assessed symptoms of anxiety, depression, and fatigue, and mood states at baseline and weeks two, four, six, and eight. Differences in outcome change were examined with 3 group X 4 time ANCOVAs adjusted for baseline. Significant interactions were decomposed with simple effects analysis. Hedges'  $d$  effect sizes quantified magnitude of change. **Results:** Attrition was high for supervised Pilates ( $n=2$  of 5; 40%); no home-based or wait-list participant withdrew. Compliance was high across groups (>80%). No adverse events were reported. Group X time interactions were significant for feelings of depressed mood ( $F_{(6,33)}=2.80$ ,  $p<0.03$ ), physical symptoms of fatigue ( $F_{(6,33)}=4.92$ ,  $p\leq 0.001$ ), and total fatigue ( $F_{(6,33)}=3.76$ ,  $p\leq 0.006$ ). Compared to wait-list, scores for home-based Pilates were significantly lower (all  $p\leq 0.02$ ) for feelings of depressed mood at weeks 4 ( $d=1.25$ ), 6 ( $d=0.47$ ), and 8 ( $d=0.90$ ), physical symptoms of fatigue at weeks 4 ( $d=0.84$ ) and 8 ( $d=0.82$ ), and total fatigue at weeks 4 ( $d=0.60$ ) and 8 ( $d=0.57$ ). **Conclusions:** Findings support the feasibility of home-based Pilates to improve mental health outcomes among women with MS. These results support development of larger randomized controlled trials to better understand Pilates' clinical effectiveness and plausible mechanisms of action.

**413** Board #251 May 29 11:00 AM - 12:30 PM  
**Physical Activity and Sedentary Behaviors Influence Executive Function and Psychological Well-being in Chinese University Students**

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**PURPOSE:** To investigate the associations of physical activity and sedentary behaviors with executive function and psychological well-being in Chinese university students.

**METHODS:** Participants were 214 college students (aged  $19.0 \pm 1.1$  yrs, 46.3% women) recruited from Shanghai, China. Executive function was assessed using a task switching paradigm. The outcomes of the task were global switch costs and local switch costs. The self-rating anxiety scale (SAS) and the self-rating depression scale (SDS) were used to measure anxiety and depressive status, respectively. Sleep quality was assessed by the Pittsburgh sleep quality index (PSQI). Physical activity was objectively measured using hip-mounted accelerometry monitors (Actigraph wGT3X-BT, Pensacola, FL, USA). Time spent on TV viewing, computer use, and smartphone use was used as indicators of sedentary behaviors, which were surveyed by a questionnaire. Linear regression modelling was conducted to assess the associations of physical activity and sedentary behavior with executive function and psychological variables.

**RESULTS:** Female students accumulated more time spent on light physical activity (LPA) ( $157.2 \pm 37.7$  vs.  $131.1 \pm 48.0$  min,  $P < 0.01$ ) and moderate-to-vigorous physical activity (MVPA,  $49.6 \pm 22.3$  vs.  $38.6 \pm 17.0$  min,  $P < 0.01$ ), and had higher total PA ( $326.9 \pm 119.6$  vs.  $271.7 \pm 114.8$  CPM,  $P < 0.01$ ) than males. After adjustment for wear time of accelerometers, age and gender, MVPA ( $\beta = -0.19$ , 95% CI, -0.35 to -0.03,  $P = 0.02$ ) and LPA ( $\beta = -0.17$ , 95% CI, -0.34 to -0.01,  $P = 0.04$ ) were associated with smaller global switch costs, which indicated that higher levels on MVPA and LPA were associated with better task switching performance. Longer time spent on smartphone use was associated with worse scores on depression ( $\beta = 0.31$ , 95% CI, 0.15 to 0.47,  $P < 0.001$ ), anxiety ( $\beta = 0.29$ , 95% CI, 0.13 to 0.45,  $P < 0.001$ ) and sleep quality ( $\beta = 0.29$ , 95% CI, 0.14 to 0.44,  $P < 0.001$ ). No other significant associations were observed. **CONCLUSIONS:** Participation in physical activity was associated with better performance on a test of executive function. Longer time on smartphone use was associated with worse scores on depression, anxiety and sleep quality. Therefore, interventions targeting college students should be developed to increase physical activity and reduce smartphone use.

**414** Board #252 May 29 11:00 AM - 12:30 PM  
**High Intensity Interval Training Is Associated With Decreased Negative Affect In Individuals With Anxiety Disorders**

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**INTRODUCTION:** Exercise has been shown to reduce negative affect (NA) in people with anxiety.

**PURPOSE:** To investigate associations between 2 heart rate (HR)-derived indices of exercise volume and change scores on NA measures using a novel high intensity interval training (HIIT) protocol administered at home with remote coaching in people with anxiety disorders.

**METHODS:** In a pilot study, eleven insufficiently active people (Chester Step Test estimated baseline  $VO_{2peak} = 33.18 \pm 5.89$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) diagnosed with an anxiety disorder and State-Trait Anxiety Inventory (STAI) score > 44 performed a 6-week, 4 days/week HIIT program using a stepper machine. Each session included 8 to 12-minutes of HIIT (20/40 sec ratio - target HR 85% of estimated maximal HR) and data were uploaded to a cloud server. Questionnaires were collected at baseline, 3, and 6 wks. Continuous HR was recorded, producing an HR curve. Amount of exercise was computed as the sum ( $AUC_s$ ) and average ( $AUC_a$ ) area under these HR curves above the baseline resting HR. For each combination of the 6 clinical outcomes (STAI, Depression, Anxiety, and Stress Scales and Quality of Life Questionnaires) and 2  $AUC$  measures, nonparametric correlations were calculated and adjusted by Bonferroni correction for multiple comparisons (significant if  $p < .0014$ ). Correlations were calculated for change scores from baseline to wk 6, baseline to wk 3, and wk 3 to 6. **RESULTS:** 2 males and 9 females aged  $25.05 \pm 2.82$  years, BMI  $23.95 \pm 4.27$  completed the study. Adherence was 88%.  $AUC_s$  and  $AUC_a$  in the first 3 wks were negatively associated with wk 3-baseline change in state anxiety ( $r = -.95$ ,  $p < .0001$  and  $r = -.84$ ,  $p < .0014$  respectively), indicating that patients with greater volume of exercise experienced greater state anxiety reductions over the same period.  $AUC_s$  and  $AUC_a$

variance explained 90.25% and 70.56% of the variance in state anxiety change over the same period, respectively. Correlations between AUC indices and other NA measures also were negative but nonsignificant, possibly due to small sample size.

**CONCLUSIONS:** AUC indices were significantly and inversely associated with changes in state anxiety from baseline to wk 3 and the remaining outcomes showed nonsignificant associations in the predicted directions. HIIT could be a promising intervention to reduce NA in anxiety disorders.

**415 Board #253 May 29 11:00 AM - 12:30 PM**  
**Examination of Eating Disorder Risk among Female College Athletes and Performers**

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The demands of being a female college athlete/performer may create mental and physical stress that may increase the likelihood of eating disorders and disordered eating. **PURPOSE:** The overall purpose was to examine the prevalence of Eating Disorder (ED) risk among female college athletes/performers across academic status and sport type (equestrian, volleyball, beach volleyball, women's soccer, softball, and ballet). **METHODS:** Data from a larger cross sectional was used. A convenience sample of NCAA Division I female athletes/performers (n=127; age: 19.8±2.0 years; weight: 63.6±9.2 kg, height: 163.9±28.8 cm) from a University in the southeastern region of the United States participated in the study. Participants completed a basic demographic survey, the Eating Disorder Inventory-3 (EDI-3), and the EDI-3 Symptoms Checklist (SC). Basic descriptive stats were used for demographic information. Cross-tabulations were used to examine the proportion of participants classified as "at risk for EDI-3 and EDI-3 SC" across sport and academic status. **RESULTS:** Significant differences [X<sup>2</sup>(15, N=127) = 25.2, P=0.04] were found between the distribution of ED risk and sport with 18.9% (n=24) at risk for EDI-3; 29.9% (N=38) EDI-3 SC, and 31.5% (n=40) were at risk for both EDI-3 and EDI-3 SC. Overall, pathogenic behaviors revealed: 52.8% (n=66) dieting, 13.6% (n=17) exercise 50-100% of the time to lose weight, 20% (n=25) binge eating, 13.6% (n=17) purging, 4.0% (n=5) laxatives, 7.2% (n=9) diet pill use, and 1.6% (n=2) use diuretics. A significant difference between dieting and sport [X<sup>2</sup>(5, N=125) = 12.2, P=0.03] was found with the highest prevalence within equestrian (16%, n=20/28) and ballet (13.6%, n=17/29). Sport type and exercise to control weight more than 50-100% of the time was significantly different [X<sup>2</sup>(20, N=125) = 54.1, P<0.01] with the highest prevalence within equestrian (10.4%, n=13/29). **CONCLUSIONS:** Athletes in the college setting are at risk for eating disorders. Medical professionals such as athletic trainers who work within this setting need to be educated on the potential risk factors that can lead to EDs. There should be a referral process in place for those athletes who are at risk. Those involved in the screening, prevention, and treatment of at-risk athletes should understand the sensitive nature of the topic.

**416 Board #254 May 29 11:00 AM - 12:30 PM**  
**The Relationship Between Physical Activity, Sleep Quality, and Subjective Well-being in College Students**

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While previous studies have well documented the beneficial effects of physical activity (PA) and sleep quality on mental disorders (e.g., depression and anxiety), relatively few have explored their relationship with subjective well-being (SWB), which is a core construct in positive psychology and is linked with various health outcomes. **Purpose:** To examine the associations between the PA, sleep quality, and SWB in college students while controlling for gender and age. **Methods:** 726 college students (41.1% female, mean age = 19.28 years) voluntarily completed a set of questionnaires assessing the life satisfaction (Satisfaction with Life Scale), happiness (Subjective Happiness Scale), positive affect and negative affect (Scale of Positive and Negative Experience), walking, moderate-intensity PA (MPA), and vigorous-intensity PA (VPA; International Physical Activity Questionnaires), and sleep quality (Pittsburgh Sleep Quality Index). Four multiple regression models were performed with happiness, life satisfaction, positive affect, and negative affect as the outcome variables, respectively. Walking, MPA, VPA, and sleep quality were predictor variables for each model. Age and gender were controlled in each model as covariates. **Results:** The regression models indicated that the predictors significantly explained the variance for each outcome with R<sup>2</sup> being 15.68% for life satisfaction, 19.43% for happiness, 22.32% for positive affect, and 24.81% for negative affect (p's < 0.001). Higher levels of VPA were associated with higher levels of life satisfaction (β = 0.09, p = 0.008), happiness (β = 0.26, p < 0.001), and positive affect (β = 0.13, p < 0.001), and lower levels of negative affect (β = -0.10, p = 0.003). However, MPA and walking were associated with none of the outcome variables (p's > 0.05). This emphasized the importance of the intensity of physical activity in advancing SWB. Better sleep quality

was associated with higher levels of life satisfaction (β = 0.37, p < 0.001), happiness (β = 0.36, p < 0.001), and positive affect (β = 0.43, p < 0.001), and lower levels of negative affect (β = -0.47, p < 0.001).

**Conclusion:** For college students, better sleep quality and regular participation in VPA are beneficial for SWB while increased levels of walking and MPA might not be helpful in improving SWB.

**417 Board #255 May 29 11:00 AM - 12:30 PM**  
**Patterns of Physical Activity and Mental State Among College-Aged Men and Women**

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**PURPOSE:** Increasingly, mental health is a concern among young adults. It is known that physical activity can improve mental health. The present investigation sought to examine the associations of physical activity on mental health by sex. **METHODS:** Eighty-one young adults (20.5±1.5 years) took part in the investigation. The participants underwent body fat percentage assessment and completed the Depression, Stress and Anxiety Scale (DASS 21) and the Leisure and Physical Activity Survey (LPA). Data were analyzed for associations between sex, physical/sedentary activities, body composition and mental health via multiple linear regression analysis. **RESULTS:** Female participants (n=49) reported less weightlifting exercise (p<0.001, 55% 0-2 days, 41% 3-5 days, 4% 6-7 days) compared to males (23% 0-2 days, 61% 3-5 days, 16% 6-7 days); however, no significant sex differences were noted for aerobic exercise. Physical activity by sex was regressed against scores from the DASS 21. Significant interactions were noted between sex and min/day of aerobic exercise (F=6.26, p=0.003) and days/week engaged in weightlifting exercise (F=5.46, p=0.006) for anxiety. In contrast to males, females engaged in higher numbers of weight training sessions and reported increased anxiety (0-2 days: 5.33±4.28; 3-5 days: 5.65±5.51; 6-7 days: 7.50±9.19). Whereas increasing time of aerobic exercise among females was associated with lower anxiety (0-15 min per session: 12.5±5.0; 16-30 min per session: 4.65±4.74; >30 minutes per session: 4.47±2.87), male students who engaged in more days per week of weight lifting exercise reported lower levels of anxiety (0-2 days: 10.00±5.88; 3-5 days: 4.52±2.98; 6-7 days: 3.6±3.21). **CONCLUSIONS:** For college-aged females, a focus on time engaged in aerobic exercise may produce not only cardiovascular benefits, but also psychological, and encouraging resistance exercise among college males may have similar results. University and college communities should encourage different patterns of exercise for male and female students to reduce anxiety.

**418 Board #256 May 29 11:00 AM - 12:30 PM**  
**Moderate and Intense Exercise not Modify Anxiety Scores but Promote Different Affective Answers in Adults**

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It is well known that moderate exercise can positively modulate mood states; however, few studies have shown the effects of intense exercise. **PURPOSE:** Compare the impact of moderate and intense exercise on anxiety, affective and positive subjective experience answers in healthy adults. **METHODS:** Ten healthy male subjects (28.70±6.25yrs; 72.51±10.68kg; 175±4.38cm; 23.60±2.66kg/m<sup>2</sup>; 16.56±6.38%Fat mass), were submitted to two intensities based on maximal treadmill test separated by 7 days: 1) 60%; 2) 85%. For these conditions, the subjects answered a Subjective Exercise Experiences Scale (SEES) and IDATE-State scale in the following time-courses: baseline (B), immediately after (IA) and 30 minutes after (R) finishing of the exercise. The Feeling Scale (FS) was recorded at 1, 5, 10 and last minutes of exercise. The situations were compared by two-way ANOVA with post-hoc Duncan test, with significance p<0.05. The protocol was approved by Unifesp Ethics Committed (#2.381.537). **RESULTS:** We didn't observe differences in anxiety comparing groups or time-courses, however, SEES Positive well-being subscale show lower scores at IA during 85% when compared with 60% (19.90±2.23vs17.40±2.95; p=0.02). The increase of fatigue was observed at B when compared IA in 60% (6± 3.83vs11.10±7.64; p=0.01). Similar data was observed in 85%, with increase in B when compared to IA (8.80±6.39vs14.40±7.41; p=0.006) and remain higher at R (p=0.03). The FS on 60% show a significant decrease at last minute compared to 1 (p=0.0002), 5(p=0.002) and 10(p=0.009) minutes; on 85%, similar data was observed. The last minute was lower when compared to 1 (P<0.001), 5 (p<0.001), 10 (p<0.001); but the 10 minute was

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lower compared to 1 ( $p < 0.001$ ) and 5 ( $p < 0.001$ ). When comparing intensities 60% showed higher scores at the FS at the 10 ( $p < 0.001$ ) and the last minute ( $p < 0.001$ ) compared to 85%.

**CONCLUSIONS:** The comparison between the exercise intensities show that, there was no difference between anxiety scores, on the other hand, moderate exercise presented better IA well-being response, faster fatigue recovery and maintained affectivity with positive values indicating pleasure from the beginning to the end of the test.

**419** Board #257 May 29 11:00 AM - 12:30 PM  
**Impact of Wearing Graduated Compression Stockings on Psychological and Physiological Responses during Prolonged Sitting**

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**PURPOSE:** Links between a prolonged sitting and increased risk of cardiovascular diseases or poor mental health have been found. A usage of compression garment may have some potential psychological and physiological benefits during prolonged sitting.

**METHODS:** We investigated the impact of with or without wearing graduated compression stockings on psychological and physiological responses in 18 healthy young people (12 men and six women) during 3 h prolonged sitting. Heart rate (HR) was measured throughout the sitting time, and heart rate variability (HRV) was analyzed to evaluate sympathetic and para-sympathetic nerve activity at pre, 1h, 2h, and 3h during the sitting for 5-min each. To assess psychological stress-related variables, Profile of Mood States (POMS) and saliva cortisol were evaluated before and after 3 h sitting. Visual analogue (VAS) scale was also assessed for whole body and lower limbs uncomfortable feelings.

**RESULTS:** POMS scores did not show marked differences between with and without stockings. A 3 h sitting significantly decreased saliva cortisol in both conditions ( $P < 0.05$ ) with no differences between conditions ( $0.263 \pm 0.108$  mg dl<sup>-1</sup> vs.  $0.189 \pm 0.075$  mg dl<sup>-1</sup> without stockings at pre vs. post;  $0.267 \pm 0.100$  mg dl<sup>-1</sup> vs.  $0.186 \pm 0.081$  mg dl<sup>-1</sup> with stockings at pre vs. post). Wearing stockings suppressed a subjective uncomfortable sensation (e.g., pain; swelling) in the lower limbs assessed by VAS ( $58.2 \pm 23.3$  mm without vs.  $39.3 \pm 24.4$  mm with stockings,  $P < 0.001$ ). HR at 1 h and 3 h was significantly greater without than with stockings ( $77 \pm 8$  bpm without vs.  $74 \pm 6$  bpm with stockings at 1h, and  $80 \pm 9$  bpm without vs.  $75 \pm 6$  bpm with stockings at 3h,  $P < 0.05$ , respectively). High-frequency oscillations (0.15-0.4 Hz) showed higher values with than without stockings throughout the 3 h sitting period, and it was significantly higher at 1 h ( $229 \pm 169$  m sec without vs.  $324 \pm 251$  m sec with stockings,  $P < 0.05$ ). When data for both conditions were pooled, pre-to-post changes in saliva cortisol were positively associated with higher VAS in the lower limbs and negatively associated with changes in the Vigor subscale of POMS ( $P < 0.05$ , respectively).

**CONCLUSIONS:** These findings suggest that wearing graduated compression stockings may benefit from subjective comfort and increased parasympathetic nerve activity.

**420** Board #258 May 29 11:00 AM - 12:30 PM  
**Psychosocial Mechanism of Adolescents' Physical and Mental Health: A Self-Determination Health Behavior Perspective**

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**PURPOSE:** Research indicates that adolescents' health can be promoted by satisfying their basic psychological needs through a supportive social environment in school physical education (PE; Ryan & Deci, 2017). Guided by the Self-Determination Health Behavior Model (SDHBM; Ryan et al., 2008), this study aimed to examine the relations among perceived need support (i.e., autonomy support, competence support, and relatedness support), need satisfaction (i.e., autonomy, competence, and relatedness), physical health (i.e., physical fitness [PF]), and mental health (i.e., health-related quality of life [HRQOL]) among adolescents. The mediation models were conducted to specify relations among psychosocial processes toward PE, adolescents' PF and HRQOL, respectively. **METHODS:** A prospective correlational design was used across one academic school year. Participants were 198 adolescents (58.6% female;  $M_{age} = 12.63$ ) recruited from three schools in the south region of the U.S. At the beginning of school year, participants completed previously validated questionnaires assessing their perceived need support and need satisfaction toward PE. At the end of school year, they self-reported their HRQOL using the PedsQL™ inventory, which included measures of physical, emotional, school, and social functioning. Finally, FitnessGram® test battery was used to measure their PF including body composition,

aerobic fitness, and muscular fitness. **RESULTS:** Correlation analysis revealed positive associations among the study variables ( $r$ s ranged from .19 to .83). Using structural equation modelling (AMOS 22.0), the hypothesized model resulted with a good fit to the data ( $\chi^2/df = 130.46/61$ ; IFI = .93; CFI = .93; RMSEA = .076; 90% CI [.058, .094]). The need support had a direct influence on need satisfaction ( $\beta = .79$ ,  $p < .01$ ), and need satisfaction had a direct contribution on PF ( $\beta = .23$ ,  $p < .05$ ). The psychosocial process from need support to need satisfaction had no direct influence on HRQOL, but had an indirect influence through PF ( $\beta = .34$ ,  $p < .01$ ). **CONCLUSION:** The findings supported the theoretical tenets of SDHBM in adolescents, particular on their physical health. Creating a need-supportive environment in PE is critical in order to enhance adolescents' need satisfaction, which ultimately indirectly influence their HRQOL.

**421** Board #259 May 29 11:00 AM - 12:30 PM  
**Differences in Depressive Symptoms across Physical Activity Levels Based on Comorbid Anxiety and Depression Status**

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 (No relevant relationships reported)

Research supports inverse associations between physical activity (PA) and depressive symptoms and status among adolescents. However, the degree to which comorbid anxiety and depression status may influence relations of PA with depressive symptoms is unknown. **PURPOSE:** This study investigated differences in depressive symptoms across low, moderate, and high PA frequencies among adolescents with no anxiety or depression, anxiety-only, depression-only, and comorbid anxiety and depression. **METHODS:** Adolescents ( $N = 481$ ; 200 female) aged 15.1±1.7y self-reported PA frequency (modified PACE+); low, moderate, and high PA were classified as engaging in  $\geq 60$ mins of PA 0-2, 3-4, and  $\geq 5$ /wk, respectively. Depressive symptoms were assessed with the Quick Inventory of Depressive Symptomatology ( $\geq 6$  indicated depression status). The Trait subscale of the State-Trait Anxiety Inventory assessed trait anxiety ( $\geq 50$  indicated high trait anxious status). Two-way ANCOVA examined variation in depressive symptoms according to the interaction of PA and comorbid anxiety and depression status. Covariates were age, sex, rural or urban residence, and school sex-type (i.e., female only, male only, or mixed sex). Bonferroni-adjusted simple effects analysis decomposed significant interaction. **RESULTS:** The two-way interaction between PA and comorbid status was statistically significant ( $F_{(6,385)} = 4.69$ ,  $p < 0.001$ ,  $\eta_p^2 = 0.07$ ). Depressive symptoms were significantly lower among those with comorbid anxiety and depression with moderate PA compared to low PA (mean difference = -2.29,  $p \leq 0.007$ ) and high PA (mean difference = -2.65,  $p \leq 0.003$ ). Depressive symptoms were significantly higher for comorbid anxiety and depression compared to depression-only for those engaged in low PA (mean difference = 3.73,  $p < 0.001$ ) and high PA (mean difference = 3.40,  $p < 0.001$ ), and non-significantly higher among those engaged in moderate PA (mean difference = 1.26,  $p > 0.30$ ). This finding may be due partly to the smaller number of comorbid anxiety and depression participants with moderate PA (22 vs. 48). **CONCLUSIONS:** Depressive symptoms differed across PA levels based on comorbid anxiety status. Though the exact role of comorbid anxiety is not clear, it may be important to consider relative to relations of PA with depressive symptoms among adolescents.

**422** Board #260 May 29 11:00 AM - 12:30 PM  
**Improving Acute Exercise Prescription In Depression: Predictors Of Optimal Intensity For Improving Depressive Mood**

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Overall mood improves following acute exercise for people with major depressive disorder (MDD), yet it is unclear how to maximize this effect. Determining factors that predict what the most beneficial intensity of exercise is for an individual could lead to prescriptions that maximize the positive effects of each session potentially leading to increased exercise participation. **PURPOSE:** To explore potential factors influencing the most effective exercise intensity for improving mood in individuals with MDD. **METHODS:** Women with MDD ( $n = 24$ ) were prescribed 20-minute sessions of light (L), moderate (M), and hard (H) intensity exercise (rating of perceived exertion: 11, 13, 15, respectively) in a counterbalanced, within-subject design. The most effective session was defined as the one resulting in the greatest reduction in depressive mood (measured via depression subscale of Profile of Mood States) from pre- to post-exercise for each participant [L ( $n = 10$ ), M ( $n = 9$ ), and H ( $n = 5$ )]. Potential individual factors related to these effects were age, body mass index (BMI), objectively measured minutes of total daily moderate to vigorous physical activity as well as weekly physical activity in bouts  $\geq 10$ min, and total sedentary time and prolonged sedentary time

(PSED; time in bouts  $\geq 30$ min). Kruskal-Wallis tests compared all groups for each predictor, with the Dunn test and effect sizes (Cohen's  $d$ ) comparing each group pair (L:M, M:H, L:H). **RESULTS:** Potential predictive factors did not differ significantly based on group (all  $p > 0.05$ ). However, effect sizes showed large differences for L:H comparisons in: PSED (pairwise  $p = 0.021$ ;  $d = -1.23$ ), age ( $d = 1.08$ ), and BMI ( $d = 0.81$ ). While effect sizes comparing L or H to M were smaller, PSED, age and BMI generally followed a linear pattern L-M-H. **CONCLUSIONS:** While there were no overall differences across groups, effect sizes indicated that light intensity led to the greatest improvement for people who were younger, had lower BMI, or spent more hours in PSED, while hard exercise was most beneficial for the reverse (i.e. older, high BMI, low PSED). The large effect sizes in the present sample suffering from MDD suggest personal characteristics may influence the affective response to acute exercise, yet more research is required to determine the reliability and magnitude of these effects.

**423** Board #261 May 29 11:00 AM - 12:30 PM  
**Impact of a Simulated Workday of Sit-stand Desk Use on Sleep Among Adults Screened as High Risk for Sleep Apnea**

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Exercise improves sleep and reduces apnea severity in adults with obstructive sleep apnea (OSA). However, whether reducing sedentary behavior impacts sleep and apnea severity is unknown. **Purpose:** To examine whether reducing prolonged sitting during a simulated workday by use of a sit-stand desk leads to changes in sleep compared to a sedentary workday in a sample of adults at high risk for OSA. **Methods:** Eight inactive adults (5 males, 53.8 $\pm$ 8.5 yr, body mass index: 29.8 $\pm$ 5.5 kg/m<sup>2</sup>) who were classified as 'high risk' for OSA based upon the STOP-BANG screening algorithm participated in a randomized crossover trial consisting of two simulated 8-h workdays: (1) continuous sitting (SIT); and (2) alternating periods of sitting and standing every 30 min (SIT-STAND). Sleep and apnea were assessed on the night following each simulated workday by wrist-worn actigraphy and a portable OSA testing device, respectively. Actigraphic measures of total sleep time (TST) and wake after sleep onset (WASO) served as the primary sleep variables, while the apnea-hypopnea index (AHI) assessed OSA severity from the OSA testing device by a blinded assessor. Natural logarithm transformation of AHI was performed due to non-normality. Effect sizes (Hedges'  $g$ ) and Pearson correlations evaluated differences in sleep following each condition and associations between changes in sleep measures, respectively. **Results:** In the full sample, trivial improvements in WASO ( $g=0.16$ ) and TST ( $g=0.03$ ) were observed following SIT-STAND compared to SIT. In contrast, a small increase in AHI (i.e., worsening of OSA) was observed following SIT-STAND compared to SIT ( $g=0.31$ ). The change in AHI was associated with the change in actigraphic WASO ( $r=.63$ ,  $P=.09$ ). Four of the 8 adults had clinically significant OSA (i.e., mean AHI $\geq 10$  across conditions). Among those with clinically significant OSA, large increases in WASO and AHI were seen following SIT-STAND relative to SIT ( $g=1.16$  and 0.89, respectively). In those without significant OSA, small- to moderate-sized reductions in WASO and AHI were observed following SIT-STAND compared to SIT ( $g=0.68$  and 0.30, respectively). **Conclusion:** Following sedentary behavior reduction during a simulated workday, changes in sleep and apnea seemed to differ based upon the presence of clinically significant OSA.

**424** Board #262 May 29 11:00 AM - 12:30 PM  
**Effectiveness Of Short-term Yoga Interventions For Stress Of College Students: A Meta-analysis**

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**Effectiveness of Short-Term Yoga Interventions for Stress of College Students: A Meta-analysis**

Liwen Ju, Weimo Zhu (FACSM), Hai Yan, Zhenglun Wang

**Purpose:**

To determine the effectiveness of yoga interventions for the stress management of college students using a meta-analysis.

**Methods:**

Key words, such as "yoga," "stress," "college students", etc. were searched in a number of databases such as PubMed/Medline, Scopus, Cochrane Library, PsycINFO, Webscience and Google through Dec., 2018. Only randomized controlled trials of yoga

based stress interventions for college student were included for the meta-analysis. Risk of bias the studies were independently assessed by two of the authors using the Risk of Bias Tool by the Cochrane Back Review Group. Effectiveness of Yoga intervention was determined by computing standardized mean differences (SMD), in which the difference in the means of pre- and post-test difference between groups was divided by the pooled standard deviations.

**Results:**

12 studies (Total college students = 763, Male%=16.64, Intervention length = 8.79 $\pm$ 3.96 wk.) were included in the final analysis. Main outcomes included self-reported anxiety, depression, stress, as well as objective measures of heart rate and blood pressure. The yoga interventions were found effective in reducing anxiety, depression, stress and heart rate:

	Anxiety	Depression	Stress	Heart Rate
SMD	-0.995,	-1.708	-0.953	-1.623
95% CI	[-1.762 -0.227]	[-2.005 -1.412]	[-1.707 -0.199]	[-2.911 -0.334]
P	<b>0.011</b>	<b>0</b>	<b>0.013</b>	<b>0.01</b>

Due to the paucity and heterogeneity of the researches, the long-term effects could not be examined.

**Conclusion:**

Short-term yoga intervention has been found effective in helping the stress management of college students. Studies with longer intervention, with a comparison with other exercise mode, are needed

**Key Words:** stress, yoga, college students, meta-analysis, review

**425** Board #263 May 29 11:00 AM - 12:30 PM  
**Potential Effects of Mediators on Health Perception in Older Adults**

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Several aspects could influence mental and physical components of subjective quality of life perceptions. In particular, healthy diet and physically active lifestyles could play a crucial role for successful aging and sustainable quality of life in advancing years. **PURPOSE:** To determine the mediating effects of energy expenditure (EE) and intake (EI), body composition (BC) and dissatisfaction (BD) on the relation between age and health and quality of life perception. **METHODS:** 42 senior athletes, 55 physically active, and 61 sedentary adults (aged 55-85 years) were submitted to anthropometric (body mass, height - Body Mass Index [BMI]), weekly energy expenditure (EE), and dietary intake (EI) evaluations, and administered Body Image Dimensional Assessment (BDI), Short Form Health Survey - Physical (PCS) and Mental Component Summary (MCS) questionnaires. Two serial multiple model mediation analyses were applied to assess whether mechanisms involving diet-related and physical activity-related personal characteristics and behaviors (4 mediators: EE, EI, BMI, BDI) mediated the relation between age and PCS or MCS health-related quality of life perception. **RESULTS:** Only for MCS the mediation analysis showed: a) a direct effect of age on MSC ( $c'=0.31$ ,  $p=0.002$ ; CI(95%)=0.12; 0.50); b) a mediation path by EE, EI, BMI, and BDI (-0.0027, Bootstrap CI(95%)=-0.0105; -0.0002); and c) a positive total effect ( $c=0.22$ ,  $p=0.02$ ; CI(95%)=0.04; 0.39). **CONCLUSIONS:** The combination of positive and negative effects throughout the mediation path of mental health perception of older individuals underlined that the maintenance of adequate level of physical activity could influence the body image and, in turn, positively impact mental health with advancing age. Supported by MIUR Grant 2010KL2Y73

**426** Board #264 May 29 11:00 AM - 12:30 PM  
**Cardiorespiratory Fitness Moderates the Relation Between Years of Drug Use and Stress in Drug Abusers**

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Substance use disorders (SUD) have increased worldwide and is currently a major global issue. In SUD, stress is linked to drug-seeking behaviors and greater rates of relapse. Physical activity has been related with increased self-esteem, mood and reduced stress levels in SUD. However, it remains unclear whether the relation between the time of drug use over the years and stress might be under influence

of cardiorespiratory capacity. **PURPOSE:** This study investigated whether cardiorespiratory fitness has a moderate function over the relation between years of drug use and stress levels. **METHODS:** Sixth-two male SUD individuals ( $34.17 \pm 8.82$  years;  $24.62 \pm 2.91$  m/kg<sup>2</sup>) have participated in the study. We took a collection of measures in one visit including: (1) anthropometric measures of height and weight to compute BMI; (2) self-reported demographics and drug use history, including years of drug use, days of abstinence, and number of hospitalizations; (3) a questionnaire to measure negative emotional states; and (4) a shuttle run test to estimate the maximum consumption of oxygen (VO<sub>2max</sub>). For this study, we tested a moderation analysis using the Macro PROCESS plugin for SPSS (Model 1), in which the independent variable was the years of drug use, the dependent variable was stress levels and the moderator was VO<sub>2max</sub>. The moderation analysis was adjusted for age, days in abstinence, BMI and number of hospitalizations. **RESULTS:** It was found that VO<sub>2max</sub> moderates the relation between years of drug use and stress levels ( $\beta = -0.82$ ,  $p = 0.03$ , 95% confidence interval (-0.15 to -0.007)). The conditional effect at each level of the moderator (one SD below the mean, at the mean and one SD above the mean) showed that for those individuals with lower VO<sub>2max</sub> the negative relation between years of drug use and stress was not significant ( $\beta = -0.23$ ,  $p > 0.05$ ), for those with an average VO<sub>2max</sub> it was significant ( $\beta = -0.81$ ,  $p = 0.04$ ) and for those with higher VO<sub>2max</sub> the relation was even more significant ( $\beta = -2.03$ ,  $p < 0.01$ ). **CONCLUSION:** For those SUD individuals with an average and higher VO<sub>2max</sub>, the negative relation between years of drug use and stress is more pronounced. Therefore, fitness level seems to have a protective effect over stress in SUD individuals, which may minimize the chances of relapse and enhance the rehabilitation process.

**427** Board #265 May 29 11:00 AM - 12:30 PM  
**Identifying Mental Health Risks through Screening among Collegiate Ethnic-Minority Athletes**  
 Samantha R. Weber, Toni M. Torres-McGehee, Allison Smith.  
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 (No relevant relationships reported)

Ethnic minority student-athletes are under immense amounts of pressure to perform, meet academic requirements for scholarships, and maintain relationships with peers, coaches, and parents. A change in stressors can cause physiological disturbances and mental health disorders such as depression (DEP), eating disorders (ED), low self-esteem (LSE) and body image dissatisfaction (BID). **PURPOSE:** To examine the prevalence of DEP, ED, LSE, and BID in ethnic minority student-athletes. A secondary purpose examined mental health risks across sex, academic status, and sport type. **METHODS:** Student-athletes ( $n = 274$ ) were recruited from multiple Ethnic Minority Universities to participate in an online study. Demographic information, Center for Epidemiologic Studies Depression Scale, Eating Attitudes Test, Rosenberg Self-Esteem Scale, and Standard Figural Stimuli were completed. **RESULTS:** Overall prevalence was 31.8% for DEP, 18.1% for ED, and 8.4% for LSE. Chi-square analysis revealed no significant differences between mental health risks and sex, academic status and sport type. A 2 sex (female, male) x 2 clothing type (daily clothing, competitive uniform) x 2 perceptions (perceived, desired) repeated measures ANOVA indicated a main effect ( $P \leq 0.01$ ) with significant interactions for perceptions ( $F_{1,208} = 4.586$ ,  $P < .033$ ,  $n_2 = .022$ ) and perceptions by gender interactions ( $F_{1,208} = 7.384$ ,  $P < .007$ ,  $n_2 = .034$ ). Body image results revealed female athletes desired to be smaller than their perceived image in both daily clothing and uniforms, whereas males desired to be larger. A 2-sex x 3 meta-perceptions (peers, parents, coaches) x 2-perceptions repeated measures ANOVA indicated a main effect ( $P \leq 0.01$ ) with significant interactions between perceptions by gender ( $F_{1,208} = 5.896$ ,  $P < .016$ ,  $n_2 = .028$ ), meta-perceptions by perceptions ( $F_{1,208} = 2.382$ ,  $P < .001$ ,  $n_2 = .037$ ), and perceptions by meta-perceptions and gender ( $F_{1,416} = 4.923$ ,  $P < .009$ ,  $n_2 = .023$ ). **CONCLUSIONS:** Although no significant associations were found for gender, academic status or sport type, both male and female athletes demonstrated a high risk of DEP, ED, BID, and a lower risk for LSE. Future research is necessary to further examine mental health risks, screening, prevention strategies, and intervention in ethnic minority student-athletes.

**428** Board #266 May 29 11:00 AM - 12:30 PM  
**Prevalence of Low Self-esteem and Weight Pressures among Collegiate Male Athletes**  
 Nicole C. Pruchnik, Toni M. Torres-McGehee, Allison B. Smith, Samantha R. Weber, Eva Monsma. *University of South Carolina, Columbia, SC.*  
 (No relevant relationships reported)

Previous studies have examined mental health disorders in female athletes, but very few have examined the prevalence of signs and symptoms of sub-clinical mental health conditions (i.e., low self-esteem [LSE], and weight pressures [WP]) in male athletes. Understanding these sub-clinical mental health conditions may aid in preventing mental health disorders.

**Purpose:** Examine the prevalence of low self-esteem (LSE) across academic status and the effects LSE on weight pressures (WP) in sport among male collegiate athletes.

**Methods:** As part of a larger study, collegiate male athletes ( $n = 238$ ; age:  $19.7 \pm 1.3$  years; males:  $n = 234$ , height:  $184.3 \pm 7.5$  cm, weight:  $91.5 \pm 19.4$  kg) were recruited over a 3-year period from a NCAA Division I Institution. Demographic information (e.g., age, self-reported height, self-reported weight, ideal weight, mental weight, sex, academic status, and sport type), the Rosenberg's Self-Esteem scale, and the Weight Pressures in Sports-Males surveys were collected via SurveyMonkey. Cross tabulations and chi square analyses examined the relationship and distribution of general weight pressures, LSE and WP risk and academic status. One way ANOVA examined LSE risk and WP Total score and subscales.

**Results:** A total of 95 athletes (39.9%) reported feeling pressure to change their weight and/or eating habits for their sport and 18.5% ( $n = 44$ ) revealed they felt pressured to meet a target weight with routine weigh ins. More specifically, athletes wanted to weigh  $2.4 \pm 4.1$  kg more than their current weight. Overall, Prevalence of LSE for all male athletes was 9.4% ( $n = 22$ ). No differences were found between academic status and prevalence of LSE, WP total score, Coach/Teammate Pressure subscale and Appearance Pressure subscale. Significant differences were found between Coach/Teammate Pressure subscale and LSE prevalence (LSE risk:  $2.4 \pm 1.1$  vs. Not at Risk:  $2.6 \pm 0.86$ ;  $P = 0.019$ ).

**Conclusion:** Although there was a relatively low number of male athletes at risk for LSE, male athletes still displayed weight pressures for their sport. Healthcare professionals working with male athletes need to be aware of these sub-clinical mental health concerns to ensure that prevention and treatment can occur before the onset of issues such as eating disorders and depression.  
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**429** Board #267 May 29 11:00 AM - 12:30 PM  
**Characterization of Potential for Relationship between Anxiety and Cardiovascular Health in Different Racial Groups**  
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 (No relevant relationships reported)

There are a multitude of factors that contribute to cardiovascular (CV) health. Psychosocial factors contribute to CV risk, and anxiety is one of the psychological disorders diagnosed in CV patients. It is unclear whether there is a potential relationship between inflammation and anxiety.

**PURPOSE:** 1) To compare CV health between Caucasian (C) and Mixed-Race (MR) adults, and 2) to explore the relationship between anxiety levels and CV health measures across these populations. This pilot study is the first step in our clinical trial to investigate the relationship between anxiety measures and CV risk factors across racial differences. **METHODS:** Thirty-two young adults (C:  $N = 16$ ,  $22.94 \pm 7.4$ ; MR:  $N = 16$ ,  $22.813 \pm 7.51$  yrs) underwent 2 test visits. First, CV health was assessed by fasting glucose, lipids, blood pressure (BP), carotid artery intima media thickness (IMT), body fat (BF) measured by bioelectrical impedance, and flow-mediated dilation (FMD). At the second visit, ECG, clinic BP and VO<sub>2max</sub> were measured. Anxiety measurements using the DASS-21 scale are ongoing. **RESULTS:** Pilot data on physiological outcomes show no differences between groups. Compared to C adults, the adults in MR group show a small trend towards having worse CV profiles. In the MR group, we found higher levels of cholesterol ( $156.4 \pm 27.2$  vs.  $144.2 \pm 36.6$  mg/dL), BF ( $31.1 \pm 9.7$  vs.  $28 \pm 9.2$  %), and lower levels of FMD ( $7.1 \pm 4.3$  vs.  $8.7 \pm 4$  %) and VO<sub>2max</sub> ( $42.95 \pm 8.8$  vs.  $38.65 \pm 10.6$  ml/kg-min). Within groups, we found significant ( $p < 0.05$ ) race-related relationships between several variables. In C, we found an inverse relationship between IMT and HDL ( $R = -0.654$ ). In MR, we found an inverse relationship between BF and FMD ( $R = -0.832$ ), BF and HDL ( $R = -0.836$ ), and BF and VO<sub>2max</sub> ( $R = -0.741$ ). Also, we found direct relationships between BF and glucose ( $R = 0.834$ ) and BF and DBP ( $R = 0.751$ ). Data from DASS-21 is being analyzed between groups. **CONCLUSION:** We found relationships with BF in the MR group that did not exist in the C group. Considering that literature suggests that young adults of color tend to have higher levels of anxiety, we hypothesize that we will find relationships between anxiety and CV measures in the MR group that are different than that in the C group.

430 Board #268 May 29 11:00 AM - 12:30 PM  
**Effect Of Aerobic Exercise On Depression In Rats: Role Of Mitophagy**

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(No relevant relationships reported)

**Abstract:**

Depression is a common health problem and a major cause of agrypnia and disability. Recent evidence supports an anti-depressive effect of aerobic exercise on unpredictable chronic mild stress (UCMS)-induced depression in rats; however, the biological mechanism remains to be investigated.

**Purpose:** To investigate whether aerobic exercise could improve UCMS-induced depression and alter mitophagy in depressive rats.

**Method:** Thirty-six male Sprague-Dawley rats were randomly divided into three groups: a control group (Con, n=12), a UCMS-induced depression group (UCMS, n=12), and a UCMS-induced depression plus aerobic exercise group (UCMS+E, n=12). After 4 weeks of UCMS stimulation, rats in the UCMS+E group carried out 3 weeks (60 min/day) of swimming exercise. A sucrose preference test (SPT) was performed, and the content of 5-hydroxytryptamine (5-HT) was measured to verify whether the depression model was successful. A Morris water maze (MWM) test was used to evaluate spatial learning and memory ability. The expression levels of mitophagy-related proteins (Beclin1, LC3-I, LC3-II and P62) were determined by Western blot. Statistically significant group differences were assessed by using one-way ANOVAs and post-hoc tests.

**Results:** Based on the change of sucrose consumption and the expression level of 5-HT following UCMS treatment, the depression model was successfully established in the rats. Spatial learning and memory ability were lower in the UCMS group than the Con group (both  $p < 0.05$ ), but improved in the UCMS+E group (both  $p < 0.05$ ). According to the Western blot results, the expression levels of Beclin1 (Con:  $0.37 \pm 0.02$ , UCMS:  $0.26 \pm 0.04$ , UCMS+E:  $0.43 \pm 0.07$ ) and P62 (Con:  $0.34 \pm 0.03$ , UCMS:  $0.20 \pm 0.02$ , UCMS+E:  $0.31 \pm 0.05$ ), as well as the LC3-II/LC3-I ratio (Con:  $0.36 \pm 0.05$ , UCMS:  $0.19 \pm 0.04$ , UCMS+E:  $0.33 \pm 0.04$ ) were significantly lower in the UCMS group than the Con group (all  $p < 0.05$ ), but were significantly higher in the UCMS+E group than the UCMS group (all  $p < 0.05$ ).

**Conclusion:** This study suggests that rats with UCMS-induced depression presented alterations in mitophagy. Three weeks of aerobic exercise significantly up-regulated mitophagy in depressive rats. Therefore, mitophagy may play an important role in the biological mechanism underlying the anti-depressive effect of aerobic exercise.

**A-55 Exercise is Medicine®/Poster - EIM - Mental Health**

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
 Room: CC-Hall WA2

431 Board #269 May 29 11:00 AM - 12:30 PM  
**Exercise And Physical Activity Promotion Improves Cardiorespiratory Fitness, Symptoms Of Disease And Well-being In Patients With Schizophrenia**

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Patients suffering from Schizophrenia (SZ) show low fitness, a sedentary lifestyle and comorbidities like diabetes and cardiovascular diseases, resulting in 20 years less of life expectancy.

**Purpose:** To evaluate the impact of an intervention combining exercise and physical activity promotion (PAP) on cardiorespiratory fitness (CRF), severity of SZ, symptoms of disease and well-being.

**Methods:** 35 patients were randomized into an intervention (n=19, aged  $39.0 \pm 13.6$  years, BMI  $28.3 \pm 7.3$ ) or control group (n=16, aged  $36.0 \pm 9.3$  years, BMI  $25.7 \pm 5.2$ ), directly after inpatient treatment for SZ. Intervention included two sessions of high intensity indoor cycling (IC; each 45min), and one session of PAP (60min) per week for three months. In months 4-6, the intervention was reduced to one session IC and one session PAP per week. The control group received a physiologically ineffective control intervention. Measurements were conducted at baseline (t0), after three (t1)

and 6 months (t2) of intervention, and after 12 months (six-month follow up, t3). Measurements included CRF (bicycle ergometry), severity of SZ (PANSS-Score), well-being (SF-36), and psychological distress (SCL-90).

**Results:** The intervention improved significantly severity of SZ (t0:  $55.4 \pm 16.3$ , t2:  $34.8 \pm 3.3$ ,  $p < .05$ ), well-being (t0:  $50.4 \pm 10.1$ , t2:  $60.5 \pm 7.1$ ,  $p < .05$ ) and psychological distress (t0:  $159 \pm 47.4$ , t2:  $119.8 \pm 34.3$ ,  $p < .05$ ). For CRF, patients were able to improve their physical capacity, expressed as W/kg (t0:  $1.85 \pm 0.6$ , t2:  $2.13 \pm 0.6$ ,  $p < .05$ ), but did not significantly improve their peak oxygen uptake, expressed as ml/min/kg ( $29.0 \pm 7.0$ , t2:  $30.5 \pm 8.7$ , n.s.). Six month after the intervention, only improvements in severity of SZ, well-being and psychological distress remained statistically significant (PANSS:  $38.0 \pm 9.0$ , SF-36:  $59.2 \pm 8.0$ , SCL-90:  $119.2 \pm 36.6$ , all  $p < .05$ ).

**Conclusion:** Exercise and PAP significantly improves CRF, severity of SZ, well-being and psychological distress in SZ patients. Effects on CRF are declining shortly after the end of the intervention. We recommend the implementation of exercise and PAP into the post-acute care of SZ patients. Moreover, it is necessary to further strengthen the sustainability of effects with respect to CRF, in order to prevent fall-backs and health detriments caused by low physical fitness.

432 Board #270 May 29 11:00 AM - 12:30 PM  
**Fitness, Fatness And Survival In Older Adults With Intellectual Disabilities. Which One Is Key?**

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Older adults with intellectual disabilities have very poor physical fitness levels. Additionally, overweight and obesity are highly prevalent in this population, even more prevalent than in the general population. Both fitness and fatness have been found to be related to survival in the general population. To improve healthy ageing and survival of older adults with intellectual disabilities we need to know which problem requires our main focus. **PURPOSE:** To determine whether fitness or fatness is more important for survival in older adults with intellectual disabilities. **METHODS:** As part of the Healthy Ageing and Intellectual Disabilities (HA-ID) study, fitness (comfortable gait speed) and fatness (Body Mass Index) of 874 older adults with intellectual disabilities ( $\geq 50$  years;  $61.4 \pm 7.8$  years) was measured at baseline. All-cause mortality was collected over a 5-year follow-up period. The relationship between fitness, fatness, and survival was analysed with Kaplan-Meier curves and Cox proportional hazard models. **RESULTS:** Fitness was significantly related to survival (HR = 0.21, 95% CI = 0.09 - 0.48,  $p < 0.001$ ), while fatness was not related to survival. People who were unfit and fat were 4.6 (95% CI = 2.0 - 10.7) times more likely to die, and people who were unfit and not fat were 3.6 (95% CI = 1.7 - 7.5) times more likely to die within the follow-up period, than people who were fit, regardless of their fatness. **CONCLUSIONS:** Being fit is key for survival in older adults with intellectual disabilities. Our results therefore do not support the emphasis seen in research and practice on reducing weight. The focus should primarily be on improving the fitness of older adults with intellectual disabilities to improve healthy ageing and survival.

433 Board #271 May 29 11:00 AM - 12:30 PM  
**The Effect Of Moderate-intensity Physical Activity On Biopsychosocial Factors Among Veterans With Symptoms Of Ptsd**

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(No relevant relationships reported)

Physical activity has been shown to have a positive impact on biopsychosocial variables among individuals who may be experiencing symptoms related to PTSD.

**PURPOSE:** The purpose of this study was to evaluate the impact of a moderate-intensity physical activity regimen on aerobic endurance, barriers to accessing health care, and symptom severity of PTSD among military veterans. **METHODS:** Participants of this study (n=4) engaged in a 4-week physical activity regimen that met two times per week. The dependent variables were aerobic endurance, measured with the Cooper 12 Minute Walk test, barriers to accessing health care, measured with the BACE, and symptoms of PTSD, measured with the PCL-5. **RESULTS:** Descriptive statistics and a paired samples *t*-test were utilized to analyze data. There were statistically significant differences for all dependent variables at the post-assessment level, indicating statistically significant improvements in the PCL-total score ( $p = .032$ ), BACE-total score ( $p = .043$ ), BACE-stigma score ( $p = .032$ ),  $VO_{2max}$  ( $p = .014$ ), and METS ( $p = .014$ ). **CONCLUSION:** Researchers concluded that a moderate-intensity physical activity regimen may be effective at improving aerobic endurance, perceived barriers to accessing health care, and symptom severity of PTSD among military veterans. Future studies should aim to increase sample size and utilize a laboratory grade assessment for capturing changes in  $VO_{2max}$  and METS. Additionally, future

research should aim to investigate the dose-response effect on dependent variables based on varying physical activity intensity levels, duration of intervention, and the duration of acute bouts of physical activity.

**434** Board #272 May 29 11:00 AM - 12:30 PM

### Exercise Is Medicine And Could Improve Your Gpa

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(No relevant relationships reported)

**Purpose:** The aim of this study is to evaluate the impact of physical activity (PA) on academic performance. Several studies have already confirmed the importance of physical activity for the life quality and health. Several health problems can be avoided with the regular practice of PA, which is why it can be said that "exercise is medicine". The question in this work is to seek key points in order to evaluate whether PA positively impacts academic activity. Will the practice of PA bring a positive impact on academic performance, will it entail a higher grade point average (GPA)? The final objective will be to present a framework with potentially impacting variables, within an physiological elements.

**Methods:** An initial research was done on academic bases to raise academic articles on the subject. The base consulted was PubMed. Keywords used were physical activity and academic performance. There was no concern in evaluating studies relating PA and health, because we assumed such a relationship as true in this review.

**Summary of Results:** From a physiological standpoint there are some important studies showing the impacts on cognitive and motor functions coming from the practice of PA. Through a dynamic interaction, regular PA can lead to a cerebral capillary growth, with the increase in blood flow and oxygenation. The growth of nerve cells in the hippocampus, that have a great function as a center of memory and learning, is another important effect of PA. The production of neurotrophins and the development of new connections, with the increase of density of neural network could have a positive impact in attention, cognition and academic performance.

**Conclusion:** There are good reasons to be physically active. Including reducing developing heart disease and diabetes, for example. So, it's possible to say: Exercise is medicine. It's a good point you can be health, lose weight, lower your blood pressure. But, maybe we have another one great reason to be physical active. Some studies show us that physical activity can improve academic performance and it's great. You can be health, fell better and improve your GPA.

**435** Board #273 May 29 11:00 AM - 12:30 PM

### Effects of Alternative Treatments on Behavioral Outcomes In Patients with Mild Cognitive Impairment, Alzheimer's Disease and Dementia: A Comprehensive Summary of Evidence and Meta-analysis

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(No relevant relationships reported)

**Purpose:** Mild cognitive impairment, Alzheimer's disease (AD) and dementia are associated with onset behavioral disturbances such as depression, psychosis, and anxiety. These ailments affect overall outcomes, decrease quality of life, and are primarily treated with antidepressants. However, there are additional therapies available to alleviate and mitigate these onset disturbances. Based on published clinical data, this comprehensive review and meta-analysis evaluates the effects of alternative therapies and treatments on behavioral outcomes in patients with mild cognitive impairment (MCI), mild or moderate AD, and dementia. **Methods:** We applied novel clinical data extraction and aggregation technologies developed by MedAware Systems, Inc. It is a patent-pending process where two scientists, blinded to each other, extract data from the same study. Intelligent software compares each data field for matches (or mismatches). A senior scientist reconciles data mismatches. Where pre- and post-treatment outcomes are available, a standardized mean difference is calculated as the MedAware Standardized Index of treatment effect (MSI-E). This methodology was used to examine differences in efficacy and behavioral outcomes among the alternative treatments (supplements, therapy and counseling, exercise, education and training, and rehabilitation) to identify efficacious treatments for behavioral outcomes.

**Results:** A total of 89 studies reporting anxiety and depression outcomes in patients with MCI, AD or dementia were located. There were no significant differences in MSI-E among treatments. Cognitive and behavioral showed the most efficacy (MSI-E = 0.023 ± 0.002). Among alternative treatment categories, there were no significant differences, with rehabilitation showing the most efficacy (MSI-E = +0.254 ± 0.063), and exercise showing the least (MSI-E = -0.105 ± 0.013). **Conclusions:** Using the MedAware Systems, Inc. literature database and meta-analytic methodology, we found that rehabilitation therapy may decrease anxiety and depression, while exercise has almost no effect. Overall results for alternative therapies were not significant. Because the number of studies within each therapy is small, additional research on alternative therapies is warranted.

Supported by MedAware Systems, Inc.

**436** Board #274 May 29 11:00 AM - 12:30 PM

### Mental Health in First Responders and Military Personnel: Is Physical Activity A Viable Option?

Allyson G. Box, Steven J. Petruzzello, FACSM. *University of Illinois Urbana-Champaign, Urbana, IL.* (Sponsor: Steven J. Petruzzello, FACSM)

(No relevant relationships reported)

Mental Health (MH) is a growing concern among first responders and military personnel, with a relatively large percentage presenting with disorders. However, many avoid or remove themselves from treatment, which may be related, in part, to treatment stigmas. **PURPOSE:** Compare physical health (PH) and MH stigmas, and explore whether physical activity is a viable option for treatment. **METHODS:** The Perceived Stigma and Barriers to Care for Psychological Problems and Self Stigma of Seeking Help questionnaires were provided through an online survey, along with researcher developed questions regarding physical activity behavior. Separate paired-samples *t*-tests were used to compare PH versus MH treatment stigmas, and descriptive statistics were used to denote interest in physical activity for mental health treatment. **RESULTS:** First responders and/or military personnel ( $N = 35$ ; 36.2±11.6 yrs; 80% male) currently residing in the United States completed the survey. When comparing PH and MH, differences ( $P < 0.001$ ) were observed between perceived (PH=1.99; MH=2.56) and self-stigmas (PH=2.17; MH=2.52). The majority (91.4%) of participants indicated interest in using physical activity for MH improvement. Additionally, 29 participants (82.9%) indicated they would be more willing to undergo physical activity as a treatment mechanism for MH than traditional methods (e.g., medication, psychotherapy). **CONCLUSIONS:** This study expands upon previous stigma literature by emphasizing the discrepancies between physical and mental health stigmas. Additionally, these findings suggest physical activity as a viable option to circumnavigate MH stigmas in first responders and military personnel.

**437** Board #275 May 29 11:00 AM - 12:30 PM

### Effects Of Physical Activity On Cognitive Function In Alzheimer's Disease: A Comprehensive Meta-analysis

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(No relevant relationships reported)

**Purpose:** Global cognitive function is associated with increased physical activity, physical frailty is associated with increased risk of Alzheimer's disease (AD), and can predict future cognitive decline in adults. We performed an exhaustive literature review and meta-analysis of the effects of physical activity on cognitive functions in adults with AD and dementia, based on the published clinical data. **Methods:** We applied novel clinical data extraction and aggregation technologies developed by MedAware Systems, Inc. It is a patent-pending process where two scientists, blinded to each other, extract data from the same study. Intelligent software compares each data field for matches (or mismatches). A senior scientist reconciles data mismatches. Where pre- and post-treatment outcome data are available, standardized mean differences are calculated as the MedAware Standardized Index of treatment effect (MSI-E). This methodology is used to capture the published literature, with physical activity as the intervention, reporting cognitive functions as outcomes, in AD patients. **Results:** A total of 2,201 studies were screened for possible inclusion. 34 studies reported the use of some form of physical activity interventions, such as aerobic exercise (9 studies), other types of physical activity (23 studies), and strength training (5 studies) in AD and dementia patients, and were included in the meta-analysis. Instruments such as the ADAS-cog and the MoCA measured cognitive outcomes. Overall, there appears to be little to no cognitive decline over time (MSI-E = 0 indicates no change) in the aerobic exercise group (MSI-E = -0.08±0.003), other physical activity group (MSI-E = -0.015±0.001), and a slight improvement in the strength training group (MSI-E = +0.016±0.005). **Conclusions:** Using the MedAware Systems, Inc. literature database and meta-analytic methodology, we found that physical activity appears to mitigate cognitive declines in AD and dementia patients, with strength training having a small beneficial effect. Although these findings are based on a small number of studies in each physical activity category, results of this meta-analysis should provide investigators with evidence to further explore the use of physical training in AD and dementia patients.

Supported by MedAware Systems, Inc.

438 Board #276 May 29 11:00 AM - 12:30 PM

**Depression and Fitness Level in College Students Attending a Diverse University**

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**PURPOSE:** The purpose of the study was to determine the association between estimated cardiorespiratory fitness (eCRF) and moderate to severe depression (MS\_DEP) in college students. The relationships between MS\_DEP and age, sex, race, sexual/gender orientation, and grade point average (GPA) were examined.

**METHODS:** This cross-sectional study occurred at a public university via electronic survey. Participants (n=438) reported their age, height, weight, race, sex, sexual orientation, GPA, resting heart rate, exercise habits (frequency, intensity, and duration), and completed the Patient Health Questionnaire (PHQ-9), a standard depression survey. A validated regression model (Nes et al., 2011) was used to calculate eCRF (ml/min/kg). The difference between eCRF and age-predicted CRF was used for analyses. Chi square and independent t-tests determined differences in demographic characteristics between students who reported MS\_DEP and students who reported no depression. For odds ratio analyses, MS\_DEP was dichotomized (yes/no) and fitness was categorized as FIT (reference), LOW-FIT, and HIGH-FIT. The reference (FIT) represented those with eCRF within +/- 1, LOW-FIT was <1, and HIGH-FIT >1 of their age-estimated CRF.

**RESULTS:** Chi square analyses indicated fit individuals (=> age-predicted CRF) were less likely than unfit (< age-predicted CRF) to have MS\_DEP (36.4% vs. 63.6% respectively) (P = 0.02). Belonging to a sexual gender minority (SGM) (P <0.01) or to the Hispanic race (P=0.04) were also significant for MS\_DEP. T-tests revealed that individuals who reported depression were more likely to be younger (P=0.04) or have a lower GPA (P<0.01) than those who reported no depression. Odds ratio analyses found that those with LOW-FIT were 2.39 times more likely to report MS\_DEP when compared with the reference (95% CI=1.17-4.87). HIGH-FIT compared with FIT was not significant.

**CONCLUSION:** Students with low fitness are at a higher risk for depression. However, fitness above age-predicted CRF did not decrease susceptibility indicating that an age-appropriate level of fitness is sufficient to reduce depression risk. Also, Hispanic, SGM, and younger students may be more vulnerable. Those with depression have a lower GPA. Estimated CRF could provide a simple method to identify students at-risk for depression.

439 Board #277 May 29 11:00 AM - 12:30 PM

**Comparison Between Pilates And Home-exercises On Health-related Outcomes In Individuals With Chronic Low Back Pain**

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(No relevant relationships reported)

Chronic non-specific low back pain (CNLBP) is a major cause of disability and absenteeism. Pilates is commonly adopted in the treatment of CNLBP, though the evidence is controversial. Low-cost interventions such as home-exercises are prominent and considered effective to improve disability. **Purpose:** To compare the efficacy of Pilates and home-exercises on disability and utility (health states). **Method:** Randomized controlled trial with blind assessor. Thirty-one participants with CNLBP for at least 12 weeks were randomly assigned to the Pilates (PT; n=16) or Home-Exercise (HE; n=15) groups. Allocation was concealed. The intervention lasted 6 weeks (two times/week), and 4-months follow-up. The PT was composed by fifty-minutes sessions (seven to ten exercises; two sets of 8 to 12 repetitions). The HE was composed by prescribed postural, muscle stretching and strengthening exercises (booklet, instructions to perform 2 times/week, weekly monitored by text message). Disability was measured by the Quebec Back Pain Questionnaire. The score ranges from no disability (0) to worst disability (100). Health states were measured by the EQ-5D-3L (mobility, self-care, usual activities, pain/discomfort, anxiety/depression; final utility score ranging from 0 to 1). A linear mixed-model was used to analyze the global effect over time and separate effects at baseline, post-intervention and follow-up. Significance was set at 5%. **Results:** No significant differences were found between PT vs HE (global effects). Both groups showed a significant improvement only for disability (post-intervention and follow-up, compared to baseline). **Conclusion:** Both PT and HE were effective and improved the disability of individuals with CNLBP. However, the utility was not influenced by the interventions.

**Table.** Effects of PT (Pilates) and HE (Home Exercises)

Disability	PT	HE	Effects	
	Mean (ste)	Mean (ste)	B (CI95%)	P-value
Baseline	26.6 (2.9)	28.0 (2.9)	-	-
Post-intervention	11.9 (3.2)	13.3 (3.0)	-14.7 (-20.8; -2.0)	<0.02
Follow-up	15.2 (4.3)	16.6 (4.6)	-11.4 (-21.4; -7.9)	<0.01
Global Effect	n.a	n.a	-3.3 (-10.0; 3.2)	0.3
<b>Utility</b>				
Baseline	0.60 (0.04)	0.61 (0.04)	-	-
Post-intervention	0.67 (0.05)	0.68 (0.04)	0.06 (-0.003; 0.13)	0.06
Follow-up	0.62 (0.05)	0.63 (0.06)	0.02 (-0.08; 0.13)	0.6
Global Effect	n.a	n.a	-0.01 (-0.13; 0.11)	0.8

Ste: standard error

440 Board #278 May 29 11:00 AM - 12:30 PM

**Do Pilates And Home-exercises Improve Balance And Kinesiophobia Of Individuals With Low Back Pain?**

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Chronic non-specific low back pain (CNLBP) is the main cause of years lived with disability, and can be associated with strength deficits and postural instability. Pilates exercises are deemed to be useful in the management of CNLBP and improvement of outcomes such as flexibility and postural control, though evidence is controversial.

**Purpose:** To compare the efficacy of Pilates and home-exercises on kinesiophobia and postural balance. **Method:** Randomized controlled trial with blind assessor and concealed allocation. Thirty-one participants of both sexes, with CNLBP for at least 12 weeks were randomly assigned to Pilates (PT; n=16) or Home-Exercise (HE; n=15) groups. PT group was composed by sessions of fifty-minutes (seven to ten exercises; two sets of 8 to 12 repetitions). The HE was prescribed to the participants (characterized by general exercises - postural, muscle stretching and strengthening) within a booklet, and they were instructed to exercise 2 times/week, weekly monitored by text messaging. The intervention lasted 6 weeks (two times/week). Outcomes were assessed on baseline, post-intervention and after 4-months follow-up. Kinesiophobia was measured by the Tampa Scale. The score ranges from 17 to 68 (higher scores meaning a worse fear of moving). Balance was measured by the limits of stability (challenge to move and control the center of gravity within the base of support). A linear mixed-model was used to analyze the global effect over time and separate effects at baseline, post-intervention and follow-up. Significance was set at 5%. Dropouts were included by multiple imputation. **Results:** No significant differences were found between PT vs HE (global effects). Likewise, no separate effects were found for balance and kinesiophobia. **Conclusion:** An intervention of Pilates and home-exercises did not improve the balance and kinesiophobia.

**Table.** Effects of PT (Pilates) and HE (Home Exercises)

Kinesiophobia	PT	HE	Effects	
	Mean (ste)	Mean (ste)	B (CI95%)	P-value
Baseline	42.7 (1.9)	42.2 (2.0)	-	-
Post-intervention	38.7 (2.3)	38.2 (2.3)	-3.9 (-8.1; 0.2)	0.06
Follow-up	38.8 (3.0)	38.3 (3.1)	-3.8 (-10.6; 2.9)	0.2
Global Effect	n.a	n.a	0.51 (-4.3; 5.3)	0.8
<b>Balance</b>				
Baseline	52.4 (4.2)	55.9 (4.3)	-	-
Post-intervention	57.3 (4.6)	60.8 (4.6)	4.9 (-3.3; 13.1)	0.2
Follow-up	56.0 (5.7)	59.4 (5.8)	3.5 (-8.8; 15.9)	0.5
Global Effect	n.a	n.a	-3.4 (-13.5; 6.6)	0.5

Ste: standard error

441 Board #279 May 29 11:00 AM - 12:30 PM  
**Effect Of Core Strength Training On Dysfunction And Rehabilitation Of Patients With LBP**

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**PURPOSE:** To observe the effect of core strength training on dysfunction and rehabilitation of patients with chronic low back pain.

**METHODS:** 120 patients diagnosed as LBP in the affiliated sports hospital of Chengdu Sport Institute are divided into core strength training group, regular gymnastics group and general treatment group (40 in each) by using randomized, controlled, single-blind experimental methods. The patients in the first group (group A) use basic treatment (acupuncture, massage, TDP irradiation) and core strength training. Basic treatment and gymnastics training are applied for the patients in the second group (group B), while basic treatment is used for the third group (group C). All the trainings continue 8 weeks. Spss 19.0 is used for statistics analyses. Efficiency, VAS score, JOA score are tested before treatment, 3 and 8 weeks after treatment. The overall scores before and after treatment are measured, the efficiency is calculated by Redit analysis.

**RESULTS:** 106 patients participate the whole process and the baseline data before intervention are basically the same. After intervention, all the indicators have changed as follows: 1.Efficiency: The total effective rate is 94.1% in group A, 88.6% in group B, 86.5% in group C. There is a significant difference between group A,B and C by Redit analysis( $P<0.01$ ). There is no difference between group B and C ( $p>0.05$ ). 2.VAS score: There is no significant difference before intervention. After intervention, the VAS scores are reduced significantly. The score of group A decreased by 4.68 points, 3.77 points in group B and 3.81 points in group C. There is a significant difference in three groups ( $p<0.01$ ), while there is no significant difference between group B and C( $p>0.05$ ). The difference indicates that the improvement of this index in group A is better than others. 3.JOA score: There is no significant difference before intervention. The average of group A decreased by 6.74 points, 4.34 points in group B, 4.16 points in group C. After 8 weeks, there is a significant difference between group A and B and C ( $p<0.01$ ). There is no significant difference between group B and C( $p>0.05$ ).

**CONCLUSIONS:** After 8 weeks intervention, basic treatment and core strength training can significantly improve the dysfunction and rehabilitation of patients with pain and activity limitation.

442 Board #280 May 29 11:00 AM - 12:30 PM  
**Dose-related Effects of Moderate Intensity Walking Exercise on Sensitivity to Pain in Healthy Humans**

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 (No relevant relationships reported)

Increasing evidence implicates exercise as a front-line adjuvant therapy for the treatment of nearly all forms of chronic pain. Knowledge of efficacious dosing respective to exercise type and pain condition is extremely limited in the literature. This leaves both clinicians and patients less informed with regard to the best practice.

**PURPOSE:** To determine the optimal dose of moderate intensity treadmill walking necessary to reduce acute pain in healthy human participants. **METHODS:** After screening, 40 female participants (21.6±0.4 yrs) were pseudo-randomized into 1 of 4 groups: control (no exercise), low dose exercise (3x/wk), moderate dose exercise (5x/wk) and high dose exercise (10x/wk). Over a 7-day period, participants performed moderate intensity walking on a treadmill during assigned exercise days (days 1-5). Quantitative measures of pain were measured at baseline (day 0), 5- and 30-min post intervention on days 1, 3, and 5 and 24 hrs post-final intervention session (day 6) via sensitivity thresholds to painful thermal stimulation and painful pressure stimulation. Subjects also rated the intensity and unpleasantness of both thermal and pressure stimuli qualitatively on a visual analog scale (VAS). **RESULTS:** One-way ANOVA revealed a significant analgesic effect of treatment for constant pressure pain intensity ( $F_{3,36}=6.2, p<0.01$ ) and constant pressure pain unpleasantness rating ( $F_{3,36}=6.4, p<0.01$ ) as measured by VAS. Tukey post-hoc tests showed significant differences between the control and moderate dose groups (157.6±20.8 vs. 49.6±6.9%baseline,  $p<0.01$ ) and control and high dose groups (157.6±20.8 vs. 67.3±25.8%baseline,  $p<0.01$ ) for constant pressure pain intensity rating and significant differences between control and moderate dose groups (127.9±19.3 vs. 46.6±9.4%baseline,  $p<0.01$ ) and control and high dose groups (127.9±19.3 vs. 46.6±14.6%baseline,  $p<0.01$ ) for constant pressure pain unpleasantness rating. **CONCLUSION:** In healthy adults, we have identified a dose response of exercise-induced analgesia. Our study suggests that a low dose of exercise is insufficient to induce analgesia. The moderate dose of exercise may be an appropriate starting dose for exercise-based adjuvant pain therapy. Future studies include applying these results and techniques in chronic pain groups.

443 Board #281 May 29 11:00 AM - 12:30 PM  
**The Efficacy of Qigong on the Main Symptoms of Fibromyalgia. A Randomized Clinical Trial**

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Some of the most debilitating symptoms of fibromyalgia (FM) include widespread chronic pain (WCP), sleep disturbances (SD) and chronic fatigue (CF) all that negatively impact health status (HS) in individuals with FM. Yet, there's a lack of effective self-management exercise interventions capable of alleviating FM symptoms.

**PURPOSE:** To examine the efficacy of a 10-week daily practice qigong program on WCP, SD, CF, and HS in individuals with FM. **METHODS:** 20 individuals with FM were randomly assigned to one of two groups with participants blinded to the intervention allocation. The experimental group learned, and practiced mild body movements synchronized with deep diaphragmatic breathing and meditation. The control group learned and practiced only the mild body movements (same movements as the experimental group). Both groups were asked to practice the interventions for 10-week, two times per day at home plus one weekly group practice with a qigong instructor. Clinical assessments collected at baseline and upon completion of the intervention were: Short-Form McGill Pain Questionnaire, a visual analog scale for pain graded from 0 (no pain) to 10 (worst possible pain), Pressure Pain Threshold measured by a dolorimeter, the Pittsburgh Sleep Quality Index and the Revised Fibromyalgia Impact Questionnaire. WCP score comparisons were made using MANOVA. SD, CF and HS were compared with *t*-tests. **RESULTS:** The experimental group experienced greater clinical improvements when compared to the control group with the mean scores differences of WCP, SD, CF, and HS all being statistically significant at  $p<.05$ . Within group analysis revealed that the experimental group improved WCP by 35% ( $p<.01$ ), SD by 34% ( $p<.01$ ), CF by 30% ( $p<.05$ ) and HS by 31% ( $p<.01$ ). The control group only presented significant improvement in HS by 21% ( $p<.05$ ). **CONCLUSION:** Daily practice of Qigong might have a positive impact on the main FM symptoms that is beyond group interaction and solely mild exercise.

444 Board #282 May 29 11:00 AM - 12:30 PM  
**Effect Of Core Strength Training On Efficiency, Core Strength Of Patients With LBP**

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 (No relevant relationships reported)

**PURPOSE:** To observe the effect of core strength training on rehabilitation and core strength of patients with chronic low back pain.

**METHODS:** 120 patients diagnosed as LBP in the affiliated sports hospital of Chengdu Sport Institute are divided into three groups by using randomized, controlled, single-blind experimental methods. The patients in the first group (group A) use basic treatment (acupuncture, massage, TDP irradiation) and core strength training. Basic treatment and gymnastics training are applied for the patients in the second group (group B), while basic treatment is used for the third group (group C). All the trainings continue 8 weeks. Spss19.0 is used for statistics analyses. Efficiency analysis, VAS score and core strength are tested before treatment, after 3 and 8 weeks of treatment. The efficiency is calculated by Redit analysis.

**RESULTS:** 106 patients participate the whole process and the baseline data before intervention are basically same, and there is no difference in three groups. After 8 weeks training, all the test indicators have changed as follows: 1.Efficiency: The total effective rate is 94.1% in group A, 88.6% in group B, 86.5% in group C. There is a significant difference between group A,B and C by Redit analysis( $P<0.01$ ). There is no difference between group B and C ( $p>0.05$ ). 2.VAS score: There is no significant difference before intervention. After intervention, the score of group A decreased by 4.68 points, 3.77 points in group B and 3.81 points in group C. There is a significant difference in three groups ( $p<0.01$ ), while there is no significant difference between group B and C( $p>0.05$ ). 3.core strength: the strength of group A has a significant improvement between three groups( $p<0.01$ ). There is no significant difference in the ratio of extension/flexion strength, left/right flexural force( $p>0.05$ ). After 8 weeks, The ratio of extension/flexion strength changes significantly in group A ( $p<0.01$ ); the ratio of muscle strength in left/right curve shows that group A and B has significant differences ( $p<0.05$ ) while highly significant difference C ( $p<0.01$ ).

**CONCLUSIONS:** After 8 weeks intervention, basic treatment and core strength training can significantly improve the rehabilitation and the core strength, reduce pain and optimize the efficiency of LBP patients.

**445** Board #283 May 29 11:00 AM - 12:30 PM  
**The Mapping Knowledge Analysis of Exercise Intervention for Drug Dependence Research at Home and Abroad**  
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 (No relevant relationships reported)

Based on the 542 articles with the theme of “exercise intervention and drug dependence” from 1991 to 2018 included in WOS core collection database, this study analyzed the annual output quantity, country/region, high-yield authors, subject distribution, high-frequency keywords, keywords time zone view, high-frequency classical literature, etc. by using CiteSpace, as a mean of visualization. The purposes of this study were to analyze structural characteristics, quantitative relation, research hotspots and evolution in the field of exercise intervention and drug dependence. Results: The number of publications on exercise intervention and drug dependence was on the rise. The United States, the United Kingdom and Canada were in the world leading position in the exercise intervention and drug dependence, and Shanghai University of Sport occupied the dominating position in China. Universities and hospitals were the important positions. The research involved several interdisciplinary subjects, such as neuroscience, drug abuse, public environment and occupational health, pharmacology and sports science, etc. The research hotspots focused on tobacco and alcohol-dependent population, mainly taking exercise intervention or physical activity as the independent variable, withdrawal symptoms, behavioral cognition, craving degree, health risk and other indicators as the dependent variable, with little research on drug dependence population, especially the optimal form and neural mechanism of exercise intervention were still unclear.

**446** Board #284 May 29 11:00 AM - 12:30 PM  
**Exercise As An Adjuvant For Post-acute Withdrawal Syndrome In Substance Use Disorder**  
 Raj Masih<sup>1</sup>, Michael Landis<sup>1</sup>, Barbra Masih<sup>1</sup>, Kabeer Masih<sup>2</sup>, Justin Bates<sup>3</sup>. <sup>1</sup>Potomac Highlands Guild, Inc, Petersburg, WV. <sup>2</sup>Texas Tech University Paul Foster School of Medicine, El Paso, TX. <sup>3</sup>West Virginia University, Morgantown, WV.  
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 (No relevant relationships reported)

**Title: Exercise as an adjuvant to Post- Acute Withdrawal Syndrome in Substance Use Disorder**

The role of exercise to prevent SUD, and as a component of conventional treatment for SUD has been described before by others.

**Purpose:** Our study purpose was to explore the relationship between exercise and Post-Acute Withdrawal Syndrome symptomatology.

**Study Design:** 26 clients with documented history of SUD involving methamphetamine, heroin or both were enrolled in the study at a regional licensed behavioral healthcare facility outpatient recovery program. 17 male and 9 female clients ranging in age from 17-41 were enrolled. 13 were enrolled in traditional recovery plans (Counseling, recovery coaching, and 12 Step meetings), and 13 were enrolled in the exercise arm of the study which included structured resistance training, aerobic exercise along with the traditional recovery plan modalities. Study duration was 6 weeks.

The study specifically measured symptoms of Post-Acute Withdrawal at weeks 1-6 utilizing the Addiction Severity Index (ASI) and Post-Acute Withdrawal Symptom Index (PAWSI). The researchers utilized the indices by self-report surveys conducted at enrollment and at the end of weeks 1-6.

**Results: By Week 6 symptom reduction (see table)**

**Discussion:** Post-Acute Withdrawal syndrome is well described in early recovery from SUD and has been shown to be a significant factor in relapse. The role of dopamine depletion has been well described as the neurophysiologic correlate of Post-Acute Withdrawal Syndrome. The use of a structured exercise program including resistance training coupled with aerobic exercise can be a useful adjuvant to potentiate early recovery, reduce symptoms of Post-Acute Withdrawal Syndrome and to mitigate early relapse.

Symptom Reduction By Week 6						
PAWS Symptom	Restless Leg	Sleep	Energy	Mood	Concentration	Engagement in therapy
Conventional Arm	30%	17%	22%	26%	15%	25%
Exercise Arm	55%	43%	76%	71%	46%	80%

**Conclusion:** Exercise significantly reduces the symptoms of Acute Post-Withdrawal Syndrome in clients with SUD, and is should be considered an important adjunct to treatment.

**447** Board #285 May 29 11:00 AM - 12:30 PM  
**Physical Activity, Physical Function And Quality Of Life In Patients With Single And Multiple Chronic Diseases**  
 Fiona Skelly<sup>1</sup>, Niall Moyna<sup>1</sup>, Noel McCaffrey<sup>1</sup>, Lisa Loughney<sup>1</sup>, Kieran Dowd<sup>2</sup>, Andrew McCarron<sup>1</sup>, Mairead Cantwell<sup>2</sup>, Brona Furlong<sup>1</sup>. <sup>1</sup>Dublin City University, Dublin, Ireland. <sup>2</sup>Athlone Institute of Technology, Westmeath, Ireland.  
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**PURPOSE:** An estimated 50 million people in the Europe live with multi-morbidity (MM). Research has found that those with MM have a greater risk of physical function (PF) decline and poorer quality of life (QoL) than those with a single chronic disease (SCD). The aim of this study was to compare the physical activity (PA) levels and sedentary behavior (SB) in patients with MM and SCD and to investigate the association between PA and PF and QoL. **METHODS:** Subjects (n=229, 54.4% female, age (mean±SD) 62.2±11.1 yr) were recruited at induction to a community-based exercise program for chronic disease. Medical history was obtained from a referral letter provided by a healthcare professional. Subjects with a single diagnosis of a chronic disease, primarily including cardiovascular, respiratory disease, cancer, diabetes, were classified as SCD. Participants with ≥2 of these diagnoses were classified as MM. BMI and waist to hip ratio (WHR) were measured and calculated using standard procedures. Upper and lower body strength, flexibility and cardiorespiratory fitness were assessed using a hand-grip test, sit-to-stand test (STS), sit and reach test (SRT), and 6-min time trial (6MTT), respectively. PA and SB were recorded using an activPAL<sup>3</sup> micro accelerometer. QoL was assessed using the EQ5D VAS. Independent sample T tests were used to compare MCD with SCD on measures of PA, SB, PF and QoL. General linear models were used to investigate the association between PA and SB and PF and QoL.

**RESULTS:** 102 (44.5%) participants were defined as MM. Participants with MM had higher waking SB (9.3 ± 1.8 vs 9.9 ± 1.9 hrs/d, p=.013), lower MVPA (0.3 ± 0.2 vs 0.4 ± 0.2 hrs/d, p=.001) and daily step count (6185 ± 3016 vs 7270 ± 3196 steps/d, p=.009) compared with SCD. MM had higher BMI (31.6 ± 7.3 vs 28.0 ± 5.3 kg/m<sup>2</sup>), (p=.000 for all). MM achieved significantly poorer results for the STS (23.8 ± 9.6 vs 21.2 ± 7.3 s, p=.021) and 6MTT (453.3 ± 118.9 vs 514.4 ± 113.2 m, p=0.00). There were no differences between groups for WHR, SRT and QoL. MVPA was significantly related to weight, BMI, 6MTT, daily step count was related to STS, 6MTT and QoL and waking SB was related to WHR. **CONCLUSIONS:** Individuals with MM had greater SB and less PA than those with SCD. PF was poorer for individuals with MM. There were significant associations between PA with physical function and QoL in a CD population.

**448** Board #286 May 29 11:00 AM - 12:30 PM  
**Physical Activity and Quality of Life: Using Exercise as Treatment in Primary Care**  
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 (No relevant relationships reported)

Physical inactivity is linked to a reduced quality of life (QOL) and is more pronounced in those living with chronic health conditions. The use of exercise referral as a therapeutic treatment by healthcare providers may be an important clinical tool in improving QOL in the chronic disease population. **PURPOSE:** To explore differences in QOL and physical activity (PA) of patients who were medically referred to an exercise-as-treatment (EAT) program. Secondly, to explore factors that contribute to QOL.

**METHODS:** A Midwest healthcare system referred 213 chronic disease patients to an on-site EAT program. A total of 59 patients (64y ± 12; 64.4% female) responded to a follow-up survey that included the eight-scale RAND-36 item health questionnaire to assess QOL and the Physical Activity Vital Sign questions to determine average PA level in minutes per day. Respondents were categorized into 1) did not engage in the exercise program 2) engaged in up to two sessions 3) engaged in three or more sessions. ANOVA was conducted to test for between-group differences, Pearson correlations between QOL and exercise visits, independent samples t-test for influence of PA behavior on general health QOL, and forward selection to explore a model to best inform general health QOL.

**RESULTS:** No significant differences were found between exercise visit categories, QOL scales, and PA. Number of exercise visits was found significantly negatively correlated with emotional well-being QOL (r = -.350, p<.01) and with pain QOL (r = -.326, p<.01). A significant difference was found (SF-36 score) in general health QOL for patients who met the PA guideline of 150 minutes per week (M=68.81, SD=22.299) versus those who did not meet the guideline (M=53.71, SD=17.382); t(54)=2.827, p=.007. Forward selection chose social functioning, energy, minimal role limitations due to physical health, and PA minutes as contributors to patient general health QOL with adjusted R<sup>2</sup>=.714 (p=.004).

**CONCLUSIONS:** Results support the positive influence of exercise behavior on QOL. Using the healthcare system to assess PA behavior, such as including exercise as a vital sign, is a strategy that will enable providers to refer and deliver an EAT approach. Future research should include comparison of PA behavior as well as exercise program visits with specific chronic diseases and QOL.

**449** Board #287 May 29 11:00 AM - 12:30 PM  
**Effects Of Cooled Compression Exercise Technology On Health, Sleep, And Quality Of Life In Veterans.**

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 (No relevant relationships reported)

Veterans are disproportionately affected by physical and emotional functional disorders compared to their civilian counterparts, a discrepancy that is deepened by delay to care within the Veterans Health Administration. Research has supported use of compression exercise in physically limited populations and demonstrated physiological responses at lower intensities (10-20% one repetition maximum vs 70% for hypertrophy in resistance exercise). Combination of low-pressure compression exercise and cooling has shown elevated growth hormone and testosterone and depressed nighttime cortisol, indicating this may be beneficial for addressing emotional and sleep dysfunctions.

**PURPOSE:** To determine the safety and efficacy of an accessible cooled compression exercise system on markers of physical and emotional function in veterans.

**METHODS:** 14 veterans completed 24 sessions in 12 weeks. Baseline and endpoint questionnaires validated for clinical significance were administered to determine sleep quality (Pittsburg Sleep Quality Index), quality of life (RAND Short Form 36), and respiratory dysfunction related to stress and anxiety (Nijmegen Questionnaire).

**RESULTS:** Two-tailed T-tests were performed on the data. Sleep quality improved in 71% of subjects (9.15±6.87 vs 5.57±3.74,  $p = 0.0232$ ), 57% improved quality of life (73.45±17.17 vs 84.46±9.27,  $p = 0.0316$ ), and 71% decreased adverse respiratory symptoms (11.29±8.38 vs 7.86±6.26,  $p = 0.0594$ ) compared to baseline. Increases were seen in all 8 sub-scores of quality of life, with statistically significant improvements in social functioning (75±28.17 vs 94.64±11.62,  $p = 0.0058$ ), energy and fatigue (48.93±25.21 vs 65.63±19.26,  $p = 0.0426$ ), emotional wellbeing (66±24.29 vs 85.14±14.16,  $p = 0.0054$ ), and general health (72.14±15.78 vs 79.64±12.78,  $p = 0.0497$ ). For sleep quality, those subjects with baseline scores defined as clinically disturbed sleep ( $n=8$ , 58%) all (100%) experienced sleep improvements (9.14±6.87 vs 5.57±3.74,  $p = 0.00301$ ), with 25% resolving below clinical delineation.

**CONCLUSION:** These findings suggest that the combination of cooling and compression exercise may be an effective intervention method to address symptoms in veterans and other individuals living with insomnia, post-traumatic stress, chronic fatigue, and depression.

**A-56** Exercise is Medicine®/Poster - EIM -  
**Miscellaneous Health Problems/Diseases**

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
 Room: CC-Hall WA2

**450** Board #288 May 29 11:00 AM - 12:30 PM  
**Enjoyment Responses to High Intensity Interval and Moderate Intensity Continuous Training in Crohn's Disease Patients**

Lindsay Bottoms<sup>1</sup>, Dean Leighton<sup>2</sup>, Roger Carpenter<sup>3</sup>, Simon Anderson<sup>4</sup>, Louise Langmead<sup>5</sup>, John Ramage<sup>6</sup>, James Faulkner<sup>7</sup>, Elizabeth Coleman<sup>8</sup>, Caroline Fairhurst<sup>8</sup>, Michael Seed<sup>9</sup>, Garry A. Tew<sup>10</sup>. <sup>1</sup>University of Hertfordshire, College Lane, United Kingdom. <sup>2</sup>Queen Mary University, London, United Kingdom. <sup>3</sup>University of East London, Water Lane, United Kingdom. <sup>4</sup>Guy's and St Thomas' NHS Foundation Trust, London, United Kingdom. <sup>5</sup>Barts and the London NHS Trust, London, United Kingdom. <sup>6</sup>Hampshire Hospitals NHS Foundation Trust, Winchester, United Kingdom. <sup>7</sup>University of Winchester, Winchester, United Kingdom. <sup>8</sup>University of York, York, United Kingdom. <sup>9</sup>University of East London, London, United Kingdom. <sup>10</sup>Northumbria University, Newcastle Upon Tyne, United Kingdom. (Sponsor: Dr Mark Glaister, FACSM)  
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 (No relevant relationships reported)

**PURPOSE:** The aim of this study was to undertake secondary data analysis from a three-arm feasibility trial of high intensity interval training (HIIT), moderate intensity continuous training (MICT), and usual care, in Crohn's disease (CD) patients ( $n=36$ ), with a primary focus on exploring affective and enjoyment responses to the two types of exercise training. **METHODS:** Twenty-five participants with quiescent or mildly-active CD were randomised to one of the two active groups: HIIT ( $n=13$ ) and MICT ( $n=12$ ). Both groups were offered three exercise sessions per week for 12 weeks. MICT consisted of cycling for 30 minutes at 35% peak power (Wpeak), whereas HIIT involved ten 1-minute bouts at 90% Wpeak, interspersed with 1-minute bouts at 15% Wpeak. Peak power was determined prior to the intervention and reassessed at weeks 4 and 8 to adjust training load. Heart rate (HR) and differentiated ratings of perceived exertion (RPE) for legs (RPE-L) and central (i.e. ventilatory and circulatory; RPE-C), along with feeling state (Feeling Scale; FS) were measured at regular time intervals during each exercise session. In addition, enjoyment was measured at the end of the training programmes using the Physical Activity Enjoyment Scale (PACES). Post-hoc exploratory analysis involved a mixed-model two-way ANOVA to compare HR, RPE-C, RPE-L and FS at weeks 1, 6 and 12 between groups. An independent t-test was used to assess between-group differences in PACES scores. **RESULTS:** HR was greater ( $p < 0.01$ ) during HIIT (168 ± 20 bpm) compared with MICT (124 ± 18 bpm). Similarly, RPE-L and RPE-C responses were greater ( $p = 0.03$  and  $p = 0.03$ , respectively) during HIIT (5.5 ± 1.6 and 5.1 ± 1.7 i.e. 'hard', respectively) compared to MICT (3.3 ± 1.5 and 2.9 ± 1.5 i.e. 'moderate', respectively). Overall, FS recorded was 2.2 ± 1.8 (i.e. 'fairly good') for HIIT and 2.1 ± 1.3 (i.e. 'fairly good') for MICT with no effect of condition ( $P=0.25$ ) or time ( $P=0.94$ ). There was also no statistically significant difference in PACES scores between HIIT (99.4 ± 12.9) and MICT (101.3 ± 17.4;  $p = 0.78$ ). **CONCLUSION:** Despite the differences in HR and RPE responses, the findings suggest that the HIIT and MICT protocols elicited similar enjoyment and affective responses in adults with quiescent or mildly-active CD.  
 Support by CCUK Grant SP2015/1.

**451** Board #289 May 29 11:00 AM - 12:30 PM  
**High-intensity Interval Training And Moderate-intensity Continuous Training In Adults With Crohn'S Disease: A Pilot Trial**

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 (No relevant relationships reported)

**PURPOSE:** To assess the feasibility and acceptability of two common types of exercise training—high-intensity interval training (HIIT) and moderate-intensity continuous training (MICT)—in adults with Crohn's disease (CD).  
**METHODS:** In this mixed-methods pilot trial, participants with quiescent or mildly-active CD were randomly assigned 1:1:1 to HIIT, MICT or control (usual care). The HIIT and MICT groups were offered three exercise sessions per week for the first 12 weeks and followed up for 6 months. Feasibility outcomes included rates of recruitment, retention, outcome completion, and exercise attendance. Data were collected on cardiorespiratory fitness (e.g., peak oxygen uptake), disease activity, fatigue, quality of life, adverse events, and intervention acceptability (via interviews).  
**RESULTS:** Over 17 months, 53 patients were assessed for eligibility and 36 (68%) were randomised (47% male; mean age 36.9 [SD 11.2] years); 13 to HIIT, 12 to MICT, and 11 to control. The overall exercise session attendance rate was 68% (608/891), and 64% (16/25) of participants completed at least 24 of 36 sessions. One participant was lost to follow-up. Outcome completion rates ranged from 89 to 97%. The mean increase in peak oxygen uptake, relative to control, was greater following HIIT than MICT (2.4 vs. 0.7 mL/kg/min). There were three non-serious exercise-related adverse events, and two exercise participants experienced disease relapse during follow-up.  
**CONCLUSIONS:** The findings support the feasibility and acceptability of the exercise programmes and trial procedures. A definitive trial is warranted. Physical exercise remains a potentially useful adjunct therapy in CD. Support by CCUK Grant SP2015/1.

**452** Board #290 May 29 11:00 AM - 12:30 PM  
**Metabolic Profile And Myocardial Performance Of Renal Transplant Recipients Adherent To Unsupervised Exercise As Prescription Program.**

Beatrice Leone<sup>1</sup>, Luciano Moscarelli<sup>2</sup>, Elena Zappelli<sup>1</sup>, Chiara Ingletto<sup>3</sup>, Marco Mandoli<sup>3</sup>, Giorgio Galanti<sup>4</sup>, Pietro Amedeo Modesti<sup>1</sup>, Laura Stefani<sup>4</sup>. <sup>1</sup>Sports Medicine Center -University of Florence, Florence, Italy. <sup>2</sup>Nephrology Unit-University of Florence -Italy, Florence, Italy. <sup>3</sup>Sports Medicine, Florence, Italy. <sup>4</sup>Sports Medicine-FIMS( Italian Federation of Sport Medicine), Florence, Italy.  
 (No relevant relationships reported)

**Purpose :** Renal transplant recipients (RTR) are at elevated cardiovascular mortality in comparison with the general population especially after surgical treatment. Literature supports the role of the supervised exercise intervention, however few data are available about the potential impact of the unsupervised exercise . We investigated whether a home-based program of exercise could reduce CV risk in RTR by evaluating the changes in renal and cardiometabolic parameters and myocardial performance measured by echocardiography. **Methods:** From a large cohort of 60 RTR, 30 RTR (12 females and 18 males, aged 47.9 ± 12.3 y) participated in individualized and unsupervised exercise programs for 6 months, at moderate intensity. Cardiometabolic risk factors, anthropometrics parameters, lipid and glucose blood sample profile were studied as well the myocardial performance by the 2D echo examination at T<sub>0</sub>, T<sub>6</sub> months. **Results:** lipid profile maintained in the range of a low risk level, despite without significant improvement. the myocardial performance, especially EF was significantly (p<0.05) ameliorated ( EF<sup>RTR</sup>: 60.2±5<sup>10</sup> vs 62.0±3.7<sup>16</sup> ; EF<sup>HC</sup>: 63.6±3.8<sup>10</sup> vs 62.4±3.3<sup>16</sup> ). **Conclusions:** an home based exercise program has a positive impact on myocardial function and maintains low cardiovascular risk profile since 6 months of exercise. The trend support the importance to highlight the role of a correct reconditioning of the lifestyle in RTR, by the unsupervised exercise program at moderate intensity, where well tolerated . **Table 1: Characteristics of renal transplant recipient (RTR) and healthy controls (HC)**

RTR (n =30)	RTR T <sub>0</sub>	RTR T <sub>6</sub>	P value
Weight (kg)	70.6±15.6	70.7±15.3	0.830
BMI (kg/m <sup>2</sup> )	24.3±3.8	24.9±4.4	0.631
Creatinine (mg/dL)	1.5±0.5	1.5±0.7	0.808
Urea (mg/dL)	66±0.26	71±0.43	0.787
Cholesterol (mg/dL)	187.0±55.7	194.7±47.8	0.688
HDL (mg/dL)	54.9±22.4	54.1±16.0	0.218
LDL (mg/dL)	130.6±95.0	134.5±93.0	0.655
Triglycerides (mg/dL)	198.1±152.4	193.3±127.6	0.951
Glucose (mg/dL)	1.01±0.25	0.94±0.25	0.550

**453** Board #291 May 29 11:00 AM - 12:30 PM  
**The Effect Of Traditional Chinese Exercise On early Diabetic Nephropathy**

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 (No relevant relationships reported)

**PURPOSE:** It was reported that early diabetic nephropathy (DN) is associated with sedentary lifestyle, and proper exercise can improve its symptoms and prognosis. However, limited data evaluated the effects and safety of traditional Chinese exercise in patients with early DN. This study was aimed at observing the effects and safety of traditional Chinese exercise on early DN.  
**METHODS:** Participants (n=21) were divided into the traditional Chinese exercise group (A group, n=12) and the control group (B group, n=9) for 12 weeks. On the basis of foundation treatment, group A was given the exercise 30 minutes per day, 4 times a week while no exercise intervention was given in group B. Fasting blood glucose, glycated hemoglobin (HbA1c), serum creatinine, urea, and the MUNSH scale were taken at baseline and 12 weeks later.  
**RESULTS:** 1) Significant differences were found in group A in HbA1c (6.90±0.92 vs 6.43±0.78, P<0.05), BMI (26.30±3.49 vs 25.83±3.06, P<0.05) and VO2peak (15.43±1.49 vs 16.14±1.89, P<0.05) compared with group B (Ps>0.05). The differences of MUNSH scale were significantly greater: positive emotion (6.75±3.14 vs 7.92±2.97, P<0.01), positive experience (8.08±4.03 vs 10.00±3.77, P<0.05), total score (32.67±11.28 vs 38.33±12.27, P<0.01). 2) No adverse reactions were observed during the trail. Few changes were found in renal function and urinary protein in two groups (P>0.05).  
**CONCLUSIONS:** Traditional Chinese exercise therapy was safe and effective in treating early DN patients. It also has effects on improving the physical and mental health. Supported by JDZX2015136

**454** Board #292 May 29 11:00 AM - 12:30 PM  
**Overall Fitness Benefits In Individuals With HIV Participating In A Community- Based Exercise Program**

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 (No relevant relationships reported)

Exercise has been shown to improve the health of persons living with HIV. **PURPOSE:** Identify the effects of a community-based exercise program on the immunity (CD4 cell count) and overall fitness (cardiovascular and strength) in individuals living with HIV in San Juan, Puerto Rico.  
**METHODS:** Twenty-five adults with HIV age 59.2± 1.7 years participated in this study. Individuals were recruited by word of mouth to a Community Based Exercise Program (La Perla de Gran Precio). A Certified Personal Trainer performed all the exercise testing. Cardiovascular fitness was assessed using a submaximal treadmill test (Ross). Strength was assessed by determining the 1 repetition maximum (1RM) for bench press and leg press and the maximum number of push-ups and sit-ups that could be completed in 1 minute. Flexibility was tested using the Sit and Reach Test. Participants were asked to bring in the most recent lab for the CD4 data. This same evaluation was administered three times to track each participant's progress over a year.  
**RESULTS:** A repeated measures ANOVA was used to determine whether there was a statistically significant mean difference in CD4 count, cardiovascular fitness (time

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completed and cardiac frequency), 1RM bench press and leg press, the maximum number of push-ups and sit-ups that could be performed in 1 minute, and flexibility between evaluations. There was a statistically significant difference ( $p < 0.05$ ) between CD4 count from evaluation 1 ( $695 \pm 318.58$ ) to evaluation 4 ( $945.57 \pm 433.12$ ) and the most significant mean difference was noted between evaluation 1 ( $695 \pm 318.58$ ) to evaluation 3 ( $932.85 \pm 408.42$ ). The data showed the steady improvement in strength (bench press, leg press, push-ups, and sit-ups) occurred between evaluation 1 and evaluation 3; however, the gains were not statically significant ( $p > 0.05$ ). Time completed during the submaximal test improved most between evaluation 1 and evaluation 2 but did not demonstrate the statistically significant mean difference ( $p > 0.05$ ).

**CONCLUSION:** Participation in a community-based exercise program can help significantly improve immunity (increase CD4 count) in people with HIV. Therefore, clinicians should encourage individuals with HIV to participate in regular exercise and introduce them to community/recreational programs.

455 Board #293 May 29 11:00 AM - 12:30 PM

### Web-based Individualized Exercise Intervention Improves Physical Performance and Hepatic Inflammation in Patients with NAFLD

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Non-alcoholic fatty liver disease (NAFLD) is the most frequent cause of liver disease with Non-alcoholic steatohepatitis (NASH) as a subtype showing lobular inflammation and ballooning as characteristic liver cell damage.

**PURPOSE:** Here we studied the impact of regular physical activity promoted and controlled by a novel Web-based approach on physical performance, liver inflammation, and histology. **METHODS:** We enrolled 44 Patients with NAFLD in a prospective, 8-week interventional single arm study with a 12-week follow-up period (NCT02526732). Peak oxygen uptake (VO<sub>2</sub>peak) was measured by spiroergometry from baseline (T0) to post intervention (T1) and laboratory parameters for liver function (AST, ALT) and inflammation (CRP and Ferritin) as well as liver fibrosis non-invasively by Vibration Controlled Transient Elastography (VCTE) were also measured after follow-up (T2). Training consisted out of combined endurance and strength exercise 3-5 times a week under qualified instruction. Via an online support platform, weekly bidirectional feedback was provided. Differences between groups were calculated by Mann-Whitney-U-rank test.

**RESULTS:** A total of 44 patients with NAFLD were assigned and 41 patients, including 29 patients with NASH, completed the study protocol. Median VO<sub>2</sub>peak increased significantly 6.6% from 27.0 ml/kg/min at T0 to 30.3 ml/kg/min ( $p < 0.001$ ) at T1. All laboratory values decreased significantly from T0 to T1 and T0 to T2. Median pressure measured by VCTE improved significantly from 7.4 kPa at T0 to T1 by 1.0 kPa ( $p < 0.05$ ) and also from T0 to T2 by 1.9 kPa ( $p < 0.05$ ). Interestingly, the subgroup of patients with NASH achieved better improvements of effect sizes for all measured parameters at all points in time. **CONCLUSIONS:** The current study demonstrates the feasibility and effectiveness of a Web-based individualized exercise program in patients with NAFLD. More severe liver inflammation and damage (NASH) does not compromise treatment effects. Sustained improvement in liver function tests and fibrosis marker support the concept of fibrosis resolution through decreasing hepatic inflammation during and following exercise intervention in this patient population.

456 Board #294 May 29 11:00 AM - 12:30 PM

### Exercise is Medicine®: Physical Activity Prescriptions and Behavior During Pregnancy

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(No relevant relationships reported)

Physical activity (PA) is beneficial to the health of both pregnant mother and unborn child, particularly when current PA guidelines are met (e.g., 150 min/week of moderate-intensity PA). The impact of PA prescriptions given by prenatal physicians, following the Exercise is Medicine® program, is currently unclear. **PURPOSE:** This study examined the relationship between healthcare provider PA prescriptions given at two prenatal healthcare visits and subsequent PA behavior of pregnant women. **METHODS:** Prenatal healthcare providers in Cabarrus County, North Carolina assessed physical activity days/week and minutes/day among all prenatal patients (N=965) at two prenatal visits (V1: 20 weeks gestation; V2: 28 weeks gestation).

Minutes/week of physical activity were calculated, and providers were trained to provide physical activity prescriptions if the patient was not meeting current guidelines. Wilcoxon-Mann-Whitney tests were used to determine the association between healthcare provider PA prescription and self-reported physical activity from V1 to V2. **RESULTS:** The frequency of PA assessment at visits decreased as pregnancy progressed (V1=82.1%; V2=45.9%). Median PA minutes reported increased from V1 (25.0 min/wk) to V2 (60.0 min/wk). Likewise, the percentage of pregnant women receiving a PA prescription decreased from visit to visit (V1=68.6%; V2=56.3%). Women who received a PA prescription reported a greater increase in PA from V1 to V2 (117 min/wk) compared to women who did not receive a PA prescription (72 min/wk) ( $p < 0.001$ ). However, only 18.1% of PA prescriptions were consistent with current PA guidelines at prenatal visits. **CONCLUSIONS:** PA among pregnant women appears positively influenced by PA prescriptions provided by healthcare providers. Further training of healthcare providers is needed to increase the prevalence of prenatal exercise prescriptions consistent with PA guidelines.

457 Board #295 May 29 11:00 AM - 12:30 PM  
**Provider Advice on Weight Gain, Physical Activity, and Healthy Eating in Twin Pregnancies**

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(No relevant relationships reported)

**PURPOSE:** To examine provider advice on gestational weight gain (GWG), physical activity (PA), and healthy eating (HE) during twin pregnancies, and to determine if advice on GWG is associated with women's GWG.

**METHODS:** Data are from 301 women, aged 21-43 years, who delivered twins in the prior 24 months and completed an online survey in 2018. The 2009 Institute of Medicine (IOM) provisional weight gain guidelines for twin pregnancies defined whether provider advice on GWG and women's GWG were below, within, or above guidelines. Content analysis described provider advice on PA and HE. Multinomial logistic regression examined the associations of provider advice on GWG with women's GWG, after adjustment for potential confounders.

**RESULTS:** Approximately 66% of women reported provider advice on GWG, 73% on PA, and 59% on HE during their twin pregnancy. Of those who reported GWG advice, 30% described advice below, 60% within, and 10% above the IOM guidelines. Women who were not on bedrest (15%) reported recommendations to engage in light- or moderate-intensity activities like walking or swimming, but cautioned to avoid overexertion. Advice on HE included recommendations to increase consumption of protein, fruits, vegetables and vitamins/minerals, with emphasis on increasing caloric intake. As seen in **Table 1**, compared to women who reported GWG advice within IOM guidelines, women who reported advice below guidelines or who reported no advice were 7.23 and 2.76 times more likely to gain less than recommended, respectively. Women who reported provider advice above guidelines were 5.05 times more likely to exceed guidelines (all  $p < 0.05$ ).

**CONCLUSION:** Forty percent of women reported GWG advice outside IOM guidelines, and inaccurate or no advice was strongly associated with inadequate or excessive GWG. There is a clear need for intervention strategies to educate providers about IOM guidelines, including how to counsel women on GWG, PA, and HE to optimize outcomes in twin pregnancies.

Table 1: Association Between Provider Advice on Gestational Weight Gain (GWG) and Compliance with the Institute of Medicine (IOM) Guidelines\*

Provider Advised GWG	GWG Below IOM Guidelines		GWG Above IOM Guidelines	
	Adjusted OR†	95% CI	Adjusted OR†	95% CI
Below IOM guidelines	7.23	3.20, 16.33	1.86	0.75, 4.61
Above IOM guidelines	0.64	0.07, 5.81	5.05	1.61, 15.85
Within IOM guidelines	Reference	Reference	Reference	Reference
Did not discuss	2.76	1.32, 5.78	1.88	0.92, 3.85

\*Due to differences in gestational age at delivery, a GWG ratio was calculated by dividing the lower and upper bounds of the IOM guidelines by 37 (guidelines created for women undergoing delivery ≥ 37 weeks gestation), to estimate GWG/week. The GWG ratios consistent with IOM guidelines for normal weight, overweight, and obese women were calculated as 1.00-1.46, 0.84-1.35, and 0.68-1.14 pounds per week, respectively.  
 †Model adjusted for maternal age at delivery, education, parity, twin type (dichorionic/diamniotic vs. dichorionic/monoamniotic or monochorionic/monoamniotic), assisted reproductive technologies (yes/no), and pre-pregnancy BMI category. Bolded values are statistically significant (p<0.05).

458 Board #296 May 29 11:00 AM - 12:30 PM  
**Lifestyle and Exercise Interventions for Lumbopelvic Pain and Pelvic Floor Dysfunction: A New Protocol**  
 Marc P. Bonis, Jenn Lormand, Christina Walsh. *University of New Orleans, New Orleans, LA.* (Sponsor: Mark Loftin, FACSM)  
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*(No relevant relationships reported)*

**PURPOSE:** The purpose of this study was to evaluate whether a protocol that included the implementation of lifestyle modifications and a specialized exercise program would improve the symptoms of pelvic floor dysfunction and mild pelvic organ prolapse in women.

**METHODS:** The five-week IRB-approved study included 23 female subjects aged 43.0 ± 9.0 years (Mean ± S.D.) who exhibited symptoms of pelvic floor dysfunction as defined by 3 assessments (the Pelvic Floor Distress Inventory [PFQI-7], the Oswestry Low Back Pain Disability, and the Pelvic Floor Impact [PFDI-SF20] questionnaires). The study also included InBody570 body composition measurements, pelvic alignment assessments, diastasis recti assessments, and manual external pelvic floor muscle activation assessments. Participants were instructed in specific lifestyle modifications and participated in an exercise program over the course of seven live group sessions, 45 minutes each, led by one or both of the investigator clinicians. They were also taught to perform a home exercise program at least 5 days per week and completed compliance forms that were returned at the next live group session. The clinicians were a licensed physical therapist and a clinical exercise physiologist.

**RESULTS:** IBM SPSS version 24 statistical programming was utilized and non-parametric Wilcoxon “related-items” analyses were employed. A 0.05 level of significance was applied. The study results of the pre- and post- values indicated significant improvements of lower back pain (Oswestry, z(23) = -3.67, p < .05), significant improvements of the quality of life subjective emotional gauge (PFDI -20, z(23) = -4.11, p < .05), and significant improvements of bladder, bowel, and prolapse symptoms (PFQI - 7, z(23) = -3.74, p < .05).

**CONCLUSIONS:** The study was highly labor- and time-intensive, and the sample was not large enough to eliminate statistical bias. However, the successful results warranted a continuation of the study to include 40 female volunteers with no modifications to the study’s protocol using the same clinicians. Researchers are currently recruiting volunteers to complete the study.

459 Board #297 May 29 11:00 AM - 12:30 PM  
**Association Between Cognitive Function And Funcional Capacity Of Patients With Peripheral Artery Disease**

Juliana Ferreira de Carvalho<sup>1</sup>, Marilia de Almeida Correia<sup>2</sup>, Paulo Longano<sup>3</sup>, Francielli Monteiro<sup>1</sup>, Nelson Wolosker<sup>1</sup>, Gabriel Grizzo Cucato<sup>1</sup>, Raphael Ritti-Dias<sup>2</sup>. <sup>1</sup>Hospital Israelita Albert Einstein, São Paulo, Brazil. <sup>2</sup>Universidade Nove de Julho, São Paulo, Brazil. <sup>3</sup>Hospital Israelita Albert Einstein, São Paulo, Brazil.

*(No relevant relationships reported)*

**Introduction:** Patients with peripheral arterial disease (PAD) and symptoms of intermittent claudication present reduced mobility and decreased ability to exercise activities of daily living due to atherosclerotic plaques in the lower limbs that limit blood flow to the muscles. Because it is a systemic disease, PAD has been associated with cognitive decline, however, as far as functional impairment is related to cognitive impairment is still uncertain. **Purpose:** To analyze the association of cognitive function with the overall functional capacity and fragmented in three factors: (walking speed, muscle strength and balance) of patients with PAD. **Methods:** Two hundred and nineteen patients with PAD and symptoms of intermittent claudication were submitted to the MoCA test to evaluate cognitive function. Functional ability was assessed by the Short Physical Performance Battery consisting of balance tests, sit-up and stand-up tests, and 4-meter walk test. For analysis of the associations, the binary logistic analysis was used, using the sex and age adjustment of the patients. **Results:** There was no association between MoCA and sit-up (OR = -0.099, P = 0.780) as well as the test and balance (OR = -0.084, P = 0.832). The MoCA score was associated with performance on the test regardless of gender and age (OR = 1.186, P = 0.007). Despite the non-association in the first two tests, we found that cognitive function is associated with walking capacity. **Conclusion:** The cognitive function is associated with the ability to mobility in patients with PAD, based on these results we can assume that individuals physically active, yet affected by the disease, can slow cognitive decline.

460 Board #298 May 29 11:00 AM - 12:30 PM  
**Correlates of Physical Activity in People With Heart Failure: Multivariable Analysis Based on REACH-HF Randomised Trials**

Grace O. Dibben<sup>1</sup>, Melvyn Hillsdon<sup>1</sup>, Hasnain M. Dalal<sup>1</sup>, Brad Metcalf<sup>1</sup>, Patrick Doherty<sup>2</sup>, Lars H. Tang<sup>3</sup>, Rod S. Taylor<sup>1</sup>. <sup>1</sup>University of Exeter, Exeter, United Kingdom. <sup>2</sup>University of York, York, United Kingdom. <sup>3</sup>University of Southern Denmark and Odense University Hospital, Odense, Denmark.  
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**PURPOSE:** To determine which patient demographics and patient reported outcomes (PROs) are associated with the average daily volume (ENMO) of accelerometer measured physical activity (PA) in people with heart failure (HF). **METHODS:** Baseline data was pooled from two studies which measured PA levels of people with both HF with reduced ejection fraction (HFrEF) and preserved ejection fraction (HFpEF) using 7-day wrist-worn accelerometry. Associations between PA volume, demographics and PROs were assessed using univariate linear regression. Variables with significant or close to significant associations (p<0.15) with PA were subsequently entered into multivariable stepwise regression models; (1) a demographic model, (2) a PRO model, (3) an overall model consisting of all closely associated variables (p<0.15), and (4) a final model consisting of all variables with p<0.05 identified in the demographic and PRO multivariable models. **RESULTS:** 245 participants were included in the analysis and had a mean daily PA volume of 17.8±6.6 mg, with no difference between HFrEF and HFpEF patients (t(242)=0.60, p=0.55). Univariate analysis showed age, body mass index (BMI), New York Heart Association (NYHA) class, ischaemic HF, NT-proBNP, living alone, chronic renal impairment, number of comorbidities, number of cardiorespiratory-metabolic comorbidities, incremental shuttle walk test (ISWT) distance, HEART QoL global and physical scores, EQ-5D-3L, MLHFQ overall, physical and emotional scores, and HADs depression scores were significantly associated with PA volume (p<0.05). The overall multivariable analysis (3) showed that age, BMI, being employed, currently smoking, NT-proBNP and ISWT peak distance had the strongest association with PA volume (R<sup>2</sup>=0.42, p<0.001). **CONCLUSION:** Multivariable analysis identified factors which may be important for clinicians and researchers to consider when tailoring PA interventions. However, our results should be treated with a degree of caution due to a relatively small sample size in relation to the number of exploratory variables included. That >50% of the variance in PA volume remained unexplained indicates the need for further investigation in this area, with bigger data sets required to make firm conclusions.

WEDNESDAY, MAY 29, 2019

461 Board #299 May 29 11:00 AM - 12:30 PM

**Lifestyle and Exercise Intervention Reduces Blood Pressure: A Multiethnic Control Trial**Guillermo Hernando Rodríguez Vélez<sup>1</sup>, Elvis Alvarez Carnero<sup>2</sup>, Elisero Iglesias-Soler<sup>3</sup>, Manuel Avelino Giráldez García<sup>3</sup>.<sup>1</sup>Facultad de Ciencias Naturales, Exactas y de la Educación, University of Cauca, Popayan, Colombia. <sup>2</sup>Florida Hospital, Translational Research Institute, Orlando, FL. <sup>3</sup>Facultad de Ciencias del Deporte y la Educación Física, University of A Coruna, A Coruna, Spain.

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(No relevant relationships reported)

The effect of ethnicity and medication on blood pressure (BP) have been widely described; however, less is known about the interaction between ethnicity, BP medication and regular exercise on hypertensive patients. **PURPOSE:** This study was aimed to determine the effectiveness of an exercise training and healthy lifestyle education program to reduce BP levels and improve adherence to pharmacological therapy on a multiethnic group of hypertensive patients.

**METHODS:** An 8-month quasi-experimental longitudinal intervention with an exercise group (EG) and control group (CG) was designed. Five hundred and sixty-eight hypertensive patients (67.4±8.8 years; BMI, 26.4±3.1 kg/m<sup>2</sup>; systolic BP (SBP), 146±9 mmHg and diastolic BP (DBP), 95±7 mmHg; 18% Indigenous, 23% Colombian-African and 59% Hispanic) finalized the study (EG, n= 307 and CG, n= 261). EG participated in 3 weekly exercise training sessions (30 to 60 minutes of concurrent training), which were complemented by medication and lifestyle education. The average of three repeated measures of BP performed with an electronic sphygmomanometer was utilized as primary outcome. Health status, medication adherence, salt consumption, tobacco and alcoholic habits were recorded by questionnaires during clinic history assessment. Non-parametric tests were carried out to compare differences between EG and CG. Several logistic regression models were used to find independent variables predicting two levels (-3 or -5 mmHg) of reduction in systolic (SBP) or diastolic blood pressures (DBP).

**RESULTS:** We found significant reductions both SBP and DBP in EG (-5.92 mmHg and -5.0 mmHg, respectively,  $P<0.001$  for both) but not in the CG. Also, prevalence of medication adherence was significantly improved in 28.7% ( $P<0.001$ ) in the EG. In the logistic regression, all models confirmed the EG as the main explanatory variable of a 3 or 5 mmHg BP reduction, independently of other lifestyle risk factors and medication adherence. **CONCLUSIONS:** In accordance with other studies patients in EG showed more diminution in SBP and DBP than CG, which was independent of other risks factors. However, the main findings were that either ethnic or medication adherence did not influence statistically the reduction in BP associated with our exercise/lifestyle intervention.

462 Board #300 May 29 11:00 AM - 12:30 PM

**Tai Chi as Antihypertensive Lifestyle Therapy: A Systematic Review and Meta-Analysis**Yin Wu<sup>1</sup>, Blair T. Johnson<sup>1</sup>, Shiqi Chen<sup>2</sup>, Yiyang Chen<sup>3</sup>, Jill Livingston<sup>1</sup>, Linda S. Pescatello, FACSM<sup>1</sup>. <sup>1</sup>University of Connecticut, Storrs, CT. <sup>2</sup>University of Michigan, Ann Arbor, MI. <sup>3</sup>Shanghai University of Sport, Shanghai, China. (Sponsor: Linda S. Pescatello, FACSM)

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Due to limited evidence professional health organizations are reluctant to recommend Tai Chi to treat hypertension. **PURPOSE:** We conducted a systematic review and meta-analysis to examine the efficacy of Tai Chi as antihypertensive lifestyle therapy. **METHODS:** Tai Chi interventions published in English and Chinese were included when they involved healthy adults, reported pre-and post-intervention blood pressure (BP), and had a non-exercise/non-diet control group. We systematically searched 11 electronic databases through August 1, 2018, yielding 31 qualifying controlled trials. We: 1) evaluated the risk of bias and methodological study quality; 2) performed meta-regression analysis following random-effects assumptions; and 3) generated additive models representing the largest possible clinically relevant BP reductions. **RESULTS:** On average, participants ( $N=3,223$ ) were middle-aged (56.6±15.1 years) adults with prehypertension (systolic BP [SBP] 136.9±15.2/diastolic BP [DBP] 83.4±8.7 mmHg). Tai Chi was practiced 4.0±1.4 sessions/week for 54.0±10.6 minutes/session for 22.3±20.2 weeks. Overall, Tai Chi elicited moderate to large reductions in SBP ( $d=-0.75$ , 95%*CI*s: -0.97, -0.53; -8.7 mmHg) and DBP ( $d=-0.53$ , 95%*CI*s: 0.71, 0.34; 4.7 mmHg) compared to control ( $P<0.001$ ). Controlling for publication bias among samples with hypertension, Tai Chi interventions published in English elicited SBP reductions of 10 mmHg and DBP of 4 mmHg, half the magnitude of trials published in Chinese with SBP reductions of 19 mmHg and DBP reductions of 9 mmHg. **CONCLUSION:** Our results indicate that Tai Chi is viable antihypertensive lifestyle therapy that produces BP reductions that rival or exceed the antihypertensive

effects of aerobic exercise of 5-8 mmHg in both the English and Chinese literature. Further investigation is needed to explain the discrepancy in the magnitude of the antihypertensive effects between Tai Chi trials published in English and Chinese. Supported by a sub-contract from U.S. PHS grant 5U24AG052175, and University of Connecticut Center for Excellence in Teaching and Learning

463 Board #301 May 29 11:00 AM - 12:30 PM

**Physical Activity Patterns Vary by BMI and Asthma Control in Patients with Asthma**Molly B. Conroy, FACSM<sup>1</sup>, Bonny J. Rockette-Wagner<sup>2</sup>, Juan Wisnivesky<sup>3</sup>, Fernando Holguin<sup>4</sup>, Shiqi Chen<sup>3</sup>, Emily Federmann<sup>3</sup>, Vongphone Smith<sup>4</sup>, Alex Federman<sup>3</sup>. <sup>1</sup>University of Utah, Salt Lake City, UT. <sup>2</sup>University of Pittsburgh, Pittsburgh, PA. <sup>3</sup>Icahn School of Medicine at Mt. Sinai, New York, NY.<sup>4</sup>University of Colorado, Aurora, CO.

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**PURPOSE:** Persons with chronic medical conditions, such as obesity and asthma, may be at higher risk for physical inactivity. In this analysis, we evaluated objectively-measured physical activity (PA) in a population of patients with asthma to determine whether physical activity varied by body mass index (BMI) or asthma control.

**METHODS:** We used data from a prospective cohort of English and Spanish speaking adults ≥21 years of age with physician diagnosis of asthma recruited from the outpatient practices of two health care systems located in New York, NY and Denver, CO. Exclusion criteria included history of other chronic pulmonary conditions or smoking >15 pack-years. Physical activity was objectively measured using Actigraph wGT3X-BT accelerometers. BMI (kg/m<sup>2</sup>) was measured by trained research staff and the Asthma Control Questionnaire (ACQ) was used to assess asthma control. We used Kruskal-Wallis tests to compare physical activity measures among obese (≥30 kg/m<sup>2</sup>), overweight (<30-25 kg/m<sup>2</sup>) and normal or underweight (<25 kg/m<sup>2</sup> and <18.5 kg/m<sup>2</sup>) individuals, as well as among subgroups by asthma control: good (ACQ ≤ 0.75), poor (ACQ > 0.75, but <1.5) and very poor (ACQ ≥ 1.5). **RESULTS:** Of the 125 participants, 103 (82%) were female. 56 (45%) were white; 52%, 30% and 18% were obese, overweight and normal/underweight, respectively. Half reported very poor asthma control. Mean (SD) sedentary time/day was 406.5 (114.1) minutes/day and did not vary by BMI or ACQ. Mean light activity was 397.4 (95.4) minutes/day and moderate-vigorous activity (MVA) was 38.9 (28.5) minutes/day. Patients with obese or overweight BMI had somewhat lower MVA than those with normal BMI (35.7, 39.9, 46.2 minutes/day;  $p=0.09$ ) and significantly lower daily steps (5670, 7105, 7727;  $p=0.004$ ). Similarly, patients with very poor asthma control had non-significantly lower MVA than those with poor or good control (34.1, 39.4, 49.0 minutes/day;  $p=0.08$ ) and significantly lower daily steps (5690, 6742, 7910;  $p=0.003$ ). **CONCLUSIONS:** Overall, activity levels in these patients with asthma were not lower than the general adult population. However, those with higher BMI and worse asthma control were less active (respectively), suggesting that interventions to increase PA in patients with asthma should consider addressing body weight and asthma control.

464 Board #302 May 29 11:00 AM - 12:30 PM

**Less Evening Exercise is Associated with Progressive Visual Field Defect in POAG Patients**Yuanbo Liang<sup>1</sup>, Xiafei Pan<sup>1</sup>, Kai Xu<sup>2</sup>, Xin Wang<sup>1</sup>, Guofu Cheng<sup>1</sup>, Huanhuan Cheng<sup>1</sup>, Jie Cheng<sup>1</sup>, Alice Jia Liu<sup>1</sup>. <sup>1</sup>The Eye Hospital, School of Ophthalmology and Optometry, Wenzhou Medical University, Wenzhou, Zhejiang, China, Wenzhou, China. <sup>2</sup>Nanjing Sport Institute, No.8 Linggusi Road, Nanjing, Jiangsu, China, Nanjing, China.

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**PURPOSE:** To investigate the exercise habits of those with primary open angle glaucoma (POAG) and its associations with the progression of glaucomatous visual field (VF) loss. **METHODS:** Daily PA was monitored by an accelerometer (ActiGraph wGT3x-BT), which patients wore for 24-hours on their waist (right) for 1 week. main outcome measures are daily PA, such as calories (kcal), light PA time, moderate PA time, vigorous PA time, moderate to vigorous physical activity (MVPA) and step counts. Progressive VF loss is defined as the same three or more points in pattern deviation change probability maps in at least two consecutive visits detected by Glaucoma Progression Analysis. **RESULTS:** No significant difference was found for daily PA between the 76 non-progressive and 22 progressive patients who wore the device for more than 10 hours per day ( $P>0.05$  for all). Better eye VF mean deviation (MD) averaged -3.1 dB in non-progressive group and -4.1 dB in progressive group. 88 (89.8%) participants who had worn an accelerometer for an entire day were analyzed for their 24-hour exercise habits. Patients with POAG preferred to exercise more during 07:00-09:00 am, 15:00-17:00 pm, and 18:00-20:00 pm. Additionally, MVPA time in the non-progressive group is significantly higher than the progressive group at 18:00-20:00 pm (25.0(34.3) min VS 18.9(17.6) min,  $P=0.002$ ). Binary logistic

regression analysis indicated that MVPA (18:00-20:00 pm) and other parameters, such as mean retinal nerve fiber layer (mRNFL), MD, mean arterial pressure (MAP), mean intra-ocular pressure (miOP), age and gender were significantly correlated with POAG patients' progressive VF damage. Multivariate analysis showed that MVPA (odds ratio, OR (95% confidence intervals, CI) =0.96(0.94, 0.99),  $P=0.002$ ), mRNFL (OR (95%CI) =0.97(0.94, 1.00),  $P=0.02$ ), MAP (OR (95%CI) =0.88(0.83, 0.92),  $P<0.001$ ), age (OR (95%CI) =1.10(1.06, 1.15),  $P<0.001$ ) and gender (OR (95%CI) =0.44(0.22, 0.91),  $P=0.001$ ) were still related to progressive VF loss after adjusting the other risk factors. **CONCLUSIONS:** Patients with POAG prefer to exercise more during 07:00-09:00 am, 15:00-17:00 pm and 18:00-20:00 pm. Less evening exercise is associated with glaucomatous progressive VF damage, with an increasing of one minute of MVPA time decreasing the progression of POAG about 4%.

**465** Board #303 May 29 11:00 AM - 12:30 PM  
**Increased Functional Capacity For Adaptive Athletes Through High Intensity Functional Training (HIFT)**

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**BACKGROUND:** Individuals with adaptive needs (e.g., spinal cord injuries, cerebral palsy, amputations) encounter various barriers that limit their physical activity (PA). High intensity functional training (HIFT) programs have been developed to help those with adaptive needs improve their functional capacity. Adaptive HIFT programs allow for the preservation of a workout stimulus with exercise modifications or substitutions made for current physical conditions. However, research is lacking for adaptive HIFT programs.

**PURPOSE:** To compare ratings for difficulty and confidence of functional movements before and after an adaptive HIFT intervention.

**METHODS:** Participants included 13 adults (age =  $38 \pm 11$  years, 75% male), and required the use of wheelchairs, limb braces, prosthesis, and crutches. The study consisted of an 8-week adaptive HIFT intervention with 2-3 60-minute supervised sessions per week. Participants completed a survey before and after the intervention that included the Outpatient Physical Therapy Improvement in Movement Assessment Log (OPTIMAL), which measured difficulty and confidence in performing 22 movements necessary to perform various functional activities (e.g., rolling over, squatting), on a 5-point scale (1 high, 5 low). All 13 participants completed the intervention. Due to differential survey completion (i.e., baseline  $n = 8$ , posttest  $n = 5$ ; only 2 of those completed it at each time point), data were treated as cross-sectional and independent samples t-tests were performed via SPSS 25 to compare ratings for each time point.

**RESULTS:** Difficulty ratings approached significance for lying flat,  $\Delta M = 1.1 [-0.1, 2.3]$ , ( $N = 8, 5$ ),  $t(7) = 2.3$ ,  $p = .051$ ,  $SE = .4$ ; squatting,  $\Delta M = 1.7 [-1.1, .9]$ , ( $N = 7, 5$ ),  $t(10) = 2.1$ ,  $p = .06$ ,  $SE = .8$ ; and walking long distances,  $\Delta M = 1.7 [-4.3, 3.7]$ , ( $N = 7, 5$ ),  $t(10) = 2.2$ ,  $p = .06$ ,  $SE = .8$ . Confidence ratings were significant for grasping,  $\Delta M = .6 [-0.03, 1.2]$ , ( $N = 8, 5$ ),  $t(7) = 2.4$ ,  $p = .05$ ,  $SE = .3$ . No difficulty or confidence ratings had significantly lower scores at posttest.

**CONCLUSION:** Adaptive HIFT programs show promise for addressing functional movement limitations for adaptive adults. This would allow for increased PA participation. Future studies should increase sample sizes and compare outcomes from HIFT programs to other types of PA for the adaptive population.

**466** Board #304 May 29 11:00 AM - 12:30 PM  
**The Effects of Endurance Stair Climbing on Individual Health**

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 (No relevant relationships reported)

**Purpose**

To assess cardiovascular intensity in athletes participating in an endurance stair climbing event.

**Methods**

This was an observational pilot study in which participants wore fitness tracking watches during an endurance stair climb of 103 floors. The devices provided continuous heart rate data throughout the climb. Participants completed the Borg Rating of Perceived Exertion upon completion of the event. The sample included 11 stair-climb event participants, including eight novices and three elites (i.e., Tower Running World Association members). The primary outcome was proportion of time spent with heart rate  $>50\%$  of estimated maximum (moderate-to-vigorous intensity) and  $>70\%$  of estimated maximum (vigorous intensity). Perceived level of exertion (Borg score) was a secondary outcome.

**Results**

The sample ( $N=11$ ) comprised eight women and three men, with mean age of 34 years ( $SD=11.5$ ) and BMI 23.2 ( $SD=2.8$ ). All participants spent at least 90% of the climb with heart rate  $>50\%$  of estimated maximum, and 64% of participants spent at least 50% of the climb with heart rate at  $>70\%$  of estimated maximum. Elite participants spent a greater proportion of time in vigorous intensity activity than did novices (68% vs 55%), though this finding was not statistically significant ( $p>.05$ ). Participants did not differ in time taken to reach  $>70\%$  of estimated maximum heart rate ( $M=6.5$  minutes,  $SD=5.7$ ). On average, participants perceived their level of exertion as "very hard" (Borg score  $M=16.7$ ,  $SD=2.4$ ).

**Conclusion**

This pilot study provides evidence that endurance stair climbing represents an alternative form of moderate-to-vigorous intensity exercise, as characterized by percent of estimated maximum heart rate and perceived level of exertion. Elite athletes achieved vigorous intensity activity levels for a greater duration than did novices, although a larger scale study is needed to confirm this trend. Next steps include assessing the health benefits of sustained daily stair climbing across the continuum of age and baseline activity level.

**467** Board #305 May 29 11:00 AM - 12:30 PM  
**Ankylosing Spondylitis: How Important is Exercise as Part of Management**

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**INTRODUCTION:** Ankylosing Spondylitis (AS) is an autoimmune disease characterised by chronic inflammation of the sacroiliac joints and axial spine. The body's immune response to chronic inflammation initiates calcification and excessive bone formation causing structural joint damage and spinal fusion subsequently restricting mobility. AS has a 3:1 male-to-female ratio and symptoms typically appear at 15 - 45 years of age. Current treatment involves both pharmacological and non-pharmacological therapy. **PURPOSE:** To identify the role of exercise as part of the treatment plan in AS patient. **METHODS:** Investigate and summarise current knowledge on recommended practice points, frequency, intensity, time and type of exercise as well as progression of an exercise program, in AS patients. **RESULTS:** Current literature indicates the importance of exercise as part of treatment with pharmacological agents is aimed to delay progression of disease, relieve pain, minimise inflammation, maintain function and improve quality of life. Recommended practice points include a professional team with: knowledge of continual patient assessment and monitoring, realisation of complications, understanding complex exercise and pathology interactions, and a practical approach to the exercise setting that will encourage and motivate patients. The main long-term therapeutic goals should be: posture, mobility and respiratory function. Four key elements of the FITTPro Principle (frequency, intensity, time, type and progression) is recommended in exercise prescription. An AS exercise program of 5 days/week, for 30 minutes/day is advised. It generally consists of daily range of motion (ROM), aerobic-, breathing- and strengthening exercises 1-3 times/week. The type of exercises should fit the patient's profile e.g. hydrotherapy is beneficial, but contact sports should be avoided. **CONCLUSIONS:** Individualised continual assessment and exercise prescription with the emphasis on spinal mobility, ROM, muscle strengthening and cardiorespiratory fitness to improve balance, coordination and fitness are an important part of the management plan. Continuous disease modifying treatment including anti-TNF $\alpha$  therapy combined with regular exercise prescription confers additional benefit to pharmacological therapy alone.

## A-57 Exercise is Medicine®/Poster - EIM On Campus, Children, Adolescents, EIM and Physicians

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM  
Room: CC-Hall WA2

468 Board #306 May 29 11:00 AM - 12:30 PM

### Exercise Is Medicine On Campus: A Survey Of Opinions And Attitudes

Melissa A. Reed<sup>1</sup>, Annie O'Brien<sup>1</sup>, Umit Tokac<sup>2</sup>, Katelyn Koser<sup>1</sup>, Scott Heinerichs<sup>1</sup>, Selen Razon<sup>1</sup>. <sup>1</sup>West Chester University, West Chester, PA. <sup>2</sup>University of Missouri, St. Louis, MO.  
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(No relevant relationships reported)

Exercise is Medicine (EIM) is a global joint initiative between the American Medical Association (AMA) and the American College of Sports Medicine (ACSM). West Chester University (WCU) is recognized by the ACSM as an EIM-On Campus which indicates that WCU is a campus that is actively trying to engage the campus community in physical activity. **PURPOSE:** The purpose of this study was to gauge opinions and attitudes related to EIM Day at WCU—a first-time event launched at the campus. This event was hosted by the College of Health Sciences (CHS) at WCU and included participation from all six departments in the CHS, faculty and staff across campus, alumni, and community stakeholders.

**METHODS:** Forty participants (11 male, 29 female) ( $M_{age} = 27.5$ ,  $SD=12.16$ ) who visited the event responded to an exit program evaluation survey. **RESULTS:** Descriptive results from Likert scale data (1=not at all - 5=very much) indicated that participants reported high levels of enjoyment related to the event ( $M_{enjoyment} = 4.6$ ,  $SD=0.78$ ). They also reported that they found the event largely beneficial for improving their physical activity and nutritional habits ( $M_{helpfulPA} = 4.4$ ,  $SD=0.97$ ;  $M_{helpfulNutrition} = 4.3$ ,  $SD=0.99$ ). Participants also expressed strong intentions to revisit the event in the future ( $M_{futurevisit} = 4.7$ ,  $SD=0.75$ ). Additional Bayesian analysis also suggested that in comparison to their male counterparts ( $M = 3.75$ ,  $SD=1.28$ ), female participants ( $M=4.67$ ,  $SD=0.51$ ) found the event significantly ( $p < .05$ ) more helpful for improving their nutritional habits. Of the motives for participation, 87.5% of the participants reported that they participated because they expected the event to be fun. Finally, with regards to participants' recommendations two themes emerged from the qualitative content analysis: (1) additional activities to include in the event and, (2) greater variety of food and beverage options to offer throughout the event. **CONCLUSIONS:** These results suggest that individuals that participated in this first-time event evaluated it highly favorably and found it beneficial for improving important health behaviors. Future research needs to explore the effectiveness of these initiatives and advance recommendations to further increase their impact.

469 Board #307 May 29 11:00 AM - 12:30 PM

### Exercise Is Medicine On Campus Program Comparisons: A Descriptive Study

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**PURPOSE:** The purpose of this study was to describe the client experience and program characteristics of existing Exercise is Medicine® on Campus (EIM-OC) programs. **METHODS:** A 49-question survey was emailed to all campuses with registered EIM-OC teams. Participants were identified via ACSM Exercise is Medicine® on Campus advisor email list. Permission to send the survey was obtained from the EIM-OC Committee Chair and EIM-OC Program Manager. Frequencies were used to describe EIM-OC program characteristics.

**RESULTS:** Twenty-eight campuses responded to the survey. Approximately 80% of the responding campuses offer outreach activities and special events as part of EIM-OC programs. Other EIM-OC program options included peer-led programming (50%), referral program (38%), individualized programming (36%), and motivational interviewing (17%). Campuses with funded EIM-OC programs indicated that funding came from a Kinesiology-related department, Campus Recreation, Health Promotion/Wellness, Student Health Services, grants, student government associations and/or student clubs. Seven campuses (25%) indicated no funding source. Twelve of the 28 campuses are referring clients (~80% from student health or student counseling services) or directing clients (30% by campus recreation or an EIM-OC administrator) to a fitness setting (campus recreation in 75% of cases). In all cases, referred or directed clients include students, for whom EIM-OC programs are free. Some campuses also include faculty/staff or community members among referred/directed

clients. "Not meeting physical activity guidelines" was a reason for referral in all cases, with many campuses also reporting existing physical or mental conditions and obesity as reasons for referral. Referred or directed EIM-OC clients are offered some form of individualized programming (one-on-one, small or large group training) in 75% of cases, with the remaining 25% offering reduced gym or training fees or free fitness assessments. Twenty-one respondents (88%) indicated that EIM-OC programs provide new opportunities for students.

**CONCLUSIONS:** The results provide evidence of a variety of structures and activities involved in current EIM-OC programs, with anecdotal evidence of the benefits for student clients and leaders.

470 Board #308 May 29 11:00 AM - 12:30 PM

### Implementation of Exercise is Medicine On Campus at the University of North Carolina - Chapel Hill

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**PURPOSE:** The University of North Carolina at Chapel Hill was recently registered as an Exercise is Medicine (EIM) campus. To enable effective and sustainable implementation of EIM within Campus Health, the purpose of the current study was to anonymously survey students and determine: current exercise behavior, barriers and motives, interest in receiving exercise advice and by whom, and appropriate methods of communication. **METHODS:** 500 surveys were distributed in Campus Health services between January-April 2018. **RESULTS:** The 407 responders were evenly distributed among college status (20% Freshman, 21% Sophomore, 16% Junior, 17% Senior, 23% Graduate Student, 3% Post-Doc). Time was the biggest barrier to exercise (57%). More than half wanted to receive guidance about exercise (48% Agree, 10% Strongly Agree), and agreed they would be more likely to exercise if they were given advice about exercise (46% Agree, 11% Strongly Agree). Students wanted a referral to an exercise professional (41%), and to receive initial advice and communicate through email (56%). **CONCLUSIONS:** Students attending Campus Health are interested in receiving exercise guidance and, following a referral, this advice should be delivered by trained exercise professionals, e.g., the Exercise and Sport Science Department. Findings from this study will be used to implement a full trial in Counseling and Psychological Services.

471 Board #309 May 29 11:00 AM - 12:30 PM

### Exercise Is Medicine On Campus In The Curriculum

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All universities should promote physical activity (PA) on campus to make PA a part of campus culture. Kinesiology departments can promote PA for cardiorespiratory health by offering a simple walking class. Studies indicate that even a low-volume walking program can yield cardiovascular benefits. **PURPOSE:** To determine the impact of a seven week walking course on cardiovascular health in college students. **METHODS:** Six college students (1=M; 5=F) enrolled in a walking class offered in Fall 2018. Five students completed the course. The 50 minute class met twice per week for seven weeks and students walked a minimum of 40 minutes each class period. An estimated  $VO_{2max}$  was determined for each student during the first class meeting using the Rockport 1-Mile walk test. Following the seven week course, students completed another Rockport 1-Mile walk for  $VO_{2max}$  estimation. Pre-test and post-test estimated  $VO_{2max}$  results were compared. **RESULTS:** All students showed improvements in estimated  $VO_{2max}$ . Mean estimated  $VO_{2max}$  for all students pre-intervention was 47.11 ( $ml/kg/min^{-1} \pm 8.44$ ) with a post-intervention mean of 42.06 ( $ml/kg/min^{-1} \pm 10.13$ ). Paired  $t$ -tests identified significant improvement in estimated  $VO_{2max}$  ( $\mu = 3.89 ml/kg/min^{-1} \pm 1.76$ ,  $p = 0.008$ ). Female mean estimated  $VO_{2max}$  improved significantly by 3.23 ( $ml/kg/min^{-1}$ ,  $p = 0.10$ ). **CONCLUSION:** Introducing PA courses as simple as walking to the campus course curriculum may yield improved cardiovascular health in college students. Kinesiology departments are encouraged to offer PA courses promoting Exercise is Medicine On Campus.

**472** Board #310 May 29 11:00 AM - 12:30 PM  
**Exercise is Medicine on Campus 2018 Expanding EIMOC Programming Across a Branch Campus Network**  
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**PURPOSE:** Pennsylvania State University has been promoting Exercise is Medicine on Campus (EIMOC) since 2010 and has expanded the year-round program to include events, student and employee-focused initiatives, numerous on- and off-campus partnerships, and more. A recent focus of the EIMOC program has been expansion to other Penn State campus locations. As a University, Penn State operates 24 campuses throughout the state, with over 84,000 undergraduates enrolled. The wide array of locations, sizes, and educational foci present opportunities and challenges as EIMOC at Penn State attempts to expand beyond its founding campus. **METHODS:** The central EIMOC program conducts year-round activities the main campus, while providing assistance and guidance to commonwealth campuses when appropriate. Several times per year the EIMOC team travels to commonwealth campuses to assist on-site in the development and execution of EIMOC commonwealth programs, in partnership with local EIMOC committees at each campus. Program components are adjusted based on campus location, setting, size, partners, and available funding. Counts are conducted at each event for participation and engagement, lessons learned are reviewed to ensure the successful progression and expansion of future initiatives. Reviews are shared with other campuses to inform program development. **RESULTS:** EIMOC at Penn State has expanded to six commonwealth campuses, with four locations earning official EIMOC recognition. In 2017, Penn State University Park, the largest undergraduate campus earned Gold, Penn State Berks and Harrisburg both earned Silver, and Penn State Hershey School of Medicine earned Bronze. Three other campuses are currently pursuing official EIMOC status. Larger campuses benefited from higher levels of available resources and partnerships, though struggled spreading awareness. Smaller institutions had greater success with awareness and engagement, though had smaller scopes. Additional differences were noticed between rural and urban settings. **CONCLUSIONS:** The current study offered insights on the challenges and successes in leveraging a large university network to expand EIMOC programming across a diverse array of campuses. EIMOC programming has proven successful across a broad range of campus settings and sizes.

**473** Board #311 May 29 11:00 AM - 12:30 PM  
**Exercise And Adiposity In Overweight And Obese Children And Adolescents: A Network Meta-analysis**  
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Overweight and obesity are major public health problems among children and adolescents. However, the effects of different types of exercise on adiposity are not well established. **PURPOSE:** Use the network meta-analytic approach to determine the effects of different types of exercise (aerobic, strength training, or both) on adiposity in overweight and obese children and adolescents. **METHODS:** Direct and indirect randomized exercise intervention trials  $\geq 4$  weeks that were published in any language up to June 16, 2018 and assessed body mass index (BMI) in kilogram-meters-squared, fat mass (kg), or percent body fat in overweight and obese children 2-18 years of age were eligible. Studies were retrieved by searching seven electronic databases, cross-referencing, and expert review. Dual selection and data abstraction were conducted. Results were pooled using random-effects, restricted maximum likelihood models. Surface under the cumulative ranking curves (SUCRA) were used to establish a hierarchy of exercise interventions (aerobic, strength, both). A two-tailed alpha value  $\leq 0.05$  and non-overlapping 95% confidence intervals were considered statistically significant. **RESULTS:** Fifty-seven studies representing 127 groups (73 exercise, 54 control) and up to 2,792 participants (1,667 exercise, 1,125 control) met the criteria for inclusion. Statistically significant reductions in BMI, fat mass, and percent body fat were observed in aerobic vs. control comparisons (BMI, mean, 95% CI, -1.0, -1.4 to -0.6; fat mass, -2.1, -3.3 to -1.0 kg; percent fat, -1.5, -2.2 to -0.9%) and combined aerobic and strength vs. control comparisons (BMI, -0.7, -1.4 to -0.1; fat mass, -2.5, -4.1 to -1.0 kg; percent fat, -2.2, -3.2 to -1.2%). A statistically significant reduction in percent fat was also found for strength vs. control comparisons (-1.3, -2.5 to -0.1%). Based on SUCRA results, combined aerobic and strength training was ranked first for improving both fat mass (kg) and percent body fat while aerobic exercise was ranked first for improving BMI. **CONCLUSIONS:** Combined aerobic and strength training is optimal for improving adiposity-specific outcomes in overweight and obese children and adolescents. Supported by AHA Grant 17GRNT33630158

**474** Board #312 May 29 11:00 AM - 12:30 PM  
**Freshmen Physical Activity Habits And Senior Fitness Levels: Examining A Healthy Transition To College**  
 Melissa Bopp, FACSM, Oliver W.A. Wilson, Zack Papalia, Christopher Bopp. *Pennsylvania State University, University Park, PA.*  
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 (No relevant relationships reported)

The years in post-secondary education are important for building healthy lifestyle habits to transfer into adulthood. Previous research has indicated that physical activity (PA) declines during the years of college, and Exercise is Medicine on Campus (EIMOC) programs are poised to help address this.

**PURPOSE:** To examine how freshmen exercise patterns and perceptions were related to fitness and physical activity in senior year of college at a large Northeastern university.

**METHODS:** A volunteer sample of university seniors (n=439) completed a fitness assessment (YMCA bicycle test) and an online survey which addressed their PA participation, freshman exercise perceptions and engagement in on-campus exercise opportunities. Pearson correlations examined the relationship between fitness and PA with freshman variables. T-tests examined differences in fitness and PA by freshman variables.

**RESULTS:** The sample was predominately male (n=254, 59.3%) and Non-Hispanic White (n=343, 78.4%). Many (n=232, 53%) reported being more active currently than in freshman year. Most (n=178, 52.7%) reported that they were well informed of campus exercise options, 28.5% (n=125) reported doing intramural sports and 10% (n=44) did club sports as freshmen. Current VPA was associated with being better informed of options for exercise on campus as a freshmen ( $r=.11$ ,  $p=.04$ ), campus fitness center membership as a freshmen ( $p=.004$ ), and freshman club sport participation ( $p=.004$ ). VO<sub>2</sub>max was associated with club sport participation as a freshman ( $p<.001$ ). Challenges with time management (n=305, 85.4%) and lack of motivation (n=226, 63.6%) were frequent barriers to exercise as freshmen. Motivation challenges as a freshman was negatively associated with current VPA ( $r=-.21$ ,  $p<.001$ ) and VO<sub>2</sub>max ( $r=-.19$ ,  $p=.001$ ). Students indicated that programs partnering with an exercise buddy (n=255, 74.1%) or events around outdoor exercise/outings (n=179, 52%) would have been the most useful to motivate them as freshmen.

**CONCLUSIONS:** This study examined how exercise patterns and perceptions as a freshman were related to PA participation and fitness as a senior. Findings indicate the importance of developing EIMOC programs and strategies to specifically help freshmen transition to college campuses and engage in healthy behaviors.

**475** Board #313 May 29 11:00 AM - 12:30 PM  
**Physical Play with Children Predicts Better Hematological Health; Hematological Health Predicts Cognitive and Behavioral Development**  
 Kendall D. Bietsch<sup>1</sup>, Cynthia Villalobos<sup>1</sup>, William E. Herrin<sup>1</sup>, Jessica Avalos<sup>1</sup>, Norah Madaya<sup>2</sup>, Courtney D. Jensen<sup>1</sup>.  
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More than half of all Ugandan children under the age of 5 are anemic. The consequences of anemia are amplified during this period as it is critical to cognitive and physical development. Adequate physical play may bolster hematological health, and in turn cognitive and behavioral development, but this has not been previously explored. **PURPOSE:** Examine the effect of play on serum hemoglobin (Hb) among children under the age of 5 in Uganda, and to test the effect of Hb on cognitive and behavioral development. **METHODS:** We analyzed the 2016 Demographic Health Surveys of Uganda, Children's Records dataset. Anemia testing was performed on children age 6-59 months whose parents or guardians consented (N=3,944). Hb levels were collected to determine the incidence and severity of anemia. Children with Hb  $\geq 11$  g/dL were not considered anemic. Multiple linear regression was used to identify the effect of physical play with parents on Hb. Logistic regression analyses were used to test the effect of Hb on the odds that children were developing literacy and appropriate behaviors. **RESULTS:** On average, children were  $31.3 \pm 15.6$  months old and had  $10.9 \pm 1.61$  g/dL of Hb; 54.6% were anemic. Holding constant the mothers' height and weight, the child's age, height, and weight, and the region (controlling for differences in culture, geography, and altitude), if the mother or father played with their children, the children's Hb was elevated by 0.14 g/dL ( $p=0.019$ ); if the mother smoked, the children's Hb decreased by 0.3 g/dL ( $p=0.036$ ). Holding constant the child's age, height, and weight, increased Hb associated with increased odds of behaving appropriately around other children ( $\beta=0.38$ ;  $p=0.001$ ), being capable of performing tasks independently ( $\beta=0.13$ ;  $p=0.036$ ), being able to read and count to 10 ( $\beta=0.19$ ;  $p=0.002$ ), being able to read at least 4 words ( $\beta=0.31$ ;  $p<0.001$ ), and being able to identify at least 10 letters ( $\beta=0.32$ ;  $p<0.001$ ). **CONCLUSIONS:** In a sample of children from Equatorial Africa, physical play with parents predicted elevations in Hb.

In turn, elevated Hb predicted more advanced cognitive and behavioral development. Implementing physical activity in parent-child interactions may have value as a primary prevention for anemia and it may also help advance the child's growth and maturation.

**476** Board #314 May 29 11:00 AM - 12:30 PM  
**Health/Fitness Assessments of Resident Physicians by Exercise Science Interns - Exercise Prescriptions and Follow-Up Measures**

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Resident physicians' postgraduate training and fitness status are important predictors of their decision to provide physical activity (PA) counseling to their patients. Providing instruction about these topics within medical education may improve residents' health/fitness outcomes and increase the likelihood of residents providing PA counseling to their patients. **Purpose:** To assess the health/fitness status of resident physicians during a healthy lifestyle rotation. **Methods:** We measured 187 resident physicians' health/fitness status for one required assessment and two optional follow-up assessments that were on average, 9.5 months apart. Residents learned their results, received an exercise prescription, and were supported by an Exercise Science Student Trainer during one PA session. Residents could then exercise independently at an employee only fitness facility, elsewhere, or not at all. **Results:** The mean age of the sample was 28.07 ± 1.99 yrs. All baseline measures indicated residents were in a healthy (good to above average) range for males (n = 110) and females (N = 77). T-tests were used to evaluate the waist circumference of residents who completed assessments 1 and 2 (n=55). Waist circumference increased from 78.7 ± 32.1 cm to 84.3 ± 33.7 cm (p<.05). No other measures (BMI, body fat, VO<sub>2</sub>max, RHR, SBP, DBP, push-up, plank, and sit and reach) were significantly different. ANOVA was used to evaluate those who completed three assessments (n=18). This group experienced an increased BMI (23.9 ± 3.51 kg/m<sup>2</sup>, 24.27 ± 4.11 kg/m<sup>2</sup>, 24.56 ± 3.71 kg/m<sup>2</sup>; p<0.05) and body weight (73.14 ± 15.74 kg, 74.05 ± 18.1kg, 76.90 ± 17.23 kg; p<0.05). No other measures were significantly different. **Conclusion:** Few residents participated in more than the mandatory assessment. Those who volunteered for follow-up demonstrated increases in weight-related measures and no improvement in health/fitness outcomes. Additional supports for residents to participate in PA, achieve or maintain a healthy weight, and maintain or improve health/fitness outcomes is needed to positively influence these factors and increase the likelihood of resident physicians promoting PA to their patients.

**477** Board #315 May 29 11:00 AM - 12:30 PM  
**Examining the Effects of Exercise Referral Schemes on Changes in Physical Activity Levels.**

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Exercise referral within the United Kingdom (UK) offers individuals an opportunity to take part in physical activities in a non-clinical environment, yet gain clinical health benefits. Referral schemes focus on improving health outcomes, including increased physical activity (PA), of medically referred individuals. However, inconsistencies have been found within the literature reviewing impact of exercise referral on improving PA levels. **PURPOSE:** To determine if exercise referral schemes (ERS) influence change in PA levels amongst individuals across the UK. **METHOD:** Data were obtained from 5246 participants (53 ± 15 years; 68% = female) who attended 12 different ERSs. Participants self-reported IPAQ scores pre- and post- scheme completion to determine if exercise referral had any impact on PA levels. Schemes were 12 weeks in length and situated in leisure environments including gyms, leisure centres and community halls, throughout the UK. Exercise prescriptions consisted of both aerobic and resistance training. Two-stage individual patient data meta-analysis was performed separately on the pre-ERS, and on the change scores (post- minus pre-ERS scores), for metabolic equivalent (MET)-minutes per week; analysis was chosen due to data being hierarchical and accounting for clustering at scheme level. **RESULTS:** Analyses were conducted on the continuous data collected through the IPAQ. For pre-ERS MET-minutes the estimate from random effects model was 1183 MET-minutes per week [911 to 1457], p< 0.0001. For ERS change, the estimate from random effects model for was 666 MET-minutes per week [385 to 948], p< 0.0001. Significant heterogeneity was evident among the schemes (Q<sub>(11)</sub> = 162.22, p< 0.001; I<sup>2</sup> = 97.71%). Considering the estimate for pre-ERS MET-minutes (1183 MET-minutes), the estimate for change in MET-minutes could be considered meaningful, as it would result in participants moving from the 'moderate' to 'high' category for PA. **CONCLUSION:**

This change in PA represents greater reductions of risks of specific physical inactivity-related conditions, such as obesity and type 2 diabetes. The results showed meaningful change in MET-minutes, which resulted in participants moving from 'moderate' to 'high' on the IPAQ, suggesting that a scheme length of 12 weeks is sufficient for changing PA levels.

**478** Board #316 May 29 11:00 AM - 12:30 PM  
**Low Usage of Physical Activity Related Diagnostic Codes Among Indiana Medical Providers**

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The National Academy of Medicine and "Exercise Is Medicine®" recommend physicians routinely advise patients about physical activity (PA) and, when needed, refer to PA support to improve patient and population health. Uptake of these recommendations has been slow. Knowledge of diagnostic codes for billing may influence provider behavior. The Indiana Health Information Exchange (IHIE) connects more than 100 healthcare entities and 40,000 providers for >18 million patients, with >10 billion clinical data elements. **Purpose:** To document ICD-9 and ICD-10 PA-related billing code use for "Lack of Physical Exercise" and "Physician Exercise Counseling". **Methods:** We searched IHIE for PA-related ICD-9 and ICD-10 codes and comorbidity codes from 01/01/94 through 04/24/18. **Results:** PA-related ICD codes were used for 54,543 patients, but <10% (5,221) were used for adults. Fewer occurrences were in adult patients with common chronic diseases that could be improved through PA (Table 1).

Table 1	Total Patient Count	"Lack of Physical Exercise"		"Exercise Counseling"	
		ICD-9 V69.0	ICD-10 Z72.3	ICD-9 V65.41	ICD-10 Z71.82
All Patients	54,543	993	357	52,317	1,104
Adults Only	5,221	607	329	3,970	382
<b>Comorbidities of 5,221 Adults – ICD Code Use within 1 Year of PA-Related Code</b>					
	Adults	"Lack of Physical Exercise"		"Exercise Counseling"	
Condition		ICD-9 V69.0	ICD-10 Z72.3	ICD-9 V65.41	ICD-10 Z71.82
Type 2 Diabetes	821	160	97	515	60
Hypertension	1,577	299	73	1,217	<10
Insomnia	392	58	38	275	21
Osteoarthritis	611	134	77	380	27
Osteoporosis	116	38	22	53	<10
BMI 25.0-29.9	104	<10	24	54	28
BMI 30.0-34.9	284	<10	19	167	109
BMI 35.0-35.9	352	12	22	177	155
BMI 40-49.9	425	20	19	219	173
BMI > 50	163	12	<10	87	57

**Discussion:** Low use of PA-related ICD codes may be due to a lack of awareness of existing codes. Physician education regarding PA-related ICD codes may increase physician counseling, code usage and possibly referral to PA resources.

**479** Board #317 May 29 11:00 AM - 12:30 PM  
**Making Strides Towards Health: Expanding Physician-led Walking Groups In The Community**  
 Alexa Namba, Adeola Awodele, Cherie Conley, Sarah McMahon, Jaehan Yi, Amy Zhao, Janet Bettger. *Duke University, Durham, NC.*  
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 (No relevant relationships reported)

While healthy lifestyle modification is often the first line recommendation to treat and prevent chronic disease, physicians inconsistently provide patients with guidance and resources to ensure appropriate physical activity participation. **PURPOSE:** To increase physical activity among patients, this project aimed to expand a physician-led walking program from a single clinic to a community-based partnership for broader reach. **METHODS:** The originally developed Walk with a Doc (WwaD) program was established in a family medicine clinic. Patients were referred to attend the monthly program during clinical encounters. The four phases of the IHI Scale-up Framework were applied to (1) examine the existing program (provider buy-in for walking prescriptions, rate of referral, and patient participation and satisfaction); (2) define a scalable program; (3) test the new context for scale-up (validate feasibility, utility and acceptability); and (4) plan to go to full scale. **RESULTS:** The WwaD program had 82 unique patients participating over 36 months of implementation with 15 providers making referrals to the walking program and 100% participant satisfaction. A landscape assessment of available parks and trails was completed and locations were geospatially mapped to examine distance from outpatient clinics. In partnership with the city's Parks and Recreation department, new walking program sites were identified to leverage "healthy mile" trails in local neighborhoods with existing clinics. Site surveys confirmed clinic patients' and providers' interest, and trail safety and accessibility. The scalable program was defined to include a walking prescription and referral to the program, program reminders for the patient, and use of the city's designated healthy mile trails. Pre-health students were incorporated to improve the ratio of program leads to patients, improve participant satisfaction, and to build student volunteers' understanding of exercise as medicine and interdisciplinary competencies for future health professions careers. **CONCLUSION:** Leveraging the commitment to shared goals for increased physical activity, we developed a scalable walking program with integrated clinical, academic and community resources in a mutually beneficial partnership to improve patients' health and well-being.

**480** Board #318 May 29 11:00 AM - 12:30 PM  
**Translating Physical Activity Evidence into Exercise Medicine the Moving Medicine Project, UK**  
 Kush Joshi<sup>1</sup>, Natasha Jones<sup>2</sup>, Hamish Reid<sup>2</sup>, Ralph Smith<sup>2</sup>, Rebecca Robinson<sup>3</sup>. <sup>1</sup>Homerton University Hospital, London, United Kingdom. <sup>2</sup>Oxford University Hospitals, Oxford, United Kingdom. <sup>3</sup>Sheffield University Hospitals, Sheffield, United Kingdom. (Sponsor: Kathryn Schmitz, FACSM)  
 (No relevant relationships reported)

Moving medicine is a novel interactive information resource in UK healthcare. This initiative from the Faculty of Sport and Exercise Medicine was developed in partnership with Public Health England and Sport England. **PURPOSE** The UK's pandemic levels of physical inactivity are associated with high mortality and morbidity. Despite overwhelming evidence supporting the role of physical activity (PA) in management of non-communicable chronic disease, knowledge, skills, time and healthcare professionals (HCP) confidence limit PA promotion across healthcare environments. This integrative digital resource was developed to empower HCPs to give PA advice. The resource provides an evidence-based approach to facilitate interaction and behaviour change. **METHODS** Using a knowledge into action framework this interactive tool was developed in a 2-step process. 1. Knowledge creation Literature reviews defined the evidence and expert working groups were recruited across 9 NCD streams, undertaking narrative reviews, refining evidence in clinical context. 2. Action cycle Delphi study and behavioural change framework analysis underpinned an iterative development process to create action cycles in a time based framework. **RESULTS** Moving Medicine was launched successfully in October 2018 by the UK Secretary of State for Health, headlining this flagship set of resources that champion physical activity as a powerful tool to change behaviour and improve the trajectory of chronic disease. Formal evaluation will follow the initial launch and delivery phase. **CONCLUSION** High levels of professional engagement and early positive feedback indicate Moving Medicine is an acceptable, adaptable novel tool supporting HCPs to engage patients with meaningful conversations about PA. Formal analysis will add to this knowledge and inform transferability across healthcare environments. Further steps for development are projected to include online modules on prescribing movement, educational resources and an active hospital toolkit. Moving Medicine welcomes international collaboration and is open access and free to use at [www.movingmedicine.ac.uk](http://www.movingmedicine.ac.uk).

**480b** Board #319 May 29 11:00 AM - 12:30 PM  
**Tennis Players Enjoy Better General, Physical, Social and Mental Health: A Survey of 10,380 United States Tennis Association Leagues Players Using Norm-Based SF-36 Scores**  
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 (No relevant relationships reported)

**PURPOSE:** The purpose of this study is to characterize the general, physical, social and mental health of USTA members using validated SF-36 outcomes domains in reference to the general population.

**METHODS:** A modified SF-36 version 1.0 was administered to USTA members via online form. The following patient variables were included: Age group (18-29, 30-39, 40-49, 50-59, 60-69, 70-79, 80+), days of tennis per week, self-reported ability, National Tennis Rating Program (NTRP) score, smoking status, BMI and sex. The following SF-36 outcomes domains were included for analysis: Physical Functioning (PF), Role Physical (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social Functioning (SF), Role Emotional (RE), Mental Health (MH). Physical Component Summary (PCS) and Mental Component Summary (MCS) scores were calculated. Norm-Based Scores (NBS) were computed for these domains using an algorithm provided by Optum Health (Eden Prairie, MN); general population mean of 50; standard deviation of 10.

**RESULTS:** 10,380 USTA leagues members responded and completed the modified SF-36 questionnaire. 63% of respondents were female, the average BMI of the cohort was 24.88±4.17 and 97.7% reported that playing tennis helps them manage their health. For all Norm-based SF-36 domains, USTA athletes scored higher than the general population (mean = 50). Multivariate comparisons revealed higher SF-36 outcomes scores for younger athletes (all SF-36 domains, p<0.001), and more frequent players (all domains, p<0.001). Elite tennis players (NTRP>4) scored higher for the PF domain than those with less advanced tennis skills. Female tennis players reported higher BP, GH, PCS scores and lower BMI (All p<0.002). Elderly tennis players (age > 70) scored worse for PF, RP, GH, VT, SF, RE, and MH domains for the SF-36 (p<0.001). Additionally, patients who reported playing more than 3 days per week scored higher in all categories (all p<0.003).

**CONCLUSIONS:** USTA members enjoy above average general, physical, social and mental health scores. Patients with a higher level of skill have higher physical functioning. Younger tennis players and athletes who competed more than 3 occasions per week scored higher in all SF-36 domains than those who were older and played less, respectively.