

**F-06 Thematic Poster - Cardiovascular Health in Firefighters**

Friday, May 29, 2020, 1:00 PM - 3:00 PM  
**Room:** CC-2009

**2940 Chair:** Denise L. Smith, FACS. *Skidmore College, Saratoga Springs, NY.*  
*(No relevant relationships reported)*

**2941 Board #1 May 29 1:00 PM - 3:00 PM**  
**Acute Effects Of Firefighting On Vascular Health And Blood Pressure**

Robert M. Restaino<sup>1</sup>, Gavin P. Horn<sup>2</sup>, Steve Kerber<sup>3</sup>, Kenneth W. Fent<sup>4</sup>, Bo Fernhall<sup>5</sup>, Denise L. Smith, FACS<sup>6</sup>. <sup>1</sup>*Skidmore College, Saratoga Springs, NY.* <sup>2</sup>*University of Illinois Fire Service Institute, University of Illinois at Urbana-Champaign, Champaign, IL.* <sup>3</sup>*UL Firefighter Safety Research Institute, Columbia, MD.* <sup>4</sup>*National Institute for Occupational Safety and Health, Cincinnati, OH.* <sup>5</sup>*University of Illinois at Chicago, Chicago, IL.* <sup>6</sup>*Skidmore College, Saratoga Springs, NY; University of Illinois Fire Service Institute, University of Illinois at Urbana-Champaign, Champaign, IL.* (Sponsor: Denise L. Smith, FACS)  
 Email: rrestain@skidmore.edu  
*(No relevant relationships reported)*

Firefighting is strenuous and dangerous work. Sudden cardiac death accounts for approximately 50% of firefighter line of duty deaths. **PURPOSE:** To determine the vascular and hemodynamic responses firefighting work across different positional assignments. **METHODS:** 40 experienced male firefighters completed a coordinated fire attack in a wood frame residential structure. Responding personnel were classified based upon four separate positions (assignments), including: Outside Command, Outside Vent, Inside fire suppression and search and rescue, Overhaul. Subjects were equipped with an automated blood pressure and pulse wave analysis device for measurement of cardiovascular variables (Mean Arterial Pressure, Total Vascular Resistance, Cardiac Output, Stroke Volume, Pulse-Wave Velocity). Measurements were made before, immediately after, and 30 minutes after fire suppression activities in a single-story residential structure. **RESULTS:** Increased mean arterial pressure (MAP) measured prior to the exercise indicates an anticipatory rise in sympathetic activation across all positions (Table 1). Those performing Inside suppression/search and rescue exhibited the greatest increase in MAP across all groups, with MAP remaining elevated immediately following the training exercise and a return to baseline conditions occurring 30 minutes post training (Table 1). This group also exhibited the greatest excursion in systolic blood pressure in response to training (Pre: 130.7 ± 12.7, Post: 134.6 ± 17.3). **CONCLUSIONS:** The vascular changes evidenced during acute firefighting may play a mechanistic role in the increased risk of sudden cardiac death with firefighting. Additional research is needed to better understand how these changes are related to myocardial blood flow.

Table 1, Data are expressed as Average (SD)

|                          | Outside Command/Pump | Outside Vent | Inside      | Overhaul    |
|--------------------------|----------------------|--------------|-------------|-------------|
| Age (years)              | 47.0 (3.9)           | 33.1 (6.8)   | 34.0 (6.8)  | 37.9 (8.6)  |
| BMI (kg/m <sup>2</sup> ) | 28.5 (3.2)           | 27.3 (3.4)   | 26.9 (3.7)  | 27.1 (2.9)  |
| MAP (mmHg) Pre           | 107.6 (10.7)         | 103.6 (5.7)  | 103.8 (9.3) | 103.1 (8.5) |
| MAP (mmHg) Post          | 105.3 (10.6)         | 102.0 (7.9)  | 105.9 (9.8) | 98.6 (9.5)  |
| MAP (mmHg) 30min Post    | 105.1 (8.2)          | 99.3 (3.9)   | 102.3 (9.2) | 97.4 (7.8)  |

**2942 Board #2 May 29 1:00 PM - 3:00 PM**

**Firefighters With More Service Have Smaller Blood Pressure Surge When The Pager Sounds**

Megan A. Carty<sup>1</sup>, Rachel L. Dickinson<sup>2</sup>, Emily H. Reeve<sup>3</sup>, Emily N. Blaszkow<sup>1</sup>, Julia Gilpin<sup>1</sup>, Brian Varani<sup>1</sup>, Meghan Lashley<sup>1</sup>, Paige E. DeAlba<sup>1</sup>, Deborah L. Fearheller<sup>4</sup>. <sup>1</sup>*Ursinus College, Collegeville, PA.* <sup>2</sup>*Pennsylvania Dermatology Group, Huntingdon Valley, PA.* <sup>3</sup>*University of Oregon, Eugene, OR.* <sup>4</sup>*University of New Hampshire, Durham, NH.* (Sponsor: Deborah Fearheller, FACS)  
*(No relevant relationships reported)*

Cardiac incidents cause over 50% of LODD in firefighters (FF) and may be related to their BP responses. Also, years of service may affect FF stress and depression levels and impair overall health. Using ambulatory BP (ABP) monitoring to quantify the BP surge with alarm is a novel way to assess risk, and preliminary data showed that newer FF have higher BP surge. **PURPOSE:** To compare changes in health between FF with <10yr service (FF-10) and FF with >10yr service (FF+10) after a 6-wk Mediterranean diet & circuit training program. **METHODS:** We included 21 FF who completed a 6-wk intervention. Pre- and post-intervention testing included ABP monitoring with pager activation, a fasted clinical appt, and fitness testing. Participants wore the ABP cuff for 12-hrs, during which they were paged by a pager app (OnPage) or by emergency service dispatch. When the pager sounded, they were instructed to force an ABP reading to assess the BP surge. Average BP levels and surges were determined. Fasted visit included BP, body fat, lipid panel, and vascular health measures. Fitness test included a treadmill VO<sub>2peak</sub> and a battery of other fitness tests. Participants also completed a health history form and the DASS-21 questionnaire assessing stress, anxiety, and depression. **RESULTS:** FF+10 (N=12, 45.7 ± 3yrs) had worse health and lower BP surges, but larger improvements with intervention compared to FF-10 (N=9, 36.8 ± 6.2yrs), P<0.05 for differences. FF+10 had lower HDL levels (38.3 ± 2.2 vs 57.9 ± 9.7 mg/dl), were heavier (213.1 ± 8.6 vs 205.1 ± 8.6 lbs), had higher average SBP (136.6 ± 4.8 vs 126.9 ± 3.6 mmHg) and DBP (83.2 ± 2.8 vs 75.7 ± 2.8 mmHg) levels, higher pre-alarm and post-alarm BP, but had a smaller surge in SBP (11.6 ± 3.2 vs 15.0 ± 3.3 mmHg) and DBP (4.1 ± 2.7 vs 7.3 ± 1.7 mmHg) when the pager sounded. FF+10 also had worse overall psychometric scores: higher DASS-21 (11.2 ± 5.3 vs 7.6 ± 1.3; depression 3.4 ± 1.3 vs 1.4 ± 0.3; and stress 5.4 ± 1.7 vs 3.3 ± 0.5; but similar anxiety scores 2.4 ± 1.0 vs 3.0 ± 0.9. With intervention, in FF+10 we found that BP lowered, fitness improved, and psychosocial constructs improved. **CONCLUSION:** With this subset of baseline data, we show that FF+10 have smaller BP surge, worse CV health, stress, and depression levels, but larger improvements with intervention compared to FF-10. Data confirms the importance of wellness programs for FF.

**2943 Board #3 May 29 1:00 PM - 3:00 PM**

**Perturbations In Heart Rate And Heart Rate Variability Of Volunteer Firefighters Responding To Nighttime Calls**

Cory J. Coehoon<sup>1</sup>, Thomas W. Service<sup>2</sup>, Jodie R. Gawryluk<sup>2</sup>, Lynne A. Stuart-Hill<sup>2</sup>. <sup>1</sup>*Louisiana State University Shreveport, Shreveport, LA.* <sup>2</sup>*University of Victoria, Victoria, BC, Canada.*  
*(No relevant relationships reported)*

Firefighters (FFs) can increase their risk of cardiovascular (CV) events >100-fold during emergency response. FF research has tended to analyze career FFs or a career-volunteer blend, while neglecting to provide specific results for the volunteer population. This leaves a gap in literature that seeks to understand the magnitude and duration of call-related perturbations. Autonomic tone (AT), measured by heart rate variability (HRV) is a non-invasive measure providing insight into CV risk and resiliency, and stress response. **PURPOSE:** To identify the magnitude and duration of changes in volunteer FFs' autonomic CV control during night time emergency response. **METHODS:** Eight male FFs (36.9 ± 12.1 years) wore monitors to track heart rate (HR) and R-R intervals from 1900-0700 on nights with, and without call response for a total of 12 calls. Data filtering preceded HRV analysis in both time and frequency domain. Data was organized into 15-minute epochs, focusing on: 15-0 (PRE) pre-dispatch, 0-15 (PC1) and 75-90 (PC2) post-dispatch, and 0-15 (WAKE) when waking without a call. **RESULTS:** Compared to PRE, increases in the LF/HF ratio were observed at both PC1 (1.784 ± 1.345, p=.014), and PC2 (1.265 ± 1.238, p=.046) η<sup>2</sup>=.505 in the call condition. PRE-PC1 comparisons showed increases in HRMEAN (43 ± 13 bpm, p<.0005, η<sup>2</sup>=.837) and HRMAX (60 ± 22 bpm, p<.0005, η<sup>2</sup>=.923) at PC1, though only HRMEAN remained elevated from PRE values at PC2 (12 ± 8 bpm, p=.005). RMSSD and HF Power (HFp) decreased at PC1 (RMSSD:16.868 ± 8.100 ms, p=.001, η<sup>2</sup>=.781; HFp: 552.057 ± 311.930 ms<sup>2</sup>, p=.002, η<sup>2</sup>=.758), returning within PRE ranges by PC2. Comparisons of PC1 to normal WAKE revealed decreased HFp (234.726 ± 163.721 ms<sup>2</sup>, p=.002, η<sup>2</sup>=.577) and increases in both LF/HF (6.920 ± 5.044, p=.013, η<sup>2</sup>=.556) and HRMEAN (18 ± 13 bpm, p=.012, η<sup>2</sup>=.564). **CONCLUSION:** Results from the current study show sympathetic activation and parasympathetic withdrawal at PC1 and PC2 compared to

PRE. This facilitated a rapid spike in HR to 85% of age-adjusted HRMAX. Compared to waking normally, waking for call response evokes a distinctly different response where perturbations in AT tend to persist 90-minutes. This persistent ANS imbalance may indicate physiological perturbations that could explain increased atherosclerosis and CVD risk for FFs.

**2944 Board #4 May 29 1:00 PM - 3:00 PM**  
**Prevalence Of Coronary Heart Disease Risk Factors In A Large Sample Of Southern Californian Firefighters**

Terri Wann, Kris Ross, Jennifer Meloni, Ralph Rozenek. *Santa Ana College, Santa Ana, CA.*  
 Email: wann\_terri@sac.edu  
 (No relevant relationships reported)

Firefighters (FF) are exposed to a variety of work-related stressors that can lead to increased risk of disability and premature death. Heart attack is the primary "on-duty" cause of death in these individuals. Few studies have investigated the prevalence of the various coronary heart disease (CHD) risk factors (RF) in FF and how they are affected by age in this specific group. **PURPOSE:** 1) To determine the prevalence of CHD RF and; 2) to examine the relationship between the CHD RF and age in a large group of FF. **METHODS:** Data from 1949 male (n= 1924) and female (n = 25) FF (mean age  $\pm$  s.d. =  $39.8 \pm 8.8$  yr.) representing 27 departments in Southern California were used for analyses in this cross-sectional study. Apart from age, the RF selected represented those that were independent of gender. Standard statistical techniques were applied to determine CHD RF frequencies and percentages. Chi-Square Analyses with Cramer's V were used to assess the relationship between age-group and RF prevalence and to estimate effect size. **RESULTS:** Overall 70.0% of FF had exceeded at least one CHD RF threshold. High blood pressure (HBP) was the most prevalent RF (26.9%) in the 20-29 yr. age-group followed by elevated body mass index (BMI) (11.2%) and low-density lipoprotein cholesterol concentrations (LDL-C) (11.2%). By contrast, 64.4% of FF in the 50+ yr. age-group had HBP with 31.9% having elevated BMI and 30.7% with elevated LDL-C. While the percentage of FF in the 20-29 yr. age-group with  $\geq 2$  RF was only 9.9%, it rose to 80.5% in the 50+ yr. age-group. Other than blood glucose, moderate effect sizes were observed for relationships among age-group and the individual RF.

Percentage of FF with CHD risk factor by age group.

| Risk Factor                                    | Age Group (years) |       |       |       | p value | Cramer's V |
|--|-------------------|-------|-------|-------|---------|------------|
|  | 20-29             | 30-39 | 40-49 | 50+   |         |            |
| HBP $S \geq 130/D \geq 80$ mm Hg               | 26.9%             | 38.7% | 47.7% | 64.4% | <0.001  | 0.219      |
| BMI $\geq 30$ kg x m <sup>2</sup>              | 11.2%             | 18.4% | 30.8% | 31.9% | <0.001  | 0.179      |
| Blood Glucose $\geq 126$ mg x dL <sup>-1</sup> | 0.0%              | 0.0%  | 0.8%  | 0.3%  | 0.05    | 0.063      |
| LDL-C $\geq 130$ mg x dL <sup>-1</sup>         | 11.2%             | 22.9% | 36.7% | 30.7% | <0.001  | 0.189      |
| METs < 8                                       | 0.0%              | 0.7%  | 2.7%  | 8.0%  | <0.001  | 0.172      |

**CONCLUSION:** A sizable number of FF had multiple CHD RF. Advancing age increased the percentage of FF with multiple RF. Continued efforts must be made to reduce the number of CHD RF in this specific population who serve a vital function protecting our communities.

**2945 Board #5 May 29 1:00 PM - 3:00 PM**  
**Seasonal Changes In Cardiovascular Function, Risk Factors, And Oxidative Stress Of Wildland Firefighters**

Cassie Williamson-Reisdorph, Katie S. Christison, Shae C. Gurney, Kathryn G.S. Tiemessen, Joseph A. Sol, Tiffany S. Quindry, Charles G. Palmer, Matthew W. Bundle, Charles L. Dumke, FACSM, John C. Quindry, FACSM. *University of Montana, Missoula, MT.* (Sponsor: John C. Quindry, FACSM)  
 (No relevant relationships reported)

Wildland firefighters (WLFF) experience extreme physiological strain throughout a typical season due to intense occupational demands and consistent woodsmoke exposure. There is a rationale to indicate that accumulated physiological strain, and oxidative stress, throughout a WLFF season has the potential to negatively alter cardiovascular function and risk factors. **PURPOSE:** The purpose of the study was to examine the effects of a season on cardiovascular function, risk factors, and markers of oxidative stress in WLFF. **METHODS:** Fourteen members of a Type I interagency hotshot crew participated in the study (males: n=13, females: n=1, age: 30.1 years  $\pm$  4.8). Pre- and post-seasonal resting measurements (May, October) were obtained for heart rate variability (lnRMSSD, lnHF, lnHF, LF:HF), pulse wave velocity (PWV), blood lipid panels (TC, TG, LDL, HDL), metabolic biomarkers (blood glucose, HbA1c), blood pressure (SBP, DBP) and blood oxidative stress (3-nitrotyrosine, 8-isoprostane). Paired samples t-tests were used to identify differences among pre-

and post- seasonal values. **RESULTS:** There were no seasonal effects observed on resting heart rate variability, PWV, 3-nitrotyrosine, 8-isoprostane, TC, TG, LDL, blood glucose, SBP, or DBP ( $p > 0.05$ ). A significant reduction occurred in HDL (Pre:  $53$  mg/dL  $\pm 14$ , Post:  $45$  mg/dL  $\pm 18$ ,  $p=0.043$ ) and HbA1c increased (Pre:  $5.2\% \pm 0.2$ , Post:  $5.3\% \pm 0.2$ ,  $p=0.034$ ) from pre- to post-season. **CONCLUSION:** These data suggest a WLFF season did not impact resting markers of heart rate variability, pulse wave velocity, and oxidative stress. Alterations in metabolic biomarkers of cardiovascular risk factors (HDL and HbA1c) demonstrate unfavorable seasonal changes, suggesting that the WLFF season may increase cardiovascular risk.

**2946 Board #6 May 29 1:00 PM - 3:00 PM**  
**Metabolic And Cardiovascular Alterations During Critical Training In Wildland Firefighters**

Shae C. Gurney, Katie S. Christison, Cassie M. Williamson-Reisdorph, Kathryn G.S. Tiemessen, Joseph A. Sol, Tiffany S. Quindry, Matthew W. Bundle, Charles G. Palmer, John C. Quindry, FACSM, Charles L. Dumke, FACSM. *University of Montana, Missoula, MT.*  
 (No relevant relationships reported)

**Introduction:** Wildland firefighters (WLFF) are confronted with numerous physical and mental stressors. Pre-fire season includes an intense two-week critical training period; a preparatory phase that sometimes results in injuries, illness, and rhabdomyolysis. **Purpose:** To identify physiologic changes to oxidative stress and other metabolic biomarkers that occur during 2 weeks of critical training in WLFF. **Methods:** Eighteen male ( $29.4 \pm 1.1$  yr,  $182.1 \pm 1.6$  cm) and three female ( $26.7 \pm 2.6$  yr,  $169.5 \pm 4.2$  cm) participants were recruited from a Type I interagency hotshot fire crew and monitored for the duration of their two-week critical training. Subjects were asked to arrive fasted and uncaffeinated for blood draws on days 1, 4, 8, and 11. Plasma was analyzed for changes in the metabolic profile and oxidative stress markers 3-Nitrotyrosine (3-NT) and 8-Isoprostane (8-ISO). A one-way repeated measures ANOVA was used to analyze 8-ISO and 3-NT. Paired samples t-tests were used to compare metabolic biomarkers. Data presented as mean  $\pm$  SEM. **Results:** Critical training elicited a decrease in total cholesterol ( $173.6 \pm 12.1$  to  $153.4 \pm 8.6$  mg  $\cdot$  dL<sup>-1</sup>,  $p=0.01$ ), hemoglobin A1c ( $5.2 \pm 0.1$  to  $5.1 \pm 0.1$  %,  $p=0.003$ ), hemoglobin ( $15.5 \pm 0.4$  to  $14.3 \pm 0.3$  g  $\cdot$  dL<sup>-1</sup>,  $p=0.003$ ), and estimated plasma volume ( $53.8 \pm 0.7$  to  $50.7 \pm 1.4$  %,  $p=0.005$ ) from day 1 to 11. No difference was observed in high-density lipoprotein cholesterol. A main effect for time was observed in 8-ISO ( $p < 0.001$ ) and 3-NT ( $p=0.033$ ). A significant decrease was observed in 8-ISO at day 4 and 8 when compared to day 1 (day 1:  $15.5 \pm 1.3$ , day 4:  $11.8 \pm 1.0$ , day 8:  $12.9 \pm 1.1$  pg  $\cdot$  mL<sup>-1</sup>). 3-NT was significantly elevated from day 4 to day 8 (day 4:  $2.4 \pm 0.6$ , day 8:  $2.9 \pm 0.6$   $\mu$ g  $\cdot$  mL<sup>-1</sup>). **Conclusion:** These data suggest that the exertion required of WLFF during critical training results in positive alterations to the metabolic profile. The unexpected decreases in oxidative stress markers may reflect adaptation to the stressors of critical training, although this cannot be confirmed. Additional markers should be examined across other WLFF crews to confirm and provide further information on alterations during this two-week period.

Funded by the US Forest Service 16-CR-11138200-005.

**2947 Board #7 May 29 1:00 PM - 3:00 PM**  
**Nutrition, Physical Activity And Cardiovascular Disease Risk Of Career Firefighters In A Low-income Area**

Brandy Ellen Phipps, Kathy Carter, FACSM. *Central State University, Wilberforce, OH.* (Sponsor: Kathy Carter, FACSM)  
 Email: bphipp@centralstate.edu  
 (No relevant relationships reported)

The majority of on-duty firefighter (FF) deaths result from cardiovascular incidents, and FF wellness is related to job effectiveness and safety. Departments in low-income communities are often unable to provide wellness programming, allowing opportunities for local universities to fill the need.

**PURPOSE:** To determine health and cardiovascular disease (CVD) risk of local career FF in a low-income community for use in developing ongoing wellness interventions. **METHODS:** Nutrition behavior, physical activity information, anthropometric measurements [body fat percentage (%BF), mass of body fat (MBF); waist circumference (WC); height; weight], and blood lipid levels [total cholesterol (TC); low-density lipoprotein (LDL); high-density lipoprotein (HDL); and triglycerides (TG)] were collected from a cohort of FF and analyzed. **RESULTS:** Thirty-three percent (42/127) of department members participated in the study, with even representation across unit, age, and years worked. Eighty-three percent of FF were overweight/obese, as determined by bioelectrical impedance. Similarly, 83% were at-risk or at-significant-risk for CVD by waist-to-height ratio (WTHR,  $0.5-0.6$  and  $>0.6$ , respectively). Segmental trunk mass of body fat (SMBF<sub>trunk</sub>) was correlated with waist circumference ( $r=0.915$ ), and also with TC ( $r=0.167$ ), LDL ( $r=0.189$ ) and TG ( $r=0.484$ ), while inversely correlated with HDL ( $r=-0.133$ ). BMI and %BF were positively correlated ( $r=0.81$ ). Fifty percent of FF had TC, 38% had LDL, and 45%

had TG levels which placed them at-risk for CVD. Only 33% of participants reported exercising the recommended amount (3-5 times) per week, and 36% and 14% of FF reported intake of the recommended amount of fruits and vegetables, respectively, per day. **CONCLUSION:** In a cohort of career FF in a low-income area, the majority were classified as at-risk for CVD, across multiple indices, including BMI, %BF, WC, WTHR, SMBF<sub>trunk</sub>, and lipid profiles. In addition, the cohort reported unhealthy levels of fruit and vegetable intake, as well as less-than-recommended levels of physical activity. These results suggest that local FF are an at-risk population for CVD, and that there is a need for nutrition and exercise interventions to help lower the risk and increase job effectiveness in our regional first responders.

**2948** Board #8 May 29 1:00 PM - 3:00 PM  
**Changes In Obesity And Cardiovascular Disease Risk Among Older And Younger Firefighters**  
 Brittany S. Hollerbach<sup>1</sup>, Kevin C. Mathias<sup>1</sup>, Yuchen Wu<sup>1</sup>, Donald F. Stewart<sup>2</sup>, Denise L. Smith, FACSM<sup>1</sup>. <sup>1</sup>Skidmore College, Saratoga Springs, NY. <sup>2</sup>Public Safety Occupational Health Center, Fairfax, VA.  
 Email: bhollerb@gmail.com  
 (No relevant relationships reported)

Over 80% of the US fire service is overweight (BMI: 25-29.9 kg/m<sup>2</sup>) or obese (BMI ≥ 30 kg/m<sup>2</sup>), increasing the risk for cardiovascular disease (CVD). Although age is an important CVD risk factor, it is not often examined among firefighters (FFs). Risk scores are a common tool used by medical professionals. However, no investigations have examined calculated risk scores and changes over time among FFs. **PURPOSE:** To describe changes in weight, BMI and CVD risk scores among a large cohort of younger (<45 years) and older (≥45 years) FFs over a 5-year period. **METHODS:** Age, body weight, body mass index (BMI), and calculated CVD risk scores of 672 FFs (<45: n=522; 35±6 yr; ≥45: n=150; 48±3 yr) in a large northeastern fire department were assessed during an occupational medical exam in 2009-2011 and 5 years later. CVD risk scores were calculated using the Framingham Risk Score (FRS) calculation. Descriptive statistics summarized data, logistic or linear regression models compared proportions or means, and paired t-tests were used for within subject comparisons to test for significance. **RESULTS:** At baseline, younger FFs weighed 88.5 kg with a BMI 27.9 kg/m<sup>2</sup> and FRS of 3.4. Older FFs weighed 89.9 kg with a BMI of 28.5 kg/m<sup>2</sup> and FRS of 12.1. Over the 5 years, FFs <45 yr gained (+3.0 kg) significantly more weight than those ≥45 yr (+0.8 kg; p<0.001). BMI for both groups increased significantly, +0.9±0.1 and +0.4±0.2 respectively for <45 and ≥45 yr. Significantly more (55%) FFs <45 yr gained weight compared to 38% of FFs ≥45 yr (p<0.01). However, older FFs had significantly higher (p<0.001) CVD risk scores at baseline and follow up (9.3; 12.1) than younger FFs (3.4; 4.9). Although the majority of FFs ≥45 lost/maintained body weight (62%), overall their CVD risk increased (+2.8±0.4; p<0.001). **CONCLUSION:** Although FFs cannot avoid aging, they can aggressively manage other risk factors that affect their CVD risk score including preventing weight gain. Research indicates health care providers are more likely to counsel older FFs regarding weight loss. Our findings suggest younger FFs are more at risk of gaining weight and could benefit from guidance on this important risk factor. Further efforts are needed to encourage physicians and fire departments to direct FFs to establish healthy habits early in their career.

Supported by FEMA Grant EMW-2017-FP-PP-00445

**F-07 Thematic Poster - Field Measures of Running Biomechanics**

Friday, May 29, 2020, 1:00 PM - 3:00 PM  
 Room: CC-2007

**2949** **Chair:** Allison H. Gruber, FACSM. Indiana University  
 Bloomington, Bloomington, IN.  
 (No relevant relationships reported)

**2950** Board #1 May 29 1:00 PM - 3:00 PM  
**Changes In Peak Accelerations And Shock Attenuation Over The Course Of A Marathon**  
 Marit A. Zandbergen<sup>1</sup>, Jaap H. Buurke<sup>1</sup>, Peter H. Veltink<sup>2</sup>, Jasper Reenalda<sup>1</sup>. <sup>1</sup>Roessingh Research & Development, University of Twente, Enschede, Netherlands. <sup>2</sup>University of Twente, Enschede, Netherlands. (Sponsor: Brian W. Noehren, FACSM)  
 Email: m.zandbergen@rrd.nl  
 (No relevant relationships reported)

Peak tibial and peak sacral accelerations have been shown to increase during a fatiguing run. Peak accelerations are often used as a surrogate for impacts on the body during running. High tibial impacts have been linked to development of tibial stress fractures. To understand how impacts are related to injury development, we need more insight in how shocks propagate through the body, especially under the influence of fatigue.

**Purpose**  
 To investigate bilateral peak accelerations and shock attenuation over the course of a Marathon.

**Methods**  
 5 trained athletes (2M 3F, 33.8±11.8 years, 182.3±5.8 cm, 73.9±9.1 kg years) ran a Marathon during competition. Inertial measurement units (240Hz) were placed on the sternum, pelvis, and bilaterally on the tibia and foot. Mean peak accelerations around initial contact and shock attenuation (% decrease of peak acceleration) were calculated over 25 strides during the 2<sup>nd</sup> and 42<sup>nd</sup> km of the Marathon. Paired sample t-tests were used to test for statistical differences between the 2<sup>nd</sup> and 42<sup>nd</sup> km and between the dominant and non-dominant side.

**Results**  
 See Table 1. Mean finish time was 4:07:40±0:19:07.

**Conclusion**  
 Impacts and shock attenuation changed asymmetrically during a Marathon. Both side dominance and fatigue significantly influenced shock attenuation. However, on sternum level, only fatigue influenced impacts and shock attenuation, implying some sort of protective mechanism to keep proximal impacts low. The non-dominant side showed larger impacts during the whole Marathon, possibly because this side is less strong and therefore less able to actively (i.e. muscle contractions) absorb shocks. Overall, impacts increased and shock attenuation decreased towards the end of the Marathon, possibly increasing the risk of overuse injuries.

Table 1. Bilateral peak accelerations and shock attenuations for the 2<sup>nd</sup> and 42<sup>nd</sup> km of a Marathon. An asterisk (\*) indicates a significant difference (p<0.05) between the 2<sup>nd</sup> and 42<sup>nd</sup> km. A superscript s (!) indicates a significant difference (p<0.05) between the non-dominant and dominant side at either the 2<sup>nd</sup> or 42<sup>nd</sup> km.

| m/s <sup>2</sup>    | Peak accelerations      |                          |                         |                         |
|---------------------|-------------------------|--------------------------|-------------------------|-------------------------|
|                     | Non-dominant            |                          | Dominant                |                         |
|                     | 2km                     | 42km                     | 2km                     | 42km                    |
| Foot                | 99.4±24.0* <sup>s</sup> | 116.2±35.4* <sup>s</sup> | 92.7±24.5 <sup>s</sup>  | 94.4±21.2 <sup>s</sup>  |
| Lower leg           | 92.2±21.6* <sup>s</sup> | 124.2±68.0* <sup>s</sup> | 84.8±18.4 <sup>s</sup>  | 87.2±26.6 <sup>s</sup>  |
| Pelvis              | 82.8±55.9 <sup>s</sup>  | 87.5±59.1 <sup>s</sup>   | 64.2±31.1* <sup>s</sup> | 77.3±46.2* <sup>s</sup> |
| Sternum             | 25.1±11.3*              | 35.9±16.8*               | 25.9±10.0*              | 36.7±12.6*              |
| % reduction impacts | Shock attenuation       |                          |                         |                         |
|                     | Non-dominant            |                          | Dominant                |                         |
|                     | 2km                     | 42km                     | 2km                     | 42km                    |
| Foot-Lower leg      | 7.3±18.4*               | -6.9±49.1* <sup>s</sup>  | 8.6±19.3                | 7.6±21.1 <sup>s</sup>   |
| Lower leg-Pelvis    | 10.2±22.9 <sup>s</sup>  | 29.5±35.5                | 24.3±16.9* <sup>s</sup> | 11.3±32.3*              |
| Pelvis-Sternum      | 69.6±19.6* <sup>s</sup> | 59.0±43.0*               | 59.6±20.7* <sup>s</sup> | 52.5±35.2*              |

**2951** Board #2 May 29 1:00 PM - 3:00 PM  
**Low Accelerometer Sampling Rates Attenuate Tibial Impact Acceleration Peaks During Running**

Clare E. Milner, FACSM, Kevin G. Aubol. *Drexel University, Philadelphia, PA.*  
 Email: milner@drexel.edu  
 (No relevant relationships reported)

High tibial acceleration peaks have been associated with tibial stress fracture in runners. Field-testing with wearable wireless accelerometers is now commonplace, but some devices have a lower sampling frequency than in laboratory testing. PURPOSE To determine the influence of sampling rate on peak axial tibial acceleration and peak resultant tibial acceleration magnitude during running. METHODS As part of a larger study, 19 healthy adults were recruited (10 women; 31±6 years; 1.70±0.08 m; 68.6±11.6 kg) and provided informed consent to participate. A precision accelerometer sampling at 1000Hz was attached to the distal anteromedial aspect of the right tibia. Participants ran at 3.0m/s in the laboratory for five good trials making contact with a force plate sampling at 1000Hz. Raw data were down-sampled to 500Hz and 100Hz, common sampling rates for wearable wireless accelerometers. All data were low-pass filtered at 70Hz. Stance phase was identified by foot contact on the force plate. Peak positive axial acceleration and peak resultant acceleration were determined for each trial and averaged. One factor repeated measures analysis of variance with least significant difference post-hoc tests determined whether peaks differed among sampling rates. Effect sizes were calculated to aid interpretation of the data. RESULTS Both peak axial and peak resultant acceleration were significantly reduced when tibial acceleration was sampled at 100Hz compared to 500Hz or 1000Hz ( $p = 0.041$ ). Reductions were 0.7g or about 10% of the peak magnitude at 1000Hz, a small effect. Values were stable between the 500Hz and 1000Hz sampling rates. CONCLUSION We recommend that tibial acceleration data are sampled at rates of 500Hz or greater to avoid attenuation of peaks producing erroneously low values for both peak axial and peak resultant acceleration.

Table: Mean and standard deviation of peak axial and peak resultant tibial acceleration during running when sampling data at different rates

| Accelerometer Sampling Rate (Hz) | Peak Axial Acceleration |         |             | Peak Resultant Acceleration |         |             |
|----------------------------------|-------------------------|---------|-------------|-----------------------------|---------|-------------|
|                                  | Mean (SD) g             | p value | Effect Size | Mean (SD) g                 | p value | Effect Size |
| 100                              | 5.4 (1.8)               | < 0.01  | 0.36        | 7.4 (2.9)                   | 0.025   | 0.22        |
| 500                              | 6.0 (2.1)               | 0.89    | 0.05        | 8.1 (3.4)                   | 0.93    | 0.00        |
| 1000                             | 6.1 (2.1)               | -       | -           | 8.1 (3.4)                   | -       | -           |

**2952** Board #3 May 29 1:00 PM - 3:00 PM  
**Changes In Running Mechanics During A Typical Interval Training On The Track Measured With IMUs**

Jasper Reenalda<sup>1</sup>, Emily J.C. Zoetbrood<sup>1</sup>, Marit A. Zandbergen<sup>1</sup>, Jaap H. Buurke<sup>1</sup>, Brian W. Noehren, FACSM<sup>2</sup>. <sup>1</sup>*Roessingh Research and Development, University of Twente, Enschede, Netherlands.* <sup>2</sup>*University of Kentucky, Lexington, KY.* (Sponsor: Brian W. Noehren, FACSM)  
 Email: j.reenalda@rrd.nl  
 (No relevant relationships reported)

An 8 x 400 meter interval training is often performed with the aim of improving aerobic fitness. Besides being physiological and physically challenging this type of training is also mechanically demanding. As such it could have potential negative effects on running mechanics. Inertial magnetic measurement units (IMUs) allow for continuous measurement of running mechanics during this type of training.

PURPOSE: To investigate changes in running mechanics during an 8 x 400 meter interval training on the athletic track using IMUs.

METHODS: 5 trained athletes (4M 1F, 25.4±7.9 years, 185.6±8.3 cm, 69.2±12.7 kg) ran 8 x 400 meters on the athletic track. They were paced to run each 400 meter at 5 km race pace with half of the time run as rest. Eight IMUs (240 Hz) were placed at the feet, tibia, upper legs, sacrum and sternum. Accelerometer data and sensor orientation were used to calculate the following parameters using custom code after calibration trials: Hip, knee and ankle angle at Initial Contact (IC), knee angle at Midstance (MST) and Midswing (MSW), peak tibial and sacral acceleration (PTA, PSA), and centre of mass (COM) displacement. Parameters were calculated for both straights of the 2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>th</sup> and 8<sup>th</sup> 400 meters. Borg scale (0-10) was asked after every bout for perceived exertion. Paired sample t-tests were used to test for statistical differences between the 2<sup>nd</sup> and 8<sup>th</sup> bout.

RESULTS: Table 1

CONCLUSIONS: Running mechanics (mainly ankle and knee mechanics and tibial impact) changed over the course of a typical interval training, putting runners at higher risk with increasing bouts. This indicates that this type of training is not only

physiological and physically demanding but puts increasing mechanical stress on the body. These results suggest caution should be used among athletes returning from an overuse injury.

Table 1: Results of the 8 x 400 meters interval training on the athletic track. Mean values (± SD) are presented for the selected parameters during the 2<sup>st</sup>, 4<sup>th</sup>, 6<sup>th</sup> and 8<sup>th</sup> run. P value is given for the significance between the 2<sup>nd</sup> and 8<sup>th</sup> bout.

| Bout                     | #2        | #4        | #6         | #8         | #2 vs #8 |
|--------------------------|-----------|-----------|------------|------------|----------|
|                          | Mean±SD   | Mean      | Mean       | Mean       | P value  |
| Hip angle IC             | 29.7±7.4  | 30.0±8.2  | 29.8±8.0   | 31.2±8.4   | $P=0.23$ |
| Knee angle IC*           | 24.1±7.5  | 26.8±8.5  | 27.3±9.0   | 27.2±7.7   | $P=0.00$ |
| Knee angle at MST*       | 42.0±7.8  | 42.8±7.3  | 43.3±8.4   | 43.8±7.4   | $P=0.00$ |
| Knee angle MSW*          | 112.4±8.3 | 114.1±7.8 | 113.4±11.5 | 116.2±7.7  | $P=0.00$ |
| Ankle angle IC*          | -6.2±6.5  | -3.1±8.1  | -1.5±9.1   | -1.9±8.6   | $P=0.02$ |
| PTA (m/s <sup>2</sup> )* | 91.9±11.5 | 97.8±14.2 | 94.0±11.0  | 99.3±13.0  | $P=0.05$ |
| PSA (m/s <sup>2</sup> )* | 37.1±4.0  | 41.4±4.0  | 40.1±3.8   | 43.2±4.9   | $P=0.28$ |
| COM (mm)                 | 67.7±41.7 | 77.8±46.8 | 87.7±48.9  | 101.3±57.1 | $P=0.06$ |
| Borg scale*              | 3         | 5         | 5          | 6          | $P=0.00$ |

**2953** Board #4 May 29 1:00 PM - 3:00 PM  
**Automated Gait Variability Assessment In Real-World Running Using Wearable Accelerometry**

John J. Davis, IV<sup>1</sup>, Marcin Strączkiewicz<sup>2</sup>, James McDonnell<sup>1</sup>, Jaroslaw Harezlak<sup>1</sup>, Max R. Paquette<sup>3</sup>, John S. Raglin, FACSM<sup>1</sup>, Allison H. Gruber<sup>1</sup>. <sup>1</sup>*Indiana University, Bloomington, IN.* <sup>2</sup>*Harvard T.H. Chan School of Public Health, Boston, MA.* <sup>3</sup>*Memphis University, Memphis, TN.* (Sponsor: John S Raglin, FACSM)  
 Email: jjd1@iu.edu  
 (No relevant relationships reported)

Using wearable sensors to assess running gait variability may be a valuable tool to identify deterioration in performance or health in competitive and recreational runners. PURPOSE: To measure associations between gait variability and training intensity, mood state, and perceived fatigue in collegiate runners (CR) and novice/recreational runners (NR). METHODS: 30 CR wore a waist-mounted ActiGraph GT3X+ accelerometer for all non-interval and non-competition training sessions for a full season. 16 NR wore a waist-mounted GT3X+ and an on-shoe activity monitor (MilestonePod) during 13 weeks of progressive training. Subjects completed written (CR) or email (NR) daily surveys. Recently developed running and step recognition algorithms were applied to isolate running gait cycles from raw sub-second level accelerometer data. Gait variability was assessed using amplitude deviation of resultant acceleration. Associations between variability and training intensity, mood state, and fatigue were assessed with generalized additive mixed models. RESULTS: 1069 runs and 7.64 million steps were analyzed. Variability was greater in CR than NR (0.301 vs 0.262g,  $p=0.019$ ). Within individual runs, variability was stable from 10-60 minutes in both CR and NR (Fig. 1). In CR, mood state was not significantly associated with variability ( $p=0.70$ ). In NR, variability increased nonlinearly with average running speed ( $p<0.001$ ), and a 1-point increase in fatigue on a 0-10 scale was associated with a 0.003g decrease in variability ( $p=0.051$ ). CONCLUSION: A runner's gait variability may be more strongly influenced by skill level and running speed than by acute changes in perceived fatigue or mood state. Unmeasured variables, such as training surface, may also affect gait variability.

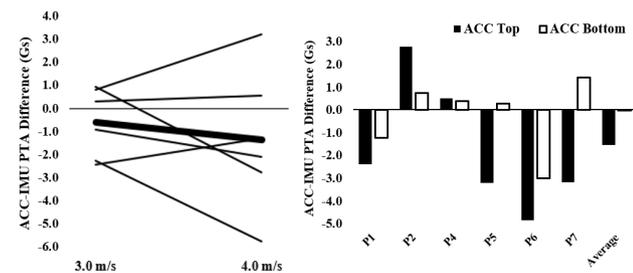
Figure 1. Gait variability in CR and NR across different individual runs (top left, black dots), across different levels of fatigue (top right), and within any given run (bottom left and right, thin lines).

**2954** Board #5 May 29 1:00 PM - 3:00 PM  
**Validity Of Peak Tibial Acceleration Using Wearable Accelerometers During Running**

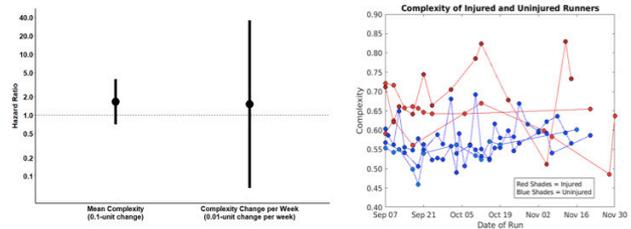
Adriana Miltko<sup>1</sup>, Taylor M. Vickery<sup>1</sup>, Richard T. Beltran<sup>1</sup>, Clare E. Milner, FACSM<sup>2</sup>, Max R. Paquette<sup>1</sup>. <sup>1</sup>*University of Memphis, Memphis, TN.* <sup>2</sup>*Drexel University, Philadelphia, PA.* (Sponsor: Clare Milner, FACSM)  
 Email: amiltko@memphis.edu  
 (No relevant relationships reported)

With wearable technology becoming more popular, more companies are creating sensors to assess biomechanical parameters including peak tibial acceleration (PTA) during running. However, validity of data from wearable technology relative to "gold-standard" research-grade instruments is highly important. PURPOSE: Assess the difference in PTA obtained from wearable inertial measurement units (IMU) and a research-grade accelerometer at different running speeds. METHODS: Six participants completed 1-2min treadmill running bouts at 3.0 m/s and 4.0 m/s while

wearing standardized footwear (1080, New Balance). A research-grade tri-axial accelerometer (ACC; 1200Hz, model 356A26, PCB Piezotronics) and a 9-axis IMU (1000Hz, Blue Trident, IMeasureU) were secured to the distal tibia to capture PTA during running. The testing at both speeds was completed with the ACC below and above the IMU to account for possible position effects. Data were collected for the final 15 seconds of each running bout and the average of both positions for 10-15 peaks of axial tibial acceleration were used for analyses. Paired t-tests and Cohen's *d* effect sizes were calculated to compare instrument PTA means at different speeds. **RESULTS:** At 3.0 m/s, mean PTA was not different between ACC (5.2±1.9 G) and IMU (5.9±2.2 G; *p* = 0.33; *d* = 0.34). At 4.0 m/s, mean PTA was not different between ACC (8.5±3.7 G) and IMU (9.8±4.2 G; *p* = 0.33; *d* = 0.33). Figure 1 demonstrates the individual variability in the difference in PTA obtained from the ACC and IMU at different speeds (A) and different positions (B). **CONCLUSION:** Despite the statistically similar PTA means obtained from both instruments, the difference in PTA between ACC and IMU appears to be highly variable among individuals. This variability in PTA may be due to differences between devices, device placement, attachment method, or individual running style. This highlights the difficulty in controlling sources of variability during testing.



**Figure 1.** A) Individual and average (bold) difference of PTA between the ACC and IMU at 3.0 m/s and 4.0 m/s with sensor position pooled. B) Individual and average difference of PTA between the ACC and IMU for both positions with pooled speeds.



**Fig. 1:** (Left) Hazard ratios (error bars representing 95% CI) of the runners' average complexity across the season and the change in complexity each week across runners. (Right) Mean complexity for each week recorded during the season of exemplar injured (blue shades) and uninjured (red shades) runners.

**2955 Board #6 May 29 1:00 PM - 3:00 PM Risk Of Running-related Injury Associated With Center Of Mass Acceleration Complexity**

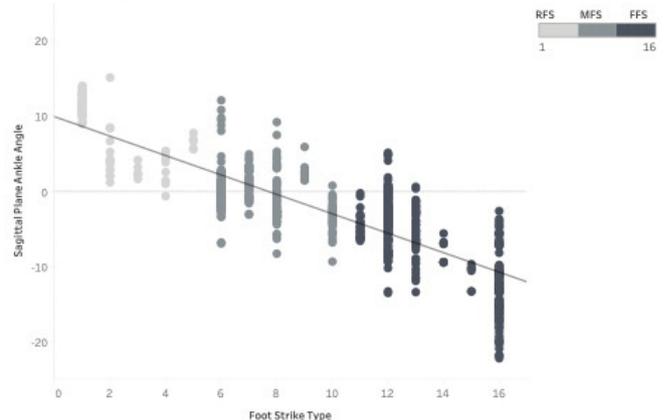
James McDonnell<sup>1</sup>, John J. Davis, IV<sup>1</sup>, Jaroslaw Harezlak<sup>1</sup>, Max R. Paquette<sup>2</sup>, Allison H. Gruber<sup>1</sup>. <sup>1</sup>Indiana University, Bloomington, IN. <sup>2</sup>University of Memphis, Memphis, TN. (No relevant relationships reported)

Dynamical systems theory suggests that examining the complexity of biological signals may be more sensitive in differentiating between groups of varying health status, including predicting who may develop a running-related overuse injury (RROI). This theory has yet to be tested in prospective running studies. **PURPOSE:** To evaluate if changes in complexity, quantified by mean control entropy, of center of mass (COM) resultant acceleration during running is associated with RROI development. **METHODS:** 30 collegiate runners wore an ActiGraph GTX3+ during 'easy' training runs throughout a cross-country season. Clinician-diagnosed RROI were reported via an online survey. Complexity was calculated on the resultant acceleration time series from each run. Cox proportional hazards analysis assessed injury risk as a function of the mean complexity for each runner across the season and the change in complexity per week. **RESULTS:** Seven runners sustained an injury. Across all 30 participants over the season, the mean ± 1SD complexity was 0.623 ± 0.086 units. The mean change in complexity over the course of the cross country season was -0.0014 ± 0.0043 units per week. Although not statistically significant, each 0.1-unit increase in complexity was associated with a 1.65-fold increase in injury rate (95% CI 0.70-3.89, *p*=0.30) and a 0.01-unit increase in complexity per week was associated with a 1.50-fold increase in injury rate (95% CI 0.06-35.5, *p* = 0.80). **CONCLUSION:** These preliminary findings suggest that COM complexity could at least contribute to RROI detection strategies in cross-country runners. Given these preliminary results, additional prospective studies with larger sample sizes are necessary to further assess relationships between baseline complexity and changes in complexity during running training that can be monitored with wearable technology.

**2956 Board #7 May 29 1:00 PM - 3:00 PM Relationship Between Wearable Sensor Foot Strike Outcomes And Ankle Sagittal Plane Kinematics During Treadmill Running**

Alexandra F. DeJong, Jay Hertel, FACSM. University of Virginia, Charlottesville, VA. (Sponsor: Jay Hertel, FACSM) Email: afd4au@virginia.edu (No relevant relationships reported)

**PURPOSE:** Wearable sensors are capable of measuring biomechanical running outcomes. Traditional gait analyses have determined a strong relationship between ankle angle at initial contact and foot strike. However, there is currently no information available on how sensor-derived metrics of foot strike type relate to ankle sagittal motion during running as a means of validation. Therefore, the purpose of this study was to validate the sensor-derived foot strike type outcome by determining the relationship between foot strike type and ankle sagittal plane kinematics during a treadmill running analysis. We hypothesized that a rearfoot strike (RFS) would highly correlate to increased ankle dorsiflexion, while a forefoot strike (FFS) would highly correlate to increased ankle plantarflexion. **METHODS:** Twenty collegiate cross-country athletes (12 females) ran on an instrumented treadmill with 3-D motion capture at standard (2.68 m/s) and fast (3.60 m/s) speeds. Foot strike outcomes were obtained bilaterally using running wearable sensors, and sagittal plane ankle kinematics were simultaneously recorded. Pearson's *r* correlation coefficients were used to determine the relationship between sensor-derived foot strike categories (1 to 16), and ankle angles at initial contact. Dorsiflexion was defined as in the positive axis. Alpha was set a priori to .05 for all analyses. **RESULTS:** Eight hundred total steps were included for analysis. Foot strike type and ankle angles at initial contact had a strong, inverse correlation, such that a higher foot strike value was strongly related to increased ankle plantarflexion angles (*r* = -0.85, *p*<.001, Figure). **CONCLUSIONS:** Sensor-derived foot strike metrics were highly correlated to sagittal plane ankle measures, thus confirming our initial hypotheses. These outcomes support that the running wearable sensors are a valid means to assess foot strike patterns during distance running.



**F-08 Thematic Poster - Methodological Advances**

Friday, May 29, 2020, 1:00 PM - 3:00 PM  
Room: CC-2011

**2957** **Chair:** Sarah Keadle. *California Polytechnic State University, San Luis Obispo, CA.*  
(No relevant relationships reported)

**2958** Board #1 May 29 1:00 PM - 3:00 PM  
**Mixed-effects Location Scale Modeling For The Analysis Of Accelerometry Data**

Whitney A. Welch<sup>1</sup>, Donald Hedeker<sup>2</sup>, Bonnie Spring<sup>1</sup>, Juned Siddique<sup>1</sup>. <sup>1</sup>*Northwestern University Feinberg School of Medicine, Chicago, IL.* <sup>2</sup>*University of Chicago, Chicago, IL.*  
(Sponsor: Ann Swartz, FACSM)  
Email: whitney.welch@northwestern.edu  
(No relevant relationships reported)

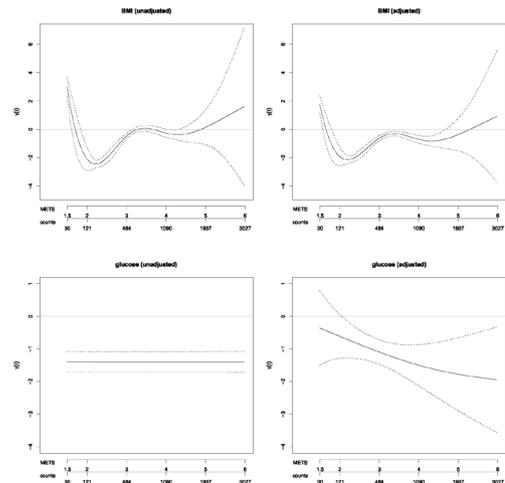
**Purpose:** To introduce a statistical technique, the mixed-effects location scale model, for analysis of longitudinal accelerometer-based physical activity (PA) data. This approach jointly models both the mean (location) and within-subject variability (scale) of participants' PA over time as a function of covariates, since within-person variability may be an important construct to explore in PA interventions. Random effects are included in both models to allow for subject-specific deviations beyond the effect of covariates. These random effects can be correlated. **Methods:** Participants (N=204, 77% female, age=33±11y, BMI=28.2±7.1 kg/m<sup>2</sup>) in the Make Better Choices Study were randomized to one of two activity-related intervention arms: 1) increase moderate-to-vigorous PA (MVPA) (PA group) or 2) decrease sedentary active control (SB group). Physical activity was measured by accelerometer for 5 weeks: a 2 week baseline assessment phase and a 3 week intervention follow-up phase: week 1 (rx1) and weeks 2 and 3 (rx23). The outcome MVPA min/d was analyzed using the mixed-effects location scale model in the MIXREGLS software program in STATA. **Results:** The mean model shows a significant group by time interaction (MVPA group by rx1: B=6.32 (95%CI: 3.93, 8.7) MVPA group by rx23: B=9.85 (95% CI: 7.59, 12.10)) indicating that those in the PA group had significantly greater MVPA min/d at rx1 and rx23 compared to the SB group. The PA group by rx23 interaction was significant in the within-subject variance model, suggesting that those in the PA group had significantly more variability in MVPA min/d during follow-up phase rx23 compared to the SB group. The random-location effect is positively associated with the within subject variance, participants with higher mean min/d MVPA tend to have higher min/d MVPA variability ( $\tau_1=0.70$  (95% CI: 0.60, 0.80)). The scale standard deviation is significant indicating that some participant's MVPA min/d are significantly more dispersed than other participants even after adjusting for group and time effects ( $\sigma_w=0.60$  (95% CI: 0.55, 0.64)). **Conclusions:** The location-scale mixed model provides a new approach for examining the mean and variability of min/d of MVPA in longitudinal data. To demonstrate, we applied this model to a randomized controlled trial to increase PA in inactive adults.

**2959** Board #2 May 29 1:00 PM - 3:00 PM  
**A Functional Data Analysis Framework For Modeling Physical Activity Intensity Continuously Using Accelerometer Data**

Chongzhi Di<sup>1</sup>, Xu Wang<sup>2</sup>, Charles Kooperberg<sup>1</sup>, Ross Prentice<sup>1</sup>, Andrea LaCroix<sup>3</sup>, David Buchner, FACSM<sup>4</sup>. <sup>1</sup>*Fred Hutchinson Cancer Research Center, Seattle, WA.* <sup>2</sup>*University of Washington, Seattle, WA.* <sup>3</sup>*University of California, San Diego, CA.* <sup>4</sup>*University of Illinois at Urbana-Champaign, Champaign, IL.*  
Email: cdi@fredhutch.org  
(No relevant relationships reported)

**PURPOSE:** Cutpoints approaches are often used to define physical activity (PA) intensity categories for accelerometry. We proposed methods to characterize the full continuum of PA intensity, free of cutpoints, and to quantify associations between PA accumulated at varying intensity levels and health outcomes. **METHODS:** During 2012-2014, 6,379 women aged 63-99 wore accelerometers on their waist for 7 consecutive days. Accelerometer counts data were analyzed in 15-second epochs. Complementary cumulative distribution functions (CCDF) were used to characterize how each subject distributes PA across all intensity levels. Functional linear regression models were used to estimate flexible dose-response relationships between PA intensity and health outcomes, including body mass index (BMI) and fasting glucose levels. **RESULTS:** The CCDFs of PA intensity showed that age-related decline in PA occurred at all intensity levels. The dose-response relationships between PA intensity and BMI and glucose were shown in Figure 1. Neither effects were constant, indicating

that intensity mattered after controlling for volume (count-min or MET-min). The relationship between BMI and intensity was complicated, while PA accumulated at higher intensity was found to be associated with lower fasting glucose levels, after controlling for volume. **CONCLUSION:** We provided a cutpoint-free analytic framework to model PA intensity continuously. The effect of PA on BMI and fasting glucose varied across intensity levels, even when fixing PA volume. The proposed methods are applicable not only to counts data, but also to other acceleration-based metrics calculated using raw data. **Figure 1.** Association of PA intensity (counts/15-sec or equivalent METs) with BMI and fasting glucose. The adjusted analysis included age, race-ethnicity and education for BMI, and for glucose additionally adjusted for BMI. Corresponding METs were calculated based on an internal calibration study.



**2960** Board #3 May 29 1:00 PM - 3:00 PM  
**Machine Learning Activity Classification Models For Preschool-aged Children: The Need For Free-living Training Data.**

Matthew N. Ahmadi, Alok K. Chowdhury, Denise K. Brookes, Stewart G. Trost. *Queensland University of Technology, Brisbane, Australia.* (Sponsor: Stewart G. Trost, FACSM)  
Email: matthewnguyen.ahmadi@hdr.qut.edu.au  
(No relevant relationships reported)

Machine learning (ML) classification models trained on laboratory activity trials exhibit poor performance when evaluated under free-living conditions. Training models on free living data, including temporal features such as lead and lag windows, and using shorter sliding windows may improve recognition accuracy under free-living conditions.

**Purpose:** To evaluate the accuracy of free-living hip and wrist Random Forest activity classifiers for pre-schoolers trained on features extracted from windows of 1s, 5s, 10s, and 15s. Performance was benchmarked against classifiers trained on laboratory-based data using a 15s window.

**Methods:** 31 preschool-aged children (4.0 ± 0.9 y) were video recorded during a 20-minute unstructured active play session. Participants wore an accelerometer on their right hip and non-dominant wrist. A bespoke two-stage direct observation system was used to code ground truth activity class and specific activity types occurring within each class. Data from 21 of the children were randomly selected to train the classifiers. Models were trained with and without temporal features and cross-validated in a hold sample of the remaining 10 children with overall and class-level accuracy.

**Results:** Accuracy improved as window size increased from 1 sec (73.5%-77.7%) to 10 sec (82.4%-86.0%); with only minimal improvements observed for 15s windows. Inclusion of lag and lead features increased accuracy by 1.6% to 6.6%, with the largest improvements observed for shorter duration windows (≤10s). Comparatively, the accuracy of the laboratory trained model was 56.9% and 67.5% for wrist and hip, respectively. For a 10s window, training models on free-living data and including temporal features increased recognition of sedentary from 70.6% - 74.4% to 83.3% - 90.4%; light activities and games from 57.5% - 76.9% to 88.6% - 88.8%; walking from 7.5% - 17.5% to 64.1% - 75.0%; and running from 50.0% - 77.8% to 71.4% - 85.7%. There was no improvement in recognition of mod-vig activities and games (56.3% - 62.5%).

**Conclusions:**

Unlike models trained on laboratory activity trials, ML activity classification models for pre-schoolers trained on free-living accelerometer data perform well when evaluated under true free-living conditions.

Funding: Australian Research Council Discovery Project Grant: DP150100116

**2961** Board #4 May 29 1:00 PM - 3:00 PM

**Novel Application Of Accelerometry Data To Enhance Detection Of Falls Risk In Older Adults**

Jennifer A. Schrack<sup>1</sup>, Jacek K. Urbanek<sup>2</sup>, Amal A. Wanigatunga<sup>1</sup>, Erin D. Michos<sup>2</sup>, David L. Roth<sup>2</sup>, Lawrence J. Appel<sup>2</sup>. <sup>1</sup>*Johns Hopkins University, Baltimore, MD.* <sup>2</sup>*Johns Hopkins School of Medicine, Baltimore, MD.*

Email: jschrac1@jhu.edu

(No relevant relationships reported)

**Purpose:** The association between physical activity (PA) and falls is complex and bi-directional, with more active persons often demonstrating greater falls risk. The role of PA in preventing or aggravating falls risk may be illuminated by novel, more sensitive measures of PA. We examined the longitudinal association between accelerometer derived PA metrics and falls in control group participants of STURDY (Study to Understand Fall Reduction and Vitamin D in You), a randomized trial of vitamin D supplementation to prevent falls in older adults.

**Methods:** PA was assessed at baseline, 12-, and 24-months using the Actigraph Link accelerometer, worn 24-hours per day for 7 days on the non-dominant wrist. Falls were reported using a monthly calendar. Minute level activity counts were examined to derive diurnal patterns of PA and number of active minutes/day in 319 participants (mean age 77 (SD=5.4) years, 43% female). Multiple logistic regression models adjusted for age, sex, and gait speed examined the: i) risk of falls by tertiles of daily PA and ii) risk of falls by demographic and functional characteristics, comparing measures of falls per unit time (year) and falls per unit of activity (active minute).

**Results:** In adjusted models, those in the high and low PA tertiles had 78% and 7% greater odds of falling over the next 12 months compared to those in the moderate PA tertile, respectively (p<.05). Moreover, peak daily PA declined 12% between baseline and 24-month follow-up among fallers vs. 8% among non-fallers (p<.05). Differences in daily PA between fallers and non-fallers tended to be greatest between 8am-12pm. Models comparing risk of falls over 24 months of follow-up demonstrated stronger trends in falls risk at higher ages (80 vs >80), among men, and for those with slower gait speeds (<0.8 m/s vs 0.8m/s) when analyzed per unit of activity (falls/active minute) vs. unit of time (falls/year).

**Conclusion:** These results demonstrate a J-shaped association between PA and falls, with stronger differences in PA between fallers and non-fallers during the morning hours. Furthermore, the trend towards more robust results for falls/active minute vs. falls/year highlight the complex nature of the association between PA and falls and suggest that novel PA metrics may serve as more sensitive indicators for discerning falls risk.

**2962** Board #5 May 29 1:00 PM - 3:00 PM

**Predicting Poor Functional Status In Adults With Knee Osteoarthritis Using Real-life Accelerometry Data**

Ruopeng Sun<sup>1</sup>, Anne Kuwabara<sup>1</sup>, Christy Tomkins-Lane<sup>2</sup>, Matthew Smuck<sup>1</sup>. <sup>1</sup>*Stanford University, Redwood City, CA.* <sup>2</sup>*Mount Royal University, Calgary, AB, Canada.*

(No relevant relationships reported)

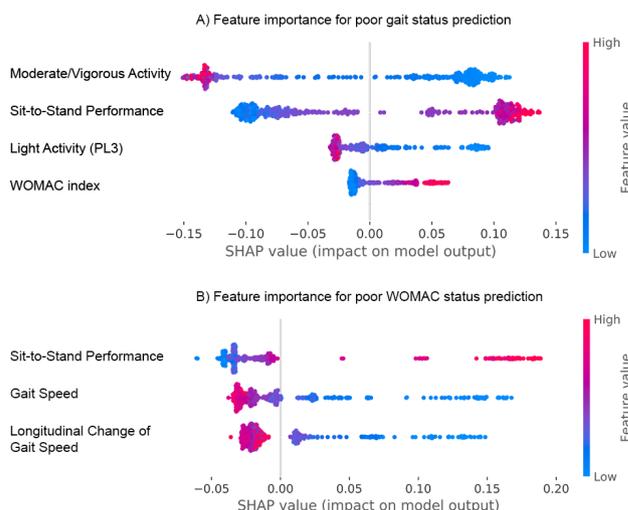
**PURPOSE:** Investigate the risk factors associated with longitudinal functional decline in people with knee OA using free-living accelerometry data.

**METHODS:** Longitudinal data from the Osteoarthritis Initiative (OAI) accelerometer study was extracted from 1229 participants tested at baseline and 2 years, including 35 features of functional capacity (gait speed, sit-to-stand time, etc), demographic characteristics, patient-reported outcome measures (WOMAC, etc.), and accelerometry-based physical activity. Poor functional status was defined as declining into or remaining in the worst function quintile compared to baseline status for two outcome measures (WOMAC score and gait speed). A Random Forest classifier was trained to predict individuals' functional status. To explore the feature importance in model prediction, the model prediction was further interpreted using a Shapley additive explanation algorithm.

**RESULTS:** For poor functional status in gait speed (Fig.1A), the top predictor is baseline low minutes in the performance moderate/vigorous activity range (CPM 2500+) followed by prolonged baseline sit-to-stand performance. Other significant contributing factors include high WOMAC score, low minutes in the performance light activity range (CPM 800-2499). The overall prediction accuracy is 82%. For poor WOMAC status prediction (Fig.1B), the top predictors are impaired baseline sit-to-stand and gait speed, as well as accelerated decline in gait speed. The overall prediction accuracy is 79%.

**CONCLUSIONS:** Accelerometry-based measures of physical activity were identified as key indicators for the decline in gait speed over time. Whereas only functional

capacity measures (gait speed and sit-to-stand performance) were identified as key indicators for the longitudinal decline in the WOMAC score. These findings may enable early detection and intervention for functional decline prevention in knee OA patients.



**2963** Board #6 May 29 1:00 PM - 3:00 PM

**Is A Smartphone App A Valid And Reliable Method To Measure Bicycling Behavior?**

Anna K. Porter<sup>1</sup>, Reegan Ford<sup>1</sup>, Kelly R. Evenson, FACSM<sup>2</sup>. <sup>1</sup>*The University of Southern Mississippi, Hattiesburg, MS.* <sup>2</sup>*The University of North Carolina at Chapel Hill, Chapel Hill, NC.*

(Sponsor: Kelly Evenson, FACSM)

Email: anna.k.porter@usm.edu

(No relevant relationships reported)

**PURPOSE:** To determine the criterion validity and test-retest reliability of a smartphone app in measuring bicycling behavior.

**METHODS:** A GPS device was used as the gold standard for comparison to the smartphone app. Courses ~2 miles in length at two locations were tested; 1) urban college campus and 2) rural bicycle path. Adult bicyclists (N=50; 21 urban, 29 rural) carried a Global Positioning System (GPS) device and their smartphone while riding a bicycle on a course loop twice (5 minute break in between); both the GPS device and smartphone app recorded location data. Movement time was recorded for the GPS device and the smartphone app, and MET\*min were calculated for bicycling assuming 6 METs/min. Using a geographic information system (GIS), a 36-foot buffer was created around the road network for each course. Location data from the GPS and smartphone devices were mapped over the course buffers in GIS, and the percent of location data within the buffers was calculated for each. Validity and reliability of the percent within buffer and validity of MET\*min for each device were examined using paired sample t-tests.

**RESULTS:** GPS device data fell within the urban course buffer 69% of the time and within the rural course 37% of the time, while data from the smartphone app was within the urban course buffer 78% of the time and within the rural course 51% of the time. For the GPS device, maximum distance of a single GPS point away from the road buffer averaged 14 meters (range 0-290), while maximum distance of a single GPS point from the smartphone app averaged 15 meters (range 0-92). Mean difference between the GPS and smartphone devices was 9% in favor of the smartphone app on the urban course (n=40, p<0.05), and 13% in favor of the smartphone app on the rural course (n=54, p<0.01). For reliability of the GPS device, mean difference between the two repeated rides was 4% on the urban course (n=20, p>0.05), and 9% on the rural course (n=28, p<0.01). For reliability of the smartphone app, mean difference between the two repeated rides was 3% on the urban course (n=21, p>0.05), and 0.6% on the rural course (n=28, p>0.05). MET\*min from the GPS device was 1.22 versus 1.21 from the smartphone app (n=94, p>0.05).

**CONCLUSIONS:** The smartphone app tested is a reasonable alternative to GPS devices in assessing bicycling behavior in urban and rural environments.

**2964** Board #7 May 29 1:00 PM - 3:00 PM  
**Dynamic Segmentation Of Youth Accelerometer Data By Sojourn And Change Point Detection Methods**  
 Paul R. Hibbing, Scott E. Crouter, FACSM. *University of Tennessee, Knoxville, TN.*  
*(No relevant relationships reported)*

Dynamic segmentation algorithms are used to find activity transitions in accelerometer data. Youth Sojourn models use a crude algorithm, which may be improved by instead using a change point detection (CPD) algorithm. Pruned exact linear time (PELT) is a CPD algorithm that finds transitions by minimizing a cost function while iterating over the data and pruning out inviable transition points. **PURPOSE:** To compare the performance of youth Sojourn and PELT. **METHODS:** Raw acceleration data (hip-worn ActiGraph GT9X) from 86 youth (age 6-18 yrs; 48% male; 16% overweight/obese) were processed using Sojourn and PELT. Participants performed two semi-structured activity routines on separate days, with each visit lasting approximately 2-2.5 h. A total of 16 activities (eight each day) were performed, twice each, and the study protocol was designed to promote variability in the ordering and duration of activities. Throughout each trial, direct observation was performed using focal sampling, which served as a criterion measure of when activity transitions occurred. Sojourn and PELT were compared to the criterion using the transition pairing method, with a maximum of 5-s lag time allowed for a prediction to be considered a true positive. Performance metrics were recall, precision, and root mean squared error (RMSE). The metrics were calculated for each participant (both visits combined), after which paired t-tests were used to compare Sojourn-vs-PELT means for each metric. **RESULTS:** Values are mean  $\pm$  SD. Recall was similar for Sojourn (49.6%  $\pm$  9.0%) and PELT (51.5%  $\pm$  9.2%,  $p = 0.15$ ), and the same was true for RMSE (2.9  $\pm$  0.3 s for Sojourn, versus 3.1  $\pm$  0.4 s for PELT,  $p < 0.001$ ). However, precision for Sojourn (21.7%  $\pm$  4.9%) was substantially lower than for PELT (38.7%  $\pm$  11.0%,  $p < 0.001$ ). **CONCLUSION:** Youth Sojourn models may benefit from replacing their current segmentation algorithms with CPD algorithms like PELT. Thus, CPD warrants further investigation. Supported by NIH R01HD083431

**2965** Board #8 May 29 1:00 PM - 3:00 PM  
**Re-examining The Energy Expenditure Of Driving**  
 Rachel Barnett, Karen Yagi, Sarah Keadle. *California Polytechnic State University, San Luis Obispo, CA.* (Sponsor: Todd A. Hagobian, FACSM)  
*Reported Relationships: R. Barnett: Industry contracted research; National Cancer Institute.*

**PURPOSE:** Sedentary behaviors are commonly defined as having an energy expenditure  $< 1.5$  metabolic equivalents (METs), while in a sitting, reclining or lying posture. However, the Compendium of Physical Activities (Compendium), a widely used resource, assigns a MET value of 2.5 for driving, which would not meet the consensus definition of sedentary. This MET value is based on outdated automobile and metabolic technology, thus the purpose of this study is to re-examine the MET value of driving and compare driving to other sedentary behaviors and light-intensity walking (Compendium = 2.8 METs).

**METHODS:** Participants ( $n=17$ , average age = 32 y, 11 females) wore a portable metabolic system (Cosmed K5), during five different conditions that include sitting quietly, watching TV, sitting while working on a computer, driving, and walking at 2.0 mph. We compared mean measured MET values to the corresponding value from the Compendium using one-sampled t-test. We also ran a repeated measures ANOVA to determine whether there was any significant difference in MET values across conditions.

**RESULTS:** The mean MET value for driving was 1.5, which is significantly lower than the Compendium value of 2.5 ( $p < 0.0001$ ). Driving yielded significantly higher MET values than quiet sitting (1.1 METs  $p < 0.0001$ ) and watching TV (1.1 METs  $p < 0.0002$ ) but was similar to sitting while working. Although driving and walking at 2.0 mph have similar Compendium MET values, driving produced significantly lower measured MET values (1.46 vs 3.08  $p < 0.0001$ ).

**CONCLUSIONS:** The existing Compendium MET value may not accurately quantify the energy expenditure of driving. Measured MET values for driving more closely correspond to sedentary behaviors than light-intensity walking. Since the average American spends 46 min/day in the car, there is a need to update the Compendium to reflect these findings.

**F-09** Thematic Poster - Novel Strategies to Increase Physical Activity and Fitness  
 Friday, May 29, 2020, 1:00 PM - 3:00 PM  
 Room: CC-2010

**2966** **Chair:** Sara Wilcox, FACSM. *University of South Carolina, Columbia, SC.*  
*(No relevant relationships reported)*

**2967** Board #1 May 29 1:00 PM - 3:00 PM  
**Effect Of Adapting Sedentary Video Games To Facilitate Physical Activity On Exercise Intensity**  
 Christen J. Mendonca, Susan S. Smith, Stella L. Volpe, FACSM, Glenn N. Williams, Sinclair A. Smith. *Drexel University, PHILADELPHIA, PA.* (Sponsor: Dr. Stella L. Volpe, FACSM)  
*(No relevant relationships reported)*

**PURPOSE:** To determine if adapting a sedentary video game's controls to involve total body movements can elicit an exercise intensity consistent with moderate-to-vigorous physical activity. **METHODS:** Thirty adults, 19 to 55 years of age, visited our exercise lab twice. During each visit, the participants played a sedentary video game in three randomized conditions: 1) sitting, using a hand-held controller (Controller), 2) standing, reaching and jumping in front of a motion sensor (Sensor), and 3) standing, moving and reaching for buttons with their hands and feet (Button). Oxygen consumption ( $VO_2$ ), heart rate, and ratings of perceived exertion (RPE) using the Borg 6 to 20 scale were assessed throughout each condition. We hypothesized that mean relative  $VO_2$  would be 3 to 6 metabolic equivalents (METs), mean heart rate would be 50% to 80% of age-predicted maximum heart rate (%HRmax), and RPE would be 12 (somewhat hard) to 15 (very hard) in the Sensor and Button conditions. Further, METs, %HRmax, and RPE would be lower in the Controller condition than in Sensor and Button conditions. A two-way repeated-measures analysis of variance with Bonferroni post-hoc analysis was used to compare within-participant differences in METs, %HRmax, and RPE across the two visits and three conditions. Chi-square analysis was used to determine if a significant proportion of participants achieved moderate-to-vigorous physical activity during the Sensor and Button conditions. **RESULTS:** All measures were less during the Controller condition (0.99  $\pm$  0.09 METs, 39  $\pm$  6% HRmax, 7  $\pm$  1 RPE) compared to the Sensor (3.52  $\pm$  0.58 METs, 59  $\pm$  10% HRmax, 13  $\pm$  2 RPE,  $p < 0.01$ ) and Button (4.02  $\pm$  0.61 METs, 62  $\pm$  12% HRmax, 14  $\pm$  2 RPE,  $p < 0.01$ ) conditions. There was no difference between visits ( $p > 0.32$ ). For the 30 participants, 83% and 100%, respectively, sustained MET levels of 3 to 6 during the Sensor and Button conditions ( $p < 0.01$ ). Similar results were found for %HRmax and RPE ( $p < 0.01$ ). **CONCLUSION:** Sustained moderate-to-vigorous physical activity was achieved by adapting sedentary video game controls to require total body movements. Future studies should consider adapting video game controls to increase exercise enjoyment, adherence and intensity.

**2968** Board #2 May 29 1:00 PM - 3:00 PM  
**Testing The Feasibility Of Referred At-risk Patients Participating At A Hospital-based Healthy-lifestyle Management Program**  
 Navin Kaushal<sup>1</sup>, Ryan Bojrab<sup>2</sup>, Brian Krohn<sup>1</sup>, Daniel O. Clark<sup>1</sup>, NiCole R. Keith, FACSM<sup>1</sup>. <sup>1</sup>*Indiana University, Indianapolis, IN.* <sup>2</sup>*Eskenazi Health, Indianapolis, IN.* (Sponsor: NiCole R. Keith, FACSM)  
 Email: nkaushal@iu.edu  
*(No relevant relationships reported)*

**PURPOSE:** Facilitating health promotion programs within healthcare is supported by the Institute of Medicine, which is establishing a systematic implementation approach that incorporates eight social and behavioral vital signs including exercise in the electronic health record (EHR). Though limited time during clinic visits is a challenge for implementation. Using an established healthy-lifestyle management program (HLMP) to support this approach could reduce burden on clinical practitioner. The purpose was to test the feasibility of implementing fitness measures in an HLMP. **METHODS:** Healthy Me is a free HLMP offered to patients in a public, Midwest health system. Patients are enrolled through physician referral via EHR. Eligible patient have a BMI  $> 25$ , cardiovascular disease, pre /type II diabetes, and/or depression. Low-risk patients who meet eligibility criteria can enter Healthy Me through an EHR automated bulk referral process. Healthy Me is delivered by health coaches trained in motivational interviewing, group fitness, health promotion, and chronic disease management. Patients performed chair stand, arm curl and two-minute step tests.

**RESULTS:** The sample included 1254 patients (80.1% women), who were 48.9 + 15.46 years of age, with a BMI of 37.4 + 10.46 and reported fair/good (74.9%), poor (16%) or very good/excellent (9.1%) health. Eighty-three patients (6.7%) completed multiple fitness tests and 654 (52.2%) completed one test. Only females completed multiple fitness tests. Chi-square test found those who completed one test had higher perceived health ratings ( $\chi^2 = 15.6, p = .048$ ). Bivariate correlations found BMI was associated positively with waist measures ( $r = .88, p < .001$ ), and negatively with chair the stand score ( $r = -.21, p = .015$ ), march score ( $r = -.32, p = .029$ ), general health rating ( $r = -.53, p < .001$ ), general physical ( $r = .11, p = .054$ ) and mental ( $r = .33, p = .043$ ) health.

**CONCLUSIONS:** Results revealed differential characteristics between patients who only visited Healthy Me and those who completed the health/fitness tests. Future directions include using tailored approaches to encourage fitness test completion. Multiple correlations with BMI and health/fitness parameters align with previous work and emphasize the importance of promoting healthy behaviors in HLMPs, such as exercise.

**2969** Board #3 May 29 1:00 PM - 3:00 PM  
**Determining Intervention Components For A Physical Activity Program Designed For Former Division I College Athletes**

Paula-Marie M. Ferrara<sup>1</sup>, Rebecca A. Zakrajsek<sup>1</sup>, Morgan R. Eckenrod<sup>2</sup>, Cory T. Beuamont<sup>1</sup>, Kelley Strohacker, FACSM<sup>1</sup>.  
<sup>1</sup>The University of Tennessee, Knoxville, Knoxville, TN. <sup>2</sup>The University of Southern Mississippi, Hattiesburg, MS.  
 Email: pferrarl@vols.utk.edu  
 (No relevant relationships reported)

Emerging research shows retired college athletes experience detrimental physical and mental health declines following retirement from sport. Such effects include worsening body composition, health-related quality of life, and physical function, as well as increased prevalence of depression, alcohol dependence, and eating disorders. Despite sports training, former college athletes exhibit substantial decreases in physical activity (PA) levels following retirement, which may contribute to these health declines.

**PURPOSE:** Explore what intervention components would be attractive, effective, and feasible for a PA program designed for former NCAA Division I (DI) college athletes.

**METHODS:** Semi-structured, bracketed interviews were conducted with former NCAA DI athletes retired  $\leq 10$  years from college sport and inactive based on the PA Guidelines for Americans (PAGA; assessed via the Paffenbarger PA Questionnaire). Qualitative analysis was conducted using the Consensual Qualitative Research Method to determine domains, categories, and core ideas from participant responses.

**RESULTS:** Participants (N=17, 7 men, 26±3 y, 91% Caucasian) retired 3 months to 10 years (4±3 y) and representing 9 sports across 13 athletic conferences underwent individual interviews. Based on the PAGA, 18% did not meet the muscle strengthening guidelines, 29% did not meet the aerobic guidelines, and 53% did not meet both thresholds. Emergent domains include: 1) The Recreated Team, 2) Program Needs, 3) Preventive Factors, 4) Timing. **CONCLUSIONS:** Participants highly advocated for the creation of a PA program for their population. Based on domains, effective program factors include recreating the camaraderie and accountability of a sports team, fitness testing, goal setting, and electronic communication. Potential barriers include high cost, inconvenient scheduling, lack of individual attention, and an intimidating atmosphere. Further, following a break after their last competition, participants stated they would have been ready to begin a PA program tailored for them within one year of retirement. Future directions include testing optimal combinations of intervention components to maximize their effectiveness in a future PA program. Funding provided by the Association for Applied Sport Psychology 2019 Research Grant.

**2970** Board #4 May 29 1:00 PM - 3:00 PM  
**Commercial App Use Linked With Sustained Physical Activity In Two Canadian Provinces: A 12-month Quasi-experimental Study**

Marc Mitchell<sup>1</sup>, Erica Lau<sup>2</sup>, Lauren White<sup>3</sup>, Guy Faulkner<sup>2</sup>.  
<sup>1</sup>Western University, London, ON, Canada. <sup>2</sup>University of British Columbia, Vancouver, BC, Canada. <sup>3</sup>Carrot Insights Inc, Toronto, ON, Canada.  
 Email: marc.mitchell@uwo.ca  
 Reported Relationships: **M. Mitchell:** Ownership/interest/stock; Stock options, but co. went out of business June 2019.

**BACKGROUND:** Top tier commercial physical activity apps rarely undergo peer-reviewed evaluation. Even fewer are assessed beyond six months, the theoretical threshold for behaviour maintenance.

**PURPOSE:** The purpose of this study was to examine whether a commercial app rewarding users with digital incentives for walking was associated with an increase in physical activity over one year.

**METHODS:** This 12-month quasi-experimental study was conducted in two Canadian provinces (n=39113 participants). Following a two-week baseline period, participants

earned digital incentives (\$0.04 CAD/day) every day they reached a personalized daily step goal. Mixed-effects models estimated changes in weekly mean daily step count between the baseline period and the last two recorded weeks. Models were fit for several engagement groups and separately by baseline physical activity status within engagement groups.

**RESULTS:** Nearly half of participants (43%) were categorized as physically inactive at baseline (fewer than 5000 daily steps), and 60% engaged with the app for at least six months [‘Regular’ (24-51 weeks of step data) or ‘Committed’ sub-groups (52 weeks)]. Weekly mean daily step count increased for physically inactive users regardless of engagement status ( $P < .0001$ ). The increase was largest for ‘Regular’ and ‘Committed’ participants—1215 and 1821 steps/day, respectively. For physically active participants, step count increases were only observed in the ‘Committed’ sub-group ( $P < .0001$ ). Effect sizes were modest-to-medium depending on the sub-group analyzed.

**CONCLUSIONS:** A commercial app providing small but immediate digital incentives for individualized goals was associated with an increased weekly mean daily step count on a population-scale over one year. This effect was more evident for physically inactive and more engaged participants.

**2971** Board #5 May 29 1:00 PM - 3:00 PM  
**Enjoyability And Acceptability Of Bone Targeted Exercise For Young Adult Women: The OPTIMA-Ex Trial**

Benjamin K. Weeks, Belinda R. Beck, FACSM, Amy T. Harding, Steven L. Watson, Conor Lambert. *Griffith University, Gold Coast, Queensland, Australia.* (Sponsor: Prof Belinda Beck, FACSM)  
 Email: B.Weeks@griffith.edu.au  
 (No relevant relationships reported)

**PURPOSE:** While physical activity participation is recognized as an effective modifiable risk factor for osteoporosis, adherence and compliance present significant challenges. We aimed to explore the experiences related to a bone-targeted exercise intervention, determine enjoyment and acceptability of each exercise mode, and identify barriers and facilitators to osteogenic exercise for young adult women with low bone mass. **METHODS:** A mixed-methods study was conducted within the OPTIMA-Ex trial, a three-arm RCT comparing musculoskeletal outcomes from high-intensity impact training (IT), high-intensity resistance training (RT), and a home-based low-intensity exercise control (CON). All 32 participants (IT=10, RT=12, CON=10) who finished the trial completed questionnaires on physical activity enjoyment (PACES-8, Kruskal-Wallis and Friedman’s test), quality of life (AQoL-6D, repeated measures ANOVA), and semi-structured interviews to facilitate qualitative analysis (Leximancer v4.50) of participant experiences. **RESULTS:** At follow-up, RT had the highest total score for PACES-8 (48.6±4.7), while only the IT group experienced an increase in total score over the 10 months (34.8±4.1 to 41.4±6.9,  $p < .05$ ). Only CON experienced an improvement in total AQoL-6D score. For the sub-domains, all groups experienced clinically significant improvements ( $> 0.06$  points) for ‘mental health’, while IT improved for ‘senses’ and CON improved for ‘coping’ ( $p < .05$ ). The qualitative analysis revealed that overall trial exercises were viewed positively by all groups, yet the two high-intensity groups had the ‘richest’ exercise experiences, developing a more positive attitude to exercise. Barriers to exercise related to time, convenience, accessibility, and cost. Both IT and CON groups experienced a 41% drop out compared to 29% in the RT group. Compliance did not differ between CON (78.8±4.1%), IT (61.4±15.1%), or RT (66.4±11.2%) ( $p = 0.085$ ). **CONCLUSIONS:** While IT and RT provide enjoyable bone-targeted exercise experiences for young adult women, on balance RT appears most favorable. It seems prudent, that bone-targeted exercise interventions for this demographic address perceptions of time demands and environmental barriers to participation in order to maximize compliance and adherence.

**2972** Board #6 May 29 1:00 PM - 3:00 PM  
**Positive Lifestyle Enhancement In At-risk Youth After A 16-wk Mountain Bike Program**

Scott N. Drum, FACSM<sup>1</sup>, Dana L. Bolduc<sup>1</sup>, Connor Ryan<sup>1</sup>, Erich Petushek<sup>2</sup>. <sup>1</sup>Northern Michigan University, Marquette, MI. <sup>2</sup>Michigan Technological University, Houghton, MI.  
 Email: sdrum@nmu.edu  
 (No relevant relationships reported)

Weekly, physical activity should be a primary component in long term, healthy lifestyles to enhance aerobic capacity and potentially decrease risk of cardiovascular disease (CVD). Start The Cycle (STC) is a non-profit, community-based program dedicated to building confidence and self-esteem in at-risk youth (e.g., helping them achieve healthy, life goals) through weekly mountain bike rides and adult mentorship.

**PURPOSE:** To quantify physiological change and probability of CVD in at-risk youth during a 16-wk, mentored mountain biking program. **METHODS:** Participants included (mean ± SD) new members (NM, n = 15, age = 13.6 ± 1.8 yrs), returning members (RM, n = 15, age = 15.9 ± 2.3 yrs), and combined (NM + RM) members (CM, n = 30, age = 14.7 ± 2.4 yrs). Free mountain bikes were provided to participants

by STC with a promise of ownership if the full program was completed. The program met 16-wks, 1 x week, and 2-hrs·day<sup>-1</sup> starting late spring and into late summer. Indoor physical conditioning and bike maintenance + skills classes were implemented the initial 4-wks with mentored, group rides occurring the last 12-wks. Maximal oxygen uptake (i.e., via the progressive aerobic cardiovascular endurance run or PACER test) and CVD risk (via a prediction equation from prior, unpublished research) were assessed pre- and post-intervention following the indoor training sessions (i.e., after 4-wks) and immediately prior to a final, 28-mile organized bike race. Data were analyzed using paired t-tests between pre- and post-intervention within NM, RM and CM groups with significance set at  $p < 0.05$ . Effect size is reported as Cohn's  $d$  with  $d = .2, .5, \text{ and } .8 = \text{small, medium, and large effect sizes, respectively. RESULTS:}$  Significance from pre- to post-test (mean  $\pm$  SD), respectively, is as follows for  $\text{VO}_{2\text{max}}$  in  $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$  (NM,  $37.1 \pm 2.5$  vs  $41.8 \pm 5.4$ ,  $p = 0.004$ ,  $d = 0.98$ ; RM,  $40.7 \pm 6.9$  vs  $46.2 \pm 10.9$ ,  $p = 0.037$ ,  $d = 0.19$ ; and CM,  $38.7 \pm 5.1$  vs  $43.8 \pm 8.3$ ,  $p = 0.000$ ,  $d = -0.04$ ) and CVD risk with lower score = decreased risk (NM,  $5.2 \pm 2.8$  vs  $3.8 \pm 2.8$ ,  $p = 0.018$ ,  $d = -0.38$ ; RM,  $6.2 \pm 6.2$  vs  $3.9 \pm 8.0$ ,  $p = 0.027$ ,  $d = 0.19$ ; and CM,  $5.7 \pm 4.7$  vs  $3.8 \pm 5.8$ ,  $p = 0.001$ ,  $d = -0.07$ ). Body mass index (BMI) did not change across any group. **CONCLUSION:** A community-based, adult-mentored, youth mountain bike program is a practical means to improve aerobic capacity and reduce CVD risk in at-risk minors.

**2973 Board #7 May 29 1:00 PM - 3:00 PM**  
**A Randomized Controlled Trial Comparing Two Different Approaches To Prescribe Exercise**

Melody A. Kramarz, Beth A. Taylor, FACSM, Rachel Berkowsky, Ming-Hui Chen, Elyssa Eror, Linda S. Pescatello, FACSM. *University of Connecticut, Storrs Mansfield, CT.*  
 Email: melody.kramarz@uconn.edu  
 (No relevant relationships reported)

The Physical Activity Guidelines for Americans (PAG) recommend 150min/wk of moderate intensity aerobic physical activity (PA) plus 2days of muscle strengthening PA for health. Yet, 26% of Americans and 36% of college students perform no leisure time PA, stressing the need to increase PA in these populations. **PURPOSE:** We conducted a randomized controlled trial (RCT) comparing two different exercise prescription ( $\text{ExR}_x$ ) approaches to increase PA among college students. The purpose of this interim analysis was to assess differences in the Transtheoretical Model stage of change (SOC) and drop-out (DO) rates at the 6wk mid-point (6W) of the RCT compared to baseline (BL) between the two  $\text{ExR}_x$  approaches. **METHODS:** 60 sedentary, healthy college students >18yr were randomized to two groups:  $\text{ExR}_x$  #1 emphasized meeting the PAG via the Frequency, Intensity, Time, and Type or FITT principle of  $\text{ExR}_x$ ; and  $\text{ExR}_x$  #2 emphasized that all PA counts. Both  $\text{ExR}_x$  approaches progressed students from being sedentary to meeting weekly PA goals over the 12wk PA intervention. The primary RCT outcome was the change in PA volume at 12wk, assessed via accelerometer and the Paffenbarger PA Questionnaire. At BL and 6W students completed the SOC to measure PA action transitions over time. Height (cm) and weight (kg) were measured to calculate the body mass index (BMI) at BL. DO was calculated as those who ceased participation at 6W divided by the total randomized sample  $\times 100$ . RMANOVA tested if SOC differed over time by group and Chi-Square tested if DO differed between groups. **RESULTS:** Subjects ( $n=32$ ) were sedentary, overweight ( $\text{BMI}=26.0\pm 4.2 \text{ m}^2/\text{kg}$ ), healthy college students ( $24.7\pm 5.2\text{yo}$ ) with no differences in BL characteristics between  $\text{ExR}_x$  groups or DO and completers ( $>0.05$ ). At 6W DO was 28.1% for the total sample with no differences between  $\text{ExR}_x$  groups ( $p>0.05$ ). At 6W SOC increased from BL in both  $\text{ExR}_x$  groups ( $p<0.001$ ), but to a greater level in  $\text{ExR}_x$  #1 of  $3.6\pm 1.2$  indicating progression from the contemplation to action stage than  $\text{ExR}_x$  #2 of  $2.7\pm 1.0$  indicating progression from the contemplation to preparation stage ( $p=.045$ ). **DISCUSSION:** Improvements in SOC suggest PA increased with both  $\text{ExR}_x$  approaches at 6W. Whether these SOC improvements persist at 12wk and translate into greater increases in PA and lower DO remains to be determined.

**F-10 Thematic Poster - Resistance Training**

Friday, May 29, 2020, 1:00 PM - 3:00 PM  
 Room: CC-2000

**2974 Chair:** J. G. Mouser. *Troy University, Troy, AL.*  
 (No relevant relationships reported)

**2975 Board #1 May 29 1:00 PM - 3:00 PM**  
**Is There A Cross Over Effect In Post Activation Potentiation?**

Vickie Wong, Yujiro Yamada, Zachary W. Bell, Robert W. Spitz, Ricardo B. Viana, Raksha N. Chatakondi, Takashi Abe, Jeremy P. Loenneke, FACSM. *The University of Mississippi, University, MS.* (Sponsor: Jeremy P. Loenneke, FACSM)  
 Email: vwong@go.olemiss.edu  
 (No relevant relationships reported)

Post activation potentiation (PAP) is a phenomenon whereby strength is acutely increased following a conditioning contraction. This effect is purported to be small and specific to the contraction history of the muscle (local), however, a potential cross-over effect in PAP has not been ruled out. **PURPOSE:** To determine if PAP is specific to the muscle being conditioned or if it is also observed within the homologous muscles of the contralateral limb. **METHODS:** 56 men and women participated in a four-visit study. Visit 1 included baseline measurements and familiarization of the unilateral biceps contractions (isometric and isokinetic for each arm). Visits 2-4 included the completion of one of the three experimental conditions: 1) control, 2) same side PAP, and 3) cross over PAP in a randomized order. Each visit included a warm up followed by three maximal isokinetic contractions at 210°/second (baseline). The control condition then rested eight minutes prior to completing three more maximal isokinetic contractions (post). The other two conditions completed the pretest followed five minutes later by a six-second maximal isometric contraction on the same side as the baseline isokinetic test (same side PAP) or on the opposite side (cross over PAP) followed by three additional maximal isokinetic contractions (post) three minutes after conditioning stimulus. The variable of interest was the change from baseline in isokinetic strength. Three hypotheses were compared using Bayesian Informative Hypothesis Evaluation (BAIN). The hypotheses were as follows: H1) same > cross = control; H2) same > cross > control; H3) same = cross = control. **RESULTS:** Torque produced during the potentiating stimulus was similar between PAP conditions (same: 47 Nm vs. cross: 45 Nm). The change [mean (95% credible interval)] in isokinetic strength for each condition was: control = -0.41 (-0.91, 0.07) Nm; same side PAP = 0.48 (-0.20, 1.16) Nm, and cross PAP = -0.03 (-0.67, 0.60) Nm. The posterior probabilities were 0.45, 0.28, 0.19, and 0.06 for H1, H2, H3, and the unconstrained model, respectively. H1 was 1.5 and 2.2 times more likely than H2 and H3, respectively. **CONCLUSIONS:** The current evidence indicates that if a PAP effect exists, it is small and may be specific to the muscle being conditioned. There does not seem to be a substantial cross over effect in PAP.

**2976 Board #2 May 29 1:00 PM - 3:00 PM**  
**Muscle Thickness Changes Do Not Mediate Changes In Muscle Strength**

Matthew B. Jessee<sup>1</sup>, Scott J. Dankel<sup>2</sup>, John P. Bentley<sup>1</sup>, Jeremy P. Loenneke, FACSM<sup>1</sup>. <sup>1</sup>*The University of Mississippi, University, MS.* <sup>2</sup>*Rowan University, Glassboro, NJ.* (Sponsor: Jeremy P. Loenneke, FACSM)  
 (No relevant relationships reported)

The position that hypertrophy mechanically increases muscle strength is currently debated among scientists.

**Purpose:** To determine indirect (via hypertrophy) and direct (not hypertrophy) effects of training on muscle strength.

**Methods:** 151 participants were randomized into control, one-repetition maximum training, or traditional training. For 6 weeks control avoided resistance exercise; training groups performed elbow flexion 3x/week (dominant arm). One-repetition maximum participants had 5 attempts to lift the greatest load possible. Traditional participants performed 4 sets to task failure (load adjusted for ~8-12 repetitions). Attempts/sets were separated by 90 s. Anterior muscle thickness (B-mode ultrasound) at 50, 60, and 70% upper arm length, and strength (one-repetition maximum) were assessed pre- and post-training. Change-score mediation models (adjusted for sex, pre-muscle thickness, and pre-strength) were constructed for each muscle thickness site. Effects of each training were evaluated relative to control. Data presented as coefficient (95% CI).

**Results:** Relative direct effects on strength were greater for one-repetition maximum [50% = 1.89 (1.20, 2.58); 60% = 1.88 (1.19, 2.58); 70% = 1.81 (1.12, 2.50) kg] and

traditional training [50% = 2.04 (1.28, 2.79); 60% = 1.98 (1.21, 2.74); 70% = 1.79 (1.04, 2.53) kg]. The relative effect of one-repetition maximum on muscle thickness was different in 60% [0.09 (0.01, 0.17) cm] and 70% [0.09 (0.00, 0.17) cm] models [50% = 0.67 (-0.01, 0.14) cm] while traditional was greater in all three: [50% = 0.24 (0.15, 0.32); 60% = 0.24 (0.16, 0.33); 70% = 0.22 (0.14, 0.31) cm]. The effect of muscle thickness on strength was not significant for 50% [-0.44 (-1.72, 0.84) kg], 60% [-0.15 (-1.48, 1.17) kg], or 70% [0.73 (-0.48, 1.96) kg] models. The relative indirect effect on strength was not significant for one-repetition maximum [50% = -0.02 (-0.16, 0.09); 60% = -0.01 (-0.17, 0.16); 70% = 0.06 (-0.09, 0.27), or traditional training [50% = -0.10 (-0.48, 0.29); 60% = -0.03 (-0.42, 0.40); 70% = 0.16 (-0.22, 0.58)].

**Conclusions:** One-repetition maximum and traditional training increase strength, however, there was no evidence that the increase in strength was mediated by hypertrophy, providing experimental and analytical evidence for the disconnect between variables.

**2977** Board #3 May 29 1:00 PM - 3:00 PM  
**Effects Of Six Weeks Of Unilateral High-volume Versus High-intensity Resistance Training On Vastus Lateralis Muscle Morphology In Previously Trained, College-aged Males.**

Carlton D. Fox<sup>1</sup>, Christopher G. Vann<sup>1</sup>, Shelby C. Osburn<sup>1</sup>, Casey L. Sexton<sup>1</sup>, Morgan A. Smith<sup>1</sup>, Johnathon H. Moore<sup>1</sup>, Stuart M. Phillips, FACSM<sup>2</sup>, Kaelin C. Young<sup>3</sup>, Michael D. Roberts<sup>1</sup>. <sup>1</sup>Auburn University, Auburn, AL. <sup>2</sup>McMaster University, Hamilton, ON, Canada. <sup>3</sup>Edward Via College of Osteopathic Medicine - Auburn Campus, Auburn, AL.  
 Email: cdf0007@tigermail.auburn.edu  
 (No relevant relationships reported)

**Purpose:** To compare the effects of high-volume (HV) versus high-intensity (HI) resistance training on vastus lateralis muscle morphology. **Methods:** Resistance trained, college-aged males (n=15) participated in 6 weeks of resistance training in which their legs were randomized to undertake HV and in the contralateral leg HI. Resistance training was undertaken 3 days per week. All participants went through 10 days of deload following the 6 weeks of training. Muscle ultrasound of both vastus lateralis muscles was conducted prior to week 1 of training (T1), 72 hours following the last training bout of week 6 (T2), and 10 days following the last training bout (T3) for muscle thickness, pennation angle, and fascicle length assessments. **Results:** There was a significant condition by time effect ( $p=0.039$ ) for muscle thickness. Post hoc analysis revealed that muscle thickness significantly increased from T1 to T2 ( $2.7\pm 0.4$  cm to  $2.9\pm 0.4$  cm,  $p=0.023$ ) in the HV leg, but not in the HI leg. However, there was no difference between conditions at any time point. Furthermore, there were no significant interactions or main effects for pennation angle or fascicle length. **Conclusion:** HI versus HV training elicits differential effects in vastus lateralis muscle thickness over a 6-week period, albeit neither training modality altered pennation angle or fascicle length.

**2978** Board #4 May 29 1:00 PM - 3:00 PM  
**Effects Of High-Load Versus High-Volume Resistance Training On Muscle Sarcoplasmic, Actin, And Myosin Protein Concentrations**

Christopher G. Vann<sup>1</sup>, Casey L. Sexton<sup>1</sup>, Shelby C. Osburn<sup>1</sup>, Morgan A. Smith<sup>1</sup>, Carlton D. Fox<sup>1</sup>, Brian K. Ferguson<sup>1</sup>, Bradley A. Ruple<sup>1</sup>, Cody T. Haun<sup>2</sup>, Kaelin C. Young<sup>3</sup>, Darren T. Beck<sup>3</sup>, James R. McDonald<sup>1</sup>, Stuart M. Phillips, FACSM<sup>4</sup>, Michael D. Roberts<sup>1</sup>. <sup>1</sup>Auburn University, Auburn, AL. <sup>2</sup>LaGrange College, LaGrange, GA. <sup>3</sup>Edward Via College of Osteopathic Medicine - Auburn Campus, Auburn, AL. <sup>4</sup>McMaster University, Hamilton, ON, Canada.  
 Email: cgv0001@auburn.edu  
 (No relevant relationships reported)

**PURPOSE:** Our laboratory has recently shown high-volume resistance training (RT) can elicit increases in skeletal muscle sarcoplasmic protein concentrations, while also causing a dilution of contractile protein concentrations (i.e., sarcoplasmic hypertrophy). The purpose of this study was to evaluate effects of 6 weeks of high-load (HL) and high-volume (HV) training on skeletal muscle sarcoplasmic and contractile protein concentrations. **METHODS:** Trained college-aged males (n = 15; training age =  $7 \pm 3$  yrs; mean 1RM squat relative to bodyweight =  $1.9 \pm 0.4$  kg) performed 6 weeks of unilateral lower-body RT, with one leg performing HV training and the contralateral leg performing HL training using leg press and leg extension. Participants underwent a period of passive recovery lasting 10 days following the training intervention. Vastus lateralis biopsies were obtained from both legs prior to the start of training (PRE), 72 hours following the last training day (POST), and 1 week following POST testing (POSTPR). Sarcoplasmic protein content was determined following differential centrifugation using bichononic assays, and actin and myosin

concentrations were quantified using SDS-PAGE and Coomassie staining. **RESULTS:** Significant main effects of time ( $p = 0.022$ ) and condition ( $p=0.002$ ) were observed and condition by time approached significance for sarcoplasmic protein concentrations ( $p = 0.088$ ). There were no significant interactions or main effects for actin or myosin concentrations. **CONCLUSIONS:** Contrary to our prior data, sarcoplasmic, actin and myosin concentrations remained unaffected with HV training. However, interesting trends were observed for sarcoplasmic protein concentrations and these will be further interrogated.

**2979** Board #5 May 29 1:00 PM - 3:00 PM  
**Acute Signaling Responses To Resistance Exercise In Previously Trained And Untrained Skeletal Muscle**

Sebastian Edman, Marcus Moberg, Niklas Psilander. Åstrand Laboratory, Swedish School of Sport and Health Sciences, Stockholm, Sweden.  
 Email: sebastian.edman@gih.se  
 (No relevant relationships reported)

It has been indicated that human skeletal muscle has a heightened sensitivity to exercise stimulus when it has been previously trained i.e. possess a "muscle memory". While previous studies have been directed to the aspects of myonuclear content and epigenetic modifications, no previous study have explored the potential of a muscle memory concerning signaling responses related to acute resistance exercise.

**PURPOSE:** The aim here was to study whether basal and acute resistance exercise induced cell signaling is influenced by previous strength training history in human skeletal muscle.

**METHODS:** 19 training naïve women and men completed 10 weeks of hypertrophy inducing unilateral strength training followed by 20 weeks of detraining. Subsequently, an acute resistance exercise session involving leg press and knee extensions was performed alternated with both legs. Vastus lateralis biopsies taken at rest and 1 h post exercise in both the Control- and Memory-leg. Immunoblotting was used to assess total content and phosphorylation status of proteins in the mTORC1- and related pathways.

**RESULTS:** Following detraining leg muscle hypertrophy had been reversed, but the Memory-leg was on average 19% stronger than the Control-leg. There were no differences between legs with regard to total protein content of all the signaling proteins analyzed. The phosphorylation of AMPK<sup>Thr172</sup> and eEF2<sup>Thr56</sup> was 16%, respectively 21%, higher in the Memory-leg compared to the Control-leg at both time points. The effect on AMPK<sup>Thr172</sup> was attributed to changes in the women only, whereas the effect on eEF2<sup>Thr56</sup> was present in both sexes. Exercise induced an increased phosphorylation of mTOR<sup>Ser2448</sup> (26-36%), S6K1<sup>Thr389</sup> (6- to 7-fold) and S6<sup>Ser235/236</sup> (13- to 18-fold), that did not differ between the Control- and Memory-leg. In contrast, post exercise phosphorylation of 4E-BP1<sup>Thr46</sup> and 4E-BP1<sup>Ser65</sup> was 18%, respectively 31%, higher in the Memory-leg compared to the Control-leg. For 4E-BP1<sup>Ser65</sup> the effects were attributed to changes in the male subjects only.

**CONCLUSION:** In summary, we illustrate that both basal- and exercise induced cell signaling important for muscle adaptations to strength training can be altered by previous training history, and that some of the changes seem to be sex dependent.

**2980** Board #6 May 29 1:00 PM - 3:00 PM  
**Effect Of Muscle Contraction Number On Muscle Protein Synthesis And Hypertrophy In Rat**

Tatsuro Maekawa, Karina Kouzaki, Yuki Tamura, Takaya Kotani, Naoki Kikuchi, Koichi Nakazato. Nippon Sport Science University, Tokyo, Japan.  
 Email: ta0514na@icloud.com  
 (No relevant relationships reported)

**PURPOSE:** When a high number of lifts are performed in resistance exercise (RE), the power (load × lifting speed) gradually decreases. In particular, the physiological meaning of repeated lifting at low power in the latter half of the session is unclear. In this study, we investigated the effect of different numbers of REs on the anabolic response of skeletal muscle using the RE model of Sprague Dawley (SD) rats.

**METHODS:** Eleven weeks old male SD rats (n=17) were randomly assigned into low repetitions group (n=8, 5 repetitions x 5 sets) and the high repetitions group (n=9, 10 repetitions x 5 sets). Unilateral electrical stimulation of rat right gastrocnemius as a resistance exercise (isometric contraction, 100V, 100 Hz, 3 sec stimulation-7 sec rest). Left hindlimb was served as the internal control. Six hours after exercise session, we injected puromycin 15 minutes prior to dissection. Medial gastrocnemius muscles were used for biochemical analysis. Puromycin-labeled newly synthesized proteins and a mammalian target of rapamycin complex 1 signal proteins were measured by western blot. In addition, 4-weeks training (3 sessions per week) was conducted. 48 hours after training, the medial gastrocnemius muscles were excised to perform further analysis. **RESULTS:** We found significant elevations muscle of protein synthesis rate and phosphorylated ribosomal protein small 6 (rpS6) at ser240/244 in both groups. However, there was no difference between groups. Both of chronic training similarly increased muscle wet weights. Muscle protein synthesis increased

at 30% in the high contraction frequency group and 50% in the low contraction frequency group. Phosphorylated rpS6 (Ser240/244) significantly increased 70% in both groups ( $P < 0.05$ ). After the chronic training sessions, muscle wet weight increased significantly on the exercise side by 10.7% in the high contraction group and 6.8% in the low contraction group ( $P < 0.05$ ) without significant difference between the two groups. **CONCLUSIONS:** Even though exercise volume was different (5 repetitions x 5 sets vs 10 repetitions x 5 sets), anabolic responses and muscle hypertrophy rate were equivalent. We speculate that repetitions with high power output are enough for inducing muscle protein synthesis and muscle hypertrophy.

**2981** Board #7 May 29 1:00 PM - 3:00 PM  
**Does Muscle Glycogen Content Account For The Contralateral Force Deficit During Unilateral Fatigue?**  
 JoCarol E. Shields, Jesus A. Hernandez-Sarabia, Alejandra Barrera-Curiel, Micheal J. Luera, Jason M. DeFreitas. *Oklahoma State University, Stillwater, OK.*  
*(No relevant relationships reported)*

Performing unilateral contractions to exhaustion has been shown to lead to force deficits of both the exercised and unexercised limbs. It has been proposed that the contralateral force deficits are of neural origin, and not due to peripheral mechanisms of fatigue (e.g. glycogen depletion). While this proposed model appears likely, it remains speculative as the absence of peripheral factors to contralateral force deficits have not been verified. **PURPOSE:** Therefore, the purpose of the study was to quantify the changes in muscle glycogen content and maximal force of both limbs in response to unilateral fatigue. **METHODS:** Nineteen healthy subjects performed two maximal voluntary isometric (MVC) knee extensions of each leg before (PRE) and after (POST) a fatiguing protocol of the right leg. The fatiguing protocol consisted of repeated 56 second long ramp contractions of the right leg at 30% MVC until failure. During the plateau phase of each contraction, ultrasound images were taken at the midpoint of the rectus femoris (RF). The echo intensity, which has been shown to be sensitive to acute changes in muscle glycogen content, was analyzed from each image of the RF muscle. **RESULTS:** A two way repeated measures ANOVA showed a significant time x limb interaction ( $p < 0.001$ ) for MVCs. Follow-up paired sample t-tests indicated that both limbs showed significant force loss. However, the right leg (-33%, from 773.36±191.79 to 517.13±136.72,  $p < 0.001$ ) demonstrated a much larger force deficit than the left leg (-9.7%, from 803.07±215.32 to 725.04±198.44,  $p = 0.002$ ). For echo intensity, the right leg demonstrated a significant change (8.8%, from 48.64±7.70 to 52.58±8.68,  $p = 0.009$ ) from PRE to POST. However, the left leg did not change (1.34%, from 53.93±7.65 to 54.65±7.72,  $p = 0.621$ ). It is worth noting the increase in echo intensity, such as seen with the right leg, represents a decrease in tissue density (e.g. decreased muscle glycogen content). **CONCLUSION:** Our findings suggest peripheral fatigue mechanisms, such as muscle glycogen content, were not responsible for the decreased force in the contralateral limb. This absence of peripheral, intracellular changes supports the original proposal that the contralateral force deficit is of a central, neural origin.

**2982** Board #8 May 29 1:00 PM - 3:00 PM  
**Does Skeletal Muscle Growth Contribute To Strength Adaptation In Resistance Trained Individuals?**  
 Ryo Kataoka, Ecaterina Vasenina, Noam Yitzchaki, Wenyuan G. Zhu, Tayla E. Kuehne, Samuel L. Buckner. *University of South Florida, Tampa, FL.*  
*(No relevant relationships reported)*

Performing a one-repetition maximum (1RM) strength test twice a week has been shown to produce similar strength adaptations as traditional resistance exercise. Of note, the increase in muscle size with traditional training has no additive effect on strength adaptation in non-resistance trained individuals. The training status is often pointed out as a limitation to understanding the "potential" of muscle growth to contribute to strength. Specifically, it is thought that growth would be of increased importance for resistance trained individuals. **PURPOSE:** To examine the changes in biceps muscle thickness (MT), and 1RM strength following 8 weeks of 1RM practice or traditional training. **METHODS:** 19 individuals completed the study. Participants visited the lab for 18 visits. During visit 1, MT and strength were measured. MT was measured at 50,60 and 70% the distance between the acromion process and lateral epicondyle. Participants then performed biceps curls twice a week for 8 weeks. One arm performed 4 sets of as many repetitions as possible with approximately 70% of their 1RM, and the other arm performed a single maximal repetition. Post measurements of MT and strength were taken. Results are displayed as means (SD). **RESULTS:** For MT at the 50% site there was an interaction ( $p = 0.004$ ). MT increased from pre [2.60 (.6) cm] to post [2.71(.5) cm,  $p = 0.02$ ] intervention in the hypertrophy condition, with no change in the strength condition ( $p = 0.57$ ). For MT at the 60% site there was an interaction ( $p = 0.03$ ). MT increased from pre [2.86 (.6) cm] to post [3.02 (.5) cm,  $p = 0.004$ ] intervention in the hypertrophy condition, with no change in the strength condition ( $p = 0.52$ ). For MT at the 70% site there was an interaction ( $p < 0.001$ ). MT increased from pre [3.26 (.5) cm] to post [3.48 (.5) cm,  $p < 0.001$ ]

intervention in the hypertrophy condition, with no change in the strength condition ( $p = 0.26$ ). For 1RM strength there was no condition x time interaction ( $p = 0.29$ ). However, there was a main effect for time ( $p < 0.001$ ). 1RM strength increased from pre [16.7 (4.2) kg] to post [18.9 (4.2) kg] intervention, with no difference observed between conditions. **CONCLUSIONS:** In resistance trained individuals, bi-weekly 1RM training produces similar increases in 1RM strength as a more traditional resistance training approach without inducing muscle growth.

**F-11** Free Communication/Slide - Cardiorespiratory Physiology  
 Friday, May 29, 2020, 1:00 PM - 2:45 PM  
 Room: CC-3014

**2983** Chair: JJ Duke. Northern Arizona University, Flagstaff, AZ.  
*(No relevant relationships reported)*

**2984** May 29 1:00 PM - 1:15 PM  
**Relationship Between Lung Diffusion And Exercise Capacity In Heart Failure With Preserved Ejection Fraction**  
 Caitlin C. Fermoye, Glenn M. Stewart, Barry A. Borlaug, Bruce D. Johnson. *Mayo Clinic, Rochester, MN.*  
 Email: fermoye.caitlin@mayo.edu  
*(No relevant relationships reported)*

**Purpose:** Patients with heart failure with preserved ejection fraction (HFpEF) have impaired lung diffusion (DL) at rest and during exercise which may contribute to a reduced exercise capacity. However, it is unclear whether these impairments are solely due to alterations in pulmonary hemodynamics or related to other cardiopulmonary factors which may impair oxygen uptake such as the inability to recruit lung surface area. Therefore this study examined simultaneous measurements of DL for carbon monoxide (DLCO) and nitric oxide (DLNO), which allows for partitioning of DL into its alveolar-capillary membrane (Dm) and pulmonary capillary blood volume (Vc) components, to better understand the relationship between exertional changes in lung diffusion and exercise capacity.

**Methods:** HFpEF patients (N=17, age=62±9y, BMI=36±8kg/m<sup>2</sup>) undergoing exercise right heart catheterization performed simultaneous rebreath DLCO/NO tests at rest and during each stage of incremental supine cycling exercise, and membrane conductance (Dm) and pulmonary capillary blood volume (Vc) were calculated. Breath-by-breath pulmonary gas exchange was recorded throughout rest and exercise. **Results:** All patients were hemodynamically diagnosed with HFpEF (pulmonary capillary wedge pressure >15 at rest and/or >25 mmHg during exercise). Overall lung and alveolar-capillary membrane diffusion increased from rest to peak exercise (DLCO: 11.8±4.0 to 16.2±7.4 ml/min/mmHg, DLNO: 33.1±11.5 to 48.4±21.9 ml/min/mmHg, Dm: 18.9±7.2 to 28.3±13.1 ml/min/mmHg;  $p$ 's<0.01). The change in DL was related to exercise capacity (change in DLCO vs. peak  $\dot{V}O_2$ : R=0.69,  $p < 0.01$ , change in DLNO vs. peak  $\dot{V}O_2$ : R=0.65,  $p < 0.01$ ) and this was primarily driven by changes in Dm (change in Dm vs. peak  $\dot{V}O_2$ : R=0.63,  $p < 0.01$ ) but not Vc (change in Vc vs. peak  $\dot{V}O_2$ : R=0.15,  $p = 0.582$ ).

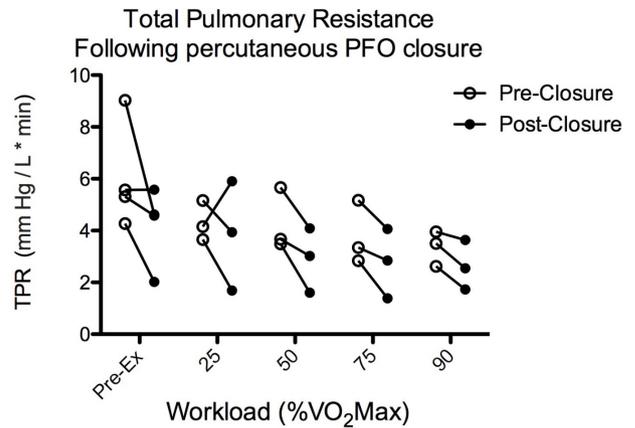
**Conclusions:** These data highlight that a limited increase in lung diffusion and alveolar-capillary membrane conductance during exercise are associated with a lower  $\dot{V}O_2$  peak in HFpEF patients. In addition to hemodynamic constraints previously reported in HFpEF, an inability to recruit lung surface area during exercise may also contribute to the reduced exercise capacity in these patients.

**2985** May 29 1:15 PM - 1:30 PM  
**The Effect Of Exercise Intensity On The Development Of Diaphragm And Expiratory Abdominal Muscle Fatigue**

Tim A. Hardy, Matt R. Chadwick, Carrie Ferguson, Bryan J. Taylor. *University of Leeds, Leeds, United Kingdom.* (Sponsor: Dr Thomas P Olson, FACSM)  
 Email: bsth@leeds.ac.uk  
*(No relevant relationships reported)*

Exhaustive high-intensity exercise (85-95% of  $\dot{V}O_{2peak}$ ) elicits respiratory muscle fatigue, likely due to a high work of breathing (WoB) combined with a competition for available cardiac output (Q). However, the WoB associated with submaximal heavy-intensity exercise ( $\leq 75\% \dot{V}O_{2peak}$ ) makes insufficient demands for  $\dot{V}O_2$  and Q to engender a substantial competition for available blood flow. Whether the respiratory muscles fatigue in response to exhaustive heavy-intensity exercise remains unclear.

**PURPOSE:** To investigate the effect of exercise intensity on the presence and severity of exercise-induced diaphragm and expiratory muscle fatigue in healthy humans. **METHODS:** Ten healthy adults (25 ± 3 y, 3 females) performed a 'ramp sprint' test to determine critical power (CP), peak ramp power ( $P_{peak}$ ) and  $\dot{V}O_{2peak}$  ( $54 \pm 9$  ml/kg/min). The subjects then performed two constant-power cycling tests to exhaustion: 1) 5% < CP ( $173 \pm 50$  W, *heavy intensity*); 2) ~25% of the difference between CP and  $P_{peak}$  ( $215 \pm 53$  W, *severe intensity*). Diaphragm and expiratory muscle fatigue were quantified as the pre- to post-exercise reduction in the transdiaphragmatic ( $Pdi_{tw}$ ) and gastric ( $Pga_{tw}$ ) twitch pressure response to magnetic stimulation of the cervical and thoracic nerves, respectively. **RESULTS:** Exercise time was longer for heavy vs. severe exercise ( $36 \pm 6$  vs.  $10 \pm 3$  min,  $P < 0.05$ ). Final min  $\dot{V}O_2$  was lower during heavy ( $3.12 \pm 0.74$  L/min;  $82 \pm 5\%$  of  $\dot{V}O_{2peak}$ ) vs. severe exercise ( $3.60 \pm 0.83$  L/min;  $95 \pm 4\%$  of  $\dot{V}O_{2peak}$ ) ( $P < 0.05$ ). Both heavy and severe exercise elicited a significant reduction in  $Pdi_{tw}$  ( $-13 \pm 11\%$  and  $-19 \pm 13\%$ ) and  $Pga_{tw}$  ( $-23 \pm 20\%$  vs.  $-24 \pm 17\%$ ) (both  $P < 0.05$ ); however, the magnitude of exercise-induced respiratory muscle fatigue was not different between trials ( $P > 0.05$ ). The cumulative diaphragm and gastric pressure-time products were greater for heavy vs. severe exercise ( $PTP_{di}$ :  $16790 \pm 6727$  vs.  $5945 \pm 1956$  cmH<sub>2</sub>O/s;  $PTP_{ga}$ :  $7818 \pm 3368$  vs.  $2595 \pm 1233$  cmH<sub>2</sub>O/s; both  $P < 0.05$ ). **CONCLUSION:** The diaphragm and expiratory muscles fatigue in response to exhaustive heavy- and severe-intensity exercise in healthy humans. The magnitude of exercise-induced respiratory muscle fatigue between trials was not different despite a substantially greater cumulative  $PTP_{di}$  and  $PTP_{ga}$  for heavy- vs. severe-intensity exercise.



**2986** May 29 1:30 PM - 1:45 PM  
**Reduction In Pulmonary Arterial Pressure At Rest And During Exercise Following Percutaneous Closure Of Patent Foramen Ovale**  
 Tyler Kelly, University of Oregon, Eugene, OR.  
 Email: tkelly5@uoregon.edu  
 (No relevant relationships reported)

**Purpose:** The PFO is a source of intracardiac right-to-left shunt and is present in ~1/3<sup>rd</sup> of the adult population. Deficits in pulmonary gas exchange efficiency associated with PFO have been well-documented (Lovering *et al*, J Appl Physiol 2016). However, changes in pulmonary artery pressure and total pulmonary resistance (TPR) following closure have not previously been reported. **Methods:** Four candidates (3F, 1M) for closure of PFO were identified by local cardiologists and referred to our laboratory as subjects. 3 subjects (3F) received physician clearance to participate in the exercise trials. 1 subject (1M) was not cleared for exercise so only resting measures were taken. Presence and size of PFO was confirmed utilizing transthoracic saline contrast echocardiography (TTSCE). Subjects exercised at 4 sub-maximal workloads (25%, 50%, 75% and 90% of pre-closure  $VO_{2Max}$ ). Transthoracic ultrasound measures of cardiac output (QT) and pulmonary arterial systolic pressure (PASP) were taken prior to exercise and during the final minute of each workload. TPR was calculated as  $PASP / QT$ . All measures were repeated in the laboratory 3-6 months after closure of PFO following confirmation of endothelialization of the closure device with TTSCE. **Results:** Data were analyzed by a 2-way (Closure x Workload) RMANOVA. There was a main effect of closure on PASP  $F(1, 11) = 21.05, p = 0.0008$ , and a main effect of closure on TPR  $F(1, 11) = 9.899, p = 0.0093$ , with reductions in both following closure. There was a main effect of workload, but not closure, on cardiac output  $F(4, 11) = 60.18, p < 0.0001$ . **Conclusion:** Improvements in pulmonary gas exchange efficiency are expected with removal of the intracardiac right-to-left shunt. However, our results demonstrating a significantly reduced pulmonary artery pressure, due to a significantly reduced TPR, are intriguing and deserve more attention to better understand the contributing factors of a PFO to exercise-induced pulmonary hypertension.

**2987** May 29 1:45 PM - 2:00 PM  
**Effect Of Active Muscle Mass On Work Of Breathing And Oxygen Cost Of Ventilation**  
 Saad A. Alhammad<sup>1</sup>, Monira I. Aldhahi<sup>2</sup>, Andrew A. Guccione<sup>1</sup>, Randall E. Keyser, FACSM<sup>1</sup>. <sup>1</sup>George Mason University, Fairfax, VA. <sup>2</sup>Princess Nourah Bint Abdulrhaman University, Riyadh, Saudi Arabia. (Sponsor: Randall E. Keyser, FACSM)  
 Email: salhamma@masonlive.gmu.edu  
 (No relevant relationships reported)

**PURPOSE:** To compare estimates of work of breathing (Wb) and O<sub>2</sub> cost of ventilation in the respiratory muscles ( $V_{RMO2}$ ) among three types of exercise, representing smaller and large active muscle masses. **METHODS:** Twenty healthy adults (25±4.9 yrs, BMI: 23.9 ±2.6 kg/m<sup>2</sup>) completed three randomized peak cardiopulmonary exercise tests (CPET) on separate days: 2-leg (large muscle mass) and 1-leg (medium mass) tests and 1-arm (small mass). Estimates of Wb and  $V_{RMO2}$  were compared at power outputs corresponding to 25%, 50%, 75%, and 100% of the peak power output on the tests and at Isomax, defined as the power output identical to peak exercise on the 1-arm CPET. Wb was estimated using an established algorithm:  $Wb = V_{RMO2} \times P_{aw}$  and  $V_{RMO2} = \frac{Wb}{P_{aw}}$ . **RESULTS:** Peak power output was 32 ±11.96 watts for the 1-arm, 97.8 ±30.48 watts for the 1-leg, and 186.25 ±44.03 watts for the 2-leg CPETs. At 50% of peak WR, significant differences in Wb and  $V_{RMO2}$  between 1-arm and 2-leg (Wb  $p=0.001$ ;  $V_{RMO2}$   $p=0.001$ ). At 100%, there were differences in Wb and  $V_{RMO2}$  between 1-arm and 2-leg (Wb  $p<0.01$ ;  $V_{RMO2}$   $p<0.01$ ) and between 1-leg and 2-leg CPETs (Wb  $p=0.02$ ;  $V_{RMO2}$   $p=0.02$ )

|                                 | 1-arm    |          | 1-leg    |            |          | 2-leg    |            |          |
|---------------------------------|----------|----------|----------|------------|----------|----------|------------|----------|
|                                 | 50%      | 100%     | 50%      | 100%       | Isomax   | 50%      | 100%       | Isomax   |
| Wb kg.m.min <sup>-1</sup>       | 1.3±0.9  | 5.91±4.7 | 2.2±1.2  | 9.5±6.5    | 1.2±0.8  | 2.8±1.3  | 15.8±9.7   | 0.3±0.3  |
| $V_{RMO2}$ mL.min <sup>-1</sup> | 44.9±7.4 | 79±35.4  | 51.2±9.2 | 105.9±48.2 | 43.8±5.9 | 55.5±9.7 | 152.7±72.1 | 37.4±2.4 |

At Isomax, significant increases were found in Wb and  $V_{RMO2}$  between the 1-arm and 1-leg ( $p<0.001$ ) CPETs and between the 1-arm and 2-leg ( $p<0.001$ ) CPETs. **CONCLUSION:** The findings suggest that breathing economy is diminished with respect to exercising that requires progressively smaller active muscle masses. This study suggests that CPETs requiring smaller active muscle masses may not be sufficient for examining maximal Wb or  $V_{RMO2}$  capacity

2988 May 29 2:00 PM - 2:15 PM

**External Dead Space Explains Sex-differences In The Exercise Ventilatory Response In Obese And Nonobese Children**

Bryce N. Balmain<sup>1</sup>, Daniel P. Wilhite<sup>1</sup>, Dharini M. Bhammar<sup>2</sup>, Ashley Peck<sup>1</sup>, Marcus Payne<sup>1</sup>, Tanya Martinez-Fernandez<sup>3</sup>, Tony G. Babb, FACSM<sup>1</sup>. <sup>1</sup>Institute for Exercise and Environmental Medicine, Dallas, TX. <sup>2</sup>University of Nevada Las Vegas, Las Vegas, NV. <sup>3</sup>UT Southwestern Medical Center, Dallas, TX. (Sponsor: Dr Tony Babb, FACSM)  
Email: brycebalmain@texashealth.org  
(No relevant relationships reported)

**PURPOSE:** Increases in external dead space augment the exercise ventilatory response independent of the potential respiratory effects of sex and obesity. Therefore, the dead space imposed by the mouthpiece and breathing valve ( $V_{DM}$ ) should be accounted for when comparing the exercise ventilatory response, particularly in prepubescent children who have smaller lungs. We evaluated the impact of  $V_{DM}$  on the exercise ventilatory response, defined as the slope of the relation between minute ventilation ( $\dot{V}_E$ ) and carbon dioxide ( $\dot{V}CO_2$ ), in obese and nonobese prepubescent boys and girls. **METHODS:** 27 nonobese (age:  $10 \pm 1$  y; height:  $146 \pm 8$  cm; weight:  $39 \pm 7$  kg; BMI percentile:  $57.2 \pm 21.3$ ) and 46 obese (age:  $10 \pm 1$  y; height:  $147 \pm 8$  cm; weight:  $62 \pm 16$  kg; BMI percentile:  $98.0 \pm 1.3$ ) children were studied. Subjects were divided into groups by sex (nonobese: 13 girls and 14 boys; obese: 17 girls and 29 boys). All subjects performed a 6-minute constant load cycling test at a fixed intensity (40W). To correct the  $\dot{V}_E/\dot{V}CO_2$  slope for the effects of  $V_{DM}$ , we subtracted  $V_{DM}$  (0.225 L) from  $\dot{V}_E$  to derive a slope that was absent from the effects of  $V_{DM}$ . A two-way group (obese vs nonobese) by sex (girls vs boys) analysis of variance was conducted. **RESULTS:** When  $\dot{V}_E$  was not corrected for  $V_{DM}$ , there was no group by sex interaction in the  $\dot{V}_E/\dot{V}CO_2$  slope ( $p = 0.76$ ).  $\dot{V}_E/\dot{V}CO_2$  slope was not different ( $p = 0.48$ ) between obese ( $32.7 \pm 4.3$ ) and nonobese children ( $32.2 \pm 6.1$ ) however, there was a main effect for sex ( $p = 0.03$ ) where the  $\dot{V}_E/\dot{V}CO_2$  slope was higher in girls ( $35.4 \pm 5.6$ ) compared with boys ( $32.6 \pm 4.9$ ). When  $\dot{V}_E$  was corrected for  $V_{DM}$ , the  $\dot{V}_E/\dot{V}CO_2$  slope remained similar ( $p = 0.31$ ) between obese and nonobese children; however, the main effect for sex was eliminated ( $p = 0.12$ ). There was no main effect for group (obese vs nonobese) or sex (girls vs boys) in the end-tidal partial pressure of carbon dioxide at rest ( $p > 0.05$ ) or during exercise ( $p > 0.05$ ). **CONCLUSIONS:** Accounting for the external dead space imposed by the valve and mouthpiece eliminates the difference in the exercise ventilatory response detected between pre-pubescent boys and girls. Considering that the breathing apparatus comprises a large portion of both resting and exercise tidal volume in children, it should be accounted for before evaluating the  $\dot{V}_E/\dot{V}CO_2$  slope, especially in prepubescent children.

2989 May 29 2:15 PM - 2:30 PM

**Bronchodilation Increases Estimated Ventilatory Capacity In Children With Mild Asthma**

Nicholas A. Ross<sup>1</sup>, Michael W.H. Wong<sup>1</sup>, Ani L. Kechkarian<sup>1</sup>, Donna J. Gould<sup>1</sup>, Craig Nakamura<sup>2</sup>, Dharini M. Bhammar<sup>1</sup>. <sup>1</sup>University of Nevada, Las Vegas, Las Vegas, NV. <sup>2</sup>Childrens Lung Specialists, Las Vegas, NV. (Sponsor: Tony G. Babb, FACSM)  
(No relevant relationships reported)

**Purpose:** Children with asthma experience reduced maximal expiratory flows, which can decrease ventilatory capacity and increase ventilatory limitations during exercise; however, the effects of mid-flow bronchodilation on these variables are underappreciated. The purpose of this study was to examine the effect of bronchodilation on ventilatory capacity and ventilatory limitations during a maximal exercise test.

**Methods:** Nine children with mild asthma (7 boys,  $10 \pm 1$  yr, BMI percentile:  $66 \pm 30$ , forced expiratory volume in 1s, FEV<sub>1</sub>;  $106 \pm 24$  %predicted, Range 78-144) completed spirometry before and after 360µg of albuterol. On a separate visit, they completed an incremental exercise test to exhaustion. Estimated ventilatory capacity was calculated using the volume time curve from estimated maximal tidal volume (FVC/2) and estimated maximal total respiratory cycle time ( $2 \times FET_{25-75\%}$ ) both before and after bronchodilator. Ventilatory limitation was defined as  $<10\%$  of breathing reserve (Estimated ventilatory capacity - maximum minute ventilation).

**Results:** Estimated ventilatory capacity increased by 16% after bronchodilator ( $60 \pm 23$  vs.  $69 \pm 27$  L/min;  $p = 0.013$ ). Measured maximal tidal volume was lower than estimated ( $1.12 \pm 0.32$  vs.  $1.33 \pm 0.25$ ,  $p = 0.002$ ) but measured maximal total respiratory cycle time ( $T_{tot}$ ) was not different from estimated ( $1.41 \pm 0.36$  vs.  $1.47 \pm 0.46$ ,  $p = 0.792$ ). In a subset of seven children who received 180µg albuterol before the incremental test, five would have been ventilatory limited (i.e.,  $<10\%$  breathing reserve) at maximal exercise using "before bronchodilator" estimated ventilatory capacity (breathing reserve range: -61 to +9%). However, only one child was ventilatory limited at maximal exercise using "after bronchodilator" estimated ventilatory capacity.

**Conclusions:** Bronchodilator administration prior to maximal exercise testing may be necessary to increase estimated ventilatory capacity and reduce ventilatory limitations even in children with mild asthma.

2990 May 29 2:30 PM - 2:45 PM

**Exercise Training In Chronic Obstructive Pulmonary Disease: Examining The Plasticity Of Oxygen Transport Limitations To  $\dot{V}O_{2peak}$** 

Ryan M. Broxterman<sup>1</sup>, Jan Hoff<sup>2</sup>, Peter D. Wagner<sup>3</sup>, Russell S. Richardson<sup>1</sup>. <sup>1</sup>University of Utah, Salt Lake City, UT. <sup>2</sup>University of Science and Technology, Trondheim, Norway. <sup>3</sup>University of California, San Diego, La Jolla, CA.  
Email: ryan.broxterman@utah.edu  
(No relevant relationships reported)

In patients with chronic obstructive pulmonary disease (COPD), exercise training-induced improvements in peak O<sub>2</sub> uptake ( $\dot{V}O_{2peak}$ ) are reliant on adaptations beyond the lungs, particularly in skeletal muscle. Muscle  $\dot{V}O_{2peak}$  is determined by the integration of convective and diffusive O<sub>2</sub> transport, which are markedly diminished in COPD. It remains to be determined how these components of O<sub>2</sub> transport respond to exercise training and if their adaptation is compromised in COPD. **PURPOSE:** To test the hypothesis that exercise training improvements in muscle convective and diffusive O<sub>2</sub> transport, and therefore  $\dot{V}O_{2peak}$ , would not be attenuated in patients with COPD compared to matched controls. **METHODS:** Metabolic and vascular adaptations to single leg knee extensor exercise (KE) training (1 h, 3 times a week for 8 weeks) were compared between 8 patients with severe COPD (FEV<sub>1</sub>±SE=0.9±0.1 L, 30% of predicted) and 8 controls matched for age and physical activity. Femoral arterial and venous blood samples, in conjunction with thermodilution, were used to determine muscle O<sub>2</sub> transport and utilization at peak KE. **RESULTS:** Training increased muscle convective O<sub>2</sub> transport in the controls ( $0.69 \pm 0.07$  vs.  $0.80 \pm 0.10$  l/min,  $p < 0.05$ ), but not in the patients with COPD ( $0.44 \pm 0.06$  vs.  $0.49 \pm 0.08$  l/min,  $p > 0.05$ ). Muscle diffusive O<sub>2</sub> transport was increased with training in both the patients ( $6.6 \pm 0.8$  vs.  $9.1 \pm 0.12$  ml/min/mmHg) and controls ( $10.4 \pm 0.9$  vs.  $13.3 \pm 0.9$  ml/min/mmHg) (each  $p < 0.05$ ), which equated to an 86% training response in the patients relative to the controls. Training increased  $\dot{V}O_{2peak}$  in the patients with COPD ( $0.27 \pm 0.04$  vs.  $0.34 \pm 0.05$  l/min) and controls ( $0.42 \pm 0.05$  vs.  $0.58 \pm 0.07$  l/min) and peak work rate in the patients ( $12 \pm 2$  vs.  $16 \pm 2$  W) and controls ( $24 \pm 4$  vs.  $36 \pm 4$  W) (each  $p < 0.05$ ), which equated to a 44% ( $\dot{V}O_{2peak}$ ) and 33% (peak work rate) training response in the patients relative to the controls. **CONCLUSION:** These findings document limited plasticity in convective O<sub>2</sub> transport to the muscle, but relatively conserved plasticity in muscle diffusive O<sub>2</sub> transport with exercise training in COPD. Thus, despite a near restoration of muscle diffusive O<sub>2</sub> transport, the improvements in muscle  $\dot{V}O_{2peak}$  and peak work rate in patients with COPD were constrained by the limited plasticity in convective O<sub>2</sub> transport.

**F-12 Free Communication/Slide - Endurance and Interval Training**

Friday, May 29, 2020, 1:00 PM - 2:45 PM  
Room: CC-3020

2991 **Chair:** Matthew D. Barberio. George Washington University, Washington D.C., DC.

(No relevant relationships reported)

2992 May 29 1:00 PM - 1:15 PM

**DOES TRAINING ALTER BIOMARKERS OF IRON HOMEOSTASIS IN FEMALE COLLEGIATE ATHLETES RESIDING AT MODERATE ALTITUDE?**

Dillon J. Frisco<sup>1</sup>, Jesse A. Goodrich<sup>1</sup>, Sewan Kim<sup>1</sup>, Sourav Poddar<sup>2</sup>, Miguel Rueda<sup>1</sup>, William C. Byrnes, FACSM<sup>1</sup>. <sup>1</sup>University of Colorado, Boulder, CO. <sup>2</sup>University of Colorado School of Medicine, Denver, CO. (Sponsor: William C Byrnes, FACSM)  
Email: Dillon.Frisco@colorado.edu  
(No relevant relationships reported)

Iron deficiency is reported to be more prevalent in female athletes compared to the general population, which can negatively affect athletic performance. Hcpidin (HEP) and erythroferrone (ERY) play a significant role in the homeostatic control of iron, but erythropoietic activity, inflammation, and red cell turnover also influence iron homeostasis. It is unknown whether these factors are altered in female athletes while

training at altitude. **Purpose:** To determine how markers of iron homeostasis, including ferritin (fer), hemoglobin concentration (Hb), reticulocytes, HEP, ERY, interleukin 6 (IL6), and tumor necrosis factor alpha (TNFa), lactate dehydrogenase (LDH) and creatine phosphokinase (CPK) change during training in female endurance and team sport athletes residing at moderate altitude. **Methods:** We recruited 94 female athletes from the University of Colorado DI cross country (XC; n = 28), nordic (n = 6) and alpine (n = 8) skiing, lacrosse (LAX; n = 35) and soccer teams (n = 17). In addition, 12 full time female college students were recruited as controls. Between 2 to 7 fasted blood samples were collected over a minimum of 3 months. All athletes were provided with oral iron supplements from a certified nutritionist during this period. **Results:** Average fer and Hb were higher in endurance athletes (fer:  $53 \pm 30$  ng/dL; Hg:  $14.6 \pm 0.8$ ) compared to team sport athletes ( $31 \pm 19$ ;  $13.8 \pm 0.8$ ) and controls ( $18 \pm 9$ ;  $13.9 \pm 1.1$ ). Fer remained stable over time for all groups except LAX, who decreased by 20 ng/dL post season. HEP was higher in endurance ( $36.6 \pm 60.3$  ng/dL) compared to team sport athletes ( $18.0 \pm 12.0$ ), but there were no differences between groups for ERY (overall average:  $10.1 \pm 50.8$  ng/dL); neither HEP or ERY changed significantly over time. In LAX, soccer, and nordic, IL6 and TNFa were lower than XC and remained stable over time; however, IL6 and TNFa started higher in XC and decreased over time. All teams except nordic showed fluctuations in LDH and CPK over the training cycle, but there were no differences between groups for these parameters or percent reticulocytes for any groups. **Conclusion:** Endurance athletes had higher Hb, fer, and HEP. While IL6 and TNFa were higher in XC athletes, other biomarkers of iron homeostasis tended to not be different between groups, although some parameters fluctuated over time.

2993 May 29 1:15 PM - 1:30 PM

### Markers Of Training Stress Associated With Functional Overreaching In Middle Distance Runners

Phillip Michael Bellinger, Chris Irwin, Clare Minahan, Surendran Sabapathy, Jonathan Craven, Evan Pennell, Amanda Cox, Ben Desbrow. *Griffith University, Southport, Australia.*  
Email: p.bellinger@griffith.edu.au  
(No relevant relationships reported)

**PURPOSE:** The present study aimed to identify markers of training stress that were related to the incidence of overreaching in response to overload training in middle distance runners. **METHODS:** Twenty-four middle distance runners ( $n=16$  M,  $\dot{V}O_{2peak}$ :  $73.3 \pm 4.3$  mL·kg<sup>-1</sup>·min<sup>-1</sup>;  $n=8$  F,  $\dot{V}O_{2peak}$ :  $63.2 \pm 3.4$  mL·kg<sup>-1</sup>·min<sup>-1</sup>) completed 3 wk of normal training, followed by 3 wk of high-volume training (HVTr; 10% increase in volume each successive week), and a 1-wk taper (TapTr; 55% exponential reduction in training volume from HVTr wk 3). Before, and immediately after each training phase, an incremental treadmill test was performed to measure time to exhaustion (TTE), peak heart rate (HR<sub>peak</sub>), HR recovery, peak blood lactate concentration ([La]<sub>bpeak</sub>) and  $\dot{V}O_{2peak}$ . In addition, resting metabolic rate (RMR), body composition, energy intake and resting blood biomarkers of training stress were measured. Runners who had a decreased TTE (>CV) after HVTr were classified as being functionally overreached (FOR), others as acutely fatigued (AF; no decrease performance). Differences between AF and FOR were analysed using mixed-model ANOVAs with pairwise comparisons. **RESULTS:** Following HVTr, there were significant between group differences in the responses to exhaustive running, whereby FOR ( $n=12$ ) had a decrease in TTE ( $-49 \pm 14$  s), HR<sub>peak</sub> ( $-4 \pm 3$  BPM;  $p = 0.02$ ), [La]<sub>bpeak</sub> ( $-4.30 \pm 1.80$  mmol·L<sup>-1</sup>;  $p = 0.01$ ) and  $\dot{V}O_{2peak}$  ( $-2.33 \pm 2.0$  mL·kg<sup>-1</sup>·min<sup>-1</sup>) and a faster HR recovery ( $-5 \pm 4$  BPM;  $p = 0.03$ ) compared to AF ( $n=12$ ). There were no between group differences in these variables during submaximal running, nor were there changes in absolute or relative RMR, while only the FOR group increased energy intake during the HVTr. There was no statistically significant change in body composition in either group throughout the study nor were there changes in resting blood biomarkers that reflected inflammation (IL-6, GDF-15 and CRP), metabolism (thyroid hormones), catabolism and anabolism (DHEA, urea, total protein, testosterone, cortisol and GH) or iron regulation (iron, ferritin, and UIBC). **CONCLUSIONS:** Middle distance runners who were classified as FOR following an overload training period did not have alterations in RMR, resting blood biomarkers or submaximal exercise responses compared to runners who did not have impaired performance.

2994 May 29 1:30 PM - 1:45 PM

### Molecular Mechanisms Underpinning The Regulation Of Peak Fat Oxidation Rates During Exercise

Oliver Chrzanowski-Smith, Robert Edinburgh, Eleanor Smith, Mark Thomas, Jean-Philippe Wahlin, Francoise Koumanov, Sean Williams, James Betts, FACSM, Javier Gonzalez. *University of Bath, Bath, United Kingdom.* (Sponsor: Professor James Betts, FACSM)  
Email: o.j.chrzanowski-smith@bath.ac.uk  
(No relevant relationships reported)

**PURPOSE:** The molecular regulation of peak fat oxidation (PFO) during exercise remains poorly characterized. The aim of this study was to examine the relationship between the content of key proteins involved in adipose tissue and skeletal muscle fat metabolism with PFO.

**METHODS:** Thirty-six healthy men and women adults [15 females; mean (SD) age 40 (11) years;  $\dot{V}O_{2peak}$   $42.5$  (9.5) mL·kg<sup>-1</sup>·min<sup>-1</sup>; body fat %: 21.8 (8.2) %] completed two incremental exercise tests (separated by 7-28 days) to determine PFO via indirect calorimetry. A DEXA scan and adipose tissue and/or skeletal muscle biopsies were obtained 2-7 days after the second exercise test to determine the protein content of PLIN1, CGI-58, ATGL, HSL, ACSL1, and oestrogen receptor  $\alpha$  (ER $\alpha$ ) in adipose tissue, and FABPpm, ATGL, ACSL1, CTP1b and ER $\alpha$  in skeletal muscle. Sex comparisons were performed on sub-groups of males and females matched for aerobic capacity relative to fat free mass and classifications of the physical activity level index and fat mass index ( $n = 14$  and 12 for adipose tissue and skeletal muscle comparison sub-groups, respectively).

**RESULTS:** Moderate strength correlations were found between PFO (mg·kg<sup>-1</sup>·min<sup>-1</sup>) and the protein content of ATGL [ $r = 0.41$  (0.05 - 0.68),  $p < 0.05$ ] and CPT1b [ $r = 0.41$  (0.05 - 0.68),  $p < 0.05$ ] in skeletal muscle. No other statistically significant bivariate correlations were found between PFO and the content of proteins in adipose tissue or skeletal muscle. Females had a greater PFO compared to males when expressed relative to fat-free mass [mean (SD): 7.1 (1.9) and 7.3 (1.7) vs 4.5 (1.3) and 4.8 (1.2) mg·kg<sup>-1</sup>·min<sup>-1</sup> in the adipose tissue and skeletal muscle-sub-groups, respectively,  $p < 0.05$ ]. No statistically significant sex differences were found in the content of any of the measured proteins involved in lipid metabolism in adipose tissue or skeletal muscle.

**CONCLUSIONS:** The molecular regulation of PFO may primarily lie within skeletal muscle rather than adipose tissue, involving processes relating to intramyocellular triglyceride hydrolysis (ATGL) and mitochondrial fatty acid transport (CPT1b). Future studies should explore alternative molecular mechanisms that may account for sexual dimorphism in exercise fuel metabolism.

2995 May 29 1:45 PM - 2:00 PM

### The Effect Of Ischemic Preconditioning And Hypoxia On Neuromuscular Function During Intense Exercise

Samuel Halley, Paul Marshall, Jason Siegler, FACSM. *Western Sydney University, Sydney, Australia.* (Sponsor: Dr Jason Siegler, FACSM)  
(No relevant relationships reported)

Ischemic preconditioning (IPC) has been proposed to preserve neural drive during fatiguing exercise, however the underlying mechanism of this response remains unclear. Previous research has shown exercises impairing local tissue oxygenation to be more favourable in eliciting the humoral effects of IPC. **PURPOSE:** To determine whether IPC mediated effects on neuromuscular function are dependent on tissue oxygenation. **METHODS:** Eleven resistance-trained males completed four exercise trials (6 sets of 11 repetitions of maximal effort dynamic single-leg extensions) in either normoxic (fraction of inspired oxygen (FiO<sub>2</sub>): 21%) or hypoxic (FiO<sub>2</sub>: 14%) conditions, preceded by treatments of either IPC (3 x 5 min bilateral leg occlusions at 220 mmHg) or sham (3 x 5 min at 20 mmHg). Femoral nerve stimulation was utilized to assess voluntary activation and potentiated twitch characteristics during maximal voluntary contractions (MVCs) performed at baseline, prior to the exercise task and after each set of the exercise task. Tissue oxygenation (via near-infrared spectroscopy), blood oxygenation (via pulse oximetry) and surface electromyography activity was measured throughout the exercise task. **RESULTS:** MVC and twitch torque declined 62% and 54%, respectively (MVC:  $96 \pm 24$  Nm, 95% CI = 73 to 119 Nm, Cohen's  $d = 2.9$ ,  $p < 0.001$ ; twitch torque:  $37 \pm 11$  Nm, 95% CI = 26 to 48 Nm,  $d = 1.6$ ,  $p < 0.001$ ), between pre- and post-exercise measurements without reductions in voluntary activation (mean decrease  $0.2 \pm 6.2\%$ , 95% CI = -5.7 to 6.1%,  $d = 0.05$ ,  $p > 0.21$ ); there were no differences between conditions. Hypoxia reduced both blood and tissue oxygenation by 5% and 6%, respectively, compared to normoxic conditions (blood oxygenation:  $4.8 \pm 0.3\%$ , 95% CI = 4.7 to 5.0%,  $d = 1.9$ ,  $p < 0.001$ ; tissue oxygenation:  $3.5 \pm 1.5\%$ , 95% CI 2.6 to 4.4%,  $d = 2.4$ ,  $p < 0.001$ ), with a further 3% reduction in tissue saturation evident in the hypoxic IPC compared to hypoxic sham trial (mean decrease  $1.8 \pm 0.7\%$ , 95% CI = 0.5 to 3.5%,  $d = 1.0$ ,  $p < 0.05$ ).

**CONCLUSION:** IPC did not affect any measure of neuromuscular function regardless of tissue oxygenation. A reduction in  $\text{FiO}_2$  did invoke a humoral response and improved muscle  $\text{O}_2$  extraction during exercise, however it did not manifest into any performance benefit.

2996 May 29 2:00 PM - 2:15 PM

**Blood Lactate Steady State Is Maintained During Moderate Intensity Interval Training Depending Rest Time Duration**

Juan C. Mazza, FACSM<sup>1</sup>, Raul R. Festa<sup>1</sup>, Sandra L. Prieto<sup>2</sup>, Gustavo D'Andrea<sup>3</sup>, Maria B. Pasquali<sup>4</sup>, Alvaro N. Gurovich, FACSM<sup>5</sup>. <sup>1</sup>Biosystem Institute Sports Sciences, Rosario, Argentina. <sup>2</sup>National University of Colombia, Bogota D.C., Colombia. <sup>3</sup>Echesortu Swimming Club, Rosario, Argentina. <sup>4</sup>National University of Rosario, Rosario, Argentina. <sup>5</sup>The University of Texas at El Paso, El Paso, TX.  
Email: juanmazza@arnet.com.ar  
(No relevant relationships reported)

Interval training (IT) is a method commonly used by coaches. The rest between stimuli is a variable that can be manipulated in IT. Rest time influences the specificity of workload. Considering that Blood Lactate (BLA) represents the balance of metabolic intracellular production-removal-oxidation, is very important to determine different levels of Lactate Steady-State (La SS) with variation in rest time, which are able to sustain La SS for longer periods, using IT workouts. **PURPOSE:** To analyze BLA during 90s of passive rest (pr) in steady-state moderate intensity IT (mIT). In previous work, we have shown that La SS was maintained for 60s of pr (Mazza et al., 2018), without significant differences (SD). **METHODS:** Eleven trained swimmers (19.4±3.8 y) performed a mIT (BLA 4 to 6 mMol/l). The bout was 10x100m freestyle with 90s pr. BLA and heart rate (HR) were measured at 10s, 50s and 80s at same time, during pr, every 2 reps. We applied Shapiro-Wilk test to analyze distribution's data. We compared BLA-10s vs. BLA-50s vs. BLA-80s applying One-way ANOVA ( $p < 0.05$ ) in reps 2-4-6-8 and 10; also, we determine Pearson correlation coefficient (r) between BLA-10s, BLA-50s, BLA-80s vs. HR-10s, HR-50s, HR-80s, respectively. **RESULTS:** BLA data show normal distribution ( $p > 0.05$ ). The mean BLA max./min. values were 6.25/5.08 mMol/l, respectively, at 1.49±0.07 m/s. Statistical analyses are shown in the following table: & SD BLA-10s vs. BLA-50s; \* SD BLA-50s vs. BLA-80s; # SD BLA-10s vs. BLA-80s. We found a low r between BLA and HR ( $r = 0.25-0.30$ ). **CONCLUSION:** This work shows that La SS in mIT depends of pr duration to generate sustained metabolic stress during whole exercise - rest workout. BLA-10s vs. BLA-50s does not register SD (except rep. 6). However, BLA-50s vs. BLA-80s are SD, showing a tendency to lower BLA level. La SS is maintained within BLA 4 to 6 mMol/l range with only 1.17 mMol/l differences between max./min. mean values. Also, we found that HR is not valid variable to control metabolic stress in mIT.

2997 May 29 2:15 PM - 2:30 PM

**Training Alterations In Total Hemoglobin Mass And Plasma Volume In Collegiate Athletes Residing At Altitude**

Sewan Kim<sup>1</sup>, Jesse A. Goodrich<sup>1</sup>, Dillon J. Frisco<sup>1</sup>, Miguel Rueda<sup>1</sup>, Sourav Poddar<sup>2</sup>, William C. Byrnes, FACSM<sup>1</sup>. <sup>1</sup>University Colorado Boulder, Boulder, CO. <sup>2</sup>University Colorado School of Medicine, Denver, CO. (Sponsor: William C. Byrnes, FACSM)  
Email: sewan.kim@colorado.edu  
(No relevant relationships reported)

Total hemoglobin mass (THM) is directly related to maximal oxygen consumption and can be used to determine blood volume, red cell volume and plasma volume (PV). The effect of training on THM and PV for male and female intercollegiate athletes across sports residing at altitude has received limited attention. **Purpose:** To examine if training alters THM and PV in NCAA DI athletes residing at altitude. In addition, the effects of sex and/or sport were investigated. **Methods:** We recruited 88 NCAA DI athletes from the University of Colorado Boulder alpine ski, (8M & 7F), nordic ski (NSKI; 6M & 6F), football (FB; 9M), lacrosse (LAX; 35F) and soccer (17F) teams. THM and PV were measured over 3 or more months at selected time points where coaches indicated a change in training stimulus. Recreationally active students (14M & 12F) served as baseline controls. The optimized carbon monoxide rebreathing procedure was used to measure THM and determine PV. Values were reported as means and standard errors while significance was set at  $p < 0.05$ . **Results:** Females: Initial THM for controls, alpine, LAX, NSKI and soccer (577 ± 27, 622 ± 39, 614 ± 11.2, 658 ± 29, 628 ± 23 g, respectively) were not different between groups and did not change with training for any teams. Initial PV for controls, alpine, LAX, NSKI and soccer (2981 ± 190, 3079 ± 128, 3118 ± 56, 3160 ± 194, 3341 ± 107 mL, respectively) were not different between groups. PV decreased with training for alpine, LAX and soccer by 304 ± 116, 112 ± 51 and 268 ± 84 mL, respectively. Males: Initial THM

for alpine, FB and NSKI (996 ± 43, 1169 ± 35 & 1089 ± 64 g, respectively) were not different and did not change with training. Initial THM for controls (894 ± 38.1) was lower than FB and NSKI. Initial PV values for controls, alpine, FB and NSKI were 3763 ± 158, 3901 ± 268, 4855 ± 121 and 4597 ± 260 mL, respectively. Initial PV for controls were lower than FB and NSKI, while alpine was lower than FB. NSKI had a decrease in PV (-477 ± 157 mL), which then returned to initial values. **Conclusion:** THM remained constant during training, regardless of sport or sex, indicating that the training stimuli experienced by the athletes may not alter THM. During the course of training certain teams exhibited a decrease in PV, which could be a result of the nature of training stimuli and/or hydration status.

2998 May 29 2:30 PM - 2:45 PM

Abstract Withdrawn

**F-13 Free Communication/Slide - Neuroscience**

Friday, May 29, 2020, 1:00 PM - 3:00 PM  
Room: CC-2005

2999 Chair: Ali Boolani. Clarkson University, Potsdam, NY.

(No relevant relationships reported)

3000 May 29 1:00 PM - 1:15 PM

**Brain-Heart Dynamics Are Associated With Cardiorespiratory Fitness & Cognitive Control**

Derek C. Monroe<sup>1</sup>, Matthew P. Herring, FACSM<sup>2</sup>, James W. Hicks<sup>1</sup>, Julian F. Thayer<sup>1</sup>, Steven L. Small<sup>3</sup>. <sup>1</sup>University of California, Irvine, Irvine, CA. <sup>2</sup>University of Limerick, Limerick, Ireland. <sup>3</sup>University of Texas at Dallas, Richardson, TX.  
Email: dcmunroe@uci.edu  
(No relevant relationships reported)

An association between cardiovagal activity and cognitive control may represent overlapping roles of the prefrontal cortex for autonomic and cognitive functions. Greater vagal tone is associated with greater cardiorespiratory fitness and may partially explain the well-established benefits of exercise for cognitive control.

**PURPOSE:** The aim of this study was to relate cardiorespiratory fitness ( $\text{VO}_{2\text{max}}$ ) and cognitive control to dynamic brain-heart connectivity.

**METHODS:** Twenty-three, recreationally active young adults (14 women; 18-35 years old) completed a treadmill  $\text{VO}_{2\text{max}}$  test, assessment of cognitive control, and resting measures of electroencephalography (EEG) and electrocardiography (EKG). Cognitive control was defined by performance on the Flanker Test ('inhibitory control') and Dimensional Change Card Sort Test ('cognitive flexibility'). A multi-taper method (1-50 Hz; 1 Hz steps) was used to compute dynamic power from from six frontal electrodes and six posterior electrodes as controls. A point-process model, based on an inverse Gaussian distribution fit between R-peaks, was used to produce an instantaneous estimate of heart rate. The maximal information coefficient (MIC), a non-parametric statistic capable of identifying linear and non-linear associations, was computed between the heart rate model and time-varying power at each electrode and frequency to represent dynamic brain-heart connectivity. A partial least squares analysis characterized the brain-heart connections that significantly and reliably contributed to a relationship between MIC and  $\text{VO}_{2\text{max}}$  and cognitive control.

**RESULTS:** One latent variable ( $p = .036$ ) represented independent, negative correlations between MIC and  $\text{VO}_{2\text{max}}$ , inhibitory control, and cognitive flexibility. High  $\text{VO}_{2\text{max}}$  and cognitive control were positively associated with right-lateralized MICs (boot-strap ratios  $\leq 1.96$ ) in the delta band (1-3 Hz) and negatively associated with left-lateralized MICs (boot-strap ratios  $\geq 1.96$ ) in the delta and theta bands (1-7 Hz). There was no relationship between MIC measured with control (posterior) electrodes and the dependent variables ( $p > .236$ ).

**CONCLUSION:** The benefits of exercise for cognitive control may be associated with right-lateralized communication between the prefrontal cortex and heart.

3001 May 29 1:15 PM - 1:30 PM

**Aerobic Exercise Regulates Synaptic Homeostasis In The Hippocampal CA1 Region Of APP/PS1/tau Mice**

Laikang Yu, Li Zhao. Beijing Sport University, Beijing, China.  
(No relevant relationships reported)

**PURPOSE:** Physical exercise is an important lifestyle behavior that may reduce the risk of Alzheimer's disease (AD) and delay the onset and progression of AD. Most of the mechanisms underlying these effects are based on molecular biology and little reports are involved in cellular function. In this study, we were to explore the changes

of synaptic homeostasis in the early pathology (6 months) of APP/PS1/Tau transgenic (3xTg) mice, and the possible mechanism of aerobic exercise improving synaptic plasticity.

**METHODS:** 3xTg mice (2 months old) were randomly divided into exercise groups and sedentary groups (AS, AE), and C57BL/6J mice as cohort control (CS, CE). The exercise groups would run on the treadmill for 16 weeks. Brain slice patch clamp were used to detect the changes of I-O curve, PPF, LTP, LTD, miniature EPSCs (mEPSCs), miniature IPSCs (mIPSCs) and E/I ratio of pyramidal neurons in hippocampal area CA1.

**RESULTS:** In hippocampal area CA1 of AS, the I-O curve ( $0.31 \pm 0.02$ ) was reduced compared with the CS ( $0.60 \pm 0.02$ ,  $p < 0.01$ ), also in LTP ( $151.29 \pm 7.63$  vs  $183.55 \pm 13.71\%$ ,  $p < 0.01$ ), the mEPSCs frequency ( $0.25 \pm 0.02$  vs  $0.39 \pm 0.03$  Hz,  $p < 0.01$ ), the amplitude of mIPSCs ( $23.48 \pm 0.44$  vs  $26.11 \pm 0.55$  pA,  $p < 0.05$ ) and E/I ratio ( $0.51 \pm 0.02$  vs  $0.81 \pm 0.02$ ,  $p < 0.01$ ) of pyramidal neurons. At the interval time of 20 ms, the PPF ( $1.78 \pm 0.08$  vs  $1.55 \pm 0.04$ ,  $p < 0.01$ ) was increased, as were LTD ( $62.61 \pm 3.25$  vs  $76.14 \pm 2.88\%$ ,  $p < 0.01$ ), the amplitude of mEPSCs ( $14.51 \pm 0.34$  vs  $12.83 \pm 0.35$  pA,  $p < 0.01$ ) and the frequency of mIPSCs ( $2.46 \pm 0.19$  vs  $1.99 \pm 0.10$  Hz,  $p < 0.05$ ) of pyramidal neurons. Aerobic exercise apparently reversed the changes above of AS in I-O curve ( $0.74 \pm 0.03$ ), LTP ( $170.97 \pm 5.42\%$ ), the frequency of mEPSCs ( $0.51 \pm 0.04$  Hz), the amplitude of mIPSCs ( $41.20 \pm 1.13$  pA) and E/I ratio ( $0.71 \pm 0.03$ ), and decreased PPF ( $1.42 \pm 0.07$ ), LTD ( $79.01 \pm 4.99\%$ ), the amplitude of mEPSCs ( $11.52 \pm 0.29$  pA) and the frequency of mIPSCs ( $1.72 \pm 0.12$  Hz). Meanwhile, those electrophysiology signals were also increased in the CE group.

**CONCLUSIONS:** Aerobic exercise could regulate synaptic homeostasis plasticity by increasing mEPSCs frequency and mIPSCs amplitude, and decreasing mEPSCs amplitude and mIPSCs frequency. Then it would improve basic synaptic transmission and LTP, weaken LTD in hippocampal area CA1 of the early pathology in 3xTg mice to enhance synaptic plasticity.

**3002** May 29 1:30 PM - 1:45 PM

### Is Aerobic Fitness Associated With The Dopaminergic System? Evidence From Spontaneous Eye Blink Rate

Ryuta Kuwamizu, Kazuya Suwabe, Takemune Fukuie, Genta Ochi, Taichi Hiraga, Hideaki Soya. *Faculty of Health and Sport Sciences, University of Tsukuba, Tsukuba, Ibaraki, Japan.*  
(No relevant relationships reported)

Many studies, including ours, have revealed that aerobic fitness, as a physiological indicator of physical activity, is associated with cognitive performance based on the prefrontal cortex and the hippocampus (Hyodo, Soya *et al.*, *NeuroImage*, 2016; Suwabe, Soya *et al.*, *Sci Rep*, 2017). As a potential neurobiological basis for this, the brain dopaminergic system is postulated by animal and a few human studies. Current studies hypothesize that higher physical activity levels may prevent elderly people from declining cognitive function probably via a protective effect against reduced dopamine D2/3-receptor availability (Köhnecke *et al.*, *NeuroImage*, 2018; Jonasson *et al.*, *NeuroImage*, 2019). It remains uncertain, however, whether this association could generally be observed in a healthy population without cognitive decline. To this end, we measured spontaneous eye blink rate (EBR), a potential non-invasive marker for activity in the dopaminergic system related to D2/3-receptors (Groman *et al.*, *J Neurosci*, 2014). **PURPOSE:** We examined the association between aerobic fitness, physical activity and EBR as an indicator of the dopaminergic system in healthy young adults. **METHODS:** Thirty-six 18- to 24-yr-old healthy young men completed an aerobic fitness assessment ( $V(\bullet)O_{2peak}$ ) using a graded exercise test with a recumbent ergometer, self-reported on their leisure-time physical activity (the Japanese language version of the International Physical Activities Questionnaire), and had their EBR measured while staring at a fixation cross while at rest. **RESULTS:** Greater aerobic fitness ( $V(\bullet)O_{2peak}$ ) was correlated with both higher leisure-time physical activity ( $r = 0.51$ ,  $p < 0.01$ ) and higher EBR ( $r = 0.40$ ,  $p < 0.05$ ) after controlling for age. In addition, Leisure-time physical activity was also positively correlated with EBR ( $r = 0.37$ ,  $p < 0.05$ ). **CONCLUSION:** These results show that aerobic fitness is associated with EBR in healthy young adults, supporting the hypothesis above that aerobic fitness is an indicator of physical activity associated with cognitive function via the dopaminergic system related to D2/3-receptors.

**3003** May 29 1:45 PM - 2:00 PM

### Forced Running Exercise Modulates Amyloid-beta Protein Clearance Anddegradation Pathways In Prevention Of Alzheimer'S Disease

Li ZHAO<sup>1</sup>, Yangyang TONG<sup>1</sup>, Ziqi Zhao<sup>2</sup>. <sup>1</sup>Beijing Sport University, Beijing, China. <sup>2</sup>Chinese Academy of Sciences, Beijing, China.  
Email: zhaolispring@126.com  
(No relevant relationships reported)

**PURPOSE:** Most of studies demonstrate positive effects of exercise on A $\beta$  levels in Alzheimer's Disease (AD) model, while a small subset of investigations reports no change. Nearly all studies using the APP/PS1 mouse showed reduced A $\beta$  levels after

a forced exercise, but studies using the 3xTg-AD mouse did not after a voluntary exercise. Discrepancies in the data may be due to the wide range of transgenic animal strains, starting age, intervention type, and length of intervention used in these studies. Here, we used 12-week protocol starting with different age of 3xTg mouse to investigate forced running effect on A $\beta$  levels.

**METHODS:** 6, 9 and 12 months 3xTg mice were randomly divided into exercise and sedentary groups, 2-month 3xTg mice as the control group. The exercise groups would run on the treadmill for 12 wks. Immunofluorescence and Dot blot were used to detect A $\beta$  plaque and soluble A $\beta$  respectively. Western blot was used to detect  $\beta$ -site APP cleaving enzyme (BACE1) and A $\beta$  degradation or clearance enzyme Neprilysin (NEP) in the cerebral cortex and hippocampus and Insulin-degrading enzyme (IDE) in liver.

**RESULTS:** The hippocampal and cortical tissue showed soluble A $\beta$  increased with age. Obvious A $\beta$  plaque accumulation was showed at 9 and 12-month-old. With AD-pathology the BACE1 levels were increased ( $p < 0.05$ ) while NEP expression decreased ( $p < 0.05$ ) in hippocampus and cortex, and IDE content decreased ( $p < 0.05$ ) in liver. Disturbances went more severe with aging. Exercise treatment ameliorated soluble A $\beta$  aggregation and A $\beta$  plaque, BACE1 ( $0.70 \pm 0.13$ ,  $0.78 \pm 0.13$ ,  $0.81 \pm 0.08/1.06 \pm 0.12$ ,  $0.78 \pm 0.08$ ,  $0.69 \pm 0.10$ ,  $p < 0.05$ ), NEP ( $1.50 \pm 0.24$ ,  $1.19 \pm 0.12$ ,  $1.20 \pm 0.12/1.16 \pm 0.04$ ,  $1.22 \pm 0.26$ ,  $1.31 \pm 0.12$ ,  $p < 0.05$ ) and IDE ( $1.07 \pm 0.13$ ,  $1.19 \pm 0.20$ ,  $1.24 \pm 0.12$ ,  $p < 0.05$ ) changes were partially protected by exercise.

**CONCLUSIONS:** In the 3xTg-AD mice at different age of 6, 9 and 12 months, 12 wks forcing treadmill exercise can obviously reduce the levels of A $\beta$  with lower BACE1, higher NEP expression in the brain and IDE of the liver. Although it is not definite that forced exercise interventions are better for reducing A $\beta$  levels, the benefits of exercise interventions still support the value of this healthy life-style against neurodegeneration.

**3004** May 29 2:00 PM - 2:15 PM

### Effects Of Aerobic Exercise On The Nicotine Addiction Induced Inhibitory Synaptic Plasticity In The Vta

Yan Li, Jie Zhang, Li Zhao. *Beijing Sport University, Beijing, China.*

(No relevant relationships reported)

**PURPOSE:** Disinhibition of the ventral tegmental area (VTA) dopamine neurons has been implicated in nicotine addiction. This study aimed to investigate the effect of aerobic exercise on the nicotine addiction behavior in mice, and the effect on GABAergic transmission and dopaminergic activity in the VTA.

**METHODS:** 2 months old male C57BL/6J mice were randomly divided into sedentary + saline group (SS), sedentary + nicotine group (SN), exercise + saline group (ES) and exercise + nicotine group (EN) respectively. The ES and EN groups were made to run on the treadmill for 1 hour per one day, five times a week, for 12 weeks. The exercise workload consisted of running at a speed of 12 m/min for the first 10 min, 15 m/min for the last 50 min, with 0% grade of inclination. The conditioned place preference (CPP) assay was used to evaluate nicotine addiction related behavior. In the CPP assay, SN and EN mice were given an intraperitoneal (i.p.) injection of nicotine (0.5 mg/kg) while SS and ES mice were given an injection of saline. Patch clamp was used to investigate the dopamine neuron excitability and GABAergic transmission in the VTA. Immunofluorescence was used to detect the expression of tyrosine hydroxylase (TH) in the VTA.

**RESULTS:** 8 weeks of treadmill exercise decreased nicotine exposure induced CPP expression (CPP score, SS,  $-33.69 \pm 16.57$ ; SN,  $121.51 \pm 14.53$ ; ES,  $-21.72 \pm 15.12$ ; EN,  $66.34 \pm 15.12$ ; SS vs. SN,  $p < 0.001$ ; EN vs. SN,  $p < 0.05$ , two-way ANOVA). Exercise decreased nicotine CPP induced dopamine neuron hyperexcitability (SS,  $3.36 \pm 0.45$ ; SN,  $6.63 \pm 0.56$ ; ES,  $3.22 \pm 0.48$ ; EN,  $4.60 \pm 0.18$ ; SS vs. SN,  $p < 0.001$ ; EN vs. SN,  $p < 0.01$ , two-way ANOVA). Exercise decreased nicotine CPP induced increase of TH expression in the VTA (relative fluorescence intensity, SS 1.00; SN,  $2.03 \pm 0.15$ ; ES,  $1.38 \pm 0.06$ ; EN,  $1.04 \pm 0.07$ ; SS vs. SN,  $p < 0.001$ ; EN vs. SN,  $p < 0.001$ , two-way ANOVA). Exercise restored nicotine CPP induced impairment of GABA transmission in the VTA (sIPSCs frequency, % as baseline, SS,  $154.62 \pm 6.86\%$ ; SN,  $102.19 \pm 6.20$ ; ES,  $141.36 \pm 5.84$ ; EN,  $121.82 \pm 4.41$ ; SS vs. SN,  $p < 0.001$ ; EN vs. SN,  $p < 0.05$ , two-way ANOVA).

**CONCLUSIONS:** Aerobic exercise restores nicotine addiction induced VTA dopamine neuron hyperexcitability by enhancing the inhibitory transmission. Supported by the China Postdoctoral Science Foundation (2018M641260, 2019T120067).

3005 May 29 2:15 PM - 2:30 PM

**Pupillary Responses Indicate Working Memory Processing Differences: Implications For Healthy And Clinical Populations**

Christina B. Vander Vegt<sup>1</sup>, Lawrence Gregory Appelbaum<sup>2</sup>, Jason P. Mihalik, FACSM<sup>1</sup>, Kevin M. Guskiewicz, FACSM<sup>1</sup>, Johna K. Register-Mihalik<sup>1</sup>. <sup>1</sup>The University of North Carolina at Chapel Hill, Chapel Hill, NC. <sup>2</sup>Duke University, Durham, NC. Email: cbv33@email.unc.edu  
(No relevant relationships reported)

Task-evoked pupillary responses (PR) are established psychophysiological measures for neural resource allocation. During working memory tasks, pupils dilate proportional to increasing cognitive demands and constrict when demands exceed resource availability. PRs have demonstrated greater sensitivity to load-dependent processing differences in clinical populations, beyond performance accuracy, under high cognitive demands. Few studies have examined concussion history, sex, and performance accuracy effects on PRs across varying cognitive load levels.

**PURPOSE:** To examine effects of concussion history, sex, and performance accuracy on PR in healthy individuals during a digit-span task. **METHODS:** Participants self-reported sex (female vs. male) and concussion history (yes vs. no), and completed a backwards digit-span task in a single testing session. A virtual reality headset with 60Hz infrared eye tracking displayed the task and recorded pupil size fluctuations. Pupil size (diameter in mm) was recorded before each trial (baseline=3sec) and following randomly presented digit sequences between 4 and 14 digits long (retention=2sec). PR was calculated as the mean size during retention, normalized to mean baseline. Accuracy was calculated as the proportion of correctly recalled digits by serial position. A mixed effects model examined concussion history, sex, and accuracy effects on PR across sequence-lengths (*a priori*  $\alpha=0.05$ ). **RESULTS:** 40 participants were included [age=21.9±2.1years; males=50%; 17 (43%) with concussion history]. There were significant effects of sex ( $F_{1,36}=15.66, p<0.001$ ) and accuracy ( $F_{1,2588}=4.70, p<0.03$ ) on overall relative PR controlling for all other model predictors and interactions. Specifically, females exhibited smaller mean PRs compared to males. Smaller mean PRs were also associated with higher average task accuracy. **CONCLUSION:** In our study, females exhibited smaller overall pupillary responses during a digit-span working memory task compared to males, indicating potential sex-dependent processing differences. The association between better task accuracy and smaller PRs may further support PR measures to better inform neurocognitive processing differences in healthy and clinical populations, when demands exceed cognitive resource availability.

3006 May 29 2:30 PM - 2:45 PM

**Behavioral-induced Prefrontal Cortex Activation And Episodic Memory Function**

Lindsay Crawford, Paul D. Loprinzi, Grace Burnett, Morgan Chism, Gina Robinson, Jeremiah Blough. University of Mississippi, Oxford, MS.  
(No relevant relationships reported)

**PURPOSE** Here we evaluated the effects of several behaviors (e.g., acute exercise, fist clenching, and saccades) on episodic memory, and whether prefrontal cortex oxygenation mediated these relationships. Six experiments were conducted to evaluate these direct and indirect effects. **METHODS & RESULTS** Experiment 1 was a four-visit, within-subject, counterbalanced randomized controlled experiment. The visits included 1) exercise and saccadic eye movements, 2) exercise only, 3) saccadic eye movements only, and 4) no exercise and no saccadic eye movements (control). A word-list based episodic memory assessment was employed, including a long-term memory evaluation. The RM ANOVA was statistically significant ( $P=0.01, \eta_p^2=0.15$ ), as the number of words recalled at the delay period were, respectively, 7.8 (2.7), 8.1 (2.7), 8.1 (2.3), and 6.6 (2.8). In our second experiment, we evaluated the effects of saccadic eye movements on prefrontal cortex oxygenation (PFC O<sub>2</sub>Hb), a proxy for neuronal activity. We found a main effect for time over a three-minute period, ( $P<0.001, \eta_p^2=0.31$ ), representing higher oxygenation levels during saccadic eye movement. In our third experiment, we evaluated the effects of acute exercise on PFC O<sub>2</sub>Hb, which also demonstrated an increase in PFC O<sub>2</sub>Hb across time, ( $P=0.04, \eta_p^2=0.09$ ). Experiment 4 replicated Experiment 1, but instead of saccadic eye movements, used a fist clenching protocol. The RM ANOVA was statistically significant ( $P<0.001, \eta_p^2=0.46$ ), with memory being significantly better for the exercise only, fist only, and exercise + exercise visit compared to control. Experiment 5 evaluated the effects of fist clenching on PFC O<sub>2</sub>Hb. Results demonstrated a significant main effect for time, with oxygenation increasing during fist clenching, ( $P<0.001, \eta_p^2=0.35$ ). Experiment 6 demonstrated that PFC oxygenation was statistically significantly positively associated with episodic memory function, in that, for every 1  $\mu$ M increase in oxygenation during memory encoding, there was a 0.27 increase in the number of words (out of 8) recalled ( $b=0.27; 95\% \text{ CI}: 0.02, 0.52; p = .03$ ). **CONCLUSION** These six experiments suggest that several behaviors may improve memory function and may, potentially, do so via increases in PFC O<sub>2</sub>Hb.

3007 May 29 2:45 PM - 3:00 PM

**Relationships Between Muscular Strength, Cognitive Control, And Hippocampal Dependent Relational Memory Function**

Jeongwoon Kim<sup>1</sup>, Colleen F. McKenna<sup>1</sup>, Amadeo F. Salvador<sup>1</sup>, Susannah E. Scaroni<sup>1</sup>, Jonathan Cerna<sup>1</sup>, Corinne N. Cannavale<sup>1</sup>, Scott A. Paluska, FACSM<sup>1</sup>, Michael De Lisio<sup>2</sup>, Nicholas A. Burd<sup>1</sup>, Naiman A. Khan<sup>1</sup>. <sup>1</sup>University of Illinois, Urbana-Champaign, IL. <sup>2</sup>University of Ottawa, Ottawa, ON, Canada. (Sponsor: Scott A. Paluska, FACSM)  
Email: jk51@illinois.edu  
(No relevant relationships reported)

**PURPOSE:** An increasing number of studies have shown a positive correlation between aerobic fitness and cognitive control, and hippocampal memory performance. However, the relationship between muscular strength and specific domains of cognitive function has not yet been well elucidated. The aim of this study was to examine cross-sectional relationships between muscular strength and cognitive control (i.e., attention and inhibitory control), as well as hippocampal-dependent relational memory. **METHODS:** Adults (N=35) between 45 and 64 years underwent strength assessments measured by leg extension one-repetition maximum (1RM), maximal voluntary isometric contraction (MVC), and isokinetic knee extension. Selective attention, inhibitory control, and hippocampal-dependent relational memory was assessed using the Flanker, Go/NoGo, and a Spatial Reconstruction task, respectively. Lean mass was measured via dual X-ray absorptiometry (DXA). **RESULTS:** Following adjustment for covariates (i.e., age, sex, and lean mass), greater MVC ( $r=-0.37, P=0.04$ ) and isokinetic peak knee extension torques measured at 60°·s<sup>-1</sup> ( $r=-0.47, P=0.008$ ), 120°·s<sup>-1</sup> ( $r=-0.37, P=0.04$ ), and 180°·s<sup>-1</sup> ( $r=-0.39, P=0.03$ ) were related to faster incongruent reaction time during the Flanker task. Misplacement error during spatial reconstruction task was inversely related to peak knee extension torques measured at 120°·s<sup>-1</sup> at the trend level ( $r=-0.36, P=0.05$ ). No significant associations were observed for Go/NoGo accuracy (all  $r$ 's  $\leq -0.34$ , all  $P$ 's  $\geq 0.6$ ). **CONCLUSION:** Individuals with greater muscular strength exhibit greater cognitive function. These findings provide insights into the potential for domain-specific interrelationships between muscular strength attentional abilities over memory performance and inhibitory control. This work was funded by The Beef Checkoff.

**F-14 Free Communication/Slide - Older Adults: Methods, Interventions, and Outcomes**

Friday, May 29, 2020, 1:00 PM - 3:00 PM  
Room: CC-2022

**3008 Chair:** Loretta DiPietro, FACSM. *The George Washington University School of Public Health and Health Services, Washington, DC.*

(No relevant relationships reported)

3009 May 29 1:00 PM - 1:15 PM

**Effect Of Type And Intensity Of Community-based Exercise Interventions In Older Women**

Emmanuel Gomes Ciolac<sup>1</sup>, Gabriel Souza Zanini<sup>1</sup>, Vanessa Teixeira Amaral<sup>1</sup>, Gabriel Falcão<sup>1</sup>, Bianca Fernandes<sup>1</sup>, Isabela Roque Marçal<sup>1</sup>, Awassi Yophiwa Ngoman<sup>1</sup>, Guilherme Veiga Guimarães<sup>2</sup>. <sup>1</sup>São Paulo State University - UNESP, Bauru, Brazil. <sup>2</sup>University of São Paulo - USP, São Paulo, Brazil. Email: emmanuel.ciolac@unesp.br  
(No relevant relationships reported)

**PURPOSE:** To assess the effect of different community-based exercise interventions on hemodynamic and functional variables in older women. **METHODS:** 33 sedentary or insufficiently active older women (69 ± 5 ys) were randomly assigned to perform a twice-weekly community-based moderate-intensity continuous aerobic training plus resistance training (MCT+RT), high-intensity interval training plus resistance training (HIT+RT) or resistance training (RT) programs. Anthropometric (weight, height and BMI), hemodynamic (resting blood pressure and carotid-femoral pulse wave velocity) and functional variables (seat-and-reach, handgrip, five times sit-to-stand (FTSS), timed up-and-go (TUG), and 6-minute walking (6MW) tests) were assessed before and after 9 months of follow-up.

**RESULTS:** There were no significant difference between groups in any variable at baseline. Anthropometric and hemodynamic variables, as well as seat-and-reach and handgrip did not change during follow-up in any group. However, FTSS, TUG and 6MW improved ( $P < 0.05$ ) similarly between groups during follow-up. (Table 1).

**CONCLUSION:** The present preliminary results suggest that twice-weekly community-based exercise programs of different types and intensity are effective to improve functional capacity, but not anthropometric and hemodynamic variables, in older women.

Table 1. Anthropometric, hemodynamic and functional variables before and after 9 month follow-up

| Variable       | MICT_RT    |             | HIIT+RT     |              | RT         |              |
|----------------|------------|-------------|-------------|--------------|------------|--------------|
|                | Before     | After       | Before      | After        | Before     | After        |
| Weight         | 70 ± 12    | 74 ± 14     | 66 ± 9      | 63 ± 10      | 72 ± 16    | 71 ± 16      |
| BMI            | 28.2 ± 4.2 | 28.5 ± 5.1  | 27.0 ± 4.4  | 26.2 ± 4.4   | 29.9 ± 5.6 | 29.5 ± 5.3   |
| Systolic BP    | 118 ± 11   | 122 ± 8     | 124 ± 19    | 128 ± 15     | 131 ± 16   | 127 ± 20     |
| Diastolic BP   | 64 ± 6     | 66 ± 7      | 63 ± 7      | 69 ± 9       | 70 ± 12    | 72 ± 9       |
| PWV            | 9.4 ± 2.3  | 9.0 ± 3.0   | 10.5 ± 10.1 | 10.1 ± 1.9   | 10.6 ± 1.7 | 11.6 ± 2.1   |
| Seat and reach | 22.5 ± 7.7 | 28.0 ± 8.2  | 23.0 ± 21.5 | 21.5 ± 8.0   | 28.5 ± 5.6 | 28.0 ± 6.5   |
| Handgrip       | 25.0 ± 5.3 | 24.0 ± 4.3  | 22.5 ± 5.9  | 25.5 ± 4.9   | 26.0 ± 5.7 | 27.5 ± 6.9   |
| FTSS           | 11.6 ± 2.1 | 7.8 ± 1.6** | 11.1 ± 2.9  | 8.9 ± 1.7**  | 10.4 ± 3.6 | 7.6 ± 1.1*** |
| TUG            | 8.3 ± 1.1  | 6.2 ± 1.3*  | 7.6 ± 2.5   | 5.9 ± 1.1*** | 7.4 ± 2.0  | 6.2 ± 1.6*   |
| 6MW            | 482 ± 33   | 512 ± 43*   | 464 ± 88    | 536 ± 53***  | 462 ± 82   | 503 ± 53*    |

FTSS: five time sit-to-stand test; HIIT+RT: high-intensity interval training plus resistance training group; MICT+ moderate-intensity continuous training plus resistance training group; PWV: carotid-femoral pulse wave velocity; RT: resistance training group; TUG: timed up-and-go test; 6MW: six minute walking test; Asterisk: significant difference from before follow-up at the same group (\* =  $P < 0.05$ ; \*\* =  $P < 0.01$ ; \*\*\* =  $P < 0.001$ )

**3010 May 29 1:15 PM - 1:30 PM**  
**Associations Between Accelerometer-derived Daily Physical Activity Patterns And Frailty Among Older Adults At Elevated Risk For Falls**

Amal A. Wanigatunga<sup>1</sup>, Jacek K. Urbanek<sup>2</sup>, David L. Roth<sup>2</sup>, Erin D. Michos<sup>2</sup>, Qian-Li Xue<sup>2</sup>, Karen Bandeen-Roche<sup>1</sup>, Jeremy D. Walston<sup>2</sup>, Lawrence J. Appel<sup>2</sup>, Jennifer A. Schrack<sup>1</sup>. <sup>1</sup>Johns Hopkins Bloomberg School of Public Health, Baltimore, MD. <sup>2</sup>Johns Hopkins School of Medicine, Baltimore, MD. (Sponsor: Todd M. Manini, FACSM)  
 Email: awaniga1@jhu.edu  
 (No relevant relationships reported)

**BACKGROUND:** With aging, the degradation of free-living physical activity patterns may indicate phenotypic frailty.

**PURPOSE:** To determine the baseline, cross-sectional association between accelerometer-derived physical activity patterns and frailty in participants of Study to Understand Fall Reduction and Vitamin D in You (STURDY) trial

**METHODS:** Baseline wrist-worn accelerometer and frailty data were collected from 505 STURDY participants (mean age 77 (SD=5.5) years; 43% women). Accelerometer data collected over 24-hour, 7-day periods were used to derive continuous physical activity metrics, including mean activity minutes/day and activity fragmentation (reciprocal of the average length of activity bouts). Robust, pre-frail and frail statuses were identified using a modified version of the physical frailty phenotype defined as having 0, 1, or ≥2 (of 4) phenotypes, respectively: weight loss, exhaustion, slowness, and weakness. Using multiple logistic regression models, the interaction between age and each accelerometer metric was examined to estimate an odds ratio between frailty and pre-frailty/robustness.

**RESULTS:** Robust (30%) and pre-frail participants (48%) had similar physical activity patterns, spending approximately 6.5 hours/day in activity with a 25% level of activity fragmentation, while frail participants (28%) appeared to accumulate less activity in a more fragmented manner (5.8 hours/day and 29% activity fragmentation). The odds of frailty (versus pre-frailty/robustness) was lower by a factor of 3% with each higher year of age by higher hour of activity (OR:0.97, 95% CI:0.94-0.99, age x activity interaction  $p=0.01$ ). The interaction between age and fragmentation was not significant ( $p=0.39$ ) but higher fragmentation was associated with a higher likelihood of frailty (OR:1.04, 95% CI:1.01-1.07,  $p=0.02$ ).

**CONCLUSION:** Our results show an inverse relationship between objectively-measured physical activity and frailty that becomes stronger with age among at-risk older adults. More daily activity breaks (activity fragmentation) was associated with

higher frailty odds; an association that remained stable across age. Our findings warrant further investigation into whether longitudinal declines in objectively-measured physical activity patterns precede frailty onset.

**3011 May 29 1:30 PM - 1:45 PM**  
**Abstract Withdrawn**

**3012 May 29 1:45 PM - 2:00 PM**  
**Effects Of Community-based Exercise Training And Detraining On Hemodynamic Variables In Older Women: Role Of Intensity And Modality**

Vanessa Teixeira Amaral, Gabriel Souza Zaninni, Guilherme Falcão, Isabela Roque Marçal, Bianca Fernandes, Awassi Yophiwa Ngomane, Emmanuel Gomes Ciolac. São Paulo State University - UNESP, Bauru, Brazil.  
 Email: amaral.vtm@gmail.com  
 (No relevant relationships reported)

Regular exercise is associated with a reduced risk of developing chronic diseases and improved physical capacity. However, to our knowledge, the effects of modality, intensity and consequences of detraining have not yet been investigated in the elderly population. We sought to evaluate and compare the effect of modality and intensity (moderate intensity continuous aerobic training - MICT, high intensity interval aerobic training - HIIT, resistance training - RT, or combined - MICT + RT and HIIT + RT) of a training program, on the behavior of hemodynamic and functional variables of elderly women after 12 weeks of training and 16 weeks after their interruption.

**PURPOSE:** To verify the effect of exercise modality and intensity on the hemodynamic variables of the elderly.

**METHODS:** 69 elderly women (69.19 ± 7.89 years) were randomized into MICT (n = 29), RT (n = 15), MICT + RT (n = 12), and HIIT + RT (n = 13). Participants performed physical exercises twice a week during 60 minutes. The variables investigated were blood pressure (BP), heart rate (HR), abdominal circumference (AC) at pre, after 12 weeks of intervention, and after 16 weeks of training interruption (detraining).

**RESULTS:** Diastolic blood pressure decreased in HIIT + RT between pre and untrained ( $p < 0.01$ ) and in RT between post and untrained ( $p < 0.02$ ). There was a significant increase in HR between post and detraining MICT ( $p < 0.02$ ) and a decrease in MICT + RT between pre and post training ( $p < 0.000$ ), with no significant difference in detraining. AC decreased in HIIT + RT between pre and post ( $p < 0.01$ ), in RT between pre and detraining ( $p < 0.009$ ) and post and detraining ( $p < 0.00$ ). There was an increase in post and detraining WC for MICT ( $p < 0.05$ ) and MICT + RT ( $p < 0.03$ ).

**CONCLUSION:** Isolated or combined aerobic training can be effective in reducing blood pressure levels. Resistance training was also effective for reducing abdominal fat levels.

Table 1. Blood pressure, heart rate and abdominal circumference during follow-up

|                                 |            | HIIT+RT  | MICT+RT   | MICT     | RT        |
|---------------------------------|------------|----------|-----------|----------|-----------|
| Systolic blood pressure (mmHg)  | Pre        | 136 ± 17 | 129 ± 19  | 131 ± 19 | 127 ± 17  |
|                                 | Post       | 132 ± 27 | 126 ± 17  | 133 ± 17 | 120 ± 20  |
|                                 | Detraining | 129 ± 14 | 119 ± 15  | 126 ± 20 | 133 ± 14  |
| Diastolic blood pressure (mmHg) | Pre        | 78 ± 9   | 68 ± 10   | 68 ± 11  | 71 ± 9    |
|                                 | Post       | 73 ± 13  | 70 ± 7    | 71 ± 8   | 68 ± 10   |
|                                 | Detraining | 72 ± 7*  | 66 ± 9    | 66 ± 9   | 72 ± 10†  |
| Heart rate (bpm)                | Pre        | 74 ± 8   | 73 ± 8    | 70 ± 8   | 69 ± 10   |
|                                 | Post       | 70 ± 7   | 70 ± 7*   | 71 ± 8   | 68 ± 10   |
|                                 | Detraining | 75 ± 6   | 72 ± 12   | 73 ± 13† | 73 ± 8    |
| Abdominal circumference (cm)    | Pre        | 96 ± 13  | 102 ± 17  | 98 ± 9   | 104 ± 12  |
|                                 | Post       | 91 ± 14* | 97 ± 15   | 97 ± 10  | 105 ± 12* |
|                                 | Detraining | 97 ± 12  | 108 ± 21† | 99 ± 10† | 99 ± 11*† |

HIIT+RT: high-intensity interval training plus resistance training; MICT: moderate-intensity continuous training; MICT+RT: moderate-intensity continuous training plus resistance training; RT: resistance training; \* different from pre ( $P < 0.05$ ); †: different from pos ( $P < 0.05$ )

### 3013 May 29 2:00 PM - 2:15 PM

#### Effects Of Moderate Versus Vigorous Intensity Exercise Training In Older Adults With Prediabetes

Seth A. Creasy<sup>1</sup>, Jennifer M. Blankenship<sup>1</sup>, Shelby L. Panter<sup>1</sup>, Victoria A. Catenacci<sup>1</sup>, Kenneth P. Wright, Jr<sup>2</sup>, Jane E.B. Reusch<sup>1</sup>, Kerry L. Hildreth<sup>1</sup>, Edward L. Melanson, FACSM<sup>1</sup>.  
<sup>1</sup>University of Colorado- Anschutz Medical Campus, Aurora, CO. <sup>2</sup>University of Colorado, Boulder, CO. (Sponsor: Edward Melanson, FACSM)  
 Email: seth.creasy@cuanschutz.edu  
 (No relevant relationships reported)

**PURPOSE:** Aerobic exercise is recommended to improve glycemic control; however, the optimal intensity of exercise for older adults with prediabetes is unknown. The objective of this pilot study was to compare the effects of moderate vs. vigorous intensity aerobic exercise on glycemic control and non-exercise physical activity (NEPA). **METHODS:** 19 older adults (14F; 68.1 ± 5.8 yrs) with prediabetes (HbA1c 5.7-6.4% or fasting glucose 100-125 mg/dl) were randomized to 12-weeks of supervised aerobic exercise (45-min sessions 4 days/wk) at either moderate (MOD: 60-65% HR<sub>max</sub>) or vigorous (VIG: 80-85% HR<sub>max</sub>) intensity. Free-living glycemic control (24h mean; percent of day ≥140 mg/dL) was measured using continuous glucose monitors (CGM, Dexcom). NEPA (>1.5 METs, excluding exercise sessions) was assessed using a thigh worn accelerometer (ActivPAL v4). A 3h Oral glucose tolerance test (OGTT, 75g) was performed at baseline and following the exercise intervention (72-96h following the last exercise bout) to compare to free-living CGM and as measure of insulin sensitivity (Matsuda Index). Data are presented as mean±SE. **RESULTS:** Adherence rates to the exercise interventions were 85±9% and 89±3% in MOD and VIG with mean heart rates during exercise of 99±1 bpm (65% HR<sub>max</sub>) and 123±4 bpm (79% HR<sub>max</sub>), respectively. Mean 24h glucose (-8.4±6.4 vs. -2.2±6.7 mg/dl) and percent of day >140 mg/dL (-9.7±11.0% vs. 0.7±4.6%) did not significantly change in MOD or VIG, respectively. However, there was a significant group by time interaction (p=0.05) for change in insulin sensitivity in MOD (+2.4±1.1) and VIG (-0.6±0.8). There were no differences between groups for change in NEPA, fasting glucose, or 2h glucose. Changes in free-living CGM were not significantly correlated with changes in OGTT outcomes. **CONCLUSION:** In older men and women with prediabetes, both MOD and VIG had minimal effects on free-living glycemic control, but MOD induced greater improvements in insulin sensitivity. These preliminary results suggest that a more comprehensive lifestyle intervention combining dietary intervention and exercise may be needed to improve glycemic control in this population.

### 3014 May 29 2:15 PM - 2:30 PM

#### The Stay Strong, Stay Healthy Program's Effect On Fall Risk In Older Adults

Kelsey J. Weitzel, Breanne S. Baker, Lisa A. Royse, Stephen D. Ball, Dana L. Duren. University of Missouri, Columbia, MO.  
 (Sponsor: Dr. Jill Kanaley, FACSM)  
 Email: kelsweitzel@gmail.com  
 (No relevant relationships reported)

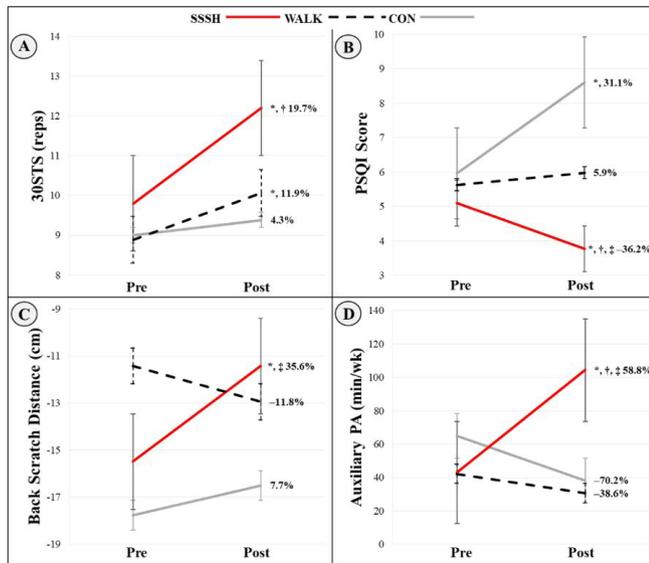
Falling and fear of falls among older adults can have significant impacts on daily life such as restricted activity, functional decline, and social isolation. Exercise interventions need to target modifiable risk factors to have the greatest impact. **PURPOSE:** The first aim was to determine the effectiveness of an eight-week Stay Strong, Stay Healthy (SSSH) exercise intervention on older adults' fear of falling and risk of falls. The second aim was to determine the strongest predictors of reported number of falls among older adults. **METHODS:** 60 adults over the age of 60 yrs, were randomized into SSSH, active control (WALK), or sedentary control (CON) groups. 46 participants (SSSH n=15, WALK n=17, CON n=14) completed pre/post intervention questionnaires on physical activity (PA), fear of falling, and sleep quality using the Pittsburgh Sleep Quality Index Survey (PSQI). Participants also completed the 8 ft timed up and go (TUG) and 30 s sit to stand (30STS), dynamic balance tasks and grip strength testing. Repeated measures ANOVAs were used to determine group (SSSH, WALK, CON) × time (pre, post) interaction effects for TUG, 30STS, and grip strength; one-way ANOVAs were used to analyze percent changes (%Δ); and simple linear regression was used to predict the number of falls in the last 12 months; alpha was set at 0.05. **RESULTS:** SSSH and WALK significantly improved 30STS performance by 2.4 repetitions and 1.1 repetitions, respectively, while CON did not improve. PSQI scores significantly increased (worsened) in CON (p=0.040), did not change in WALK, and decreased (improved) by 1.3 points in SSSH (p=0.009). Reported PA did not change for WALK or CON; however, SSSH increased by 60+ min/wk (p=0.049). A significant time effect was observed as TUG times decreased and grip strength did not change for all groups. CON and WALK increased their overall fear of falling scores by 7.7% and 3.9% respectively, while SSSH decreased by 2.3%. The strongest predictive model for the number of falls reported in the past 12 months included PSQI scores, PA, and grip strength (R<sup>2</sup>=0.282; p=0.003). **CONCLUSIONS:** These data suggest participation in eight weeks of the SSSH significantly improves important modifiable risk factors (e.g., sleep and PA), and reduced fear of falling scores which is consistent with our prediction model for the number of falls sustained.

### 3015 May 29 2:30 PM - 2:45 PM

#### The Stay Strong, Stay Healthy Program Improves Physical Function And Fall Risk In Older Adults

Breanne S. Baker, Kelsey J. Weitzel, Lisa A. Royse, Stephen D. Ball, Dana L. Duren. University of Missouri, Columbia, MO.  
 (Sponsor: Dr. Jill Kanaley, FACSM)  
 Email: bakerbre@health.missouri.edu  
 (No relevant relationships reported)

The aging process, even in the absence of chronic disease, is marked by a decline in the mass, quality, and function of skeletal muscle, increasing the risk of falls. **PURPOSE:** The purpose was to determine effectiveness of an 8-week Stay Strong, Stay Healthy (SSSH) exercise intervention on improving older adults' muscle strength, dynamic balance, and fall risk compared to controls. **METHODS:** 60 adults aged ≥60 yrs, were randomized into SSSH, active control (WALK), or sedentary control (CON) groups. 46 participants (SSSH n=15, WALK n=17, CON n=14) completed pre and post intervention general health and physical activity (PA) questionnaires, the Pittsburgh Sleep Quality Index Survey (PSQI), and total body DXA. Participants also completed the 10 m walk test (10MWT), 8 ft timed up and go (TUG), 30 s sit to stand (30STS), back scratch (BS), sit and reach flexibility tests, and the CDC four phase balance task. Repeated measures ANOVAs were used to determine group (SSSH, WALK, CON) × time (pre, post) interaction effects and percent changes (%Δ) were analyzed using one-way ANOVAs, alpha was set at 0.05. **RESULTS:** SSSH and WALK participants significantly improved 30STS performance by 2.4 repetitions (p < 0.001) and 1.1 repetitions (p = 0.008), respectively, while CON did not improve. PSQI scores significantly increased (worsened) in CON (p = 0.040), did not change in WALK, and decreased (improved) by 1.3 points in SSSH (p = 0.009). Average BS distance for WALK or CON did not change, but SSSH participants improved (+ 4.3 cm, p = 0.040). Reported auxiliary PA did not change for WALK or CON; however, SSSH increased by more than 60 min/wk (p = 0.049). **CONCLUSIONS:** Participation in the 8-week SSSH resistance training program significantly improves lower body strength/coordination, dynamic balance, sleep quality, and engagement in auxiliary PA over sedentary and exercise volume matched walking groups.



**Figure 1.** Significant interactions for 30STS, PSQI, back scratch flexibility, and auxiliary physical activity. \* denotes a significant within group difference from pre ( $p < 0.05$ ). † and ‡ denote significant magnitudes of change greater than CON or WALK respectively ( $p < 0.05$ ).

3016 May 29 2:45 PM - 3:00 PM

**Influence Of Exercise And Gardening Activity On Successful Aging: A Six-year Cohort Study**

Yuxin Yang, Xu Wen. *Zhejiang University, Hangzhou, China.*  
Email: yangyx20@163.com

(No relevant relationships reported)

**Purpose:** Population aging has become a prominent social problem in China. This study aimed to examine the influence of exercise and gardening activity on successful aging (SA).

**Methods:** This study was based on the 2008-2014 data set of Chinese Longitudinal Healthy Longevity Survey (CLHLS). A total of 5245 elderly people aged 65 and older were included in this study. SA was defined as no major illness, being free of disability, normal cognitive function, engaging in social or productive activity, and satisfaction on life. Correlates of SA included demographics (gender and age) and socio-economic feature (education). With activities being measured in 2008 and 2011, SA being assessed both in 2008, 2011 and 2014. Binary logistic regression analysis was used to determine whether these two activities have positive effects on SA.

**Results:** According to the activity data of 2008 and SA situation in 2014, the regression analyses indicated that regular exercise (OR=1.223, 95%CI: 1.001-1.495) and gardening (OR=1.640, 95%CI: 1.272-2.115) were significant predictors to better SA ( $P < 0.05$ ). From the combination activity data of 2008 and 2011, compared with the sedentary elderly, the elderly participated exercise (OR=1.661, 95%CI: 1.286-2.145,  $P < 0.05$ ) or gardening (OR=1.807, 95%CI: 1.331-2.453,  $P < 0.05$ ) continuously were found to have higher odds to be successful agers in 2014. Moreover, the results showed that the elderly just participated from 2011 have higher probability to be successful agers in 2014 than the sedentary elderly, the odds ratios of exercise and gardening were 1.396 and 1.441 respectively.

**Conclusion:** These findings suggest that exercise and gardening activity may have positive effects on SA, and continuous participation has better effects.

**F-32 Thematic Poster - Blood Flow Restriction**

Friday, May 29, 2020, 3:15 PM - 5:15 PM  
Room: CC-2010

3070 **Chair:** Truls Raastad. *Norwegian School of Sport Sciences, Oslo, Norway.*  
(No relevant relationships reported)

3071 Board #1 May 29 3:15 PM - 5:15 PM

**Exercise With Blood Flow Restriction To Improve Muscular And Physical Function After Total Knee Arthroplasty**

Alexander Kuck<sup>1</sup>, Benjamin Cockfield<sup>2</sup>, Alicia DenHerder<sup>1</sup>, Lydia Lytle<sup>3</sup>, Isaac Wedig<sup>4</sup>, Steven Elmer<sup>2</sup>. <sup>1</sup>Central Michigan University, Mt Pleasant, MI. <sup>2</sup>Michigan Technological University, Houghton, MI. <sup>3</sup>Aspirus Keweenaw Outpatient Therapies, Laurium, MI. <sup>4</sup>Michigan Technological University, Houghton, MI.

Email: bacockfi@mtu.edu

(No relevant relationships reported)

After a total knee arthroplasty (TKA), quadriceps strength and physical function can be impaired for several years. Blood flow restriction (BFR) exercise is an effective method to improve muscular and physical function in clinical populations with knee joint pathologies. To date, there are two case studies documenting application of BFR after TKA. A next step is to determine the feasibility of BFR in a larger TKA cohort. **PURPOSE:** To evaluate the effectiveness of a 10wk home-based BFR exercise program to improve muscular and physical function after TKA. **METHODS:** Six adults (age: 59±9yrs, BMI: 33±5) with a unilateral TKA (2.7±1.7yrs post-surgery) performed body weight half squats, isolated knee extension using a resistance band, and walking exercises with BFR 3x/wk for 10wk. During exercise, blood flow in the affected limb was restricted using a 15cm wide thigh cuff inflated to 50% of limb occlusion pressure which was identified using Doppler ultrasound. Outcome measures of vastus lateralis thickness, maximal knee extensor isometric torque, and physical function (repetitions performed during 30s chair stand test, distance covered during 6min walk test) were assessed at baseline and post-training. **RESULTS:** Participants completed 98% of the home-based BFR training sessions and tolerated the exercise program well as joint pain (0.6±0.1cm) and muscle soreness (0.5±0.1cm) were very low (0-10cm visual analogue scale). Vastus lateralis thickness and knee extensor strength in the affected leg increased by 18±11% and 17±13%, respectively (both  $P < 0.05$ ). After training, number of repetitions during the 30s chair stand test increased (11±2 vs. 18±4 repetitions,  $p < 0.01$ ) and this change (6 repetitions) exceeded the minimally important clinical difference. There was a significant increase in distance covered during the 6min walk test (51±28 vs. 556±36m, 9±7%,  $p = 0.03$ ) but this improvement (46m) did not exceed the clinical threshold. **CONCLUSION:** Results from this pilot study are promising and suggest that home-based BFR exercise can be feasible, safe, and effective for improving muscular and physical function after TKA. Further research is needed to confirm these initial findings in a larger randomized TKA control trial.

3072 Board #2 May 29 3:15 PM - 5:15 PM

**Acute Physiological Responses To Low-intensity Exercise With Different Levels Of Blood Flow Restriction**

Jia Wei<sup>1</sup>, Zhengqiu Gu<sup>1</sup>, Yongdi Zou<sup>1</sup>, Xiaolu Wang<sup>1</sup>, George Nassis<sup>2</sup>, Yongming Li<sup>1</sup>. <sup>1</sup>Shanghai University of Sport, Shanghai, China. <sup>2</sup>City Unity College, Athens, Greece.

Email: weijia\_gavin0807@163.com

(No relevant relationships reported)

**PURPOSE:** External pressure is a key factor in blood flow restriction (BFR) training. Previous studies have used a limited range of occlusion pressures to compare the acute physiological and perceptual responses during leg exercise. The aim of this study was twofold: i) to compare the physiological and perceptual responses of low-intensity exercise (LI) with different levels of BFR, and ii) to compare LI with BFR on the bike with high-intensity (HI) exercise without BFR.

**METHODS:** Twenty-one healthy, moderately-trained male (age: 24.6±2.4 yrs;  $VO_{2peak}$ : 47.2±7.0 ml/kg/min, mean±sd) volunteered to perform one maximal graded exercise test on the bike and seven 5-min constant intensity exercise bouts on separate days and in a counterbalanced order. Six bouts were at 40% peak power ( $P_{peak}$ ; LI); one without BFR and five with different levels of BFR (40%, 50%, 60%, 70%, 80% of arterial occlusion pressure, LI-BFR<sub>40/50/60/70/80</sub>). Finally, they performed one HI bout (70%

$P_{peak}$ ) without BFR. Oxygen uptake ( $VO_2$ ), heart rate (HR), blood lactate (BLa), rating of perceived exertion (RPE), and tissue oxygen saturation (TSI) with near-infrared spectroscopy were recorded.

**RESULTS:** Regardless of pressure, HR, BLA and RPE during LI-BFR were higher compared to LI ( $p<0.05$ ), and TSI reduction was greater in LI-BFR (LI-BFR<sub>40/50/60/70/80</sub>:  $-10.6\pm 3.1\%$ ,  $-10.2\pm 4.0\%$ ,  $-10.1\pm 5.1\%$ ,  $-10.0\pm 4.2\%$ ,  $-11.3\pm 4.9\%$ , respectively) than LI ( $-6.0\pm 4.2\%$ ,  $p<0.05$ ). The responses of  $VO_2$ , HR, BLA, RPE and TSI induced by the different levels of BFR applied in LI-BFR were similar. Regardless of pressure, the responses of  $VO_2$ , HR, BLA and RPE induced by LI-BFR was lower than HI ( $p<0.05$ ), except for TSI. TSI change was similar between LI-BFR<sub>40/50/60/70/80</sub> and HI (LI-BFR<sub>40/50/60/70/80</sub> range:  $-10.0\pm 4.2\%$  to  $-11.3\pm 4.9\%$ , HI:  $-11.5\pm 4.5\%$ ).

**CONCLUSION:** It appears that BFR equal to 40% of arterial occlusion pressure is sufficient to reduce TSI. This BFR level seems to stress the physiological mechanisms adequately and there is no need for higher external pressure application. This level of BFR can also produce local hypoxia similar to that during HI. Therefore, low-intensity exercise with BFR could be an alternative exercise mode for individuals who are unable to perform high-intensity exercise.

**3073 Board #3 May 29 3:15 PM - 5:15 PM**  
**Central And Systemic Haematological Responses Are Similar Between Continuous And Intermittent Blood Flow Restricted Resistance Exercise**

Llion A. Roberts<sup>1</sup>, Charlie Davids<sup>2</sup>, Jeff Coombes, FACSM<sup>2</sup>, Jonathan Peake<sup>3</sup>, Truls Raastad<sup>4</sup>. <sup>1</sup>Griffith University, Southport, Australia. <sup>2</sup>University of Queensland, Brisbane, Australia. <sup>3</sup>Queensland University of Technology, Brisbane, Australia. <sup>4</sup>Norwegian School of Sport Science, Oslo, Norway. (Sponsor: Jeff Coombes, FACSM)  
 Email: llion.roberts@griffith.edu.au  
 (No relevant relationships reported)

Resistance training (RT) with blood flow restriction (BFR) induces similar adaptations to traditional RT but uses markedly lower training loads. However, information about the acute exercise pressor, hemodynamic, and local metabolic cost of this training approach is sparse. These data are needed to understand the acute safety implications of this training approach and help identify an optimal BFR protocol. **PURPOSE:** To compare the acute central and systemic cardiovascular, and local metabolic responses to resistance exercise performed with continuous (BFR-C) and intermittent (BFR-I) BFR.

**METHODS:** 12 resistance-trained males (mean  $\pm$  SD) aged  $22.3 \pm 3.2$  yrs,  $1.82 \pm 0.06$  m, and  $84.1 \pm 9.0$  kg performed 4 separate acute resistance training sessions in a random order, each separated by 7 days. Training sessions involved four sets of squat-based RT at 30% of individuals' 1 repetition maximum with 1) no BFR (CON), 2) BFR-C, 3) BFR-I, and 4) traditional high load training at 70% of 1 repetition maximum with no BFR (HL). Systemic blood pressure and derivatives of cardiac output, central aortic blood pressure pulse wave characteristics, and local blood volume and metabolism were assessed periodically during, and after each training session. Data were assessed by two-way ANOVA with Bonferroni-corrected post-hoc comparisons.

**RESULTS:** All sessions similarly increase average metabolic demand, seen by a decreased tissue saturation index ( $-15\%$ , 95% CI 13.3 to 17.4,  $p<0.0001$ ) with no difference between conditions ( $p>0.05$ ). Whilst changes in haemoglobin-derived Vastus Lateralis blood volumes were similar between conditions, they were higher with BFR-C than CON ( $6.97 \mu\text{mol/L}$ , 95% CI 0.2 to 13.6,  $p=0.04$ ) and HL ( $7.9 \mu\text{mol/L}$ , 95% CI 1.2 to 14.8,  $p=0.01$ ). Training equally increased mean systemic mean arterial pressure (MAP) ( $+70.5$  to  $76.6$  mmHg,  $p<0.001$ ) and cardiac output ( $+0.74$  to  $0.96$  L,  $p<0.001$ ) above baseline, with no difference between conditions. Training also equally increased mean aortic MAP ( $+14.8$  to  $24.2$  mmHg,  $p<0.001$ ) above baseline across conditions.

**CONCLUSIONS:** BFR-C and BFR-I cause similar exercise pressor responses comparable with both traditional resistance training, and training without BFR. Adding BFR to resistance training didn't exacerbate the magnitude or duration of the associated cardiovascular stress.

**3074 Board #4 May 29 3:15 PM - 5:15 PM**  
**The Effect Of Blood Flow Restriction Resistance Training On Exercise-induced Hypoalgesia**

Stephen David Patterson, Luke Hughes. St Marys University, Twickenham, United Kingdom.  
 Email: Stephen.patterson@stmarys.ac.uk  
 (No relevant relationships reported)

**PURPOSE:** Exercise-induced hypoalgesia (EIH) describes a reduction in pain sensitivity following exercise, characterised by an elevation in pain threshold or decrease pain intensity ratings following exercise. Recent research suggests that performing light-load resistance exercise with blood flow restriction (BFR-RE) may have a pain-modulation effect. Therefore, the aim of this study was to compare

the magnitude of EIH with BFR-RE to resistance exercise at both low and high intensities. **METHODS:** Twelve recreationally active individuals were recruited to participate. In a randomised crossover design, participants completed 4 experimental trials of resistance exercise ((1) light load resistance exercise (LLRE); (2) BFR-RE with low pressure (BFR40); (3) BFR-RE with high pressure (BFR80) and (4) heavy load resistance exercise (HLRE)). Pressure pain threshold (PPT) was then assessed at multiple body sites (dominant and non-dominant quadriceps and non-dominant trapezius muscle) pre, 5 min, 10 min and 24 hr post exercise. **RESULTS:** There was a two-way interaction effect for the dominant quadriceps site. Post-hoc analysis showed that, compared to LLRE, PPT was higher following BFR40, BFR80 and HLRE. PPT was higher following BFR80 compared to BFR40 and HLRE. At 24h post-exercise, PPTs were  $14.5 \pm 6.7\%$  and  $23.9 \pm 8.2\%$  higher than pre-exercise values in the BFR40 and BFR80 trials, respectively, whereas PPTs had returned to baseline in the LLRE and HLRE trials. Compared to LLRE, the increase in PPT was greater following BFR40 ( $0.28 \pm 0.13$  AU), BFR80 ( $0.64 \pm 0.42$  AU) and HLRE ( $0.34 \pm 0.20$  AU) in the non-dominant quadriceps. At 24h PPTs had returned to baseline. Compared to LLRE, the increase in PPT was greater following BFR40 ( $0.31 \pm 0.27$  AU), BFR80 ( $0.30 \pm 0.17$  AU), and HLRE ( $0.26 \pm 0.13$  AU) for the trapezius. At 24h PPTs had returned to baseline. **CONCLUSIONS:** In conclusion BFR with higher pressure leads to EIH in both dominant and non-dominant limbs suggesting both central and peripheral mechanisms of action.

**3075 Board #5 May 29 3:15 PM - 5:15 PM**  
**Resistance Exercise With Blood Flow Restriction Under Different Occlusion Pressure On Muscular Performance**

Jieming Lu, Zhiqiang Lian, Peng Sun, Wulan Li, Shanyun Liu, Dongqing Xu. Tianjin University of Sport, Tianjin, China.  
 (No relevant relationships reported)

**PURPOSE:** The study compared the effect of low intensity resistance exercise with blood flow restriction (BFR) in the proximal thigh under different occlusion pressure on muscle morphology and function.

**METHODS:** Twenty-seven healthy college students who had no training experience were randomly divided into three groups by different occlusion pressure: 0 mmHg (CON), 120 mmHg (LBFR) and 180 mmHg (HBFR). Before and after 12 weeks training with an inflatable cuff (20% 1RM, half squat, 4 sets, 75 repetitions in total, 3 days a week) in three groups, the muscle thickness (MT) of rectus femoris and medius femoris were assessed by ultrasound for all subjects. The maximal isokinetic torque (IT<sub>max</sub>), relative maximal isokinetic torque (R-IT<sub>max</sub>) and maximal power ( $P_{max}$ ) were measured at angular velocities of 60°/sec by ISOMED 2000 System in dominant low limb of all subjects.

**RESULTS:** The MT of rectus femoris and medius femoris in LBFR increased after training compared with pre-training ( $2.12\pm 0.22$  vs.  $1.99\pm 0.16$  cm and  $2.01\pm 0.09$  vs.  $1.82\pm 0.15$  cm,  $p<0.05$ ), as well as in HBFR ( $2.15\pm 0.16$  vs.  $1.95\pm 0.19$  cm and  $2.02\pm 0.19$  vs.  $1.86\pm 0.14$  cm,  $p<0.01$ ). The IT<sub>max</sub> after training were higher than pre-training not only in LBFR ( $213.00\pm 26.04$  vs.  $204.56\pm 29.16$  Nm,  $p<0.01$ ), but also in HBFR ( $217.00\pm 20.13$  vs.  $190.33\pm 15.71$  Nm,  $p<0.01$ ). A significant increase in R-IT<sub>max</sub> was noted in LBFR than pre-training ( $2.87\pm 0.35$  vs.  $2.74\pm 0.38$  Nm/kg,  $p<0.01$ ), and also in HBFR ( $2.94\pm 0.26$  vs.  $2.57\pm 0.20$  Nm/kg,  $p<0.01$ ). However, there was no significant increase in  $P_{max}$  after training in LBFR ( $124.78\pm 18.93$  vs.  $119.89\pm 13.32$  W,  $p>0.05$ ) or HBFR ( $122.56\pm 16.44$  vs.  $120.26\pm 17.43$  W,  $p>0.05$ ). There was no significant change in MT, IT<sub>max</sub>, R-IT<sub>max</sub> and  $P_{max}$  before and after training in CON ( $p>0.05$ ). Besides, the MT, IT<sub>max</sub> and R-IT<sub>max</sub> in LBFR and HBFR had a significant change compared with CON respectively after training ( $p<0.05$ ). There was no any significant difference in the MT, IT<sub>max</sub>, R-IT<sub>max</sub>,  $P_{max}$  between LBFR and HBFR after training ( $p>0.05$ ).

**CONCLUSION:** BFR training protocols under 120mmHg or 180mmHg pressure are effective in improving muscular morphology and function. But the higher occlusion pressure may not have more benefit in improving muscular performance than the lower occlusion pressure.

**3076 Board #6 May 29 3:15 PM - 5:15 PM**  
**Blood Flow Restriction Training During A Dynamic Warm-Up And Its Effects On Various Sprint Times**

Alexandra Howard<sup>1</sup>, Justin Goins<sup>1</sup>, Matthew Steurys<sup>2</sup>, Amy Fraley Hand<sup>1</sup>, Jay Patel<sup>2</sup>. <sup>1</sup>University of South Carolina, Columbia, SC. <sup>2</sup>Primis Health, Columbia, SC.  
 Email: ah56@email.sc.edu  
 (No relevant relationships reported)

**PURPOSE:** To examine the effects of blood flow restriction (BFR) during a dynamic warm-up on a 25, 50, and 100-meter run time, rating of perceived exertion (RPE), and heart rate (HR) in recreational athletes. **METHODS:** Fourteen participants ( $22.3 \pm 1.8$  years) volunteered to participate in this cross-over study. Participants were randomly assigned to either the BFR or control group during their first trial, then completed the other trial seven days ( $\pm 1$  day) later. During the BFR training intervention, the cuffs

were placed on the proximal thigh at the level of the gluteal fold and were inflated to 80% of the participants' limb occlusion pressure (LOP), which was assessed prior to participation. Participants completed a five-minute dynamic warm-up wearing the blood flow restriction cuffs, and the same dynamic warm-up was completed during the control intervention without the use of the cuffs. After each warm-up, a three-minute revascularization period was provided before participants ran a 100-meter sprint at maximal effort, in which 25, 50, and 100-meter times were recorded. Heart rate was measured throughout the entirety of the study, and RPE was measured immediately after the sprint for both trials. Time measures, RPE scores, and heart rate were compared using a paired samples t-test ( $\alpha < .05$ ). **RESULTS:** There were no significant differences between control and BFR sprint times, post warm-up HR, or post run HR. There was a significant difference between the control and BFR RPE scores ( $3.14 \pm .66$  vs.  $4.79 \pm 1.42$ ,  $p < .001$ ). **CONCLUSION:** There is currently minimal evidence investigating the acute effects of BFR. Based on our results, there were no significant differences in sprint times between the control and BFR trials. RPE scores during the BFR trial were significantly higher than the control, indicating that participants felt the intensity of the BFR trial was more difficult although the times did not vary. Although not statistically different, average heart rates in the BFR trial were lowered by up to nine beats per minute compared with the control. This may be attributed to the perceived difficulty of the BFR trial as participants possibly could not exert themselves as much as when completing the control trial. These results do not support acute use of BFR to increase short-term performance, but more research should be performed.

**3077** Board #7 May 29 3:15 PM - 5:15 PM  
**Physiological Responses To Acute Arm Cranking With Blood Flow Restriction**

Benjamin Cockfield, Isaac Wedig, Jana Hendrickson, Steven Elmer. *Michigan Technological University, Houghton, MI.*  
 Email: sjelmer@mtu.edu  
 (No relevant relationships reported)

Aerobic exercise with blood flow restriction (BFR) is emerging as an effective method to improve both aerobic capacity and muscular function. Using an inflatable cuff, blood flow is usually restricted during walking and cycling. The extent to which BFR can be applied during upper-body aerobic exercise such as arm cranking is not well documented. Arm cranking with BFR might offer an exercise option for clinical populations that need to exercise upper-body muscles (e.g., wheelchair users, individuals with shoulder injuries). **PURPOSE:** To evaluate physiological and perceptual responses to acute submaximal arm cranking with BFR. **METHODS:** Five active adults (age:  $23 \pm 3$  yrs, arm cranking  $VO_{2peak}$ :  $33 \pm 8$  ml/kg/min) performed 4 intermittent arm cranking protocols (6x2 min, 1min recovery): 1) low-load arm cranking (LL, 40%  $VO_{2peak}$ ), 2) low-load arm cranking with BFR (BFR, 40%  $VO_{2peak}$ ), and 3) high-load arm cranking (HL, 80%  $VO_{2peak}$ ). For BFR, blood flow was restricted using 5cm cuffs inflated to 70% of limb occlusion pressure as identified using Doppler ultrasound. Cardiorespiratory and perceptual responses ( $VO_2$ , HR, perceived effort) and tissue perfusion (tissue saturation, deoxyhemoglobin concentrations) were measured using a metabolic cart and near-infrared spectroscopy, respectively. **RESULTS:** Oxygen consumption during BFR ( $1.15 \pm 0.32$  ml/kg/min) did not differ from LL ( $1.04 \pm 0.26$  ml/kg/min,  $P=0.31$ ) and was less than HL ( $2.28 \pm 0.60$  ml/kg/min,  $P<0.01$ ). Compared to LL ( $104 \pm 6$  b/min), heart rate during BFR increased ( $115 \pm 13$  b/min,  $P=0.04$ ) but was less than HL ( $166 \pm 19$  b/min,  $P<0.01$ ). BFR required greater perceived effort in the arms ( $12 \pm 3$ ) compared to LL ( $9 \pm 2$ ,  $P=0.03$ ) but less effort than HL ( $16 \pm 2$ ,  $P=0.01$ ). In general, BFR decreased tissue saturation and increased deoxyhemoglobin concentrations compared to arm cranking without BFR (all  $P<0.05$ ). **CONCLUSION:** These results suggest that arm cranking with BFR has potential to increase metabolic stress without excessive cardiorespiratory strain. This exercise mode may provide a useful alternative to HL for populations that need to exercise upper-body muscles for rehabilitation. These findings provide guidance for future acute and chronic studies examining the feasibility and efficacy of arm cranking with BFR.

**3078** Board #8 May 29 3:15 PM - 5:15 PM  
**Combining Blood Flow Restriction Training With Heat To Maximize Hypertrophy And Strength In Rugby Players**

Franck Brocherie<sup>1</sup>, Leo Morelet<sup>1</sup>, Olivier Girard<sup>2</sup>, Brendan R. Scott<sup>2</sup>. <sup>1</sup>French Institute of Sport, Paris, France. <sup>2</sup>Murdoch University, Perth, Australia.  
 Email: franck.brocherie@insep.fr  
 (No relevant relationships reported)

**PURPOSE:** We assessed whether blood flow restriction (BFR) training with the addition of heat stress (BFRH) improves hypertrophy, muscle strength and sport-specific physical performance in rugby union players, compared to BFR training alone. **METHODS:** Nineteen elite U23 rugby union male players were randomly assigned to BFRH (n = 7), BFR (n = 6) or traditional high-load resistance training (CON, n = 6) groups. BFRH and BFR groups trained twice weekly for 3 weeks using BFR exercise (half squat, 4 sets of 30-15-15-15 repetitions at 30% 1 maximum repetition (1RM)

with 30 s of passive recovery; 50% of resting arterial occlusion pressure) in hot (37°C) and cool (22°C) conditions, respectively. Before and after the intervention, thigh circumference, half squat 1RM, squat jump force-velocity profile, and performance in vertical jump, sprint and repeated-sprint ability (RSA) tasks were measured. Muscle damage marker (creatin kinase) was measured before and after (0.1-24 h) the first and last training session. **RESULTS:** Thigh circumference significantly increased ( $P<0.001$ ) from pre- to post-training in both BFRH (+6%,  $P<0.001$ ) and BFR (+4%,  $P<0.05$ ). Significant time  $\times$  group interaction revealed improvement in half squat 1RM (+12% and +19%,  $P<0.01$ ) and maximal force component (+102% and +116%,  $P<0.001$ ) of the force-velocity profile for BFRH and BFR. Vertical jump performance did not change. 10-m sprint (-5% and -3%,  $P<0.001$ ) and RSA best and total times (both -2%, both  $P\leq 0.001$ ) improved similarly in BFRH and BFR. Although not significant, muscle damage was lowered after the last session in BFRH only. No pre- to post-training changes occurred in CON.

**CONCLUSIONS:** Combining BFR training with heat stress can potentially induce hypertrophy and improve rugby union-specific physical performance while also inducing lower muscle damage than BFR training alone. Such gains could be of benefit during competitive period or rehabilitative setting.

**F-33** Thematic Poster - Carbohydrate and Time Restricted Feeding

Friday, May 29, 2020, 3:15 PM - 5:15 PM  
 Room: CC-2011

**3079** Chair: Javier Gonzalez. *University of Bath, Bath, United Kingdom.*

(No relevant relationships reported)

**3080** Board #1 May 29 3:15 PM - 5:15 PM  
**Effects Of 4 Weeks Of Time Restricted Feeding On Performance, Metabolism And Blood Outcomes In Elite Cyclists.**

Antonio Paoli, FACSM<sup>1</sup>, Grant Tinsley<sup>2</sup>, Giovanni Longo<sup>1</sup>, Davide Grigoletto<sup>1</sup>, Antonino Bianco<sup>3</sup>, Anna Tagliabue<sup>4</sup>, Cinzia Ferraris<sup>4</sup>, Giuseppe Marcolin<sup>1</sup>. <sup>1</sup>University of Padova, Padova, Italy. <sup>2</sup>Texas Tech University, Lubbock, TX. <sup>3</sup>University of Palermo, Palermo, Italy. <sup>4</sup>University of Pavia, Pavia, Italy.  
 Email: antonio.paoli@unipd.it  
 (No relevant relationships reported)

The effects a particular kind of short term fasting called time restricted feeding (TRF) have been recently investigated on resistance training athletes; no data are available, instead, on endurance athletes. **PURPOSE:** We sought to investigate the effects of 4 weeks of 16/8 TRF (with windows of 16 hours of fasting and 8 hours of feeding) on elite cyclists. **METHODS:** 16 elite under-23 cyclists were randomly assigned to a TRF group or to a control group (CTRL) with a traditional meal pattern. The TRF group consumed 100% of its estimated daily energy needs in an 8-hour time window: from 10:00 AM to 6:00 PM whilst the CTRL group consumed 100% of its estimated daily energy needs in 3 meals between 7:00 AM and 9:00 PM. During the experimental period, training loads were similar in the two groups. Athletes were tested before and after 4 weeks of the intervention. Fat and lean body mass were measured by bioelectrical impedance analysis,  $VO_{2max}$  and basal metabolism were measured by indirect gas analyzer. In addition, blood counts, free testosterone, SHBG, IGF-1, IL-6, TNF alpha, VES, PCR, total cholesterol, triglycerides, TSH, free T3, insulin, adiponectin, and cortisol were measured. **RESULTS:** After 4 weeks, there was a significant decrease of body weight (TRF:  $-1.26$  kg  $\pm$  1.57 vs. CTRL:  $+0.22$   $\pm$  0.96 kg,  $p=0.038$ ) and fat mass in the TRF group ( $p=0.0093$ ) compared to CTRL group with no differences in lean body mass. Performance tests showed no significant differences between groups even though there was a significant increase in the peak power output/body weight ratio ( $p=0.024$ ) in the TRF group due to weight loss. Free testosterone and IGF-1 decreased significantly ( $p=0.004$  and  $p=0.048$  respectively) in the TRF group; leukocyte count decreased more in the CTRL group ( $p=0.039$ ). Lymphocyte count increased in TRF group ( $p<0.001$ ) whilst neutrophils decreased in both groups ( $p<0.001$ ), thus the neutrophils to lymphocytes ratio (NLR) decreased significantly ( $p=0.003$ ) in TRF group. No significant changes in other blood chemistry values were observed. **CONCLUSIONS:** Our results suggest that a TRF program with an 8-hour feeding window causes fat loss, maintains lean mass and performance indexes and improves peak power output/body weight ratio. The changes of white blood cells parameters worth further investigation.

3081 Board #2 May 29 3:15 PM - 5:15 PM

**The Effects Of The 16/8 Diet On Cardio-metabolic Outcomes In Competitive Male Runners**

Christine E. Richardson<sup>1</sup>, Ashley P. Tovar<sup>1</sup>, Gretchen A. Casazza<sup>2</sup>, Brian Davis, FACSM<sup>3</sup>, Nancy Keim<sup>1</sup>. <sup>1</sup>University of California, Davis, Davis, CA. <sup>2</sup>Sacramento State, Sacramento, CA. <sup>3</sup>University of California at Davis Medical Center, Sacramento, CA. (Sponsor: Dr. Brian Davis, FACSM)  
Email: Cerrichardson@ucdavis.edu

(No relevant relationships reported)

**Purpose:** The objective of the present study was to investigate the effects of the 16/8 diet on cardio-metabolic risk factors in competitive male runners. **Methods:** This ongoing study is a randomized cross-over intervention that consists of two 4-week arms: a "normal diet" arm (ND: 12 hours fasted and 12 hours fed) and a "16/8" (TRF: 16 hours fasted and 8 hours fed) arm along with a 2-week washout. Sixteen subjects will complete the study and will participate in 4 test days (12 hour fasted), one at the beginning and end of each arm, where they will undergo a DXA scan, resting energy expenditure measurement and a fasting blood draw for biomarker quantification. Overall calories, macronutrient intake and exercise training will be held constant over the 2 interventions. **Preliminary Results:** Data on 9 subjects shows no significant differences between groups in changes in body mass (+0.41 ND vs. -0.72 kg TRF,  $p=0.25$ ), fat mass (-0.29 ND vs. -0.63 kg TRF,  $p=0.65$ ), fat free mass (+0.56 ND vs. -0.25 kg TRF,  $p=0.18$ ) and body fat (-0.42 ND vs. -0.61 % TRF,  $p=0.72$ ) with the 4 week intervention. Changes in resting energy expenditure (+152.3 ND vs. +11.3 kcal TRF,  $p=0.18$ ), resting respiratory exchange ratio (-0.003 ND vs. -0.04 TRF,  $p=0.36$ ), blood glucose (-3.9 ND vs. -1.9 mg/dl TRF,  $p=0.61$ ), total cholesterol (+1.0 ND vs. -3.0 mg/dl TRF,  $p=0.68$ ), HDL cholesterol (-1.7 ND vs. 0.0 mg/dl TRF,  $p=0.71$ ), LDL cholesterol (0.0 ND vs. -3.8 mg/dl TRF,  $p=0.41$ ), and triglycerides (+17.9 ND vs. \*4.3 mg/dl TRF,  $p=0.46$ ) also did not differ between interventions. **Conclusion:** So far, with limited power, there does not appear to be any physiological health benefits in male runners adhering to a 16/8 diet when compared to a normative eating timeframe.

3082 Board #3 May 29 3:15 PM - 5:15 PM

**The Effect Of Continuous Energy Restriction Vs Intermittent Fasting, With Resistance Training, On Lean Mass**

Stephen Keenan<sup>1</sup>, Matthew Cooke<sup>2</sup>, Sam Wu<sup>1</sup>, Ebrahim Bani Hassan<sup>3</sup>, Denny Meyer<sup>1</sup>, Won Sun Chen<sup>1</sup>, Josef Sullivan<sup>1</sup>, Gustavo Duque<sup>3</sup>, Regina Belski<sup>1</sup>. <sup>1</sup>Swinburne University of Technology, Melbourne, Australia. <sup>2</sup>Swinburne University of Technology, Victoria University, Australian Institute for Musculoskeletal Science (AIMSS), Department of Medicine-Western Health, Melbourne Medical School, The University of Melbourne, Melbourne, Australia. <sup>3</sup>Australian Institute for Musculoskeletal Science (AIMSS), Department of Medicine-Western Health, Melbourne Medical School, The University of Melbourne, Melbourne, Australia.

(No relevant relationships reported)

**PURPOSE:** To determine if two energy restricted diets (continuous energy restriction (CER) and 5:2 intermittent fasting (IF)) combined with resistance training (RT) results in lean body mass (LBM) retention while reducing bodyweight.

**METHODS:** Thirty-four young, untrained males and females were randomised to undertake the following diets for 12 weeks: CER (consume 80% of estimated energy requirements (EER) every day), or IF (consume approximately 30% of EER twice per week on fast days and 100% of EER every other day). Fast days included meals of protein shakes, a soup and vegetables. Both groups aimed to be isocaloric with an average energy restriction of 20% EER, and isonitrogenous consuming an average protein intake of 1.5 grams per kilogram of bodyweight per day. Both groups completed 2 supervised RT sessions and 1 unsupervised workout per week. The IF group completed their exercise on non-fast days. Body composition was assessed by dual x-ray absorptiometry. Data was analysed using an intention-to-treat linear mixed model, assuming AR(1) dependence across time. In addition, a change analysis was conducted for participants who completed both the baseline and 12 week assessments. **RESULTS:** For females, bodyweight was significantly reduced (mean decrease 3.1%,  $p=0.009$ ), and LBM significantly increased (mean increase 5.8%,  $p<0.001$ ), with no difference observed between diets. Similarly for men, there was no significant diet effect on bodyweight; both groups experienced an overall reduction of 6.3% ( $p<0.001$ ). Combined, men in both diet groups experienced a significant increase in LBM (mean increase 1.4%,  $p=0.021$ ), however there was a trend towards a greater increase in LBM in the IF compared to the CER group (mean increase CER = 0.7%, IF = 2.0%).

**CONCLUSIONS:** Across both diet groups, males and females experienced a significant reduction in bodyweight while, on average, increasing LBM. Neither diet was more effective for bodyweight reduction, however there was a trend towards greater LBM accrual in IF compared to CER males. Gender specific responses to

the intervention were evident, with a greater increase in LBM for females. Moderate energy restriction with high protein intake and RT can lead to concomitant weight loss and LBM accrual.

3083 Board #4 May 29 3:15 PM - 5:15 PM

**Impact Of Time-Restricted Feeding On Cardiometabolic Health And Performance Among Firefighters**

Andrew E. Gonzalez<sup>1</sup>, Mark G. Abel<sup>2</sup>, Matthew J. McAllister<sup>1</sup>. <sup>1</sup>Texas State University, San Marcos, TX. <sup>2</sup>University of Kentucky, Lexington, KY.

Email: aeg96@txstate.edu

(No relevant relationships reported)

**PURPOSE:** Firefighters (FF) have an elevated risk for heart disease and sudden cardiac death (SCD) due to physiological and psychological stressors such as low cardiovascular fitness levels, disturbed sleep patterns, frequent snacking, smoke exposure, and intense physical exertion. Research suggests time-restricted feeding (TRF) may improve cardiometabolic health markers and performance variables. Therefore, the purpose of this study was to examine the effects of an 8-week TRF intervention on cardiometabolic health markers and performance variables.

**METHODS:** Twenty apparently healthy male professional structural FF completed a battery of health and fitness assessments prior to and following an 8-week TRF dietary intervention while performing a standardized resistance training program. The FF were assigned to either the normal diet ( $n=4$ ) or TRF group ( $n=16$ ) based on their preference. The TRF group followed a daily 14 hr fast vs. 10 hr feeding protocol.

**RESULTS:** Despite no interaction effect, there were significant improvements for both groups for push-ups completed (41.7 and 37.1 reps;  $p=0.007$ ) and ventilatory threshold in absolute (2.47L/min to 2.58L/min;  $p=0.01$ ) and relative (65.8% $VO_{2peak}$  to 69.7% $VO_{2peak}$ ;  $p=0.001$ ) terms. The control group had significantly lower mean body fat percentage compared to the TRF group (14.27 and 20.5%, respectively;  $p<0.0001$ ). The TRF group had significantly higher  $VO_{2peak}$  values compared to the control group (3.80 L/min and 3.65 L/min, respectively;  $p=0.016$ ).

**CONCLUSIONS:** While TRF did not directly improve health or performance variables, the diet did not hinder health or performance outcomes. The standardized resistance training program resulted in improvements for muscular endurance and ventilatory threshold. The improved performance variables may result in reduced risk for heart disease and SCD while optimizing markers of performance.

3084 Board #5 May 29 3:15 PM - 5:15 PM

**The Effect Of Fasted Cycling Exercise At Different Times Of The Day In Overweight Individuals**

Victoria J. McIver<sup>1</sup>, Lewis R. Mattin<sup>2</sup>, Gethin H. Evans<sup>2</sup>, Adora M.W. Yau<sup>2</sup>. <sup>1</sup>Northumbria University, Newcastle upon Tyne, United Kingdom. <sup>2</sup>Manchester Metropolitan University, Manchester, United Kingdom. (Sponsor: Glyn Howatson, FACSM)

Email: victoria.mciver@northumbria.ac.uk

(No relevant relationships reported)

Intermittent fasting has become an increasingly popular intervention for metabolic health. Combining intermittent fasting with exercise may lead to benefits for weight management. **PURPOSE** To investigate the effect of fasted exercise at different times of the day on metabolic responses and appetite regulation in overweight males.

**METHODS** Twelve healthy males (Mean  $\pm$  SD; age 26  $\pm$  4 y; body fat 23  $\pm$  2%) completed four, 60 min cycle ergometry trials at 60%  $VO_{2peak}$  in a randomised order; in the morning fasted (AMFAST), evening fasted (PMFAST) and after consuming a breakfast meal in the morning (AMFED) and evening (PMFED). Circulating levels of ghrelin, glucagon-like peptide-1 (GLP-1), pancreatic polypeptide (PP), peptide tyrosine tyrosine (PYY), insulin, triglycerides, non-esterified fatty acid (NEFA), glucose, and cholesterol were measured at baseline, post-breakfast, pre-exercise, post-exercise, pre-soup ingestion, then every 30 min post soup-ingestion for 2 h. Appetite was assessed at 15 min intervals throughout. Substrate utilisation was measured every 30 min and continuously throughout exercise. **RESULTS** Area under the curve (AUC) values for NEFA were greater in PMFAST compared to all trials (186.5  $\pm$  46.3 vs. AMFAST 120.5  $\pm$  42.6, AMFED 80.8  $\pm$  23.8, PMFED 91.1  $\pm$  36.4 mmol/L 4.75 h;  $P<0.05$ ). AMFAST NEFA was also greater than AMFED ( $P=0.029$ ). AUC values were greater for GLP-1 in AMFED trial compared to PMFAST (8660.2  $\pm$  12232.5 vs 5967.0  $\pm$  12027.5 mmol/L 4.75 h,  $P<0.05$ ), and PP values for PMFED greater compared to all trials (155411.9  $\pm$  86064.1 vs. AMFAST 90165.4  $\pm$  90145.6, AMFED 107162.5  $\pm$  72846.2, PMFAST 105364.0  $\pm$  81320.2 mmol/L 4.75 h,  $P<0.05$ ). A time of day effect was seen for cholesterol with PM greater than AM ( $P<0.05$ ). Fat oxidation was greater during AMFAST and PMFAST exercise compared to FED trials ( $P<0.05$ ). Ratings of appetite did not change between trials once all participants consumed the lunch meal post exercise ( $P>0.05$ ). No differences were seen in AUC between trials for ghrelin, PYY, glucose or insulin. **CONCLUSION** Fasted exercise elicited greater NEFA responses, and some appetite hormones appear to respond differently to varying

exercise conditions and time of day in overweight males. Regardless of the time of day, fasted exercise favours fat metabolism and may induce a short-term negative energy balance.

**3085** Board #6 May 29 3:15 PM - 5:15 PM  
**Changes In Fat And Carbohydrate Oxidation From Rest To Exercise After Different Fasting Lengths**

Emma Ryan Thompson, James Brown, Kelly E. Johnson, Jakob D. Lauver, Justin P. Guilkey. *Coastal Carolina University, Conway, SC.*

Email: erthomp1@coastal.edu  
 (No relevant relationships reported)

An overnight fast (10-12 hours) is a popular pre-exercise trial control in fuel use studies, but can lead to premature fatigue during exercise in participants. Measuring substrate oxidation at rest could be an alternative, but it is unclear how length of fasting effects fuel use responses from rest to during exercise. **PURPOSE:** The purpose was to examine the changes in fat (fatox) and carbohydrate (carbox) oxidation rates during rest and exercise after various fasting lengths. **METHODS:** Participants (24.5 ± 5.1 yrs) randomly performed 3 experimental trials. Trials were preceded by a standard meal (19.4 ± 1.8% of daily energy expenditure) followed by a fast for 12 hours (hrs), 3 hrs or 1 hr. Each trial consisted of 30 min of rest and 30 min of exercise at 55% of peak oxygen uptake ( $VO_{2peak}$ ).  $VO_2$  and carbon dioxide production ( $VCO_2$ ) were averaged over the final 10 minutes of rest and exercise. The equations fatox = 1.695 \*  $VO_2$  - 1.70 \*  $VCO_2$ , and carbox = 4.585 \*  $VCO_2$  - 3.226 \*  $VO_2$  were used to calculate oxidation rates ( $g \cdot min^{-1}$ ). Two-way repeated measures (RM) ANOVAs and one-way RM ANOVAs analyzed differences. Significance was established if  $p < 0.05$ . **RESULTS:** Participants exercised at a similar  $VO_2$  and % of  $VO_{2peak}$  in the 12hr (1.58 ± 0.28 L · min<sup>-1</sup>; 56.8 ± 2.4 % of  $VO_{2peak}$ ), 3hr (1.60 ± 0.30 L · min<sup>-1</sup>; 57.7 ± 4.6 % of  $VO_{2peak}$ ), and 1hr (1.64 ± 0.30 L · min<sup>-1</sup>; 59.1 ± 1.7 % of  $VO_{2peak}$ ). There was no significant interactions for fatox and carbox, but there were significant main effects of time. Fatox increased from rest to exercise in the 12hr (0.30 ± 0.04  $g \cdot min^{-1}$  vs. 7.34 ± 3.00  $g \cdot min^{-1}$ ), 3hr (0.30 ± 0.10  $g \cdot min^{-1}$  vs. 7.56 ± 3.53  $g \cdot min^{-1}$ ) and 1hr (0.34 ± 0.10  $g \cdot min^{-1}$  vs. 8.43 ± 4.00  $g \cdot min^{-1}$ ) trials. Additionally, carbox increased from rest (12 hr = 0.30 ± 0.07  $g \cdot min^{-1}$ ; 3hr = 0.27 ± 0.09  $g \cdot min^{-1}$ ; 1hr = 0.34 ± 0.10  $g \cdot min^{-1}$ ) to exercise (12hr = 1.92 ± 0.55  $g \cdot min^{-1}$ ; 3hr = 1.90 ± 0.64  $g \cdot min^{-1}$ ; 1hr = 2.18 ± 0.81  $g \cdot min^{-1}$ ). Relative percent changes from rest to during exercise were not different between 1hr, 3 hrs and 12 hrs for fatox (2489.1 ± 1008.9 % vs. 2257.5 ± 853.3 % vs. 2200.8 ± 901.7 %) or carbox (660.2 ± 294.8 % vs. 579.6 ± 231.2 % vs. 492.5 ± 241.9 %). **CONCLUSIONS:** Fatox and carbox responses from rest to exercise were similar between trials. This suggests that a standard meal and resting oxidation rates could control for differences in substrate use during exercise, regardless of fasting length.

**3086** Board #7 May 29 3:15 PM - 5:15 PM  
**Low Carbohydrate Availability, Not Energy Availability, Alters The Immune Response To Exercise In Elite Race-walkers**

Alannah K.A McKay<sup>1</sup>, Peter Peeling<sup>1</sup>, David B. Pyne, FACSM<sup>2</sup>, Nicolin Tee<sup>3</sup>, Ida A. Heikura<sup>3</sup>, Louise M. Burke, FACSM<sup>3</sup>.

<sup>1</sup>University of Western Australia, Perth, Australia. <sup>2</sup>University of Canberra, Canberra, Australia. <sup>3</sup>Australian Institute of Sport, Canberra, Australia.

Email: alannah.mckay@ausport.gov.au  
 (No relevant relationships reported)

**PURPOSE:** To compare the effects of a ketogenic low carbohydrate (CHO) high fat (LCHF) diet, and a low energy availability (LEA) diet, on innate immune response during a short-term training intervention in endurance athletes. **METHODS:** Twenty elite male race walkers completed one of three 5-7 day diet/training phases in a parallel groups design. During the initial 5 day Harmonization phase, all athletes consumed a high energy availability (HEA) diet equating to 40 kcal · kg<sup>-1</sup> · fat free mass (FFM) · day<sup>-1</sup>. Athletes were then assigned to either a HEA (n=6), LCHF (<50 g CHO day<sup>-1</sup> and isocaloric to HEA, n=7) or a LEA diet (15 kcal · kg<sup>-1</sup> · FFM day<sup>-1</sup>, n=7) for the 7 day Intervention phase. Subsequently, all athletes were placed back on a HEA diet for a further 5 days (Re-feed phase). On day 5 of each phase, athletes completed a 25 km hybrid laboratory-field race walk protocol at ~75%  $VO_{2max}$ . Venous blood samples were collected pre-, post-, and 1 h post-exercise and analyzed for serum ferritin, white blood cell counts, cortisol and blood glucose concentration. **RESULTS:** Serum ferritin decreased from Harmonization to Re-feed in all 3 groups (HEA: 30%, 20-40% (mean change, 95% CI); LCHF: 38%, 22-54%; LEA: 40%, 17-63%,  $p < 0.01$ ), however, the magnitude of decrease was similar between groups. During the Intervention phase, the LCHF had a larger post-exercise increase in total white blood cells (67%, 61-72%), neutrophils (77%, 71-82%), monocytes (49%, 32-65%) and lymphocytes (41%, 31-51%) than both HEA ( $p < 0.001$ ) and LEA ( $p < 0.001$ ). Similarly, a small increase in cortisol (14%, -10-39%) and a decrease in blood glucose levels (46%, 18-74%) were evident during the post-exercise period during LCHF,

which was significantly different to, and occurred in the opposite direction to changes seen in HEA and LEA. No differences in any marker measured occurred between HEA and LEA, or between the Harmonization and Re-feed phases.

**CONCLUSIONS:** Adherence to a ketogenic LCHF diet for 5 days resulted in transient perturbations to the immune response to exercise, however, the LEA intervention did not influence immune markers. It appears that the acute restriction of CHO, rather than energy intake, has a more detrimental impact on the immune response to exercise in elite endurance athletes.

**3087** Board #8 May 29 3:15 PM - 5:15 PM  
**The Effect Of Acute Carbohydrate Restriction On Squat Performance And Serum Energy Substrate Levels**

Amber Normann, Abbey Brown, Kurt Escobar, Joshua Cotter, FACSM, Evan Schick. *California State University, Long Beach, Long Beach, CA.* (Sponsor: Dr. Joshua Cotter, FACSM)

(No relevant relationships reported)

Carbohydrate restrictive diets have become increasingly prevalent among recreational and professional athletes as a means of losing weight and improving body composition. Currently, few data indicate a clear relationship between carbohydrate restriction (CR) and performance in resistance exercise (RE). **Purpose:** To investigate the acute effects of CR on squat performance and serum energy substrate levels in recreationally trained individuals. **Methods:** Seven healthy recreationally trained males (22.6 ± 3.47 yrs., 80.74 ± 8.40 kg, 178.05 ± 5.00 cm) completed RE under two conditions in randomized order: 1) control (CON) and 2) a (CR) condition, which included a carbohydrate depletion exercise trial (CDEX). In CR, subjects first performed the CDEX, which consisted of 60 minutes of cycling at >75% of participants' heart rate (HR) max followed by four 1-minute bouts at >95% HR max with two minute rest in between sets. CDEX was then followed by 48 hours of reduced carbohydrate (CHO) intake (<5% daily caloric intake). RE in both CON and CR consisted of squats, loaded via inertial resistance using a Yo-Yo™ flywheel squat device. Fasting blood glucose and triglyceride (TG) levels were measured pre-exercise in both conditions as well as throughout the CDEX. **Results:** Total caloric intake was significantly ( $p < 0.001$ ) lower during CR (mean ± SD: 1661.24 ± 691.6 kcal) compared to the CON (2433.85 ± 527.4 kcal). No differences were found in total grams of protein (PRO) or fat intake between conditions. Percent total daily caloric intake from CHO ( $p < 0.001$ ) was significantly lower in the CR condition (7.40 ± 3.32% CHO), while percent total daily caloric intake from PRO and fat were significantly higher in the CR (32.90 ± 8.54% PRO, 58.17 ± 11.96% fat) compared to CON (37.81 ± 9.26% CHO, 20.03 ± 5.53% PRO, 37.47 ± 11.80% fat). Fasting blood glucose levels ( $p = 0.017$ ) were significantly lower in the CR (84.57 ± 4.79 mg/dL) compared to the CON (93.28 ± 6.90 mg/dL) yet there was no difference in blood TG levels ( $p = 0.177$ ; 64.43 ± 15.13 mg/dL vs. 59.29 ± 14.16 mg/dL). Total average power output ( $p = 0.05$ ) and total peak power output ( $p = 0.047$ ) were significantly lower in the CR. **Conclusion:** While CDEX combined with CR may acutely reduce fasting blood glucose, this may be at the sacrifice of RE performance, especially during the initial phase of CR adaptation.

**F-34 Thematic Poster - Cognition and Emotions**

Friday, May 29, 2020, 3:15 PM - 5:15 PM  
 Room: CC-2000

**3088 Chair:** Walter Bixby, FACSM. *Anne Arundel Community College, Elon, NC.*  
*(No relevant relationships reported)*

**3089 Co-Chair:** Allyson G. Box. *University of Illinois Urbana-Champaign, Urbana, IL.*  
*(No relevant relationships reported)*

**3090 Board #1** May 29 3:15 PM - 5:15 PM  
**Cognitive Reappraisal Enhances Affective Valence During Exercise At The Ventilatory Threshold**  
 Kell Grandjean da Costa<sup>1</sup>, Heather L. Urry<sup>1</sup>, Eduardo Bodnariuc Fontes<sup>2</sup>, Grace Elliott<sup>1</sup>, Grace E. Giles<sup>3</sup>. <sup>1</sup>Tufts University, Medford, MA. <sup>2</sup>Federal University of Rio Grande do Norte, Natal, Brazil. <sup>3</sup>U.S. Army CDC-Soldier Center, Natick, MA.  
 Email: kellgrandjean@gmail.com  
*(No relevant relationships reported)*

Affective valence during exercise is thought to switch between positive and negative at the ventilatory threshold (VT), the upper boundary of “moderate” intensity exercise. Cognitive strategies may shift the exercise intensity at which affective responses are positive and negative. The emotion regulation strategy cognitive reappraisal (CR) involves reevaluating emotional stimuli to reduce negative and increase positive emotional experience. **PURPOSE:** Here we investigated if cognitive reappraisal would increase emotional valence, demonstrated by higher scores on the feeling scale (FS), and reduce felt arousal scale (FAS) scores and ratings of perceived exertion (RPE) during 60-min of exercise performed at the VT. **METHODS:** 26 young recreational runners (n = 13 women, Age 25.4 ± 4.3 years old; BMI 21.3 ± 2.3 kg/m<sup>2</sup>; maximal oxygen consumption (VO<sub>2</sub>max) = 55.02 ± 7.31 ml/kg/min) performed three sessions each separated by one week. During the first session, runners performed a maximal exertion test on a treadmill to assess their VO<sub>2</sub>max and VT. During the next two sessions, runners were trained in CR or UR (unregulated) instructions, in counterbalanced order. They then ran at their VT for 60 minutes, during which they were reminded of the emotion regulation instructions and were instructed to provide RPE, FS, and FAS during the last 30 seconds of every 10-minute period. FS, FAS, RPE were analyzed for main effects of time and condition with non-parametric repeated measures (Friedman test) with post-hoc pairwise comparisons of Durbin-Conover test. **RESULTS:** Runners ran at VT velocity of 6.92 ± 0.46 mph corresponding to 46.8 ± 5.2 % of the VO<sub>2</sub> max. Similar levels of RPE were reported during the CR, 11.74 ± 1.64, and UR, 11.82 ± 1.88, sessions. However, they reported marginally higher FAS during CR, 2.9 ± 0.98, than UR, 2.6 ± 0.95, X<sup>2</sup>=20.3; df=11, p=0.042. They also reported higher FS during CR, 2.54 ± 1.47, than UR, 2.1 ± 1.52, X<sup>2</sup>=65.2; df=15, p<0.001. Post-hoc analysis showed that FS was higher during CR than UR (p<0.01) only at time points 30 (CR: 2.57 ± 1.4 vs UR 1.84 ± 1.65), 40 (CR: 2.53 ± 1.54 vs UR 1.76 ± 1.57) and 50 (CR: 2.57 ± 1.52 vs UR 1.88 ± 1.73) minutes of exercise. **CONCLUSION:** Cognitive reappraisal can be used as a strategy to increase emotional valence after 30 min of exercise at light to moderate intensity in recreational runners.

**3091 Board #2** May 29 3:15 PM - 5:15 PM  
**Where Are My Keys? Can Lifestyle Factors Predict Cognitive Function In Older Adults?**  
 Vincenzo Lauriola<sup>1</sup>, Grace Liu<sup>1</sup>, Kathleen M. McIntyre<sup>1</sup>, Carol Ewing Garber, FACSM<sup>2</sup>, Richard P. Sloan<sup>1</sup>. <sup>1</sup>Columbia University, New York, NY. <sup>2</sup>Teachers College, New York, NY.  
 (Sponsor: Dr. Carol Ewing Garber, FACSM)  
 Email: vl2286@cumc.columbia.edu  
*(No relevant relationships reported)*

Strong evidence shows that physical activity (PA) affects the structure of the nervous system and can improve cognitive function (CF) in older adults. Additionally, recent studies have shown that a healthy diet may protect against aging-related impairments in hippocampal structure or function. **PURPOSE:** To investigate the influence of PA and adherence to dietary guidelines on CF in a sample of healthy older adults. **METHODS:** Demographics, habitual PA (Baecke’s Questionnaire Sport score), and cognitive function (Montreal Cognitive Assessment; MoCA) were collected at consent in a sample of 359 healthy adults (50-75 years) in a memory function study. Dietary

guidelines adherence (Alternate Healthy Eating Index 2010; aHEI), and two indices of cognitive function (Modified Benton Recognition Task (ModBent) and Modified Rey Auditory Verbal Learning Test (ModRey) were collected in the randomized subsample of these participants (N=211).

The relationship between lifestyle factors and three outcomes (MoCA, ModBent, ModRey) were assessed using Pearson correlations in the full sample and subsample. Linear models were fit for MoCA on the full sample, and for each of the three outcomes on the randomized subsample. Each series of models included age, gender, and education. PA and aHEI scores were then added to each model and their standardized regression coefficients (change in R<sup>2</sup>) were assessed to determine whether they contributed additional predictive value towards CF.

**RESULTS:** In the full sample, the correlation between MoCA total score and PA was weak (r = .111). In the subsample, correlations between aHEI and MoCA and between aHEI and ModRey were also weak (r = .175 and r = .141, respectively). Correlations between PA and aHEI and between age and ModRey were weak (r = .222 and r = -.219, respectively). Adding PA or aHEI did not significantly explain a greater proportion of variance in cognitive task scores beyond demographic factors alone.

**CONCLUSIONS:** In an older adult population, there is a weak direct relationship between performance on CF tasks and lifestyle factors. Reviewing the individual standardized regression coefficients finds that education and age were the most sensitive to changes in CF task scores, and adherence to dietary guidelines was more sensitive than a measure of habitual PA.

**3092 Board #3** May 29 3:15 PM - 5:15 PM  
**Does An Acute Bout Of Aerobic Exercise Bolster Reactivity To A Sad Mood Induction In Clinically Depressed Individuals? A Study Of Responders And Non-responders**

Anthony J. Bocchine<sup>1</sup>, CJ Brush<sup>2</sup>, Andrew A. Ude<sup>1</sup>, Gregory H. Pappas<sup>1</sup>, Kelsey L. Piersol<sup>1</sup>, Brandon L. Alderman<sup>1</sup>.  
<sup>1</sup>Rutgers University, Piscataway, NJ. <sup>2</sup>Florida State University, Tallahassee, FL.  
 Email: ajb376@scarletmail.rutgers.edu  
*(No relevant relationships reported)*

Major depressive disorder (MDD) is a debilitating mental health condition that presents a major public health burden. Respiratory sinus arrhythmia (RSA) reactivity has been proposed as an index of impaired emotion and self-regulation in depression. Acute exercise has consistently been shown to improve affect, but it is unknown whether exercise affects RSA reactivity to emotional challenge. In addition, previous studies have not addressed nonresponse to sad emotion inductions, which limits understanding of important individual differences in affective processing.

**PURPOSE:** To determine the effects of a single bout of moderate-intensity aerobic exercise on RSA and affective responses to a sad mood induction. Additionally, to characterize responders and non-responders to the sad mood paradigm and whether acute exercise impacts emotional responding to the emotion induction paradigm. **METHODS:** Using a within-subjects design, young adults diagnosed with MDD completed a 30-min exercise and sedentary control session in counterbalanced order on two separate days. Following a recovery period, RSA reactivity was assessed using electrocardiography (ECG) during a 3-min sad mood induction. The Positive and Negative Affect Scale (PANAS) was used to assess affective responses throughout each session and sadness to the mood induction was assessed on a 9-point Likert scale.

**RESULTS:** Individuals with depression demonstrated dampened RSA withdrawal during the sedentary control day. Following exercise, RSA withdrawal increased, p < .05, although post-exercise changes in NA and PA were not related to neurocardiac reactivity to the sadness induction. There were significantly more responders than non-responders to the mood induction following the exercise condition, p < .05.

**CONCLUSIONS:** These findings indicate that acute aerobic exercise may be an effective approach to increase emotional regulation and behavioral flexibility in clinically depressed individuals. Future research should continue to examine individual differences in emotional responding as well as investigating who will successfully respond to exercise treatment.

**3093 Board #4** May 29 3:15 PM - 5:15 PM  
**Effects Of Age, Body Composition, And Inflammation On Cognitive Function In Females.**

Ying-Hsuan Chang, Chien-Hui Chan, Shiou-He Chen, Hsuan Wu, Kuan-Chen Wu, Shioh-Chwen Tsai. *Institute of Sports Sciences, University of Taipei, Taipei City, Taiwan, Taipei City, Taiwan.* (Sponsor: Chia-Hua Kuo, FACSM)  
 Email: sctsaib@gmail.com  
*(No relevant relationships reported)*

**PURPOSE:** To investigate the correlation between individual parameters (age, body composition, and inflammation) and cognitive performance. **METHOD:** Fifty-six healthy women (age range: 20-60 yrs) were recruited and completed four cognitive tests, including attention, speedup test, Stroop tests (word, square, congruent,

incongruent, and neutral conditions), and memory span test. All cognition tests were conducted in a counter-balanced order. Blood samples were collected to determine the ratio of neutrophil and lymphocyte (NLR) and the ratio of platelet and lymphocyte (PLR) which were considered as indicators of inflammation. The body composition was measured by using Dual Energy X-ray Absorptiometry. The correlation between age, body composition, inflammatory factors, and cognitive variables was analyzed by Pearson's correlation coefficient ( $r$ ).  $P < 0.05$  was considered statistically significant. **RESULTS:** There were negative correlation between age and attention test ( $r = -0.47$ ,  $p < 0.005$ ), Stroop tests (word:  $r = -0.65$ ,  $p < 0.001$ ; square:  $r = -0.69$ ,  $p < 0.001$ ; congruent:  $r = -0.61$ ,  $p < 0.001$ ; incongruent:  $r = -0.70$ ,  $p < 0.001$ ; neutral:  $r = -0.70$ ,  $p < 0.001$ ). The results also showed that the higher the body fat % (BF%), the worse the cognitive test performance (attention test,  $r = 0.46$ ,  $p < 0.005$ ; Stroop's word tests,  $r = 0.49$ ,  $p < 0.005$ ; Stroop's square test,  $r = 0.61$ ,  $p < 0.001$ ; Stroop's congruent test,  $r = 0.44$ ,  $p < 0.01$ ; Stroop's incongruent,  $r = 0.56$ ,  $p < 0.001$ ; Stroop's neutral test,  $r = 0.59$ ,  $p < 0.001$ ). Similarly, the higher the body lean mass (BLM%), the better the cognitive test performance. There was positive correlation between age, NLR and PLR, but there was no significant correlation between inflammatory markers and cognitive performance. Furthermore, after controlled age, although the above net correlation was eliminated, the correlation between Stroop's square test and BF% ( $r = -0.343$ ,  $p = 0.035$ ), square and BLM% ( $r = -0.334$ ,  $p = 0.040$ ), neutral test and BLM% ( $r = 0.32$ ,  $p = 0.050$ ) still exists. Besides, after controlled BF%, the age-related correlation effects are unchanged, and only the correlation between BLM% and the speed of answering represent significant ( $r = 0.393$ ,  $p < 0.015$ ). **CONCLUSION:** In addition to age, body fat is an important factor affecting cognitive performance. Supported by MOST 107-2410-H-845-018-MY3

**3094 Board #5 May 29 3:15 PM - 5:15 PM**  
**Exercise-Based Cardiac Rehabilitation Improves Cognitive Function Among CVD Patients**

Terence Moriarty<sup>1</sup>, Kelsey Bourbeau<sup>2</sup>, Christine Mermier<sup>2</sup>, Len Kravitz<sup>2</sup>, Ann Gibson, FACSM<sup>2</sup>, Nicholas Beltz<sup>3</sup>, Omar Negrete<sup>2</sup>, Micah Zuhl<sup>4</sup>. <sup>1</sup>University of Northern Iowa, Cedar Falls, IA. <sup>2</sup>University of New Mexico, Albuquerque, NM. <sup>3</sup>University of Wisconsin-Eau Claire, Eau Claire, WI. <sup>4</sup>Central Michigan University, Mount Pleasant, MI.  
 Email: terence.moriarty@uni.edu  
 (No relevant relationships reported)

**PURPOSE:** To investigate the effects of cardiac rehabilitation (CR) exercise training on cognitive performance and if the changes are associated with alterations in prefrontal cortex (PFC) oxygenation among patients with cardiovascular disease (CVD). **METHODS:** Twenty (M=15, F=5; 64.8±11.6 yrs) participants from an outpatient CR program were enrolled in the study. Each participant completed a cognitive performance test battery (the NIH Fluid Cognition test battery which measured 5 cognitive constructs) and a submaximal graded treadmill evaluation (a measure of cardiorespiratory capacity) on separate occasions at pre and again upon completion of 18 individualized CR sessions (approximately 6 weeks later). A functional near-infrared spectroscopy (fNIRS) device was used to measure left- and right- PFC (LPFC and RPPFC) oxygenation parameters (O<sub>2</sub>Hb = oxyhemoglobin, HHb = deoxyhemoglobin, tHb = total hemoglobin, Hbdiff = oxyhemoglobin difference) during the NIH Fluid Cognition evaluation. **RESULTS:** Patients showed improvements in cardiorespiratory capacity (increased by 1.4 METs) and various cognitive constructs (processing speed, attention, executive function, and working memory scores). A significant increase in PFC oxygenation, primarily in the LPFC region, occurred at post-CR test (in four of the five cognitive tests). Correlation analyses revealed negative associations between changes in cognition (executive function (LPFC O<sub>2</sub>Hb:  $r = -0.445$ ,  $p = 0.049$ ; LPFC tHb:  $r = -0.487$ ,  $p = .030$ ) and fluid composite score (RPPFC Hbdiff:  $r = -0.467$ ,  $p = 0.038$ ; LPFC Hbdiff:  $r = -0.447$ ,  $p = .048$ )) and PFC changes. The change in cardiorespiratory capacity was positively associated with the change in working memory score ( $r = 0.546$ ,  $p = 0.016$ ). **CONCLUSION:** CVD patients enrolled in CR showed significant improvements in multiple cognitive domains along with increased cortical activation. The negative associations between cognitive functioning and PFC oxygenation suggest an improved neural efficiency, which is identified as higher cognitive performance for a given (or reduced) amount of cortical activation.

**3095 Board #6 May 29 3:15 PM - 5:15 PM**

**IMPACT OF AUTONOMY ON ENJOYMENT AND AFFECTIVE VALENCE DURING HIGH-INTENSITY INTERVAL TRAINING**

Marcus W. Kilpatrick, FACSM<sup>1</sup>, Gianna F. Mastrofini<sup>1</sup>, Lauren A. Hudson<sup>1</sup>, Alanis P. Rosado<sup>1</sup>, Chelsea M. Aggor<sup>1</sup>, Ralph C. Tauran<sup>1</sup>, Abby R. Fleming<sup>2</sup>. <sup>1</sup>University of South Florida, Tampa, FL. <sup>2</sup>University of Alabama, Tuscaloosa, AL.  
 Email: mkilpatrick@usf.edu  
 (No relevant relationships reported)

High-intensity interval training (HIIT) is a popular modality for conducting intense aerobic exercise. Research indicates that HIIT is generally well-tolerated and produces relatively positive affective valence and enjoyment responses, especially when compared to intense continuous exercise. Recent research has started considering how autonomy and choice might impact psychological responses to HIIT. **PURPOSE:** The purpose of this study was to determine the impact of autonomy and variation on enjoyment and affective valence during HIIT exercise. **METHODS:** Twenty-one physically active participants (12 male, 9 female; mean BMI =  $27 \pm 3$ ; mean age =  $28 \pm 6$ ) completed three, 20-minute HIIT trials after completion of maximal testing. Work and recovery were conducted at 90% and 10% of peak work, respectively. All trials included a total of 10 minutes of work and 10 minutes of recovery. Trials included: a standard interval bout with repeating 60-sec work and recovery segments (Traditional), an interval bout with a mix of predetermined 30-, 60-, 90-, & 120-second segments (Varied), and a bout with a self-selected number of 30-, 60-, 90-, & 120-second segments (Autonomous). In-task affective valence and enjoyment were measured four times during work and recovery. Data was analyzed using ANOVA. **RESULTS:** Affective valence declined during the Traditional and Varied trials ( $-0.75$  units;  $P < 0.05$ ) but not during the Autonomous trial ( $P > 0.05$ ). There was also a trend for the Autonomous trial to produce greater pleasure than the Traditional or Varied trials ( $-0.5$  units;  $P = 0.06$ ). Enjoyment increased during the trials ( $-0.5$  units;  $P < 0.05$ ) and enjoyment was higher in the Autonomous trial than the Varied trial ( $-0.5$  units;  $P < 0.05$ ). **CONCLUSIONS:** Findings indicate that all HIIT trials produced at least moderate levels of pleasure and enjoyment, with Autonomous HIIT resulting in the most desirable responses, especially when compared to Varied HIIT. These findings suggest that HIIT sessions that include self-selected interval durations can produce more positive responses, which provides the basis for recommending autonomy for exercisers participating in HIIT exercise sessions.

**3096 Board #7 May 29 3:15 PM - 5:15 PM**

**Abstract Withdrawn**

**3097 Board #8 May 29 3:15 PM - 5:15 PM**

**The Sustained Effects Of Acute Aerobic Exercise On Inhibitory Control In Children With ADHD**

Shu-Shih Hsieh<sup>1</sup>, Chien-Lin Yu<sup>2</sup>, Ting-Yu Chueh<sup>2</sup>, Yu-Jung Tsai<sup>2</sup>, Charles H. Hillman<sup>1</sup>, Tsung-Min Hung<sup>2</sup>. <sup>1</sup>Northeastern University, Boston, MA. <sup>2</sup>National Taiwan Normal University, Taipei, Taiwan.  
 (No relevant relationships reported)

Despite mounting evidence supporting the beneficial effects of acute aerobic exercise on cognitive control in children with attention-deficit/hyperactivity disorder (ADHD), little is known regarding the sustained effect of acute aerobic exercise.

**PURPOSE:** To examine the sustained effects of a single bout of aerobic exercise on inhibitory control in children with ADHD. **METHODS:** Twenty-four children diagnosed with ADHD (mean age =  $9.8 \pm 1.3$  years; 23 boys) underwent a moderate-intensity (60% of heart rate reserve) aerobic exercise session and a video-watching session in counterbalanced order. Following the exercise/video-watching session, each participant was administered congruent and incongruent trials from a modified flanker task under electroencephalography (EEG) at 30 minutes and 60 minutes following intervention. Response accuracy, reaction times (RT), and standard deviation of RT (SDRT) were reported as behavioral outcomes, and the P3 component of an event-related brain potential (P3-ERP) was collected as a measure of brain function. A 3-way repeated-measure ANOVAs was used to analyze behavioral and P3-ERP data. **RESULTS:** Higher response accuracy was observed following exercise relative to video-watching across both time points and trial types (Exercise:  $90.5 \pm 6.2\%$  vs. Video:  $84.1 \pm 11.1\%$ ,  $p = .002$ ). SDRT, an index of response variability, was smaller during congruent trials following exercise compared to video-watching at the 30-minute time point (Exercise:  $129.8 \pm 27.4$  ms vs. Video:  $142.2 \pm 32.9$  ms,  $p = .04$ ). Further, P3-ERP latency at the parietal site (Pz) was shorter following exercise relative to video-watching across trial types at the 30-minute time point (Exercise:  $426.9 \pm 71.5$  ms vs. Video:  $517.9 \pm 62.5$  ms,  $p < .001$ ). **CONCLUSION:** The data suggest that the beneficial effects of acute, moderate-intensity exercise are only sustained for about 30-40 minutes following exercise cessation in children with ADHD. Such a finding differs from typically developing children, who demonstrate acute exercise benefits to brain and

cognition for approximately 60-70 minutes. Future research should provide a more direct comparison to better understand the sustained effects of acute exercise across different populations of children.

Supported by MOST grant NSC102-2410-H-003-128.

### F-35 Thematic Poster - Functional Movement with Parkinson's Disease

Friday, May 29, 2020, 3:15 PM - 5:15 PM  
Room: CC-2007

**3098 Chair:** Chris J. Hass, FACSM. *University of Florida, Gainesville, FL.*  
(No relevant relationships reported)

### 3099 Board #1 May 29 3:15 PM - 5:15 PM The Influence Of Overground Locomotor Training Program On Dynamic Balance In People With Parkinson's Disease

Randy Jamil Pugh, Clinton J. Wutzke, Andrew E. Pechstein, Kerry B. Rosen, Lobna S. Elsarafy, Emily M. Leonard, Andrew A. Guccione. *George Mason University, Fairfax, VA.* (Sponsor: Randall Keyser, FACSM)  
Email: rpugh2@gmu.edu  
(No relevant relationships reported)

**PURPOSE:** People with Parkinson's disease (PD) have impaired balance during walking that contributes to reduced physical activity and lower quality of life. Overground locomotor training (OLT) is one method to improve dynamic balance for people with PD during walking. The purpose of this study is to examine the effect of an OLT program on dynamic balance during overground walking in people with PD. **METHODS:** Five participants with PD (age: 68.9±6.7 yrs) were enrolled in a 12-week OLT program with an emphasis on power, stepping and stability within all planes of movement. Participants completed a 10-minute walk test (10MWT) overground wearing portable tri-axial motion sensors at baseline (PRE) and after (POST) intervention. Temporospatial data were collected pre- and post-intervention to obtain time in double limb support (TDLS) and calculate gait stability ratio (GSR) during the 10MWT. TDLS represents one's strategy for maintaining dynamic balance during gait. GSR is the ratio between number steps per minute and gait velocity. For both TDLS and GSR, lower values following intervention represent improved dynamic balance during walking. Gait characteristics were analyzed separately for each limb using paired Student's *t* tests. **RESULTS:** Average TDLS was reduced for both limbs after intervention (PRE (L: 18.88±3.03; R: 18.89±3.04%); POST (L: 15.10±2.66; R: 15.11±2.68), *p*<.001). GSR improved following intervention (PRE (L: 82.83±9.58; R:82.61±8.83); POST (L:79.41±6.52; R:78.88±6.54) *p*<.05). **CONCLUSION:** Individuals with PD demonstrated improved dynamic balance during walking following the 12-week intervention. Decreased TDLS and GSR are gait characteristics that provide an opportunity to increase physical activity and improve quality of life. Incorporating OLT with multiplanar movements and stepping strategies should be considered as a treatment strategy to address impaired dynamic balance in people with PD.

### 3100 Board #2 May 29 3:15 PM - 5:15 PM Do Individualized Physical Therapy Interventions Improve Balance And Gait Initiation In Persons With Parkinson'S Disease?

Krista Nunn<sup>1</sup>, Natalie Atwood<sup>1</sup>, Hemang Shah<sup>2</sup>, Crystal Ramsey<sup>1</sup>, Srikant Vallabhajosula<sup>1</sup>. <sup>1</sup>*Elon University, Elon, NC.* <sup>2</sup>*Duke University, Durham, NC.* (Sponsor: Dr. Stephen Bailey, FACSM)  
Email: knunn2@elon.edu  
(No relevant relationships reported)

Resting tremor, bradykinesia, rigidity, and loss of postural reflexes are the cardinal signs of Parkinson's disease (PD). Persons with PD frequently have balance impairments and postural instability which correlates with the increase in fractures and soft tissue injuries when compared to age-matched peers without PD. Persons with PD also frequently present with increased postural sway during quiet stance in addition to impaired weight shifting when transitioning between states of static and dynamic equilibrium such as during gait initiation and termination. Previous intervention studies lasting at least 12 weeks implemented a variety of methodologies such as strength training, aerobic training, tai chi, and dance therapy and produced

long-term benefits. Previous studies are inconclusive whether a multi-faceted approach for physical therapy intervention based on preferences of the participants will affect balance and gait initiation in those persons with PD. **PURPOSE:** To investigate if 12 weeks of individualized and supervised physical therapy intervention improves balance and gait initiation in persons with PD. **METHODS:** Six adults diagnosed with mild to moderate PD (mean age= 68.8 years±10.3 years), Hoehn and Yahr Levels I-III (Level I, n=2) (Level II, n=3) (Level III, n=1) participated in a 12-week program. The interventions were tailored to address functional deficits and participants' goals. Pre- (PRE) and post-testing (POST) included the Mini-BESTest, which measures 4 balance control systems. Gait initiation assessments were also performed as the participants voluntarily initiated gait from a quiet stance position on force plates. A paired sample *t*-test was used to compare PRE and POST. **RESULTS:** Four participants met or exceeded the minimal clinically important difference for the Mini-BESTest. The Mini-BESTest scores improved significantly (PRE, 18.5±5.8; POST, 24.7±3.5; *p*=0.021). There was no significant change in gait initiation parameters related to center of pressure movement. **CONCLUSION:** The 12-week individualized and supervised physical therapy program improved dynamic and static balance, but not gait initiation. The intervention was individualized towards the functional deficits and goals that were obtained in pre-testing. A limitation for this study was the small sample size.

### 3101 Board #3 May 29 3:15 PM - 5:15 PM Improved Coordination And Coordination Variability In Response To Deep Brain Stimulation In Individuals With Parkinson's Disease

Alexis K. Nelson<sup>1</sup>, Hailey B. Fong<sup>1</sup>, Clinton J. Wutzke<sup>2</sup>, Alexandra Schaller<sup>3</sup>, David O'Reilly<sup>4</sup>, Douglas W. Powell, FACSM<sup>1</sup>. <sup>1</sup>*University of Memphis, Memphis, TN.* <sup>2</sup>*Department of Rehabilitation Science, Fairfax, VA.* <sup>3</sup>*University of Tennessee Health Science Center, Memphis, TN.* <sup>4</sup>*Central Remedial Clinic, Dublin, Ireland.* (Sponsor: Douglas Powell, FACSM)  
(No relevant relationships reported)

Parkinson's disease (PD) is a progressive neurodegenerative disease associated with motor impairments. Deep brain stimulation (DBS) is associated with vast improvements in the motor symptoms of PD. Recent evidence has identified improvements in movement complexity during treadmill walking in response to DBS [1]. However, the effects of DBS on gait coordination have not been well elucidated. **PURPOSE:** to evaluate the effects of DBS on ankle and knee joint coordination and coordination variability during a treadmill walking task. **METHODS:** Five individuals with PD performed a four-minute treadmill walking task while 3D kinematics were collected over two 30-s periods. Participants completed testing in the DBS-ON followed by DBS-OFF conditions to avoid the confounding factor of fatigue. Kinematics were recorded simultaneously using an 9-camera motion capture system (120 Hz, Qualisys Inc., Goteburg, Sweden). Visual 3D was used to calculate segmental angles and velocities. Custom software (MATLAB, MathWorks) calculated continuous relative phase angles. Mean absolute relative phase (MARP) and deviation phase (DP) were used to quantify joint coordination (MARP) and coordination variability (DP). A paired samples *t*-test was used to determine the effects of DBS on MARP and DP. **RESULTS:** At the ankle, DBS was associated with greater MARP values (*p*=0.016; DBS-ON: 3.2±1.5; DBS-OFF: 2.1±0.9) and DP values (*p*=0.047; DBS-ON: 2.2±1.0; DBS-OFF: 1.4±0.4). At the knee, DBS was associated with greater MARP (*p*=0.021; DBS-ON: 6.8±2.8; DBS-OFF: 5.1±2.8) and DP values (*p*=0.045; DBS-ON: 2.9±1.5; DBS-OFF: 2.0±0.6). **CONCLUSIONS:** DBS allows individuals with PD to perform walking tasks with greater freedom of coordination and coordination variability. Increased availability of coordinative patterns may represent a greater number of successful strategies available to the system to optimize mechanical and metabolic efficiency during walking.

[1] Powell, Blackmore, Puppa, Lester, Murray, Reed-Jones, Xia 2018.

### 3102 Board #4 May 29 3:15 PM - 5:15 PM Effects Of Motor Timing Training On Golf Swing Motion In Parkinson's Disease.

Jin hyun Kim, Zach Lemke, Younguk Kim, Angela Ridgel, FACSM. *Kent State University, Kent, OH.* (Sponsor: Angela Ridgel, FACSM)  
Email: jkim74@kent.edu  
(No relevant relationships reported)

Individuals with Parkinson's disease often show deficits in motor timing, specifically during tasks that require rhythmic motor patterns such as gait and finger tapping. However, it is not clear if rehabilitation training that focuses on improving motor timing can improve rhythmicity during coordinated movements. In this study, we utilized a computer-based rehabilitation tool, called Motor Timing training (MT), which trains individuals to improve motor timing by reacting to an auditory or visual reference cue. Changes in motor timing and coordination were measured using a golf swing motion. **PURPOSE:** The purpose of this study was to examine if MT training with golf swing motion improves motor timing in Parkinson's disease.

**METHODS:** Participants completed 12 MT sessions, three times weekly training for 4 weeks. The aim of each session was to perform the golf swing motion to match the audible beat. Visual feedback was given to the participants to encourage them to hit the 'target zone' ( $\pm 15$  ms) during the golf swing. Motor timing was assessed using the Long Form Assessment (LFA) which evaluated timing and accuracy during fourteen movement tasks of the hands and feet. A wireless kinematic sensor system was utilized to measure pelvic acceleration in 3 axes (X, Y, Z) during the backswing and down swing. To determine variation of pelvic movement, the coefficient of variation (CV) were applied for analyzing the data. Paired t-test were used to compare pre- and post-intervention measures. **RESULTS:** There was a significant difference between pre-post training in the pelvis of X-axis on the back swing [ $t=2.783$ ,  $p=.039$ ] and there was a significant difference between pre-post training in the pelvis of Y-axis on the down swing [ $t=3.873$ ,  $p=.012$ ]. Motor timing also showed significant improvements as measured with LFA [ $t=3.102$ ,  $p=.027$ ]. **CONCLUSIONS:** These results suggest that MT training can improve motor timing and reduce the variation of pelvis movement during the golf swing in Parkinson's disease. In light of these findings, future studies will also examine if MT training promotes improved motor timing and golf swing mechanics in individuals who show impaired range of motion.

**3103 Board #5 May 29 3:15 PM - 5:15 PM**

**Effects Of Motor Timing Training On The Golf Performance In Parkinson'S Disease**

Younguk Kim, Jin Hyun Kim, Zachary Lemke, Angela L. Ridgel, FACSM. *Kent State University, Kent, OH.* (Sponsor: Angela L. Ridgel, FACSM)  
Email: ykim38@kent.edu  
(No relevant relationships reported)

**BACKGROUND:** Motor timing is essential for improving motor skills and it is a critical factor to determine the success in a golf swing. However, individuals with Parkinson's disease have deficits in motor timing due to bradykinesia, tremor, and rigidity. Rehabilitative training that employs a metronome beat to set a rhythm (Interactive Metronome) could provide rehabilitative training to improvement in motor timing and variability in golf performance. **PURPOSE:** The purpose of this study is to investigate the effects of 10 sessions of Interactive Metronome training on motor timing and variability in the golf performance of older adults with Parkinson's disease. **METHODS:** The participants with Parkinson's disease completed 10 sessions, 35-40 minutes per session, three times a week for 4 weeks. The speed and tempo of the golf swing with a seven iron were measured. Motor timing was analyzed by using Long Form Assessment (LFA) which evaluates timing and accuracy when performing movement tasks of the hands and feet. The speed and tempo data were obtained using a golf simulator. Paired sample t-test was used to compare the pre and post measure outcomes. **RESULTS:** After 10 sessions, there was a significant improvement in motor timing between pre-post testing (pre:  $158.16 \pm 75.05$ , post:  $94.66 \pm 67.76$ ,  $t=3.102$ ,  $p=0.027$ ). However, tempo variability (pre:  $22.81 \pm 14.00$ , post:  $11.05 \pm 7.16$ ,  $t=1.739$ ,  $p=0.143$ ) and speed variability (pre:  $5.99 \pm 3.58$ , post:  $4.49 \pm 1.81$ ,  $t=-.721$ ,  $p=0.503$ ) were not significantly different. **CONCLUSION:** These findings indicate that Interactive metronome training can promote improvements in motor timing and golf performance in older adults with Parkinson's disease. In addition, motor timing training could be widely utilized along with the exercise to reduce the symptoms of Parkinson's disease.

**3104 Board #6 May 29 3:15 PM - 5:15 PM**

**Sample Entropy Analysis Of Dance Interventions In People With Parkinson's Disease And Older Adults**

Zachary C. Lemke<sup>1</sup>, Peter Gates<sup>1</sup>, Jin Hyun Kim<sup>1</sup>, Fred Disenozo<sup>2</sup>, Angela L. Ridgel, FACSM<sup>1</sup>. <sup>1</sup>*Kent State University, Kent, OH.* <sup>2</sup>*Retired, Brecksville, OH.* (Sponsor: Angela L. Ridgel, FACSM)  
Email: zlemke@kent.edu  
(No relevant relationships reported)

Dance comprises a broad range of techniques and styles, which have been utilized in classes specifically designed for individuals with Parkinson's disease (PD) and healthy older adults (OA). Previous studies have shown that a series of dance sessions can improve balance, posture, and gait for people diagnosed with PD and healthy older adults. However, these studies have not analyzed the features of body limb movement during dance. Sample Entropy (SamEn) analysis can be used to examine the complexity of movements in order to provide direction in the development of optimal dance interventions for these populations. **PURPOSE:** To identify dance movement patterns resulting in the greatest improvement in tests of gait, balance and upper extremity function using partnered and non-partnered dance to music in PD and OA. We hypothesize that entropy-driven variation in movement will enhance improvements in motor performance and that PD participants will show greater sample entropy during dance than OA participants. **METHODS:** Participants with and without PD participating in structured group dance classes were recruited for this study. Motion capture was used to examine movement patterns and sample entropy analysis was used to calculate the complexity of movements during dance. **RESULTS:** Participants with

PD had a greater spread of SamEn in left hip abduction during tango movements than right hip abduction ( $p < 0.0001$ ). A greater SamEn in right hip rotation during tango movements than left hip rotation ( $p < 0.0001$ ) was seen during tango but no significant difference during fox trot. Furthermore, PD group had no significant difference in left/right knee flexion SamEn during tango but left knee flexion SamEn was higher during fox trot than right knee flexion SamEn ( $p = 0.006$ ). OA participants saw a much smaller, but still significant, spread in SamEn in left hip abduction during Tango than right hip abduction ( $p = 0.002$ ), with no significant difference in hip rotation SamEn. **CONCLUSION:** We interpret our entropy results as showing a decrease in PD left hip abduction control compared to the right hip during tango. Our PD participants reported that the left side was more affected. These types of data could be used to optimize dance interventions in regards to dance type, music beat/rhythm in order to improve limb control.

**3105 Board #7 May 29 3:15 PM - 5:15 PM**

**Relationship Between Lower Extremity Muscle Function And Gait Variability In Individuals With PD**

Jared W. Skinner<sup>1</sup>, Chris J. Hass, FACSM<sup>2</sup>. <sup>1</sup>*Appalachian State University, Boone, NC.* <sup>2</sup>*University of Florida, Gainesville, FL.* (Sponsor: Scott Collier, FACSM)  
Email: skinnerjw@appstate.edu  
(No relevant relationships reported)

**PURPOSE:** Increased variability in motor function can significantly impair performing activities of daily living. The difficulty in performing daily motor tasks is increased in pathological populations, e.g., Parkinson's disease (PD). The muscular capabilities, e.g., torque production and force control, in PD, are reduced compared to older adults. It is unclear if the reduced muscular capabilities in PD are related to increased difficulty performing regular movements, i.e., gait. This study examined the relationship between muscular capabilities of the lower extremity and gait variability in persons with PD.

**METHODS:** 12 PD and 11 age-matched controls underwent gait and lower extremity muscle testing. Gait was evaluated by having the subjects perform ten over-ground walking trials over a 9-m walkway at a self-selected speed using an 8-camera motion capture system. Linear measures of gait, including stride length, stride time, step width, and velocity, were calculated. Gait variability and force variability were examined using the coefficient of variation ( $CV = \text{standard deviation}/\text{mean} \times 100\%$ ). Lower extremity testing consisted of 1) maximal isometric torque production and 2) submaximal force control using a tracing paradigm at 5, 10, and 20% of their maximal torque production in multiple directions at the hip and ankle. Pearson's correlations were applied to analyze associations between gait variability and force variability. **RESULTS:** In the PD group, stride time was positively correlated with 20% of ankle dorsiflexion CV ( $r(21)=.62$ ,  $p<.05$ ) and velocity was positively correlated with 10 and 20% of ankle plantarflexion CV ( $r(21)=.59$ ,  $p<.05$ ) and 20% of hip extension CV ( $r(21)=.63$ ,  $p<.05$ ). Maximal torque production of the dorsiflexors ( $r(21)=.75$ ,  $p<.05$ ) and plantar flexors ( $r(21)=.67$ ,  $p<.05$ ) were positively correlated stride time variability in the PD group.

**CONCLUSION:** The results highlight an association between lower-extremity muscle function and gait function in PD. Interestingly, in those with PD, both maximal strength and control of muscle strength were found to be related to the temporal parameters of gait variability. These results suggest that gait dysfunction could be the result of specific pathological impairments and provide unique opportunities for specialized interventions.

**F-36 Thematic Poster - Sex Differences During Exercise Hyperthermia and Stress**

Friday, May 29, 2020, 3:15 PM - 5:15 PM  
Room: CC-2009

**3106 Chair:** Oscar E. Suman, FACSM. *Shriners Hospitals for Children/University of Texas Medical Branch, Galveston, TX.*

(No relevant relationships reported)

**3107 Board #1 May 29 3:15 PM - 5:15 PM**

**Sex Differences In Physical Performance Under Simulated Military Operational Stress**

Phil J. Agostinelli. *University of Pittsburgh, Pittsburgh, PA.* (Sponsor: Bradley C. Nindl, FACSM)  
(No relevant relationships reported)

**PURPOSE:** Military personnel are in a constant effort to maintain operationally specific physical performance under high levels of stress. Physical exertion, cognitive

overload, sleep deprivation, and caloric restriction are all factors of operational stress in the military. This study aims to investigate how Simulated Military Operational Stress (SMOS) effects performance on the operationally relevant tasks both in men and women. **METHODS:** As part of an ongoing study; Forty male soldiers (26±5yrs, 176±8cm, 85±15kg, 20±7%BF) and eleven female soldiers (25±5yrs, 167±12 cm, 63±6kg, 26±7%BF) completed a SMOS protocol lasting 5 days (D) and nights (N). Days 3 & 4 (D3, D4), subjects consumed 50% of caloric demands. N1, 2, & 5 (D1, D2, and D5) subjects slept from 2300-0700. N3-4, subjects slept from 0100-0300 and 0500-0700. Familiarization was completed D1. During D2 & 5 participants underwent a Tactical Mobility Test (TMT), consisting of the following: 2-min water can carry (WCC) (20 kg each hand), fire & movement course, 20-m casualty drag (CD) (91kg), 300-m shuttle run unloaded (SRU) and loaded (SRL) (16 kg), 2-mi paced, and 2-mi best effort timed ruck march (RM) (15 kg). Two-way mixed ANOVAs with Bonferroni Post Hoc ( $p < 0.05$ ) were used to identify if the difference in TMT performance form D2-5 was different between men and women. **RESULTS:** Regardless of sex a main effect for SRU across days was found. SRU increased by 6% from D2 to D4 and D5 (D2: 97.2±20, D4:103.3±22.8,  $p=0.047$ ; D5: 103.5±18.8,  $p=0.011$ ); additionally, D5 increased by 4% from D3 (D5: 103.5±18.8, D3: 99.3±20.2;  $p=0.047$ ). **CONCLUSION:** Short-term exposure to military operational stress leads to a decline in anaerobic capacity; regardless of sex. Operational tasks involving muscular strength, endurance, and aerobic endurance such as the WCC, CD, and RM were well maintained over 5-days of during SMOS equally between men and women. The preliminary findings of this study suggest simulated military operational stress effects women and men equally. Future investigation with a larger sample size is needed. This study was funded by the Department of Defense (Award # W81XWH-17-2-0070). The results and opinions herein are those of the authors and do not necessarily constitute endorsement of the Department of Defense.

**3108** Board #2 May 29 3:15 PM - 5:15 PM  
Abstract Withdrawn

**3109** Board #3 May 29 3:15 PM - 5:15 PM  
**Females Have An Increased Sensitivity To Thermal Stress During Matched Exercise Metabolic Heat Production**  
Lauren Schoech, Kyleigh Allie, Paolo Salvador, Mauricio Martinez, Eric Rivas. *Texas Tech University, Lubbock, TX.* (Sponsor: Oscar Suman, FACSM)  
Email: lauren.schoech@ttu.edu  
(No relevant relationships reported)

**PURPOSE:** Females report greater sensitivity in cold compared to hot conditions. However, it is unclear how thermal sensitivity is affected when the change for internal temperature ( $\Delta T_{in}$ ) and metabolic heat production (MHprod) are matched. This project tested the hypothesis that females have enhanced sensitivity to thermal stress during exercise hyperthermia when  $\Delta T_{in}$  and MHprod is matched. **METHODS:** Twenty-two healthy active (7 day activity: 8620±3008 steps/day;  $VO_{2max}$ : 49±10 mL/kg/min) adults (11M/11F, 22.4±4.9y, 169±7.6cm, 68.3±13kg) exercised at similar MHprod (M: 7.1±1.5 W/kg, F: 6.9±1.4 W/kg;  $P=0.32$ ) for 60 min (cycle ergometer) in cool (24.0±0.0°C; 14.4±3.6%Rh) and hot (42.3±0.2°C; 27.9±5.5%Rh) conditions in random order separated by at least 7 days. The  $\Delta T_{in}$ , heart rate ( $\Delta HR$ ), and thermal stress indices for comfort (TC, -4 very cold to +4 very hot), sensation (TS, -4 very cold to +4 very hot), perception (TP, 1 so cold I am helpless to 13 so hot I am sick), feeling (TF, +5 very good to -5 very bad), and focus (F, 0 internal focus [bodily sensations] to 100 external focus [external environment]) were measured every 10 minutes. A 2-way repeated-measures analysis of variance on area under the curve was used to examine Interaction (I) and Main Effect (ME) for condition × sex. Values are expressed as means ±SD with significance set at  $P < 0.05$ .

**RESULTS:** Males and females had similar increase in hot compared to cool for  $\Delta T_{in}$  (Cool:  $\Delta 0.5 \pm 0.1^\circ C$ , Hot:  $\Delta 1.5 \pm 0.6^\circ C$ ; ME: condition;  $P < 0.0001$ ) and  $\Delta HR$  (Cool: 58±15 b/min, Hot: 71±15 b/min; ME: condition;  $P < 0.01$ ). Females reported that TC and TS felt hotter in both conditions (ME: sex;  $P < 0.0001$ ) and both groups increased in hot compared to cool (ME: condition;  $P \leq 0.04$ ). Females reported that TS was elevated compared to males in cool compared to hot (I: condition × sex;  $P < 0.005$ ). TP felt hotter in the cool but similar increase in hot for females compared to males (I: condition × sex;  $P < 0.02$ ). Females reported TF was more positive compared to males in hot (I: condition × sex;  $P < 0.0001$ ). Females reported greater external focus in cool compared to males (ME: sex;  $P < 0.0002$ ). **CONCLUSIONS:** These data indicate that sex differences exist for thermal stress. Females perceive thermal stress in hot and cool conditions to a greater extent than males exercising at similar metabolic heat production.

**3110** Board #4 May 29 3:15 PM - 5:15 PM  
**Recovery Of Heart Rate Variability And Hemodynamics After Heated Exercise In Active Females**

Hannah A. Zabriskie<sup>1</sup>, Chad M. Kerksick, FACSM<sup>2</sup>, Andrew R. Jagim<sup>3</sup>. <sup>1</sup>Towson University, Towson, MD. <sup>2</sup>Lindenwood University, St. Charles, MO. <sup>3</sup>Mayo Clinic Health Systems, Onalaska, WI. (Sponsor: Chad Kerksick, FACSM)  
(No relevant relationships reported)

Previous research has demonstrated that men who exercise in heat have challenged autonomic recovery, though little research has been conducted in females. **PURPOSE:** The purpose of this study was to assess the recovery of autonomic function in women who performed moderate-intensity exercise in heat. **METHODS:** Seven women (31.7±7.6 years, 67.3±4.1 kg, 25.7±5.6 % Fat, 43.9±5.1 mL/kg/min) completed two identical bouts of graded treadmill walking (~60%  $VO_{2peak}$ ). One bout was hot (35-40°C, &gt; 40% relative humidity (RH)), and the other served as a control (18-22°C, &lt; 40% RH). For 24 h before and after each bout, participants had heart rate variability (HRV), specifically RMSSD, monitored. After each exercise bout, HR and BP were monitored during 30 min of supine recovery and 10 min of orthostatic tolerance assessment. **RESULTS:** RMSSD was more suppressed following exercise in the heat and remained lower than in the control condition for one hour ( $p < 0.05$ ). During supine recovery, heat exposure led to higher HR ( $p = 0.002$ ) and lower DBP ( $p = 0.016$ ). SBP ( $p = 0.037$ ) and DBP ( $p = 0.008$ ) were both lower after 10 min of supine recovery following hot exercise than after control temperature. Average response did not reveal orthostatic hypotension despite heat causing a higher HR ( $p = 0.011$ ) and lower SBP ( $p = 0.026$ ) after 10 min of orthostatic exposure. **CONCLUSIONS:** Exercise in heat causes greater disruptions in cardiovascular autonomic functioning for at least one hour after exercise. Women who exercise in heat should be wary of an exacerbated HR response following exercise in the heat and low recovery blood pressures with associated symptoms.

**3111** Board #5 May 29 3:15 PM - 5:15 PM  
**Sex Difference In Cerebral Blood Flow During Exercise Hyperthermia**

Eric Rivas, Kyleigh Allie, Paolo Salvador, Lauren Schoech, Mauricio Martinez. *Texas Tech University, Lubbock, TX.* (Sponsor: Oscar Suman, FACSM)  
Email: eric.rivas@ttu.edu  
(No relevant relationships reported)

**PURPOSE:** Young healthy females are more prevalent to orthostatic hypotension compared to males. It is unknown if females show similar cerebral blood flow hemodynamics (middle cerebral artery,  $MCA_{V^{mean}}$ ) compared to males during exercise hyperthermia. We tested the hypothesis that females have an attenuated  $MCA_{V^{mean}}$  response to exercising in hyperthermic conditions.

**METHODS:** Twenty-two healthy active adults (7 day activity: 8620±3008 steps/day;  $VO_{2max}$ : 49±10 mL/kg/min) adults (11M/11F, 22.4±4.9y, 169±7.6cm, 68.3±13kg) exercised at similar metabolic heat production (M: 7.1±1.5 W/kg and F: 6.9±1.4 W/kg;  $P=0.32$ ) for 60 min (cycle ergometer) in cool (24.0±0.0°C; 14.4±3.6%Rh) and hot (42.3±0.2°C; 27.9±5.5%Rh) conditions in random order with 7 days washout.  $MCA_{V^{mean}}$  absolute and percent change from rest,  $MCA_{V^{mean}}$  conductance ( $MCA_{V^{mean}}CVC$ ), cardiac output index (COi) and systemic vascular resistance index (SVRi), and the difference between conditions (hot minus cool) were examined by a mixed model 2-way repeated-measures analysis of variance for Interaction (I) and Main Effect (ME) for time and sex. Significance was set at  $P < 0.05$ .

**RESULTS:** Thermal ( $\Delta T_{in}$ , Cool:  $\Delta 0.5 \pm 0.1^\circ C$ , Hot:  $\Delta 1.5 \pm 0.6^\circ C$ ; ME: condition;  $P < 0.0001$ ) and cardiovascular strain ( $\Delta HR$  Cool: 58±15 b/min, Hot: 71±15 b/min; ME: condition;  $P < 0.01$ ) were similar between sex and increased in hot compared to cool condition. During the cool condition, absolute  $MCA_{V^{mean}}$  and  $MCA_{V^{mean}}CVC$  were higher in females compared to males (ME: sex  $P < 0.005$ ). In contrast,  $MCA_{V^{mean}}$  and  $MCA_{V^{mean}}CVC$  increased then decreased over time in hot compared to the cool condition (ME: time;  $P < 0.0001$ ). COi increased in hot compared to cool condition (ME: condition;  $P < 0.008$ ). Females had greater SVRi compared to males in both conditions (ME: sex;  $P < 0.008$ ). However, the %change and the difference between conditions, females compared to males had an attenuated  $MCA_{V^{mean}}$  (ME: sex;  $P < 0.03$ ) and  $MCA_{V^{mean}}CVC$  (I: time × sex;  $P < 0.01$ ).

**CONCLUSIONS:** These data indicate that sex differences exist for exercise cerebral blood flow. Females have higher  $MCA_{V^{mean}}$  in cool and have an attenuated  $MCA_{V^{mean}}$  response during exercise hyperthermia compared to males. This sex difference may be due to differences in blood pressure and systemic vascular resistance.

**3112** Board #6 May 29 3:15 PM - 5:15 PM  
**Post-Exercise Hyperthermia Cerebral Blood Flow Hemodynamics Are Similar Between Males And Females**  
 Mauricio Martinez, Kyleigh Allie, Paolo Salvador, Lauren Schoech, Eric Rivas. *Texas Tech University, Lubbock, TX.* (Sponsor: Oscar Suman, FACSM)  
 Email: mauricio.martinez@ttu.edu  
 (No relevant relationships reported)

**PURPOSE:** Females have greater orthostatic intolerance and increased adrenergic sensitivity to passive heat stress compared to males. It is unknown how cerebral blood flow is affected during post-exercise heat stress. We tested the hypothesis that females would have lower middle cerebral artery blood flow velocity (MCAV<sup>mean</sup>) during post-exercise hyperthermia. **METHODS:** Twenty-two healthy active adult (7 day activity: 8620±3008 steps/day; VO<sub>2</sub>max: 49±10 mL/kg/min) subjects (11M/11F, 22.4±4.9y, 169±7.55cm, 68.3±13kg) exercised at a similar metabolic heat production (M: 7.1±1.5 W/kg and F: 6.9±1.4 W/kg; P=0.32) for 60 minutes (cycle ergometer) in cool (24±0.0°C; 14.4±3.6%Rh) and hot (42.3±0.2°C; 27.9±5.5%Rh) conditions in random order with a 7 day washout. During 1-hour post-exercise recovery, Transcranial Doppler examined MCAV<sup>mean</sup>, pulsatility index (PI) and intracranial pressure (ICP). Systemic vascular responses for mean arterial pressure (MAP), augmentation index (AIx), pulse wave velocity (PWV), systemic vascular resistance (SVR), and change in intestinal temperature (ΔTin) and heart rate (ΔHR) and were measured during 1-hour recovery. Area under the curve (AUC) variables were analyzed using a mixed model 2-way repeated-measures analysis of variance for interaction (I) and main effects (ME) for Condition x Sex. Alpha priori was set at P<0.05. **RESULTS:** Exercise thermal (ΔTin, Cool: Δ0.5±0.1°C, Hot: Δ1.5±0.6°C; ME: Condition; P<0.0001) and cardiovascular strain (ΔHR Cool: 58±15 b/min, Hot: 71±15 b/min; ME: Condition; P<0.01) was similar between groups that increased in hot compared to cool condition. During recovery both sexes had a similar AUC MCAV<sup>mean</sup>, however, MCAV<sup>mean</sup> was lower in hot compared to cool (ME: Condition; P<0.03). Females also showed reduced stiffness (AUC PWV and AIx) compared to males (ME: Condition; P<0.0001; ME: Sex, P<0.0008). Females had greater AUC SVR compared to males in both conditions (ME: sex; P<0.01). There were no differences for MAP, PI, or ICP between the Condition or Sex. **CONCLUSIONS:** These data suggest that no sex difference exists for MCAV<sup>mean</sup> during recovery. Both sexes have lower MCAV<sup>mean</sup> in hot compared to cool conditions. However, the peripheral vascular mechanisms for this attenuation may differ as females have lower arterial stiffness and higher SVR.

**F-37 Free Communication/Slide - Cardiometabolic Disease**  
 Friday, May 29, 2020, 3:15 PM - 5:15 PM  
 Room: CC-3014

**3113 Chair:** Steven K. Malin, FACSM. *University of Virginia, Charlottesville, VA.*  
 (No relevant relationships reported)

**3114** May 29 3:15 PM - 3:30 PM  
**Effect Of Pre-Operative Aerobic Exercise On Surgical Outcomes And Cardiometabolic Health In Bariatric Surgery Patients**  
 Nicole M. Gilbertson<sup>1</sup>, Natalie ZM Eichner<sup>2</sup>, Elizabeth A. Rexrode<sup>2</sup>, Sibylle Kranz<sup>2</sup>, Arthur Weltman, FACSM<sup>2</sup>, Peter T. Hallowell<sup>2</sup>, Steven K. Malin, FACSM<sup>2</sup>. <sup>1</sup>*Pennsylvania State University, Altoona, PA.* <sup>2</sup>*University of Virginia, Charlottesville, VA.* (Sponsor: Steven K. Malin, FACSM)  
 Email: nmg46@psu.edu  
 (No relevant relationships reported)

**PURPOSE:** Examine if adding pre-operative aerobic exercise to standard medical care (EX+SC) improves surgical outcomes and enhances cardiometabolic health 30 d after surgery compared to SC only in bariatric surgery candidates. **METHODS:** Patients receiving bariatric surgery were match-paired to pre-operative SC (n=7 (6F), age 39.0±5.3 y, BMI 46.4±3.0 kg/m<sup>2</sup>) or EX+SC (n = 7 (7F); age 43.9±4.2 y, BMI 45.1±2.5 kg/m<sup>2</sup>; walking 30min/d, 5d/wk, 65-85% HR<sub>peak</sub>) for 30 d. Fitness (VO<sub>2</sub>peak), body composition (waist circumference and BodPod), lipids/lipoproteins, systemic inflammation (C-reactive protein (CRP)), and arterial stiffness (augmentation index (AIx); 120min mixed meal tolerance test) were assessed pre-intervention, post-intervention (~2 d prior to surgery), and 30 d post-operation. **RESULTS:** SC and

EX+SC reduced body weight (SC -8.4±0.8% vs. EX+SC -9.3±0.8%), fat mass (SC -9.6±1.1% vs. EX+SC -12.0±1.7%), and waist circumference (SC -5.6±1.4% vs. EX+SC -2.1±2.8%) similarly (all P<0.04). Treatment had no effect on CRP (P=0.58) but lowered fasted systolic blood pressure (SC -4.5±3.1% vs. EX+SC -7.9±3.0%), low-density lipoprotein (SC -20.1±4.5% vs. EX+SC -26.2±4.9%), and total cholesterol (SC -19.7±3.8% vs. EX+SC -21.6±4.6%) as well as AIx total area under the curve (SC -40.7±14.0% vs. EX+SC -19.7±11.2%) similarly for both groups (all P<0.02) pre-intervention to 30 d post-surgery. EX+SC had a shorter length of hospital stay than SC (41.3±4.4 vs. 56.7±5.7 hrs; P=0.05). Although VO<sub>2</sub>peak (SC -5.8±5.0% vs. EX+SC 1.7±5.2% pre- to post-intervention) and lean mass (SC -2.4±0.8% vs. EX+SC -0.4±1.4% pre- to post-intervention) were not significantly different between groups after the interventions, increased VO<sub>2</sub>peak prior to surgery correlated to a shorter length of stay (r=-0.58, P=0.03). Increased VO<sub>2</sub>peak (r=-0.78, P=0.001) and lean mass (r=-0.56, P=0.04) pre- to post-intervention was also associated with decreased CRP 30 days post-operation. **CONCLUSIONS:** EX+SC did not enhance the effect of SC on cardiometabolic risk factors. However, adding aerobic exercise to SC appears to benefit the bariatric patient as increased pre-operative VO<sub>2</sub>peak related to a shorter length of stay and increased VO<sub>2</sub>peak and lean mass prior to surgery correlated to decreased systemic inflammation 30 d post-surgery.

**3115** May 29 3:30 PM - 3:45 PM  
**High Intensity Exercise Training In Patients With Hypertrophic Cardiomyopathy**  
 Mitchel Samels<sup>1</sup>, Katrin A. Dias<sup>2</sup>, Christopher M. Hearon, Jr<sup>2</sup>, James P. MacNamara<sup>2</sup>, Michinari Hieda<sup>2</sup>, Aslan T. Turer<sup>3</sup>, Mark S. Link<sup>3</sup>, Satyam Sarma<sup>2</sup>, Benjamin D. Levine, FACSM<sup>2</sup>. <sup>1</sup>*Institute for Exercise and Environmental Medicine, Texas Health Presbyterian Dallas, Dallas, TX.* <sup>2</sup>*Institute for Exercise and Environmental Medicine, Texas Health Presbyterian Dallas & University of Texas Southwestern Medical Center, Dallas, TX.* <sup>3</sup>*University of Texas Southwestern Medical Center, Dallas, TX.*  
 (No relevant relationships reported)

Patients with hypertrophic cardiomyopathy (HCM) are excluded from high intensity activities due to perceived fear of sudden cardiac death though data from athletes with HCM suggest competitive sport may be safe for some. Low cardiorespiratory fitness in sedentary HCM patients may confer a greater lifetime cardiovascular event risk than exercise *per se*. While moderate intensity exercise training in patients with HCM modestly increases fitness, high intensity exercise may be superior. **PURPOSE:** To compare the efficacy of five months of moderate intensity exercise and high intensity exercise training to improve cardiorespiratory fitness (VO<sub>2</sub>max) in patients with HCM. **METHODS:** Eight patients with HCM (50 ± 7 years, 3 female) were assessed for maximal oxygen uptake (VO<sub>2</sub>max, Douglas Bag method), cardiac output (Q̇, acetylene rebreathing), and peripheral oxygen extraction (av-O<sub>2</sub> diff, Fick equation) before randomization and after 5 months of moderate or high intensity exercise training. Patients completed 3-4 sessions of moderate intensity exercise each week, while the high intensity group also incorporated a weekly interval training session. **RESULTS:** Five months of moderate intensity exercise increased absolute VO<sub>2</sub>max by 3% and relative VO<sub>2</sub>max by 4%, while high intensity exercise consistently increased absolute VO<sub>2</sub>max by 6% and relative VO<sub>2</sub>max by 5% (Figure). Maximal Q̇ did not change after moderate intensity exercise (+0.0L [95% CI -2.0 to 1.7]) but increased in all three patients after high intensity exercise (+1.2L [95% CI -1.4 to 3.9]), while maximal av-O<sub>2</sub> diff remained stable in both groups (moderate intensity: +0.8mL/100mL [95% CI -1.0 to 2.6]; high intensity: -0.5mL/100mL [95% CI -3.6 to 2.7]). **CONCLUSION:** Preliminary findings show similar increases in cardiorespiratory fitness following five months of moderate and high intensity exercise training in patients with HCM, although improvements were more consistent after high intensity exercise.

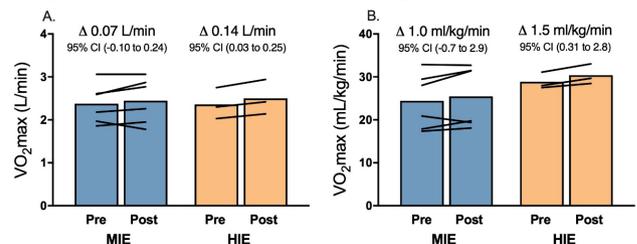


Figure. Similar increases in absolute (A) and relative (B) cardiorespiratory fitness following five months of moderate intensity exercise (MIE) and high intensity exercise (HIE). The increase in VO<sub>2</sub>max was consistent in all three patients who completed high intensity exercise training whereas the training response to moderate intensity exercise was more variable.

3116 May 29 3:45 PM - 4:00 PM  
Abstract Withdrawn

3117 May 29 4:00 PM - 4:15 PM  
**Adding Resistance Training To Endurance Training Improves Glucose Metabolism In Individuals With Metabolic Syndrome**

Alfonso Moreno-Cabañas, Juan Fernando Ortega, Felix Morales-Palomo, Miguel Ramirez-Jimenez, Laura Alvarez-Jimenez, Ricardo Mora-Rodriguez. *University of Castilla-La Mancha, Toledo, Spain.*  
Email: alfonso.moreno@uclm.es  
(No relevant relationships reported)

Elevated fasting blood glucose is one of the five components of metabolic syndrome (MetS) which is a cluster of anthropometric, metabolic and cardiovascular derangements. Insulin resistance (IR) has been identified as an important risk factor to develop diabetes (i.e. T2D) and MetS. Both, aerobic (AT) and resistance training (RT) prevent the development of T2D although it is unclear which is most effective. It has been suggested that mechanisms to improve IR are different between AT and RT. Thus, we hypothesized that the combination of both modes of training could provide additive effects to treat IR.

**Purpose:** To determine whether the addition of resistance training (RT) to high-intensity interval training (HIIT) was able to improve glucose metabolism in patients with metabolic syndrome (MetS). **Methods:** One hundred MetS patients (age, 56±8 years; weight, 92±17 kg; and Mets factors, 3.8±0.8 components) were randomized to undergo one of the following 16-wk program: (a) 4 x 4-min high-intensity interval training at 90% of HR<sub>max</sub> plus 3 sets of 8-12 rep at 60-85% 1RM of 3 legs free-weight exercises (HIIT+RT group; n=35), (b) 5 x 4-min high-intensity interval training at 90% of HR<sub>max</sub> (HIIT group; n=43) or (c) no exercise control group (CONT group; n=22). We measured the evolution of all five MetS components (i.e. Z-score), CRF (i.e. VO<sub>2max</sub>), legs strength and power (i.e. leg press 1RM and countermovement jump (CMJ)) and fasting glucose (FG) and insulin (FI) to calculate HOMA-IR before and after intervention. Pre-intervention FG was similar among groups (110±23; 115±21; 121±30, mg·dL<sup>-1</sup> for HIIT, HIIT+RT and CON, respectively). **Results:** After 16 weeks of training, HIIT+RT improved CMJ and 1RM leg press above HIIT and CON (P<0.010). After 16 weeks of training FG (4%; p=0.046) and HOMA-IR (18%; p=0.032), decreased only in HIIT+RT. However, both training groups improved similarly their VO<sub>2max</sub> (HIIT+RT, 7%, p=0.001; HIIT, 11%, p<0.001) and Z-score (HIIT+RT, 43%, P=0.022; HIIT, 63%, P=0.004). **Conclusion:** Our findings suggest that in initially sedentary individuals with MetS, RT combined with HIIT further improves the insulin-sensitizing effects of exercise reducing glucose concentrations.

3118 May 29 4:15 PM - 4:30 PM  
**Exercise Training Volume And The Fitness-fatness Index (FFI) In Adults With Metabolic Syndrome**

Joyce S. Ramos<sup>1</sup>, Lance C. Dalleck<sup>2</sup>, Claire Drummond<sup>3</sup>, Matthew P. Wallen<sup>4</sup>, Robert G. Fassett<sup>5</sup>, Jeff S. Coombes, FACSM<sup>5</sup>. <sup>1</sup>Flinders University and University of Queensland, Adelaide and Brisbane, Australia. <sup>2</sup>Western Colorado University, Gunnison, CO. <sup>3</sup>Flinders University, Brisbane, Australia. <sup>4</sup>Federation University, Victoria, Australia. <sup>5</sup>University of Queensland, Brisbane, Australia. (Sponsor: Professor Jeff Coombes, FACSM)  
Email: joyce.ramos@flinders.edu.au  
(No relevant relationships reported)

Cardiorespiratory fitness and fatness (central obesity) are purported to be mediating factors of metabolic syndrome (MetS), and consequent cardiovascular disease (CVD)/mortality risk. The recently developed fitness-fatness index (FFI) combines these and has been reported to be a better indicator of CVD and all-cause mortality risk, beyond the capacity of either fitness or fatness alone. **PURPOSE:** To investigate the effects of different exercise volumes on FFI in adults with MetS. **METHODS:** Ninety-nine adults diagnosed with MetS according to the International Diabetes Federation criteria were randomized to one of the following 16-week exercise intervention: i) moderate-intensity continuous training (MICT) at 60-70% HR<sub>peak</sub> for 30 min/session (n=34, 150 min/week); ii) 4 x 4 min bouts of high-intensity interval training (4HIIT) at 85-95% HR<sub>peak</sub>, interspersed with 3-min active recovery at 50-70% HR<sub>peak</sub> (n=34, 38min/session, 114 mins/week); and iii) 1 x 4 min bout of HIIT at 85-95% HR<sub>peak</sub> (n=31, 17 min/session, 51 min/week). Fitness (VO<sub>2peak</sub>) was determined via indirect calorimetry during maximal exercise testing and fatness was the ratio of waist circumference-to-height (WHtR). FFI was calculated as VO<sub>2peak</sub> in METs divided by WHtR. A positive response to the exercise intervention was determined as a 1FFI increase. **RESULTS:** Seventy-seven participants completed pre and post testing to determine FFI. There was a greater proportion of participants who responded positively to a change in FFI following 4HIIT (56%, 14/25) compared to MICT (31%, 8/26)

and 1HIIT (42%, 11/26), but with no significant between-group difference (p=0.19). After excluding 21 participants who had <85% adherence rate to the training sessions, a total of 56 were included in the analysis (4HIIT, n=15; MICT, n=20; 1HIIT, n=21). A similar trend in FFI responders was found (4HIIT, 60%; MICT, 30%; 1HIIT, 38%; between-group difference, p=0.19). **CONCLUSION:** This study suggests that there may be a threshold of exercise volume (intensity and duration) that must be obtained to improve FFI, and thus CVD and all-cause mortality risk in adults with MetS.

3119 May 29 4:30 PM - 4:45 PM  
**Water-based Exercise Training For Coronary Heart Disease**

Anna Sarah Scheer<sup>1</sup>, Amit Shah<sup>2</sup>, Beatriz I.R. de Oliveira<sup>1</sup>, Daniel J. Green<sup>3</sup>, Andrew J. Maiorana<sup>1</sup>. <sup>1</sup>Curtin University, Bentley, Perth, Australia. <sup>2</sup>Fiona Stanley Hospital, Murdoch, Perth, Australia. <sup>3</sup>University of Western Australia, Crawley, Perth, Australia.  
(No relevant relationships reported)

Exercise training is an important component of coronary heart disease (CHD) management, however engagement in gym-based exercise (GEX) remains sub-optimal. Water-based exercise (WEX) may provide an alternative, especially for patients with obesity or arthritis due to the buoyancy effect of water.

**PURPOSE:** To examine the effectiveness of WEX for people with CHD.

**METHODS:** Participants were randomised to 12 weeks of WEX, GEX, or control. Training groups undertook three, one-hour sessions of circuit training per week.

Aerobic capacity (VO<sub>2peak</sub>), muscular strength (one repetition maximum; 1RM), body fat (DXA) and endothelial function (flow mediated dilation; FMD) were assessed at baseline and 12 weeks. Data were analysed using STATA 16 with mixed effects linear regression.

**RESULTS:** Forty-five participants completed the study; WEX (n= 15), GEX (n=18), control (n=12). Data reported are estimated mean and 95% confidence interval.

| Outcome   | Week 0           | Week 12          | p      |
|---|------------------|------------------|--------|
| VO <sub>2peak</sub> (mL.kg <sup>-1</sup> .min <sup>-1</sup> ) WEX | 25.9 (23.5-28.7) | 27.4 (24.7-30.8) | 0.03   |
| VO <sub>2peak</sub> (mL.kg <sup>-1</sup> .min <sup>-1</sup> ) GEX | 25.2 (23.1-27.7) | 26.8 (24.4-29.7) | 0.004  |
| Hamstrings (kg) WEX   | 49.3 (43.3-55.7) | 54.0 (47.3-61.2) | 0.01   |
| Hamstrings (kg) GEX   | 50.7 (44.8-57.2) | 57.5 (51.0-64.2) | <0.001 |
| Biceps (kg) WEX   | 10.4 (8.7-12.0)  | 10.3 (8.6-12.0)  | 0.80   |
| Biceps (kg) GEX   | 10.5 (8.9-12.1)  | 11.5 (9.8-13.1)  | 0.003  |
| Body fat (kg) WEX   | 28.7 (24.9-32.5) | 27.8 (24.1-31.6) | 0.02   |
| Body fat (kg) GEX   | 28.4 (24.7-32.2) | 27.4 (23.7-31.2) | 0.003  |
| FMD (% change from baseline) WEX                                  | 3.9 (2.8-5.0)    | 5.0 (3.8-5.8)    | 0.02   |
| FMD (% change from baseline) GEX                                  | 4.8 (3.7-5.9)    | 5.2 (4.1-6.3)    | 0.39   |

No changes were evident in controls.

**CONCLUSION:** WEX and GEX improved aerobic fitness, leg strength and fat mass similarly, while WEX alone improved endothelial function. These findings support WEX as an alternative to GEX in patients with CHD.

Supported by the Spinnaker Foundation, The Heart Foundation (Australia), and the Australian Government Research Training Programme.

3120 May 29 4:45 PM - 5:00 PM  
**Aerobic Exercise Training Enhances The Blood Pressure-lowering Effect Of Antihypertensive Medication.**

MIGUEL RAMIREZ-JIMENEZ, FELIX MORALES-PALOMO, ALFONSO MORENO-CABAÑAS, JUAN FERNANDO ORTEGA, LAURA ALVAREZ-JIMENEZ, RICARDO MORA-RODRIGUEZ. *UNIVERSIDAD DE CASTILLA-LA MANCHA, TOLEDO, Spain.*  
Email: miguel.ramirez@uclm.es  
(No relevant relationships reported)

Hypertension is an important risk factor for suffering cardiovascular diseases and many hypertensive individuals are under pharmacological treatment (antihypertensive

medication; AHM). Aerobic exercise training in hypertensive individuals has been shown to reduce their blood pressure. However, information is scarce on the effects of aerobic training and AHM on the control of hypertension. **PURPOSE:** To analyze the effects of AHM on 21-h ambulatory blood pressure (ABP) before and after an aerobic exercise training program in hypertensive individuals. **METHODS:** Twenty-seven participants chronically medicated with angiotensin receptor blockers or angiotensin-converting enzyme inhibitors antihypertensive medicine (AHM) underwent high-intensity interval training (HIIT; 3 sessions per week, 4x4' at 90 HR<sub>MAX</sub>/3' at 70% HR<sub>MAX</sub>) during 4-months. Before and after training, 21-h ABP was monitored under 2 conditions in a double-blind, placebo randomized design: a) PLAC trial substituting for 3 consecutive days antihypertensive medicine by placebo, and b) AHM trial, taking their prescribed antihypertensive medicine. Cardiorespiratory fitness (CRF), body weight and aldosterone to plasma renin activity ratio (ARR) were measured as secondary outcomes. Differences among the 4 trials (i.e., PLAC<sub>PRE</sub>, AHM<sub>PRE</sub>, PLAC<sub>POST</sub>, AHM<sub>POST</sub>) were analyzed by one-way repeated-measures ANOVA. **RESULTS:** CRF increased significantly from 2.45±0.02 to 2.58±0.02 L·min<sup>-1</sup> (P=0.025), body weight decreased from 95.6±2.5 to 93.6±2.4 kg (P=0.007), whilst ARR only decreased significantly after training (-10.8±2.6 a.u., P=0.002). At baseline, AHM reduced daytime ambulatory mean arterial pressure by 4.5±1.1 mmHg, being that reduction enhanced to 7.4±1.1 mmHg after 4-months of training (P=0.047). However, at nighttime this difference faded out and the reductions of AHM before (6.1±1.5 mmHg) and after training (4.7±1.2 mmHg) remained similar (P=0.437). **CONCLUSIONS:** The present data show that 4 months of HIIT enhances the effects of antihypertensive medication on blood pressure during daytime. This effect fades out during the night, a time where BP naturally falls. These results demonstrate that aerobic training could be used as a strategy to improve pharmacological treatment in hypertensive individuals.

**3121** May 29 5:00 PM - 5:15 PM

**Effects Of Statins Therapy And Exercise On Postprandial Triglycerides In Overweight Individuals With Hypercholesterolemia.**

Ricardo Mora-Rodriguez, Juan F. Ortega, Felix Morales-Palomo, Miguel Ramirez-Jimenez, Alfonso Moreno-Cabañas, Laura Alvarez-Jimenez. *University of Castilla La Mancha, Toledo, Spain.*

Email: Ricardo.Mora@uclm.es

(No relevant relationships reported)

**PURPOSE:** To determine the effects of statins on postprandial lipemia (PPL) and to study if exercise could enhance statin actions.

**METHODS:** Ten hypercholesterolemic (blood cholesterol 204±36 mg·dL<sup>-1</sup>; LDL-c 129±32 36 mg·dL<sup>-1</sup>) overweight (BMI 30±4 kg·m<sup>-2</sup>), metabolic syndrome (MetS) individuals chronically medicated with statins (> 6 months) underwent 5-hr PPL tests in four occasions in a randomized order; a) substituting their habitual statin medication by placebo medicine during 96 hours (PLAC trial), b) taking their habitual statin medicine (STA trial), c) placebo medicine combined with a bout of intense aerobic exercise (EXER+PLAC trial) and d) combining exercise and statin medicine (EXER+STA trial).

**RESULTS:** Before the fat meal, statin withdrawal (i.e., PLAC and EXER+PLAC) increased blood triglycerides (TG; 29%), LDL-c (37%) and total cholesterol (23%; all P<0.05) evidencing treatment compliance. After the meal, statin withdrawal increased 5-h postprandial TG (PPTG) compared to its matched trials (94% higher PLAC vs STA and 45% higher EXER+PLAC vs EXER+STA; P<0.05). EXER+PLAC trial did not lower PPTG below the PLAC trial (i.e., incremental AUC of 609±152 vs 826±190 mg·dL<sup>-1</sup>·5 h; P=0.09). Neither adding exercise to statin resulted in larger reductions in PPTG (i.e., EXER+STA vs STA iAUC of 421±87 vs 421±84 mg·dL<sup>-1</sup>·5 h; P=0.99). **CONCLUSIONS:** In hypercholesterolemic MetS individuals, chronic statin therapy blunts the elevations in TG after a fat meal (i.e., iAUC of PPTG) reducing the cardiovascular risk associated to their atherogenic dyslipidemia. However, a single bout of intense aerobic exercise before the high fat meal does not reduce PPTG but neither interferes with the effects of statin treatment.

**F-38 Clinical Case Slide - Cardiovascular and Gastrointestinal**

Friday, May 29, 2020, 3:15 PM - 4:55 PM

Room: CC-2005

**3122** **Chair:** Robert B. Kinningham, FACS. *University of Michigan, Ann Arbor, MI.*

(No relevant relationships reported)

**3123** **Discussant:** Meagan Wasfy. *Massachusetts General Hospital, Boston, MA.*

(No relevant relationships reported)

**3124** **Discussant:** Barry A. Franklin, FACS. *Beaumont Health, Royal Oak, MI.*

(No relevant relationships reported)

**3125** May 29 3:15 PM - 3:35 PM

**Cardiac-Football**

Brady Fleshman. *University of Kentucky, Lexington, KY.*

(Sponsor: Robert Hosey, FACS)

(No relevant relationships reported)

**HISTORY:** A 20 year-old male Division I football player with no significant past medical history presented with syncope and collapse one hour ago. Patient was doing cone drills and was feeling short of breath with mid-sternal chest tightness. The trainers had him sit out the rest of the drill. Five minutes after resting he asked the trainer if he could go back in and they said no. Ten seconds later, he passed out from a standing position. Upon awakening a few seconds later, he was asymptomatic. He was immediately escorted from practice to the clinic. Patient states over the last week he had not been keeping up with his peers in practice.

**PHYSICAL EXAMINATION:** No acute distress. Moist oral mucosa. Heart rate 100, regular rhythm, no murmurs with Valsalva, sitting, standing, squatting or grip squeeze. Lungs are clear and normal to auscultation bilaterally without wheezing.

**DIFFERENTIAL DIAGNOSIS:** Vasovagal syncope, hypoglycemia, seizure, arrhythmia, hyponatremia **TEST AND RESULTS:** Labs showed normal CMP and TSH. CBC showed normocytic anemia (Hgb 13.1). Serum protein electrophoresis was normal. Coxsackie B virus antibody testing showed a 1:320 titer of Coxsackie type B-3. Additional history revealed that four weeks prior to collapse he had upper respiratory symptoms. Cardiac testing: EKG was normal. Echocardiogram showed borderline reduced LVEF 51% and mild hypokinesia of the left ventricle. A Holter monitor showed rare premature atrial and ventricular contractions and patient was asymptomatic while wearing. Stress echocardiogram showed supraventricular tachycardia at nine minutes of exercise, concerning for atrial flutter. The arrhythmia lasted for 10-15 minutes and then resolved spontaneously. Patient wore a Zio patch (heart rhythm monitor) for one week and it showed paroxysmal atrial flutter.

**FINAL WORKING DIAGNOSIS:** Paroxysmal atrial flutter **TREATMENT AND OUTCOMES:** It is thought that patient had viral myocarditis syndrome from Coxsackie virus causing patients symptomatic atrial flutter. He was started on Flecainide 50mg twice-daily oral tablet. Patient is allowed to continue with full contact football without restrictions while on medication. Cardiology will consider Zio patch monitor and possibility of ablation post-season but will need to briefly be on anticoagulation.

**3126** May 29 3:35 PM - 3:55 PM

**Abdominal Bloating - Cross Country**

Christine Linh Vuong. *Kaiser Permanente, Fontana, CA.*

(Sponsor: Robert Sallis, FACS, FACS)

(No relevant relationships reported)

**HISTORY:** A 17-year-old college cross country runner presents with 4 years of abdominal distension and bloating, most symptomatic after a run. Symptoms have been worsening, but do not interfere with her ability to run. She denies abdominal pain, but states that it is uncomfortable after running. She denies constipation or diarrhea, but notes that she usually has a bowel movement after running. There is no improvement of her symptoms after a bowel movement. She has had rare occasions of mucus and blood in her stools. She denies nausea or vomiting. She admits to frequent urination, but does drink a lot of water and denies dysuria or hematuria. She denies change in symptoms with her menses, which are regular.

KUBs in 2016 and 2017 showed stool in the colon and nonspecific bowel gas pattern. LFTs, H.pylori, ESR, CRP were normal in 2017. She was diagnosed with constipation and irritable bowel syndrome. She tried a daily probiotic, the low FODMAP diet, and gave up dairy for months without improvement of her symptoms.

**PHYSICAL EXAM:** The abdomen appears distended. Decreased bowel sounds in all quadrants. Dull to percussion. The abdomen is firm, but no guarding or rebound. Prior to a run, abdominal girth measured at 90cm at the umbilicus. After a run, no change.

**DIFFERENTIAL DIAGNOSES:** Exercise induced bowel ischemia, Inflammatory Bowel Disease, ascites, organomegaly, abdominal mass, pregnancy, diastasis recti.

**TEST AND RESULTS:**

Stool calprotectin negative. WBC 11.6, hemoglobin 13.4, platelets 303. LFTs within normal limits. Serum HCG negative. Creatinine 0.81

CT abdomen and pelvis with contrast: Large cystic lesion in the abdomen and pelvis measuring 28 x 19 x 38 cm. The origin of this lesion is unclear. Secondary moderate to severe right and mild to moderate left hydronephrosis.

**FINAL WORKING DIAGNOSIS:**

Large cystic abdominal mass, originating from the pelvis

**TREATMENT AND OUTCOMES:**

1. Emergent laparotomy showing large left ovarian cyst. 10L of fluid drained. Left salpingo-oophorectomy performed.
2. Pathology consistent with serous cystadenoma. Fallopian tube without significant abnormality. No malignant cells in the pelvic washing.
3. After surgery, abdominal girth measured 75cm at the umbilicus.
4. Gradual return to running 2 weeks post-op.

**3127** May 29 3:55 PM - 4:15 PM

### Diarrhea (Infectious Disease)-Swimming And Diving

Jordan P. Hilgefert, Christina Murphy, Amy Miller, Keri Denay, FACSM. *University of Michigan, Ann Arbor, MI.* (Sponsor: Keri Denay, FACSM)

Email: jordanhilgefert@gmail.com

(No relevant relationships reported)

**History:** 19-year-old men's collegiate swimming athlete with PMH of anxiety & major depressive disorder presented with 3-days of nausea, vomiting & diarrhea. He reported several teammates with similar symptoms. He returned for reassessment 1 week following initial evaluation endorsing 2 days of symptom improvement followed by return of several episodes of emesis, diarrhea & fatigue.

**Physical Examination:**

General: Well-developed, Well-nourished, NAD

HEENT:

-Head: NC, AT

-Eyes: conjunctiva clear, EOMI, PERRL, no discharge

-Ears: hearing normal on gross assessment, TMs normal

-Nose: nares clear, no deformity

-Throat: MMM, no erythema or exudate

NECK: normal ROM, no lymphadenopathy

PULM/CHEST: CTAB, no wheezes, rales or rhonchi

CV: RRR, no MRG. CR < 2 sec

ABD: BS+, soft, non-tender, non-distended, no organomegaly

SKIN: no visualized rashes or skin lesions, skin is warm and dry

PSYCH: appropriate mood and affect

**Differential Diagnosis:**

- 1) Viral gastroenteritis
- 2) Bacterial gastroenteritis
- 3) Parasitic infection
- 4) Irritable bowel syndrome
- 5) Anxiety

**Tests and Results:** Initial CBC, BMP and TSH were remarkable only for mild thrombocytosis (447 K/mm<sup>3</sup>) and hypoglycemia (63 mg/dL). After incomplete resolution of symptoms, GI PCR panel was obtained and found to be positive for cryptosporidium.

**Final Diagnosis:** Cryptosporidiosis

**Treatment and Outcomes:**

- 1) He was treated with Nitazoxanide 500 mg PO BID x 3 days and held out of the pool for 2 weeks.
- 2) Athletes with exposure to university pools presenting with diarrhea were tested for cryptosporidium via PCR. 6 were positive and all were held out of the pool for 2 weeks.
- 3) The public health department and environmental health experts were consulted to assist with management.
- 4) Administrators from every university and local swimming clubs who shared a common pool with our athletes were notified of potential exposure to cryptosporidium. One head-to-head swimming meet was cancelled in an effort to limit potential exposure.
- 5) University pools were shut down and treated twice with a high-concentration chlorine.

6) Water samples were collected serially before and after treatment cycles to ensure eradication prior to re-opening the pools.

**3128** May 29 4:15 PM - 4:35 PM

### Emesis- Football

Lauren E. Cianci, Tesa E. Johns, Peter H. Seidenberg, FACSM. *Penn State University, University Park, PA.* (Sponsor: Peter H. Seidenberg, FACSM)

Email: laurencianci@gmail.com

(No relevant relationships reported)

**HISTORY:** An 18-year-old NCAA D-I football athlete developed emesis during exercise. During his freshman season, he had recurrent URIs and emesis during practice. The vomiting appeared to be post-tussive during intense exercise. The athlete has not experienced this before but has a history of asthma and allergies. Symptoms improved temporarily with a non-sedating antihistamines and a H2 blocker. But, after one week, the vomiting returned. A PPI, fluticasone nasal spray and albuterol were then added, which appeared to help. Symptoms returned in the spring and montelukast was added to his regimen. He continued to complain of mucus accumulating in his throat that would cause him to gag which would occur with intense exercise and then even while trying to sleep. An EGD was performed which was normal. The athlete was then referred for allergy testing and immunotherapy.

**PHYSICAL EXAMINATION:** Afebrile. Pulse ox 98% on room air. NAD, A&O. Nasal mucosa is pale, boggy and swollen with clear d/c; TM clear bilaterally; OP with posterior cobble stoning; no tonsillar exudate or erythema. No cervical LAN. CV: RRR. Lungs CTAB. Abdomen ND, BS (+), mild epigastric TTP, and no rebound or mass.

**DIFFERENTIAL DIAGNOSIS:**

1. Sinusitis
2. Allergic rhinitis
3. GERD
4. Gastritis
5. asthma

**TESTS AND RESULTS:**

Chest radiograph: normal

Spirometry Testing:

- normal FVC
- FEF max was decreased
- Increased RV/TLC
- diffusion 68% of predicted

EGD: normal

Allergy testing: (+) ragweed pollen, several weed pollens, tree pollens, several grasses, dust mites, cockroach, animal dander

**FINAL/WORKING DIAGNOSIS:**

Allergic rhinitis accompanied by emesis due to hypersensitive gag reflex stimulated by postnasal drip

**TREATMENT AND OUTCOMES:**

1. Continue antihistamines and fluticasone nasal spray
2. Weekly immunotherapy injections
2. Dust mite bed covers to reduce exposure
3. Medication compliance

With the above measures, the athlete's symptoms were controlled and he continues to play football without difficulty.

**3129** May 29 4:35 PM - 4:55 PM

### General Medicine / Gastroenterology-Cycling

Laura Beth Anderson, Amie Kim. *Icahn School of Medicine at Mount Sinai Medical Center, New York, NY.*

Email: amie.kim@gmail.com

(No relevant relationships reported)

**HISTORY:** 31 year old male presents with left (L) groin pain. While cycling, he twisted rightward with sharp pull and "fullness" to L lateral abdomen and groin. This developed into new GI symptoms including constipation and acid reflux. In 4 months, his BMI decreased from 23 to 17 due to inability to tolerate food bolus. Additional urologic symptoms developed including perineal numbness and pain, incomplete void, and soreness with sexual activity.

**PHYSICAL EXAMINATION:** Positive affect, marked cachexia. Long torso relative to lower extremity length. Abdomen soft, no hernia. Marked tenderness to palpation at L perineum, inguinum, radiating to L lateral abdomen and obliques. Resisted sit-up with pain reproduced, 5/5 strength. L hip extension, 50 degrees L, 70 degrees right. No inguinal lymph nodes. Normal scrotal exam. L4-S1 motor 5/5, sensory intact to light touch. Gluteal squeeze intact **DIFFERENTIAL DIAGNOSIS:** athletic pubalgia, labral tear, iliopsoas tendonitis, osteitis pubis, small bowel dysmotility

**TEST AND RESULTS:** Hip ultrasound-rectus femoris transversalis fascia with invagination, herniating 0.2 cm at area of tenderness. Joint fluid at L anterior femoral recess. Iliopsoas bursa at L pelvic crest asymmetrically increased. Pubic symphysis

osteitis. No snapping iliopsoas tendon. **MRI pelvis with IV contrast**-trace pelvic ascites. No small bowel obstruction or mass. No abdominal hernia with Valsalva. No musculotendinous injury at pubic symphysis. **Scrotal ultrasound**-L epididymal cyst. **Endoscopy/colonoscopy**-no findings, with biopsies. **Mayo Clinic-nuclear medicine gastric emptying test**-significantly delayed 6 hour small and large bowel transit 9% (mean 58%). **Anorectal manometry**-markedly increased anal resting pressures with normal function. **Nuclear medicine gastric accommodation**-no findings. **FINAL WORKING DIAGNOSIS:** Athletic pubalgia with secondary small bowel dysmotility **TREATMENT AND OUTCOMES:** Marked improvements in musculoskeletal, neurologic, and gastrointestinal symptoms with dedicated pelvic floor PT. Has transitioned to plyometrics and high resistance activities. Acupuncture with athletic pubalgia protocol. Continues supportive boxer briefs, probiotic supplements, daily laxative. Stool transplant evaluation pending. Sports hernia surgical evaluation pending

**F-39 Clinical Case Slide - Medical Issues II**

Friday, May 29, 2020, 3:15 PM - 4:55 PM  
**Room:** CC-2022

**3130 Chair:** Robert E. Sallis, FACSM. *Kaiser Permanente Medical Center, Fontana, CA.*  
*(No relevant relationships reported)*

**3131 Discussant:** Jill Sadoski. *Michigan State University, East Lansing, MI.*  
*(No relevant relationships reported)*

**3132 Discussant:** Brian A. Davis, FACSM. *University of California-Davis, Sacramento, CA.*  
*(No relevant relationships reported)*

**3133** May 29 3:15 PM - 3:35 PM  
**Chest And Neck Pain In A Tennis Player**  
 Kathryn Elizabeth McLellan, Jeffrey Kovan, Nathan Fitton, Jill Moschelli. *Michigan State University, East Lansing, MI.*  
 (Sponsor: James Dunlap, FACSM)  
*(No relevant relationships reported)*

**History:** An 18-year old male D-1 tennis player presented to the office with new onset pain in his chest and neck. It started the night prior to presentation in the center of his chest. He fell asleep without pain, but the next day noted pain in his upper chest and neck. He described it as a stiffness and as a weight pressing down on his chest. The pain was constant and worse with swallowing, speaking, neck extension, and head rotation. He also reported feeling more out of breath than usual. Two days prior to symptom presentation, he performed baseline strength testing. He denied fever, pain with neck flexion, radiation to either arm, syncope, wheezing, sore throat, N/V/D or headache. He had no personal or family history of asthma, pneumothorax, or cardiac disease. He denied current or prior smoking, drug use, and vaping.

**Physical Exam:** Vitals: Ht 182 cm, Wt 77.1 kg, BP 119/74, HR 74 bpm, Temp 36.6 C (oral), BMI 23.2

Gen: NAD, nontoxic

ENT: no pharyngeal erythema or tonsillar swelling

Neck: no lymphadenopathy. Supple, full ROM but pain in full extension. No TTP of spine or soft tissues.

CV: RRR, no M/R/G

Resp: CTA bilaterally, good air entry, no wheeze, no accessory muscle use

Chest: No TTP of ribs, sternum, costo-sternal joint, or intercostal spaces. No palpable subcutaneous crepitus to the chest or neck.

Skin: no erythema of the skin of neck or chest

**Differential diagnosis:**

Acute coronary syndrome

Pneumomediastinum

Strain

Infection

Asthma

**Testing:**

X-ray of Chest/Neck: Lucency seen along paravertebral regions of upper thorax raising concern for pneumomediastinum. No pneumothorax.

**Final Diagnosis:** Spontaneous pneumomediastinum

**Treatment/Outcome:**

Patient was held from activity until follow-up weekly X-rays demonstrated resolution of free air in the neck.

Symptoms and X-ray findings resolved within two weeks.

He was cleared at 2 weeks with a gradual progression of activity and avoidance of full exertion or weight lifting.

One week later, he was cleared to return to full activity with no restrictions. He was advised to avoid breath-holding with activity. He has had no recurrence of symptoms.

**3134** May 29 3:35 PM - 3:55 PM  
**Severe Bleeding In A Collegiate Water Polo Athlete**

Casey N. Maxwell. *Princeton University, Princeton, NJ.*

(Sponsor: Margot Putukian, FACSM)

Email: cmaxwell@princeton.edu

*(No relevant relationships reported)*

**HISTORY:** 18 y/o male presents during review of incoming student-athlete health history documents with history of "severe hemophilia A", self-treated with Factor VIII infusions every other day & "extra doses" as needed. Letter from pediatric hematologist clearing him to participate: "there is no medical reason he cannot participate in competitive water polo." PMH: Two hospitalizations due to blood infection (2003 & 2005), ADHD diagnosis (2009), Type 2 SLAP lesion right shoulder (2016), Wisdom Teeth Extraction (3/2017).

**PHYSICAL EXAMINATION:** Visible keloid scarring present at two sites on the right and left side of patient's chest consistent with port removals. BP: 129/92mmHG. Pulse: 64bpm. Height 77in. Weight 225.2lbs. PE otherwise benign.

**DIFFERENTIAL DIAGNOSIS:**

Hemophilia A

Von Willebrand Disease

**TEST AND RESULTS:**

VWF profile: Normal

Random Factor VIII level: 12% (~30hours after infusion)

Post-infusion Factor VIII level: 147% down to 77% at 6 hours.

Hepatitis A/B/C Immune Status, HIV Antibody: negative

Normal PT. Prolonged PTT which corrects with normal plasma mixing.

Unremarkable CBC, CMP

**FINAL WORKING DIAGNOSIS:** Severe Hemophilia A.

**TREATMENT AND OUTCOMES:** Prophylactic Treatment of Advate 5000units daily, during water polo season, just prior to participation in practice or game. If practice/games extend post-infusion 8 hours or beyond, patient to self-infuse additional 5000units. Self-infusion every other day when not participating in water polo. In case of an emergency/life-threatening bleeding, patient to infuse first and then, if stable, seek care at RWJ-Rutgers ER (or other regional Hemophilia Treatment Center while traveling). If clinically warranted, patient to seek care at closest ER and bring factor with him. Annual re-evaluations to be performed at Hemophilia Treatment Center Rutgers-RWJ. Patient has been fortunate to participate in competitive collegiate water polo for 2+ seasons with no adverse sequelae.

**3135** May 29 3:55 PM - 4:15 PM

**Calf Pain-Brazilian Jujitsu Fighter**

Alyssa Neph, Kevin Burnham. *University of California, Davis,*

*Sacramento, CA.* (Sponsor: Brian Davis, MD, FACSM)

Email: aneph@ucdavis.edu

*(No relevant relationships reported)*

**HISTORY:** 29 yo male Brazilian jujitsu fighter with a history of Henoch-Schonlein purpura and eczema presents to clinic for 6 months of right anterolateral calf pain without a clear injury. He reports constant, dull, aching pain, worse with dorsiflexion and resisted plantar flexion. He notes associated pitting edema, dry leathery skin, hypopigmentation, and hyperesthesia that began 3-4 months ago. He has stopped jujitsu due to symptoms. Tib-fib xrays and venous duplex were negative. He tried acetaminophen, ibuprofen, physical therapy, topical clobetasol, and oral prednisone with short-term improvement. **PHYSICAL EXAMINATION:** Skin of the anterolateral calf is indurated with hair loss, a leathery appearance, and areas of depigmentation. The distal lateral calf is warm and erythematous, with swelling posterior to the lateral malleolus. Tinel's sign is negative at the fibular head. Pulses are normal bilaterally with ankle plantar and dorsiflexion. Ankle ROM is full. Light touch sensation is intact in L2-S2 dermatomes and strength is 5/5 in lower extremities.

**DIFFERENTIAL DIAGNOSIS:** Complex regional pain syndrome, Cellulitis, Scleroderma, Eosinophilic fasciitis, Chronic exertional compartment syndrome, Vascular insufficiency **TEST AND RESULTS:** Lab work: inflammatory markers and rheumatologic labs negative except for elevated CK (356) of unknown significance. EMG/NCS: low amplitude right vs left sural sensory nerve suggesting sural neuropathy although within normal limits; no fibular neuropathy or radiculopathy. MRI right leg: nonspecific skin thickening of anterolateral shin with fascial edema and mild fibularis longus myositis. Skin biopsy: linear morphea versus eosinophilic fasciitis **FINAL WORKING DIAGNOSIS:** Segmental Linear Morphea (localized scleroderma)

**TREATMENT AND OUTCOMES:** Dermatology referral led to biopsy; subsequently, treatment with PO methotrexate (MTX), high dose IV methylprednisolone for three cycles, and topical clobetasol ointment BID. UVA1 phototherapy was also started due to extensive disease and ankle and knee joint involvement. Subjective improvement in ROM, skin stiffness, and strength per patient after 2 cycles of methylprednisolone. Switched to SQ MTX for better absorption and lower cost. Patient continues to improve as he remains on the above treatment protocol.

**3136** May 29 4:15 PM - 4:35 PM

### An Unexpected Curveball Causing Fatigue In A Softball Player

Om Sam<sup>1</sup>, Stanley Hunter<sup>2</sup>, Nina Millet<sup>1</sup>. <sup>1</sup>UHS, Johnson City, NY. <sup>2</sup>UHS, Binghamton, NY.  
Email: omsam3288@gmail.com

(No relevant relationships reported)

**HISTORY:** 19 year old caucasian female softball player with no past medical history presented to the office for fatigue and reduced exercise tolerance for a month. She also complained of muscle cramps in her calves, decreased appetite, intermittent headaches, nausea and one episode of non-bloody, non-bilious emesis. Her athletic performance had decreased despite no changes in her training regimen. She measured her glucose via a glucometer with readings in the 70s. She maintained proper fluids, electrolyte and nutrient intake. She denies any changes in her weight, menstrual cycle, depression and recent illness.

10 point ROS was negative. Social history is unremarkable except for occasional alcohol intake. Regular menstrual cycle.

**PHYSICAL EXAMINATION:** Vital signs within normal limits. No signs of acute distress. Normal mentation and affect. No jaundice or pallor. Regular rhythm and rate. No murmurs appreciated. Lungs clear to auscultation. Abdomen is soft, non-tender, with normal bowel sounds, no masses appreciated. 5/5 strength and sensation to light touch intact in all extremities. Biceps and knee jerk reflex 2+.

**DIFFERENTIAL DIAGNOSIS:** Iron-deficiency anemia. Thalassemia.

Hypothyroidism.

**TEST AND RESULTS:** CBC: RBC 5.58, H&H 11.6/37.8, MCV 67.7, MCHC 30.7, MCH 20.8 - Microcytic anemia. Peripheral blood smear reveals anisocytes. CMP: Na 133-hyponatremia. Iron panel: Ferritin 20,1, Transferrin saturation 36, Total FE binding 376, Serum iron 137 - Normal iron panel TSH 1.120 - normal. Vit D 47 - normal. Haptoglobin 23 (low), LDH 606 (N), Total bilirubin 0.9 (N) - No signs of hemolysis. Hgb electrophoresis: Hgb A 95 (low), Hgb A2 4.7 (high), Hgb F, 0.3 (N), Hgb variant 0- Beta thalassemia trait. EKG: normal

**FINAL WORKING DIAGNOSIS:** Beta-thalassemia trait

**TREATMENT AND OUTCOMES:** Initial treatment with iron supplementation for 3 weeks showed no improvement. Although it may take 6-8 weeks for Hgb levels to return to normal. Repeat Hgb after 3 weeks should have revealed a mild improvement. Iron panel was ordered to confirm diagnosis, which was normal. Further family history revealed thalassemia, which was then confirmed with Hgb electrophoresis. Folic acid 2 mg daily started, iron supplementation discontinued. Cessation of activity for 4 weeks to promote recovery, then gradual return to full activity. Follow-up in 2 months.

**3137** May 29 4:35 PM - 4:55 PM

### Almost Vaping Your Way To Medical Disqualification

Eric Emmanuel Coris, William Anderson, Yuri Chulskiy, Sanders Chae, Byron Moran. *The University of South Florida, Tampa, FL.*

Email: ecoris@usf.edu

(No relevant relationships reported)

**HISTORY:**

18 year old male freshman Division I football athlete with a history of abnormal pre-participation EKG. Initial EKG was significant for left axis deviation, incomplete right bundle branch block, prominent p wave, t wave inversion in V1 and V2. He had no symptoms, and denied significant past medical history. Echocardiogram revealed significantly enlarged right atrium, pulmonary hypertension.

**PHYSICAL EXAMINATION:**

Normal, except CV: RRR without M/G/R; nl S1, prominent S2 in pulmonic area, Intermittent fixed split S2, normal PMI.

**DIFFERENTIAL DIAGNOSIS:**

Pulmonary hypertension/Anomalous pulmonary return/Arrhythmogenic right ventricular dysplasia/Interstitial lung disease/Sarcoid/Intracardiac shunt/Atrial septal defect/Ventricular septal defect/Obstructive sleep apnea/Obstructive lung disease/HIV/Granulomatous lung disease/Hypersensitivity Pneumonitis

**TEST AND RESULTS:**

CT angiogram of the chest revealed mild enlargement of the right atrium. Ill-defined opacities bilaterally with tiny focal lucencies which may represent focal developing cavitation. Mixed solid and ground-glass opacities with focal internal lucencies mainly located peripherally. Small lucent central regions are suggested within these regions.

Further significant history of two months prior to initial EKG, and the day after initial EKG two vaping episodes. No tobacco, no THC reportedly contained but some type of flavoring was present. Believes he split one e cigarette with another person. Prior to that episode he vaped every other weekend, for a few weekends, two months prior to the initial EKG. No symptoms ever noted after vaping that he was aware of. Did have rhinorrhea and sneezing for several months this summer, he felt related to seasonal allergic rhinitis.

**FINAL WORKING DIAGNOSIS:**

Vaping induced hypersensitivity pneumonitis

**TREATMENT AND OUTCOMES:**

Athlete refrained from further vaping. Held from competitive activity until completion of workup, athlete was gradually progressed through increasing cardiopulmonary exercise to return to play. Returned to full play over a 2 week progressive period with no symptoms. Follow up CT of the chest and pulmonary function tests returned to normal.

## F-40 Clinical Case Slide - Spine

Friday, May 29, 2020, 3:15 PM - 5:15 PM

Room: CC-3020

**3138** **Chair:** Stanley Alan Herring, FACSM. *University of Washington, Seattle, WA.*

(No relevant relationships reported)

**3139** **Discussant:** Samuel K. Chu. *Shirley Ryan AbilityLab, Chicago, IL.*

(No relevant relationships reported)

**3140** **Discussant:** Poonam P. Thaker, FACSM. *Presence Resurrection Sports Medicine Fellowship, Chicago, IL.*

(No relevant relationships reported)

**3141** May 29 3:15 PM - 3:35 PM

### "Tingling In The Scrum": Paresthesias And Neck Pain - Rugby

Jonathan Smits<sup>1</sup>, Pierre Rouzier, FACSM<sup>2</sup>, John Herbert Stevenson<sup>1</sup>. <sup>1</sup>University of Massachusetts Medical School, Worcester, MA. <sup>2</sup>University of Massachusetts, Amherst, MA.

(No relevant relationships reported)

**HISTORY:** A 19 year old female college student "new to club rugby" presented to the campus health clinic for evaluation of neck stiffness and extremity tingling following last week's practice. She was unable to recall a specific injury. However, she reported later feeling neck stiffness with associated soreness. She also reported paresthesias involving both hands, left worse than right, and her left foot. Her symptoms were improving but she had not resumed practice.

She reported being a multi-sport high school athlete with participation in varsity field hockey and lacrosse without prior concussion, head or neck pain, or extremity abnormalities. She had also been in an auto accident years prior without subsequent injury. History was notable for resolved low back pain, and a family history of back pain.

**PHYSICAL EXAMINATION:** Spine exam demonstrated FROM with no C/T/L spinous process tenderness. Spurling maneuver was negative. Tightness was appreciated in left trapezius muscle compared to right. Shoulders demonstrated FROM with normal rotator cuff strength. Upper and lower extremities with equal sensation, reflexes, and pulses. Grip strength normal. Straight leg raise and slump tests were negative.

**DIFFERENTIAL DIAGNOSIS:**

1. Cervical strain
2. Herniated cervical disc
3. Cervical spondylolysis
4. Vertebral fracture
5. Spinal stenosis
6. Spinal infection
7. Autoimmune disease

**TESTS AND RESULTS:**

1. Cervical spine x-rays: straightening without bony pathology
2. MRI brain & cervical spine:
  - Mild disc narrowing at C5-6
  - Chiari I malformation with pointed tonsils herniated 1.1 cm from foramen magnum
  - Syrinx spanning C5-T4 with max diameter 3 mm in upper thoracic cord

**FINAL WORKING DIAGNOSIS:**

Chiari I malformation with C5-T4 syringomyelia

**TREATMENT AND OUTCOMES:** The athlete was initially restricted from rugby activities until follow-up evaluation. She noted interval improvement and wished to pursue strength training at season end. Her symptoms then recurred with overhead lifting, and later with chiropractic treatments. Upon return to campus, brain and cervical MRI were ordered as recommended by a neurologist. Due to the above MRI findings, she stopped recreational activity and was referred for urgent neurosurgical evaluation. She will undergo decompression surgery.

**3142** May 29 3:35 PM - 3:55 PM

**Neck Injury - Football**

Paiyuam Asnaashari, Robert E. Sallis, FACSM. *Kaiser Fontana, Fontana, CA.* (Sponsor: Dr Bob Sallis, FACSM)

Email: paiyuam.x.asnaashari@kp.org

(No relevant relationships reported)

**HISTORY:** 21-year-old senior high school football offensive line men sustained a neck injury while tackling. During the third quarter of a midseason game, he tackled an opponent player, and they both landed on the ground. The patient was facing down with opposing player just underneath his anterior torso. Shortly after the play, given he was near the ball, a pile up of players landed on his upper back. He sustained a hyperextension injury of his cervical neck since his head was laying on the player he tackled. Patient described an immediate “pop” sensation in his neck and had “complete weakness & numbness” of his R upper & lower extremities.

**PHYSICAL EXAMINATION:** After safely placing patient in supine position on spine board, examination demonstrated he as alert and orientated x 4, had spinous process tenderness from C4-C7. Sensory testing along both extremities revealed significantly decreased and almost absent sensation in R upper & lower extremity. He was unable to raise / move his R arm or leg. His distal pulses and breathing were within normal ranges.

**DIFFERENTIAL DIAGNOSIS:** Cervical Cord Compression, Cervical Fracture, Cervical Disc Herniation, Cervical Facet Radiculopathy,

**TESTS AND RESULTS:**

Cervical X-RAYS: No osseous abnormality.

Cervical CT Scan: L neural foramina stenosis at C3/C4, R neural foramina stenosis at C6/7. Mild to moderate spinal canal stenosis at C6/7 and C7/T1.

Thoracic CT Scan: Normal CT chest, abdomen, pelvic, and thoracic spine.

MRI Cervical Spine: C6-7 where a right paracentral / foramina disc protrusion. Mild central canal stenosis at T1-2 level due to diffuse disc bulge.

**FINAL WORKING DIAGNOSIS:** C6-7 cervical disc herniation with mild to moderate cervical cord stenosis at C6/7 and T1-2.

**TREATMENT AND OUTCOMES:** R-sided weakness resolved after 4 weeks of supportive care, watchful waiting and physical therapy.

**3143** May 29 3:55 PM - 4:15 PM

**Trampoline Training Trauma: A Diver's Injury**

Luting Eckensweiler<sup>1</sup>, Anne Doran<sup>2</sup>, Poonam Thaker, FACSM<sup>1</sup>.

<sup>1</sup>Resurrection Medical Center, Chicago, IL. <sup>2</sup>Lutheran General Hospital, Park Ridge, IL. (Sponsor: Poonam Thaker, FACSM)

(No relevant relationships reported)

Trampoline Training Trauma: A Diver's Injury

**History:**

A 15 year old male presented to the emergency department with back pain after sustaining an injury while practicing a diving routine on the trampoline. He was in forward rotation when he landed awkwardly on his chin and upper chest, sending his back into hyperextension with his legs landing above his head. He felt immediate low back pain and complete loss of sensory and motor function of his legs for about 30 seconds. All sensory and motor function subsequently returned and he was able to ambulate from the trampoline into the home. He denied ongoing sensory or motor deficits in his legs, loss of consciousness, neck pain, urinary or bowel incontinence, or upper extremity weakness.

**Physical examination:**

Examination revealed a well appearing male who was able to ambulate slowly but independently with normal gait. He had midline tenderness in the upper lumbar vertebrae. There was normal alignment of the spine without step offs. His strength was 5/5 and reflexes were 2+ in lower extremities. He did not have deficits to touch sensation and did not have saddle anesthesia.

**Differential diagnoses:**

1. Spinal cord contusion
2. Lumbar vertebral fracture
3. Lumbar sprain
4. Acute spondylolysis or spondylolisthesis
5. Lumbosacral neurapraxia

**Tests and results:**

Xray of cervical spine, chest, and pelvis: unremarkable

CT cervical spine: unremarkable

MRI cervical-thoracic-lumbar:

- traumatic injury of the lumbar spine with disruption of the interspinous ligament at the L1-L2 level
- small ventral extradural hematoma contained by the posterior longitudinal ligament at L2-L4

MRI lumbar spine, hospital day #2:

- decrease in size and cradiocaudal extent of the ventral extradural collection
- edema within psoas and paraspinal muscles at L2-L4

**Final diagnosis:**

Extradural hematoma of lumbar spine at L2-L4

Tear of interspinous ligament at L1-L2

**Treatment and outcomes:**

1. Admission to PICU for close neurologic monitoring with neurosurgery and trauma on consult. He did not report further numbness or tingling in lower extremities
2. Physical therapy
3. Stepped down to general pediatric floor on hospital day #2
4. Discharged on hospital day #3 with lumbar sacral orthosis brace
5. Experienced ongoing headaches for several weeks
6. Back to activity as tolerated, continue to monitor recovery

**3144** May 29 4:15 PM - 4:35 PM

**Neck Injury-Motor Vehicle Accident**

Briana N. Fedorko<sup>1</sup>, Brent F. Fedorko<sup>2</sup>. <sup>1</sup>Pivot Physical Therapy, Cambridge, MD. <sup>2</sup>Salisbury University, Salisbury, MD.

(No relevant relationships reported)

**HISTORY:** A 57-year-old male was involved in a motorcycle accident, landing on his right side. Injuries included a flaccid right arm and hand, laceration of his right thigh, and a fracture of the 3<sup>rd</sup> metatarsal of his right foot. Patient's chief complaint was pain in right shoulder and neck and an inability to complete ADLs.

**PHYSICAL EXAMINATION:** Patient demonstrated flaccid right upper extremity with very little finger movement. Patient was able to achieve some finger flexion of all 5 digits and thumb opposition to index finger, although could not achieve pad to pad contact. All PROM of joints was preserved. Sensation was grossly intact. Patient tolerated initial examination well with mild discomfort during objective measures. No red flags arose during medical screening/systems review.

**DIFFERENTIAL DIAGNOSIS:** 1. Cerebrovascular accident 2. Brachial plexus stretch injury 3. Brachial plexus avulsion injury

**TESTS AND RESULTS:** MRI of cervical spine without contrast – small disc herniation, MRI of brachial plexus with and without contrast - edema involving right scalene and adjacent fascial planes extending into brachial plexus as well as into right C6/C7 and C7/T1 neural foramen to confirm nerve root sleeve tears, CTA of neck – negative for artery involvement, EMG study showed that the brachial plexus was not avulsed, but not currently sending EMG signals to hand.

**FINAL WORKING DIAGNOSIS:** Brachial plexus stretch injury

**TREATMENT AND OUTCOMES:** 1. Therapeutic exercises (ROM, strength, endurance, stability), 2. Therapeutic activity (work specific, ADL specific), 3. Neuromuscular rehabilitation (muscle re-education, sequencing, coordination, neurodynamics), 4. Patient education (home exercise program, home safety).

Patient has been responding well to a treatment plan combining aspects of the above mentioned interventions. Has been showing greater activation of right hand and forearm muscles with ability to complete weak grip at this stage. Right upper extremity remains supported in sling.

**3145** May 29 4:35 PM - 4:55 PM

**Abstract Withdrawn**

**3146** May 29 4:55 PM - 5:15 PM

**Bilateral Forearm And Elbow Pain - Tennis**

Christina Giacomazzi, Vivian Shih. *Stanford, Redwood City, CA.*

Email: mazzichristina@gmail.com

(No relevant relationships reported)

**HISTORY:** A 75 year-old female tennis player was referred for bilateral elbow pain with suspected lateral epicondylitis. She noted 3 months of pain in her left more than right ventral forearms with radiation into her lateral elbows as well as posterior

bilateral shoulder pains. The forearm pain was constant and worsened by single backhand with tennis, lifting weights. She reported reduced grip strength and her racquet falling out of her hands.

#### PHYSICAL EXAMINATION:

Cervical range of motion was within functional limits. Elbow examination showed full active and passive range of motion, minimal tenderness along lateral epicondyle and just distal at tendinous origin, and no pain with resisted wrist extension and middle finger extension. She had finger extension weakness without pain bilaterally 3/5 and otherwise motor testing was 5/5 C5-T1 myotomes. Sensation was intact in C5-T1 dermatomes bilaterally. Reflexes were 2+ and symmetric of biceps and brachioradialis and 3+ at the triceps bilaterally.

#### DIFFERENTIAL DIAGNOSIS:

1. Bilateral lateral epicondylitis
2. Cervical spine stenosis with myelopathy
3. Posterior interosseous neuropathy

#### TEST AND RESULTS:

Cervical Spine anterior-posterior and lateral radiographs:

- Grade 2 anterolisthesis of C7 on T1 is seen with bilateral pars fracture of C7.

Moderate multilevel degenerative disc disease.

MRI of the Cervical Spine without Contrast:

- Advanced facet arthropathy at C7-T1. Anterolisthesis of C7 on T1 causing moderate/severe spinal stenosis with mild cord deformity. Severe bilateral foraminal stenosis at this level.

#### FINAL/WORKING DIAGNOSIS:

Cervical central spine stenosis with myelopathy

#### TREATMENT AND OUTCOMES:

1. Neurosurgery referral recommended urgent C7-T1 anterior cervical discectomy and fusion followed by C5-T2 posterior spinal fusion
2. She was placed in hard cervical collar at all times and surgery was performed 1 week after neurosurgery evaluation
3. At 1 week postoperative, patient felt 80% improvement in pain in forearms and elbows along with subjectively improved grip strength
4. She continued the hard cervical collar until repeat radiographs at 6 weeks post surgery.
5. Patient was instructed to avoid playing tennis. She was also informed to avoid bending, twisting of her neck or lifting greater than 5 pounds until further evaluation in 6 week visit.

## F-53 Free Communication/Poster - Body Composition

Friday, May 29, 2020, 1:30 PM - 4:00 PM

Room: CC-Exhibit Hall

### 3180 Board #1 May 29 1:30 PM - 3:00 PM Comparison Of DXA And Ultrasound For Measurement Of Body Composition In Physically Active College Students

Jeremy T. Barnes<sup>1</sup>, Jason D. Wagganer<sup>1</sup>, Jeremy P. Loenneke, FACSM<sup>2</sup>, Monica L. Kearney<sup>1</sup>, William M. Miller<sup>3</sup>, Majid M. Syed-Abdul<sup>4</sup>. <sup>1</sup>*Southeast Missouri State University, Cape Girardeau, MO.* <sup>2</sup>*The University of Mississippi, University, MS.* <sup>3</sup>*The University of Mississippi, Cape Girardeau, MS.* <sup>4</sup>*The University of Missouri, Columbia, MO.*

(No relevant relationships reported)

Body composition is a frequently assessed component of health-related fitness. Recently, a portable computer based A-mode ultrasound system has become commercially available for estimating percent body fat (%fat). If a single-site estimate of %fat is valid against the dual-energy X-ray absorptiometry, this would have immediate implications for assessing body composition in field based settings. However, little is known how these estimates compare with each other. **PURPOSE:** The aim of this study was to determine the accuracy of the A-mode ultrasound device as a way to estimate %fat. **METHODS:** Participants %fat was estimated using an A-mode ultrasound device biceps measurement and DXA, which served as the criterion estimate. Participants (75 males, 87 females) were physically active college students [age 21 (SD 3) yrs, height 1.73 (SD 0.10) m, body mass 76.09 (SD 15.74) kg and BMI 25.4 (SD 4.1) kg/m<sup>2</sup>]. Methods were compared using a Bland-Altman plot with DXA serving as the criterion method. The coefficient of determination and standard error of the estimate were assessed using linear regression. Total error was calculated to determine the average deviation of individual scores from the line of identity. **RESULTS:** DXA estimate %fat was 25.9 (SD 11.5%) and the A-mode ultrasound estimate was 22.6 (SD 10.9%). The A-mode ultrasound device underestimated %fat by -3.3 (SD 8.0) % (p<0.00001). With a standard deviation of 8, the calculated 95% limits of agreement (SD x 1.96 ± mean difference) were -12.3 to 19.04% fat. The coefficient of determination was 0.55 with a standard error

of the estimate of 7.6 %fat. The average deviation of individual scores from the line of identity was 8.6% (total error). **CONCLUSIONS:** The development of time efficient methods for estimating %fat are important for better screening large samples; particularly in field settings. Although a single site estimate of %fat is efficient, it did not provide valid estimates when compared to DXA in this population. The limits of agreement were wide, indicating poor agreement between the two assessments of %fat. Future studies may want to consider investigating multiple measures using sites A-mode ultrasound as this may better estimate overall %fat.

### 3181 Board #2 May 29 1:30 PM - 3:00 PM The Accuracy And Reliability Of Body Composition Measurement Techniques: Using The Right Instruments In Research And Practice

Grace L. Atkinson. *The University of Queensland, St Lucia, Australia.*

Email: grace.atkinson@uq.edu.au

(No relevant relationships reported)

#### PURPOSE:

Isolated body composition measurement techniques are regularly used as time- and cost-effective alternatives to the gold standard four compartment (4C) model in clinical, sports and research settings. However, isolated measurements of body composition are subject to error. This large, population-representative validation study is the first to assess the accuracy and between-day reliability of common body composition measurement techniques, in reference to the 4C model.

#### METHODS:

Participants (n=45, age = 52±21, body mass index=26.8±3.7 kg/m<sup>2</sup>) completed two consecutive days of body composition testing under controlled conditions (fasted, nil exercise). Body composition assessment methods bio-electrical impedance spectroscopy (BIS), dual-energy x-ray absorptiometry (DXA) and air-displacement plethysmography (BODPOD) were compared to the 4C model (combined measurement of total body water, bone mineral mass, body density and body mass). A priori cut points for accurate and reliable isolated measurement techniques were an intra-class correlation co-efficient (ICC) ≥0.95 and co-efficient of variation (CV) of ≤3%.

#### RESULTS:

Compared to the 4C model, DXA was the only accurate isolated measurement technique (ICC=0.968); as all other measurements were below the limits of agreement (ICC=0.763-0.886). For measurement of reliability, DXA had the lowest between-day error (CV=2.8%) compared to the 4C model, however the confidence intervals (CI) exceeded the acceptable limits of measurement error (1.7%-3.9%). When BIS and DXA were combined, measurement error was within acceptable limits [CV=2.1(1.2-3.0% CI)]. All other isolated body composition techniques had an average between-day CV of 3.4-5.1%.

#### CONCLUSION:

Unlike BIS and BODPOD, DXA is an accurate body composition measurement technique compared to the 4C model. The between-day reliability of DXA is meaningfully enhanced when combined with BIS. It is recommended that researchers and health and sports practitioners implement DXA and BIS assessment techniques where possible, for accurate and reliable measurement of body composition.

### 3182 Board #3 May 29 1:30 PM - 3:00 PM Training Effects Of Alternated And Pulsed Currents On Body Mass Of Competitive Athletes

Pedro F A Oliveira<sup>1</sup>, Karenina A G Modesto<sup>2</sup>, Bottaro Martin<sup>2</sup>, João L Q Durigan<sup>2</sup>, Nicolas Babault<sup>3</sup>. <sup>1</sup>*Federal Institute of Brasilia - IFB, Brasilia, Brazil.* <sup>2</sup>*University of Brasilia - UnB, Brasilia, Brazil.* <sup>3</sup>*Université de Bourgogne - UB, Dijon, France.*

Email: pedro.oliveira@ifb.edu.br

(No relevant relationships reported)

Neuromuscular electrical stimulation (NMES) is widely used for strength training in healthy individuals and athletes. Previous studies have shown that alternated mid-frequency currents (MF) and low-frequency pulsed currents (PC) have similar effects on quadriceps evoked strength and level of discomfort in this population. However, little is known about the effects and best parameters of NMES to induce body mass loss.

**Purpose:** To evaluate the effects of 6 weeks of training with 2 different NMES currents - medium alternated and low frequency pulsed current - on body mass of competitive athletes. **Methods:** A double-blind controlled and randomized experimental study was carried out with 33 athletes (22.2 ± 2.6 yrs, 74.7 ± 9.8 kg, 176.8 ± 6.0 cm), divided into 3 groups: mid-frequency current (MF, n=12), pulsed current (PC, n=11) and control group (CG, n=10). Body mass was assessed before and after the intervention through a body mass scale (BC-418, Tanita Corporation of America Inc., Illinois, USA). NMES training was performed 3 times per week and consisted of 18 sessions, 15 min/session (36 involuntary isometric quadriceps contractions per session), 6s duration in each contraction interspersed with 18s rest. Data were expressed as means ± standard

deviation (SD) and normality was checked using the Shapiro-Wilk test. A two-way analysis of variance (ANOVA) with repeated-measures and Tukey post-hoc test were used to analyze data (group and time effects). Statistical significance was accepted with  $p < 0.05$ . **Results:** After the training period, body mass did not change in any group (PRE: PC =  $76.1 \pm 8.1$  kg, MF =  $74.7 \pm 9.8$  kg, CG =  $73.5 \pm 21.5$  kg; POST: PC =  $76.7 \pm 8.9$  kg, MF =  $74.7 \pm 9.4$  kg, CG =  $74.0 \pm 11.3$  kg;  $p > 0.05$ ). All currents produced similar evoked torque and levels of discomfort ( $p > 0.05$ ). **Conclusion:** Quadriceps NMES training applied through alternated or pulsed currents produced similar effects and did not change body mass in competitive athletes.

**3183** Board #4 May 29 1:30 PM - 3:00 PM  
**Changes In Body Composition Following A  
 Competitive Season In Division I Collegiate Female  
 Gymnastics Athletes**

Monica L. Kearney, Jeremy T. Barnes, Jason D. Waggener,  
 Seth M. Sievers, Patryk R. Piekarczyk, Michelle L. McIntosh.  
*Southeast Missouri State University, Cape Girardeau, MO.*  
 Email: mlkearney@semo.edu  
 (No relevant relationships reported)

A large muscle mass to total body mass ratio benefits power athletes such as gymnasts. While collegiate gymnastics athletes train strength and power in the pre-season but reduce training during the competitive season, the degree to which body composition changes during the competitive season is not known. **PURPOSE:** This study examined changes in body composition in a team of female Division I collegiate gymnastics athletes before and after their competition season. It was hypothesized that percent body fat (%BF), total fat mass (TFM), and bone mineral content (BMC) would remain unchanged from pre- to post-season. **METHODS:** Fifteen female collegiate gymnasts (age =  $19 \pm 1$  year, ht =  $1.62 \pm 0.05$  m, wt =  $62.7 \pm 7.2$  kg) volunteered to undergo measures of body composition assessment before and after their spring competitive season. During pre-season (PRE), participants were instructed to arrive to the laboratory in a euhydrated state. Following written informed consent, participants provided a mid-stream urine sample which was used to screen for pregnancy and to determine urine specific gravity (USG) using a handheld digital refractometer. Participants then performed a dual-energy x-ray absorptiometry (DXA) scan to determine TFM, %BF, and BMC. Immediately after the competitive season, participants returned to the laboratory and repeated all procedures (POST). Data were analyzed using paired-samples t-tests with significance set at  $p < 0.05$ . **RESULTS:** BMC significantly increased across the season ( $6.422 \pm 0.206$  g PRE vs.  $6.485 \pm 0.203$  g POST;  $p < 0.05$ ). While there was a downward trend in both TFM ( $34.158 \pm 2.211$  kg PRE vs.  $32.905 \pm 2.335$  kg POST;  $p < 0.1$ ) and %BF ( $25.68 \pm 1.16$  % PRE vs.  $24.99 \pm 1.23$  % POST;  $p < 0.1$ ), these were not significantly different at the a priori  $p < 0.05$  level. There was no change in body weight. **CONCLUSION:** The significant increase in BMC, combined with the downward trend in TFM and %BF, with no change in body weight, suggests athletes maintained body composition in a favorable manner during the competitive season. The increase in BMC further suggests that stimuli during the competitive season were strong enough to elicit favorable changes in bone remodeling during in-season competition.

**3184** Board #5 May 29 1:30 PM - 3:00 PM  
**Correlation Between Visceral Fat Measured By  
 Bioelectrical Impedance And Dual Energy X-ray  
 Absorptiometry In Males**

Saori Braun, Morgan Goldammer, Tucker Goesch, Alexa Hayes,  
 Garrett Stadler, Steven Fleck, FACSM. *University of Wisconsin-  
 Eau Claire, Eau Claire, WI.*  
 Email: braunsi@uwec.edu  
 (No relevant relationships reported)

Measurement of abdominal adiposity/visceral adipose tissue is clinically relevant in determining individuals' risks of developing cardiometabolic conditions. Bioelectrical impedance (BIA) can be utilized to estimate visceral adipose tissue as an indicator for cardiometabolic dysregulation. **PURPOSE:** To determine the correlation between multi-frequency BIA-derived areal visceral fat ( $\text{cm}^2$ ) and dual energy x-ray absorptiometry (DXA)-derived volumetric visceral fat ( $\text{cm}^3$ ) in normal weight college-aged males. **METHODS:** Visceral fat was measured three times in the following order: 1) BIA, 2) DXA and 3) BIA in college aged males during the early morning. The mean of the two BIA measurements was used for statistical analyses. All three measures were completed in the same session lasting no longer than 30 minutes. To ensure participants were normally hydrated [urine specific gravity (USG) range: 1.022-1.028], USG was determined immediately prior to the testing session. Correlations between BIA areal visceral fat and DXA volumetric visceral fat and a correlation between BIA visceral fat level and DXA android/gynoid (A/G) percent fat ratio Pearson  $r$  correlation coefficients were calculated. **RESULTS:** Assessments were done on 102 males (mean age =  $20.35 \pm 1.38$  years; mean body mass index =  $25.40 \pm 3.36$   $\text{kg} \cdot \text{m}^{-2}$ ). Correlation analysis indicated a moderately high direct correlation between BIA areal visceral fat ( $47.54 \pm 32.78 \text{cm}^2$ ) and DXA volumetric visceral fat ( $172.20$

$\pm 274.36 \text{cm}^3$ ),  $r = .678$ ,  $p < .001$ . There was a moderately direct correction between BIA visceral fat levels ( $4.26 \pm 3.24$ ) and DXA A/G percent fat ratio ( $0.83 \pm 0.20$ ),  $r = .570$ ,  $p < .001$ . **CONCLUSIONS:** In normal weight adults, visceral adiposity and A/G percent fat ratio have much stronger associations with cardiometabolic dysregulation than android and gynoid percent fat. The results of this investigation indicate areal visceral fat and visceral fat level derived from BIA may be a set of useful and meaningful indicators of cardiometabolic disease risk when access to DXA is not available. Future research should explore the predictability of BIA-derived areal visceral fat and visceral fat levels, while controlling for factors such as sex, age, and BMI, on cardiometabolic risk.

**3185** Board #6 May 29 1:30 PM - 3:00 PM  
**Effects Of Compression Apparel On Body Composition  
 Measurements By Air Displacement Plethysmography  
 In College Males**

Scott Murr, Alexandra Hultstrom. *Furman University,  
 Greenville, SC.* (Sponsor: Anthony Caterisano, FACSM)  
 Email: scott.murr@furman.edu  
 (No relevant relationships reported)

Body composition measured by air displacement plethysmography (ADP) accounts for the effects of trapped isothermal air in hair by having the subject wear a swim cap to compress the hair on the head. It is recommended that even subjects with very little hair wear a swim cap. Currently, there are no recommendations that account for the effects of trapped isothermal air in body hair. **PURPOSE:** The purpose of this study was to investigate the impact of exposed body hair and the effect of wearing limb length single layer compression apparel on body composition measurements using ADP in college males. **METHODS:** Forty male college students (age  $20.0 \pm 1.2$  yrs; BMI  $24.1 \pm 3.1$   $\text{kg}/\text{m}^2$ ) volunteered to participate in the study. Percentage of body fat was evaluated by ADP. To assess the impact of body hair on body composition measurements, ADP measures were performed in two conditions: wearing single layer compression shorts (CS) apparel with a swim cap (as recommended) and wearing limb length single layer compression (LC) apparel with the same swim cap. The order of apparel was conducted in random order to avoid any potential order effects. **RESULTS:** Wearing limb length single layer compression apparel to compress body hair increased body mass by an average of  $0.3$  kg ( $\pm 0.02$ ); however, there was no significant difference in body density between the CS condition ( $1.0580 \pm 0.014$   $\text{g}/\text{cm}^3$ ) and the LC condition ( $1.0629 \pm 0.015$   $\text{g}/\text{cm}^3$ ,  $p < 0.001$ ). The mean percentage of body fat in the LC condition ( $15.9 \pm 6.5\%$ ) was significantly lower than the mean percentage of body fat in the CS condition ( $18.0 \pm 6.2\%$ ,  $p < 0.001$ ). **CONCLUSIONS:** The effect of trapped isothermal air in body hair impacts body composition measurements by ADP. Covering exposed body hair in males when assessing body composition via ADP results in a significantly lower percentage of body fat compared to the minimal clothing recommendation. Attention should be paid to minimizing exposed body hair on males when assessing body composition by air displacement plethysmography. The present results suggest that this minimization may be achieved with males by wearing limb length single layer compression apparel.

**3186** Board #7 May 29 1:30 PM - 3:00 PM  
**Athlete-specific Prediction Equations For Appendicular  
 Upper And Lower Body Lean Soft Tissue With BIA**

Megan Hetherington-Rauth, João P. Magalhães, Pedro B. Júdice,  
 Inês R. Correia, Analiza M. Silva, Luís B. Sardinha. *Faculdade  
 de Motricidade Humana, Universidade de Lisboa, Lisbon,  
 Portugal.*  
 (No relevant relationships reported)

Given sport specific physiological demands, knowing the distribution of lean soft tissue among the body segments is of relevance for optimizing athletic performance, monitoring response to specific training regimens, as well as for evaluating potential injury risk. Bioelectrical impedance (BIA) is a widely used portable, low cost, and easy technique to assess body composition. However, most equations used by BIA to predict lean tissue are not specific for the athlete population.

**Purpose:** The aim of this investigation was to develop and cross-validate prediction equations to estimate dual-energy X-ray absorptiometry (DXA)-derived appendicular lean soft tissue (LST) of the arms and legs based on whole body BIA in a population of athletes.

**Methods:** Two-hundred sixty-five athletes (age  $22.2 \pm 4.6$  yrs) from a variety of sports had LST of the arms and legs assessed by DXA and whole-body reactance (Xc) and resistance (R) measured by BIA. Using measures of height, the resistance index ( $\text{RI} = \text{height}^2/\text{R}$ ) was calculated. Prediction equations were established using a cross validation method where 177 athletes (2/3 of the sample) were used for equation development and the remaining 88 athletes (1/3 of the sample) were used for equation validation.

**Results:** The developed prediction equations were as follows: arm LST =  $0.940 \cdot \text{sex}$  ( $0 = \text{male}$ ;  $1 = \text{female}$ ) +  $0.042 \cdot \text{total body weight (kg)}$  +  $0.080 \cdot \text{RI}$  +  $0.024 \cdot \text{Xc} - 3.927$ ; leg LST =  $1.983 \cdot \text{sex}$  ( $0 = \text{male}$ ;  $1 = \text{female}$ ) +  $0.154 \cdot \text{total body weight (kg)}$  +  $0.127 \cdot \text{RI} -$

1.147. Both equations cross-validated very well for the arms (mean difference=0.11 kg,  $R^2=0.89$ ,  $SEE=0.61$ ) and for the legs (mean difference=0.05 kg,  $R^2=0.81$ ,  $SEE=1.95$  kg). There were no differences ( $p > 0.05$ ) in the mean values for both arm and leg LST equations and LST assessed with DXA.

**Conclusion:** The developed BIA-based prediction equations seem to provide a valid estimation of upper and lower body LST in athletes.

**3187** Board #8 May 29 1:30 PM - 3:00 PM  
**Test-retest Reliability Of Various Methods For Body Composition Assessments**

Julia C. Blumkaitis<sup>1</sup>, Riley Stefan<sup>2</sup>, Patrick S. Harty<sup>3</sup>, Petey W. Mumford<sup>1</sup>, Alicia Barry<sup>1</sup>, Jessica M. Moon<sup>1</sup>, Kayla M. Ratliff<sup>1</sup>, Richard A. Stecker<sup>1</sup>, Kyle L. Sunderland<sup>1</sup>, Scott Richmond<sup>1</sup>, Chad M. Kerksick, FACSM<sup>1</sup>. <sup>1</sup>Lindenwood, St. Charles, MO. <sup>2</sup>Northern Illinois University, DeKalb, IL. <sup>3</sup>Texas Tech University, Lubbock, TX. (Sponsor: Chad Kerksick, FACSM)  
(No relevant relationships reported)

Multi-compartment body composition assessment techniques are common in research and for assessing intervention success. Establishing the validity and reliability of assessment techniques help to ensure appropriate outcomes. **PURPOSE:** To identify the intra (same day) and inter (between-day) test-retest reliability of BIA, BIS, and DEXA composition assessments conducted on two consecutive days in a healthy population. **METHODS:** 40 healthy, collegiate-aged participants (male:  $n=20$ ;  $24.6 \pm 4.1$  yr,  $177.5 \pm 6.7$  cm,  $88.1 \pm 13.3$  kg; female:  $n=20$ ;  $22.8 \pm 4.5$  yr,  $163.6 \pm 6.5$  cm,  $64.6 \pm 14.3$  kg) completed two study visits with 24 hours. All participants arrived fasted (10 h) and after abstaining from exercise (24 h). Each visit consisted of two consecutive rounds (four total measurements) of assessments including body weight, BIA (InBody 570), DEXA scan, and BIS. Pearson correlations, intraclass correlation coefficient (ICC), coefficient of variation (CV), and standard error of the mean (SEM) were computed to assess relationship and reliability between measurement techniques. A  $p$ -value of 0.05 was used to assess all statistical outcomes. **RESULTS:** Intra-test and inter-test ICC, CV, and SEM values for all three measurement techniques are provided in table 1. Strong, positive correlations between BIA vs DEXA FM ( $r = 0.95$ ), DEXA vs BIS FM ( $r = 0.89$ ), BIA vs DEXA FFM ( $r = 0.99$ ), and DEXA vs BIS FFM ( $r = 0.96$ ) were observed. **CONCLUSION:** All three methods yielded high intra- and inter-test retest reliability with strong correlations between measurements and excellent CV and ICC values suggesting good repeatability with the largest variation being observed for BIS FM and FFM.

| Table 1: ICC, CV, and SEM values for BIA, DXA, and BIS analysis |       |      |        |             |
|---|-------|------|--------|-------------|
|   |       | ICC  | CV (%) | SEM (grams) |
| BIA Fat Mass  | Intra | 1.00 | 1.20   | 52.13       |
|   | Inter | 1.00 | 2.36   | 94.33       |
| DXA Fat Mass  | Intra | 0.99 | 1.92   | 138.97      |
|   | Inter | 0.99 | 1.26   | 127.83      |
| BIS Fat Mass  | Intra | 0.99 | 4.22   | 179.51      |
|   | Inter | 0.98 | 5.86   | 280.90      |
| BIA Fat-Free Mass   | Intra | 1.00 | 0.36   | 59.03       |
|   | Inter | 0.99 | 0.68   | 110.04      |
| DXA Fat-Free Mass   | Intra | 1.00 | 0.38   | 56.34       |
|   | Inter | 0.99 | 0.75   | 110.90      |
| BIS Fat-Free Mass   | Intra | 0.99 | 0.97   | 118.21      |
|   | Inter | 0.99 | 1.72   | 285.12      |

**3188** Board #9 May 29 1:30 PM - 3:00 PM  
**The Impact Of Residual Lung Volume Method On Multi-compartment Model Body Composition Assessment**

Zackary S. Cicone, Bjoern Hornikel, Clifton J. Holmes, Michael V. Fedewa, Michael R. Esco, FACSM. *University of Alabama, Tuscaloosa, AL.* (Sponsor: Michael R. Esco, FACSM)  
(No relevant relationships reported)

**PURPOSE:** Researchers use both direct and indirect nitrogen analysis to determine residual lung volume (RLV) for body composition assessment. However, the agreement between direct and indirect methods, and thus the impact on percent fat (%fat), has yet to be examined. The purpose of this study was to compare multi-compartment %fat using direct and indirect measures of RLV.

**METHODS:** Thirty-four healthy adults (53% female;  $37.7 \pm 15.5$  y;  $27.6 \pm 7.0$  kg·m<sup>-2</sup>) participated in this study. RLV was measured via oxygen dilution using direct (DIR)

and indirect (IND) nitrogen analysis. Participants also completed hydrostatic weighing, dual energy X-ray absorptiometry, and bioimpedance spectroscopy for body density, bone content, and total body water. Two, three, and four-compartment (2C, 3C, and 4C) model %fat was calculated using RLV from both DIR and IND nitrogen analysis. Agreement for each model was assessed using paired  $t$  tests and Bland-Altman analysis. Significance was accepted at  $p < 0.05$ .

**RESULTS:** Strong correlations (ICCs  $> 0.98$ ) were observed for all %fat models between RLV methods. Measures of %fat using IND were larger than DIR (mean differences, 0.7 to 1.6%fat, all  $p < 0.001$ ). However, the magnitudes of the differences were small (Cohen's  $d$ , 0.08 to 0.17). Additionally, the range of individual differences between IND and DIR was less than 4.0%, with 3C and 4C producing especially narrow limits of agreement ( $\pm 1.4\%$ fat and  $1.9\%$ fat) compared to 2C ( $\pm 3.4\%$ fat).

**CONCLUSIONS:** Multi-compartment models using DIR and IND nitrogen analysis to determine RLV demonstrated strong agreement. The more complex models (3C and 4C) were less affected by RLV method than the 2C model and produced limits of agreement less than  $\pm 2.0\%$ fat. The results presented here indicate that DIR and IND nitrogen analysis may be used interchangeably for the assessment of body composition when using 3C and 4C models.

**3189** Board #10 May 29 1:30 PM - 3:00 PM  
**Body Composition And Anaerobic Fitness Testing During A Complete NCAA III Men's Hockey Season**

Adam M. Coughlin<sup>1</sup>, Brian C. Rider<sup>2</sup>, Stephen J. McGregor<sup>3</sup>, Andrea Workman<sup>3</sup>. <sup>1</sup>Saginaw Valley State University, University Center, MI. <sup>2</sup>Hope College, Holland, MI. <sup>3</sup>Eastern Michigan University, Ypsilanti, MI. (Sponsor: Rebecca A. Schlaff, FACSM)  
Email: amcoughl@svsu.edu  
(No relevant relationships reported)

**PURPOSE:** Determine the effects of a competitive Division III men's hockey season on anthropometric and anaerobic fitness markers.

**METHODS:** Seven Division III men's hockey players participated in this season-long study. Athletes reported at four time-points: pre-season (Oct), mid-season 1 (Dec), mid-season 2 (Feb), and post-season (Apr). Each time-point included athletes' height, weight, body composition via air plethysmography, and anaerobic capacity via 30-s Wingate cycle test (WCT). During this season the team appeared in the Frozen Four of the Division III National Tournament, ultimately losing in the championship game. A repeated measured ANOVA was utilized to determine differences in fitness outcomes over the course of the season.

**RESULTS:** Data for the seven athletes is presented as mean and standard deviation for Oct, Dec, Feb, and Apr time-points. Neither weight ( $87.9 \pm 6.6$ ,  $87.6 \pm 7.2$ ,  $88.5 \pm 6.7$ ,  $88.2 \pm 8.3$ kg) nor percent fat ( $14.4 \pm 4.2$ ,  $13.1 \pm 3.6$ ,  $14.2 \pm 3.0$ ,  $14.3 \pm 3.8\%$ ) differed significantly throughout the season. Additionally, fat mass (FM) nor fat-free mass (FFM) differed significantly over the course of the season. Peak power ( $958 \pm 96$ ,  $902 \pm 144$ ,  $947 \pm 139$ ,  $908 \pm 145$ W,  $p = 0.01$ ) and peak power per kilogram of body weight ( $10.9 \pm 1.0$ ,  $10.3 \pm 1.2$ ,  $10.6 \pm 0.9$ ,  $10.3 \pm 0.9$ W/kg,  $p = 0.04$ ) only differed significantly from Feb to Apr. There was also a significant decrease in mean power from Feb to Apr ( $734 \pm 67$ ,  $705 \pm 88$ ,  $729 \pm 97$ ,  $713 \pm 100$ W,  $p = 0.04$ ). The only significant difference in mean power per kilogram of body weight occurred from Oct to Dec ( $8.4 \pm 0.5$ ,  $8.0 \pm 0.5$ ,  $8.2 \pm 0.6$ ,  $8.1 \pm 0.6$ W/kg,  $p = 0.04$ ). Lastly, fatigue index also decreased significantly from Feb to Apr ( $51.4 \pm 4.3$ ,  $52.2 \pm 8.2$ ,  $50.8 \pm 3.6$ ,  $46.4 \pm 5.7\%$ ,  $p = 0.03$ ).

**CONCLUSIONS:** Anthropometric measurements did not change significantly over the course of the season. Other than an improvement in fatigue index at the end of the season, anaerobic measurements from the WCT either didn't change or worsened over the course of the season. These findings illustrate that championship caliber teams do not necessarily need to improve lab-based anaerobic performance markers (as measured by a 30s Wingate cycle test) nor anthropometric measurements (body weight, FM, FFM, or percent fat) to have successful regular and post-seasons.

**3190** Board #11 May 29 1:30 PM - 3:00 PM  
**Total And Regional Body Composition Of Ncaa Division I Female Soccer Athletes Through Competitive Seasons**

Erica Roelofs<sup>1</sup>, April Bockin<sup>1</sup>, Tyler A. Bosch<sup>1</sup>, Christopher W. Bach<sup>2</sup>, Jonathan M. Oliver<sup>3</sup>, Aaron Carbuhr<sup>4</sup>, Philip R. Stanforth<sup>5</sup>, Donald R. Dengel, FACSM<sup>1</sup>. <sup>1</sup>University of Minnesota, Minneapolis, MN. <sup>2</sup>University of Nebraska, Lincoln, NE. <sup>3</sup>Texas Christian University, Fort Worth, TX. <sup>4</sup>University of Kansas, Lawrence, KS. <sup>5</sup>University of Texas at Austin, Austin, TX. (Sponsor: Dr. Donald Dengel, FACSM)  
Email: roelo044@umn.edu  
(No relevant relationships reported)

Analyzing body composition and tracking changes over seasons is critical to have comprehensive insight to player performance and health as body composition is

strongly related to soccer performance. **PURPOSE:** To examine body composition of NCAA Division I female soccer players by position and season. **METHODS:** One hundred seventy-five female collegiate soccer players from 4 NCAA Division I Universities participated in this study. Athletes were categorized by positions of forward (n=47), midfielder (n=51), defender (n=57), and goalkeeper (n=20). Seasons were defined as pre-season (Aug), in-season (Sep - Oct), post-season (Nov - Dec), winter off-season (Jan), spring season (Feb - Apr), and summer off-season (May - Jul). A whole body dual X-ray absorptiometry scan assessed percent body fat (%BF), total lean muscle mass (LM), total fat mass (FM), arm and leg LM and FM, and visceral adipose tissue (VAT). Separate ANOVAs with linear mixed-effects models to account for repeated measures assessed differences across positions and seasons. **RESULTS:** Goalkeepers had significantly higher height, body mass, FM, and arm and leg LM and FM compared to all other positions ( $p < 0.05$ ). Goalkeepers ( $28.1 \pm 4.3\%$ ) had significantly higher %BF than defenders ( $24.4 \pm 3.4\%$ ) and forwards ( $24.5 \pm 4.0\%$ ;  $p < 0.01$ ), and midfielders ( $26.0 \pm 3.9\%$ ) had significantly higher %BF than defenders ( $p < 0.01$ ) and forwards ( $p = 0.04$ ). Goalkeepers had significantly greater LM ( $50.5 \pm 4.3$  kg) than all other positions, and defenders ( $46.2 \pm 4.7$  kg) had greater LM than forwards ( $44.2 \pm 3.7$  kg) and midfielders ( $44.3 \pm 4.0$  kg;  $p < 0.01$ ). For all positions, %BF was significantly higher in winter off-season ( $26.7\%$ ) compared to summer off-season ( $25.7\%$ ) and pre-season ( $25.8\%$ ;  $p < 0.01$ ). For all positions, total LM and leg LM was significantly lower in winter off-season compared to all other seasons, and total LM was significantly higher in summer off-season than pre-season ( $p < 0.01$ ). **CONCLUSIONS:** Goalkeepers had higher body mass and FM but also had more LM compared to the other positions. In winter off-season, %BF increased and LM decreased indicating potential undesired changes in training and/or nutrition over the holiday break. In summer off-season, LM was the highest reflecting the emphasis on resistance training and increased volume of training.

**3191** Board #12 May 29 1:30 PM - 3:00 PM  
**Combined Anthropometry And Bioelectrical Impedance To Predicted Body Fat In Female Athletes**  
 Craig Horswill<sup>1</sup>, Doug Foote<sup>2</sup>, Max Berkelhammer<sup>1</sup>. <sup>1</sup>University of Illinois at Chicago, Chicago, IL. <sup>2</sup>University of Eugene, Eugene, OR.  
 Email: horswill@uic.edu  
 (No relevant relationships reported)

**PURPOSE:** To determine whether combining anthropometry (skinfolds, SF) and bioelectrical impedance analysis (BIA), an indicator of hydration status, would accurately approximate the expected percentage body fat (%Fat) value and reliably predict %Fat. Accurate and reliable estimation of body composition in female athletes can be challenging since the methodological assumptions are easily violated. For example, hydration status can vary due to menstrual cycle phase, dehydration, and training, and thereby distort %Fat. We hypothesized that compared to outcomes for SF or BIA alone, %Fat using SF+BIA would not differ from our criterion method, and SF+BIA would account for a greater percent of the variance ( $r^2$ ) in predicting %Fat. **METHODS:** Eighteen female athletes (D1 NCAA competitors) were recruited from the swim team and gymnastic team and measured for body density (air displacement plethysmography), total body water ( $D_2O$  dilution), and bone mineral mass (DEXA). Assessments were applied to a four-component model (4C) to determine the criterion %Fat. Skinfolds (Slaughter 2-site equation; Lange caliper), and BIA (Chumlea TBW equation; Quantum VI, RJL) were measured as the predictors. SF was used to determine body volume and BIA was used to determine TBW; these values were then applied to Siri's 3-component equation to predict %Fat (SF+BIA). One-way ANOVA with repeated measures was used to compare mean %Fat values determined for SF, BIA, and SF+BIA and 4C %Fat. Bonferroni multiple comparisons were used as the post hoc test ( $p < 0.05$ ). Regression was used to determine  $r^2$  SF, BIA, and SF+BIA vs 4C criterion.

**RESULTS:** A significant one-way ANOVA led to post hoc detection of differences in %Fat for BIA ( $26.6 \pm 7.5$ ) and SF+BIA ( $25.5 \pm 7.2$ ) vs. the 4C ( $22.3 \pm 7.5$ ) ( $p < 0.05$ ). The SF estimate ( $24.0 \pm 7.8$ ) did not differ from the 4C value. Regression revealed the highest adjusted variance accounted for in 4C was SF+BIA ( $r^2 = 0.87$ ) followed by BIA ( $r^2 = 0.80$ ) and SF ( $r^2 = 0.76$ ), all of which were statistically significant.

**CONCLUSIONS:** Skinfolds alone were more accurate at predicting the mean %Fat in these female athletes but combining SF and BIA might provide greater reliability for predicting percent body fat in female athletes.

**3192** Board #13 May 29 1:30 PM - 3:00 PM  
**Increased Body Fat Negatively Impacts Aerobic Capacity Of Elite American Football Players Regardless Of Position**  
 Matthew E. Darnell<sup>1</sup>, Laura E. Kleiber<sup>1</sup>, Julian R. Chismar<sup>1</sup>, Paul N. Whitehead<sup>2</sup>. <sup>1</sup>University of Pittsburgh, Pittsburgh, PA. <sup>2</sup>University of Alabama Huntsville, Huntsville, AL. (Sponsor: Elizabeth Nagle, FACSM)  
 (No relevant relationships reported)

Aerobic capacity and body composition play an important role in athletic performance and health. Previous research demonstrates an association between lower body fat percentage (BF%) and enhanced aerobic as well as anaerobic capacity, while higher BF% is linked to an increased risk of chronic diseases related to obesity. The amount of research on aerobic performance in elite football players is limited, and even less research has compared maximal oxygen uptake ( $VO_2$  peak) with body composition by position. **Purpose:** To determine the relationship between BF% and  $VO_2$  peak in elite football players by position group. **Methods:** Elite American football players ( $n = 112$ , age:  $25.03 \pm 2.89$  yrs, ht:  $187.06 \pm 7.62$  cm, and wt:  $110.89 \pm 22.71$  kg) were split by position into three groups. Small skill (SS) ( $n=50$ ): running back, cornerback, safety, and wide receiver; big skill (BS) ( $n=27$ ): tight end, linebacker, and quarterback; and linemen (LM) ( $n=35$ ): tackle, guard, center, and defensive end. BF% was calculated using air displacement plethysmography.  $VO_2$  peak was measured via indirect calorimetry during a treadmill test using three protocols based on position group. SS and BS ran at 7.5 or 6.5 mph (respectively) with a 2% increase of elevation every 2 minutes, and LM performed a Bruce protocol. Subjects ran until volitional fatigue. A Kruskal-Wallis test with Bonferroni post hoc was used to compare BF% and  $VO_2$  peak values between position groups. A Spearman's rank-order correlation was used to determine the relationship between BF% and  $VO_2$  peak. **Results:** LM ( $39.58 \pm 5.07$  ml·kg<sup>-1</sup>·min<sup>-1</sup>)  $VO_2$  peak was significantly different from BS ( $47.75 \pm 5.47$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) and SS ( $49.93 \pm 4.31$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) ( $p < .001$ ). There was no difference in  $VO_2$  peak between BS and SS ( $p > 0.05$ ). BF% was significantly different ( $p \leq .002$ ) between all groups (SS:  $12.23 \pm 4.83\%$ , BS:  $17.81 \pm 4.32\%$  and LM:  $26.26 \pm 5.23\%$ ). A statistically significant ( $p < 0.01$ ) moderate negative correlation was found between BF% and  $VO_2$  peak overall ( $r_s = -0.772$ ) and for each position group (SS  $r_s = -0.49$ , BS  $r_s = -0.54$ , and LM  $r_s = -0.62$ ). **Conclusions:** Body composition differs between position groups. Lower BF% was associated with higher  $VO_2$  peak in elite football players regardless of position group. Future research should explore the impact of these variables on player performance and risk of injury.

**3193** Board #14 May 29 1:30 PM - 3:00 PM  
**Bioimpedance Phase Angle Reliability In Mexican College Students**  
 Jorge Aburto-Corona<sup>1</sup>, Alan D. Torres-Hernández<sup>1</sup>, Luis M. Gómez-Miranda<sup>1</sup>, Yamileth Chacón-Araya<sup>2</sup>, José Moncada-Jiménez<sup>2</sup>. <sup>1</sup>Autonomous University of Baja California, Tijuana, Mexico. <sup>2</sup>University of Costa Rica, San José, Costa Rica.  
 Email: jorge.aburto@uabc.edu.mx  
 (No relevant relationships reported)

Bioimpedance (BIA) phase angle (PA) is a body composition measure related to cell structure, integrity and body cell mass. Although PA has been positively correlated to clinical outcomes, there is scarce information on ethnic differences in PA and its overall reliability. **PURPOSE:** To determine phase angle reliability in Mexican college students. **METHODS:** College students from the city of Tijuana, México, were recruited for this study. Volunteers were 26 males (Age =  $22.7 \pm 3.1$  yr., Height =  $172.8 \pm 5.6$  cm, Weight =  $70.9 \pm 11.7$  kg) and 26 females (Age =  $21.1 \pm 2.2$  yr., Height =  $159.0 \pm 7.1$  cm, Weight =  $60.8 \pm 8.6$  kg). Participants arrived euhydrated to the testing session (Urine specific gravity =  $1.005 \pm 0.003$ ) and were measured on a multi-frequency InBody 770 BIA device in two occasions separated by five minutes of seated resting. Body weight, %fat mass, muscle mass (kg) and PA were recorded and analyzed by repeated measures 2 (gender) x 2 (measures) ANCOVA, using hydration status and age as covariates. Intraclass correlation coefficient (ICC) and 95% confidence interval were used to determine reliability between measures. **RESULTS:** Gender differences were found on PA (Males =  $6.8 \pm 0.1$  vs. Females =  $5.9 \pm 0.1$ ,  $p \leq 0.0001$ ), and muscle mass (Males =  $31.9 \pm 0.7$  vs. Females =  $23.2 \pm 0.7$  kg,  $p \leq 0.0001$ ). Significant ( $p \leq 0.0001$  for all) ICC reliability coefficients were found between pre- to post-measures of PA ( $r = 0.998$ , 95%CI =  $0.996$  to  $0.999$ ), %fat ( $r = 0.999$ , 95%CI =  $0.998$  to  $1.00$ ) and muscle mass ( $r = 1.00$ , 95%CI =  $1.00$  to  $1.00$ ). **CONCLUSION:** Young college students showed reliable BIA PA, muscle mass and %fat values following five minutes of seated resting. Mexican males showed higher muscle mass and PA than women after controlling for the influence of hydration and age.

3194 Board #15 May 29 1:30 PM - 3:00 PM

**Sex Affects The Difference In Body Fat Estimation Between Body Composition Devices**Christopher A. Fahs<sup>1</sup>, Maddison Beck<sup>2</sup>, Jonathan Boring<sup>3</sup>, Lindsay LeVault<sup>2</sup>, William Varner<sup>2</sup>. <sup>1</sup>Logan University, Chesterfield, MO. <sup>2</sup>Lindenwood University Belleville, Belleville, IL. <sup>3</sup>Lindenwood University, St. Charles, MO. (Sponsor: Michael Bembem, FACSM)

Email: christopher.fahs@logan.edu

(No relevant relationships reported)

Commercially available upper-body (UB) and lower-body (LB) bioelectrical impedance analyzers (BIA) are commonly used to measure body fat percentage (%BF) and classify body composition status. Some evidence suggests that LB BIA underestimate %BF specifically in women. It is not clear if UB BIA devices also underestimate %BF in women or if LB and UB BIA devices underestimate %BF in men. **PURPOSE:** To compare %BF from air displacement plethysmography (ADP), UB BIA, LB BIA, and whole-body (WB) BIA and to determine if the %BF differences between devices are affected by sex. **METHODS:** 53 women (21±5 yrs) and 42 men (23±5 yrs) had their %BF measured via ADP, a hand-held UB BIA, a digital scale LB BIA, and a validated eight-electrode multifrequency WB BIA device following each device's recommended procedures. Paired samples t-tests were used to compare %BF between devices within each sex. Independent samples t-tests were used to compare the %BF difference between devices for each sex. **RESULTS:** In women, UB (23.8±4.3%) and LB (20.4±5.8%) BIA yielded significantly ( $p<0.001$ ) lower %BF than ADP (28.3±7.4%) and WB BIA (28.9±5.0%). In men, UB (15.6±5.3%) and LB BIA (15.0±4.0%) also yielded significantly lower %BF values than ADP (17.6±7.7%;  $p=0.012$  vs. UB BIA;  $p=0.008$  vs. LB BIA) and WB BIA (19.1±6.7%;  $p<0.001$  vs. UB and LB BIA). The differences in %BF between devices were greater in women compared to men: WB - UB BIA difference 5.0±2.6 vs. 3.6±3.3%,  $p=0.021$  (women vs. men); WB - LB BIA difference 8.5±4.1 vs. 4.2±5.1%,  $p<0.001$ ; ADP - UB BIA difference 4.5±5.9 vs. 2.0±5.0%,  $p=0.028$ ; ADP - LB BIA difference 7.9±6.3 vs. 2.7±6.2%,  $p<0.001$ ; UB - LB BIA difference 3.4±3.5 vs. 0.7±3.2%,  $p<0.001$ . **CONCLUSIONS:** These results suggest that commercially available UB and LB BIA devices systematically underestimate %BF in both men and women compared to a validated multifrequency WB BIA and ADP. The degree of underestimation in %BF for commercially available BIA devices is greater in women compared to men. Use of these commercially available BIA devices may cause misclassification of body composition status, especially in women.

3195 Board #16 May 29 1:30 PM - 3:00 PM

**An Equation To Estimate Head Volume For Hydrostatic Weighing In Partially Immersed Subjects**Panayiotis Papadopoulos<sup>1</sup>, Forrest A. Dolgener<sup>1</sup>, David M. Reineke<sup>2</sup>, Jeff C. Tesch<sup>3</sup>. <sup>1</sup>University of Northern Iowa, Cedar Falls, IA. <sup>2</sup>University of Wisconsin-La Crosse, La Crosse, WI. <sup>3</sup>EXERTECH, Dresbach, MN. (Sponsor: Kevin J. Finn, FACSM)

Email: panayiotis.papadopoulos@uni.edu

*Reported Relationships: P. Papadopoulos: Other (please describe); One of the authors (Jeff C. Tesch) is the vendor of the equipment used in the study.*

**PURPOSE:** The purpose of the study was to derive prediction equations for head volume (HV) from head girths and diameters and to use the equations for hydrostatic weighing (HW).

**METHODS:** HW was performed with and without head submersion of subjects using a computerized, 4 load cell weighing system. Forty-four males and 46 females comprised the experimental groups from which equations were derived to predict HV by water displacement. HW was then performed on 46 additional subjects (21 males and 25 females) to compare body density (BD) and body fat percent (BF%) for head below water (HBW) and head above water (HAW) immersion using the HV prediction equations. Subjects exhaled to residual volume and maintained the same lung volume during the HAW phase and the HBW phase of each immersion trial.

**RESULTS:** Head girths showed higher correlations and smaller SEEs than head diameters for the prediction of HV. Regression analysis indicated that the equations with the highest  $R^2$  and the lowest SEE were from head girth (HG), face girth (FG) and body mass in air (MA). The equation for males was  $HV = 0.1294 \cdot HG + 0.0299 \cdot FG + 0.0055 \cdot MA - 5.7506$  ( $R^2 = 0.57$ ,  $SEE = 0.26$  L). The equation for females was  $HV = 0.1314 \cdot HG + 0.0504 \cdot FG + 0.0094 \cdot MA - 8.9008$  ( $R^2 = 0.73$ ,  $SEE = 0.21$  L). The validation groups showed no significant differences ( $p < 0.05$ ) in BD between HAW immersion and HBW immersion for either males ( $R^2 = 0.98$ ,  $SEE = 0.0028$  g·ml<sup>-1</sup>) or females ( $R^2 = 0.90$ ,  $SEE = 0.0054$  g·ml<sup>-1</sup>). There were no significant differences ( $p < 0.05$ ) in BF% between HAW immersion and HBW immersion for either males ( $R^2 = 0.98$ ,  $SEE = 1.16\%$ ) or females ( $R^2 = 0.90$ ,  $SEE = 2.24\%$ ). Fluctuations in weight scale readings were significantly lower ( $p < 0.05$ ) for HAW immersion than for HBW immersion in both males ( $SD_{HAW} = 0.31$  kg,  $SD_{HBW} = 0.40$  kg) and females ( $SD_{HAW} = 0.22$  kg,  $SD_{HBW} = 0.30$  kg).

**CONCLUSIONS:** Weight readings are more stable and BD and BF% are not significantly different when HW is performed without head submersion using predicted HV.

3196 Board #17 May 29 1:30 PM - 3:00 PM

**Test-retest Reliability Of Total Body Volume Derived From A Single 2-dimensional Digital Image**

Michael Vernon Fedewa, Katherine Sullivan, Clifton J. Holmes, Bjoern Hornikel, Shengting Cao, Yu Gan, Michael R. Esco, FACSM. University of Alabama, Tuscaloosa, AL. (Sponsor: Michael R. Esco, FACSM)

Email: mvfedewa@ua.edu

*Reported Relationships: M.V. Fedewa: Receipt of Intellectual Property Rights/Patent Holder; Provisional Patent Submitted. Dr. Fedewa developed the Intellectual Property related to this abstract as part of his research at the University of Alabama.*

Simple, accurate, and cost-effective methods to estimate body composition in field settings are valuable to practitioners and clinicians. An automated smartphone- or tablet-based method of determining body composition from a single 2-dimensional (2D) digital image has recently been developed. However, the test-retest reliability has yet to be determined. **PURPOSE:** The purpose of this study was to evaluate the test-retest reliability of total body volume (BV) estimated from a single 2D digital image. **METHODS:** A convenience sample was recruited for this study ( $n=30$ , 21.0±3.1 yrs., 86.7% female, 24.8±3.0 kg/m<sup>2</sup>). Body mass was measured (to the nearest 0.1 kg) with a calibrated digital scale (Tanita BWB-800, Tanita Corporation, Tokyo, Japan). Standing height was measured (to the nearest 0.1 cm) with a stadiometer (SECA 213, Seca Ltd., Hamburg, Germany). Two digital images of each participant were taken from the rear/posterior view using a 12.9 inch, 64g iPad Pro. A paired sample T-test was used to examine differences between BV obtained from the images (BV<sub>1</sub>, BV<sub>2</sub>). An Intraclass Correlations Coefficient (ICC) assessed the strength of the association between BV<sub>1</sub> and BV<sub>2</sub>. **RESULTS:** No differences were observed between BV<sub>1</sub> and BV<sub>2</sub> (71.2±12.0 L versus 71.1±11.7 L, respectively,  $p=0.51$ ), with excellent agreement between the two measures (ICC=0.99).

**CONCLUSIONS:** This novel method of acquiring BV produced near-perfect reliability within our small sample. Given the excellent reliability, future research should examine the validity of acquiring body composition from a single 2D digital image using an automated smartphone- or tablet-based application.

3197 Board #18 May 29 1:30 PM - 3:00 PM

**Acute Exercise And Resulting Dehydration Does Not Alter Body Composition Measures Using Fit3D**

Emily A. Freund, Jennae M. Fenton, Nick J. Rein, Courtney D. Jensen, J. Mark VanNess. University of the Pacific, Stockton, CA.

Email: e\_freund@u.pacific.edu

(No relevant relationships reported)

Fit3D is a novel, camera-based system to assess anthropometric measurements and determine body composition. Little data exist on how the values generated by this system may be influenced by acute exercise and associated dehydration and fluid shifts. **PURPOSE:** To determine the effect of a prolonged bout of acute exercise on the body composition measures generated by the Fit3D. **METHODS:** 17 subjects (7 female, 10 male) underwent body composition analysis using the Fit3D before and after one hour of acute exercise. The exercise protocol consisted of a maximal treadmill exercise test to volitional fatigue followed by 40 min of continuous exercise at the estimated anaerobic threshold calculated by taking 65% of each subject's ventilatory threshold. Each subject had their vitals (heart rate, blood pressure, and scale weight) taken, provided a urine sample to measure specific gravity, and performed a Fit3D scan before and after the exercise bout. **RESULTS:** Subjects lost 2.5±1.8 lbs during exercise. This loss of body water was associated with an increase in urine specific gravity of .007±.004. These changes did not influence any of the circumference measures and only slightly influenced percent body fat measured on the Fit3D. Pre-to-post measures of body fat (24.5±6.9% vs 24.8±6.7%), trunk-to-leg volume ratio (1.45±0.59 vs 1.49±0.56), fat mass (73.4±15.7 vs 72.5±15.6kg), lean mass (54.9±9.9 vs 54.1±10.2 kg), and basal metabolic rate (1637±242 vs 1630±242 cal/day) were not statistically different ( $p=0.894$ , 0.876, 0.999, 0.822 and 0.930 respectively). **CONCLUSION:** Our results provide preliminary evidence that the Fit3D instrument is a consistent tool for assessment of body composition even after a bout of acute exercise resulting in the loss of body water.

**3198** Board #19 May 29 1:30 PM - 3:00 PM  
**Body Composition And Aerobic Fitness Levels In College Freshmen**  
 Nicole Varone, Vipa Bernhardt. *Texas A&M University Commerce, Commerce, TX.* (Sponsor: Tony G. Babb, FACSM)  
*(No relevant relationships reported)*

**Nicole Varone & Vipa Bernhardt**  
**Texas A&M University Commerce**

**Background:** Research has shown that college students exhibit gains in fat mass that are up to 5.5 times greater than their peers of the same age who do not attend college (Mihalopoulos et al, 2008). Because of concerns over increasing rates of obesity, college campuses nationwide are engaging in campaigns designed to target college youth and educate them about the benefits of healthy lifestyle behaviors. In order to implement effective intervention strategies, a clear picture of current student fitness must be acquired.

**Purpose:** The purpose of this study was to examine objective measures of body composition and aerobic fitness levels in current first year students of a rural university.

**Methods:** 24 participants (17F/7M, 18±1yr, 167.5±72.0 cm, 67.9±17.1kg, 24.5±5.2kg/m<sup>2</sup> BMI) underwent dual energy x-ray absorptiometry for body fat determination and performed the Astrand submaximal bicycle ergometer test with metabolic measurements (e.g., VO<sub>2</sub>), from which estimated VO<sub>2</sub>max was extrapolated. The International Physical Activity Questionnaire (IPAQ) was administered to gather subjective self-evaluation of weekly exercise volume.

**Results:** The majority of students (13F/4M) fell into the "very poor" category for body fat percentage as defined by ACSM (34±7% in females and 24±10 in males). Five(5F/0M) were classified as "poor", 1 (0F/1M) as "fair", and 3 (1F/2M) as "good". 13 participants were classified as "good" or better on VO<sub>2</sub> max and 11as "fair" or worse (female: 42.5±11.2 ml/kg/min and male: 39.0±15.7 ml/kg/min). The majority (8F/7M) of participants claimed to engage in a "high" volume of physical activity per week as measured by the IPAQ, while 7 (7F/0M) scored "moderate" and 2 (2F/0M) "low" levels.

**Conclusion:** Although BMI average was normal, the majority of students failed to meet body fat standards. It is also interesting that all 7 males in the study scored themselves as "high" on the IPAQ, yet 6 of the 7 scored "poor" or "very poor" in the objective determination of VO<sub>2</sub>max. Follow-up studies will investigate how these variables change within their first semester and over their entire college life.

**3199** Board #20 May 29 1:30 PM - 3:00 PM  
**Validity Of A 3-Compartment Body Composition Model Derived From A Single 2-Dimensional Digital Image**  
 Katherine Sullivan, Clifton J. Holmes, Bjoern Hornikel, Shengting Cao, Yu Gan, Michael R. Esco, Michael V. Fedewa.  
*University of Alabama, Tuscaloosa, AL.*  
*Reported Relationships: K. Sullivan: Receipt of Intellectual Property Rights/Patent Holder; Michael Fedewa.*

Laboratory-based methods for assessing body composition often require specialized equipment, trained administrators, and relatively complex, time-consuming protocols. Simple, accurate, and cost-effective methods to assess body composition in field settings are limited. **PURPOSE:** The purpose of this study was to evaluate the validity of a digital image derived 3-compartment model estimate of body composition (IMAGE-3C) when compared to a 3-compartment skinfold estimate of body composition (SKF-3C). **METHODS:** A convenience sample of female participants was recruited for this study (n=24, 20.4±1.0 yrs., 73.1±10.3 kg). Body mass was measured (to the nearest 0.1 kg) with a calibrated digital scale (Tanita BWB-800, Tanita Corporation, Tokyo, Japan), and a standing height was measured (to the nearest 0.1 cm) with a stadiometer (SECA 213, Seca Ltd., Hamburg, Germany). Double measurements (within 2 mm of each other), of skinfold thickness were taken using calibrated skinfold calipers (Lange Skinfold Caliper, Seko, USA) across 7 standard sites on the body. A digital image of each participant was taken from the rear/posterior view using a 12.9 inch, 64g iPad Pro. A paired sample T-test was used to examine potential differences between body composition when measured via IMAGE-3C and SKF-3C. Intraclass Correlations Coefficient (ICC) was used to determine the strength of the association between the two methods. **RESULTS:** No differences in body composition were observed between IMAGE-3C and SKF-3C (17.9±5.1 versus 18.7±5.6, respectively, p=.08), with excellent agreement between methods (ICC=.96). **CONCLUSIONS:** The IMAGE-3C model appears to be a valid method of estimating body composition. The ability to evaluate body composition from a single digital image provides an accurate and efficient alternative to laboratory methods, which can be utilized by the general public. Data collection is ongoing. A larger and more diverse sample is needed to confirm these findings.

**3200** Board #21 May 29 1:30 PM - 3:00 PM  
**COMPARISON OF BODY COMPOSITION METHODOLOGIES BETWEEN SKINFOLD AND ULTRASOUND IN ELITE CROSSFIT ATHLETES: A PILOT STUDY.**

Maraline Santos Sena<sup>1</sup>, Matheus Lima Caetano<sup>1</sup>, Adriana Pereira Sampaio<sup>1</sup>, Marília Cabral Mendes<sup>1</sup>, Eder Evangelista Costa<sup>2</sup>, Marcio Leandro Ribeiro de Souza<sup>3</sup>, Valden Luis Matos Capistrano Junior<sup>1</sup>. <sup>1</sup>*VClínica de Nutrição, Fortaleza, Brazil.* <sup>2</sup>*Gurkha Crossfit, Fortaleza, Brazil.* <sup>3</sup>*Faculdade de Minas FAMINAS BH, Fortaleza, Brazil.*  
*(No relevant relationships reported)*

**PURPOSE:** The aim of the present work was to compare body composition methodologies between skinfold and ultrasound in elite CrossFit athletes.

**METHODS:** The sample consisted of 8 male CrossFit athletes with practice time (mean ± standard deviation) 58.66 ± 11.13 months, age 25.33 ± 4.38 years, height 181.11 ± 6.09 cm, weight 93.8 ± 8.41 kg and participating in national competitions, and international. The athletes were evaluated through skinfold (ST) (Cescorf plicometer) and ultrasound (BodyMetrix - BX 2000) in triceps, subscapularis, biceps, middle axillary, iliac, supraspinatus, abdominal, mid thigh and middle calf. The circumferences were measured with a flexible and inelastic anthropometric tape measure. ISAK standardization was used to measure skin folds. Descriptive statistics data are expressed as mean and ± standard deviation (SD) of absolute values of skinfold thickness measured by plicometer and ultrasound. A t-test for paired measurements was used, the Shapiro-Wilk normality test. Wilcoxon for nonparametric data). The confidence interval (CI) is 95% and Cohen's d was calculated for effect size. The existence of correlation was analyzed by Pearson's test (Spearman for non-normal data).

**RESULTS:** The difference between the means generated by ultrasound and plicometer was statistically significant for: -1.67mm ST triceps; - 4.15mm ST Subscapular; - 1.65mm ST Axillary; - 0.21mm ST Iliac; - 3.48mm ST Thigh; - 1.61mm ST Calf. Comparing each skinfold and ultrasound result it was possible to perform a proportion, and it was noted that the triceps ST was 1.56 times higher, subscapular ST 1.95, axillary ST 1.49, iliac ST 1.67, abdominal ST 1.39, and thigh DC 1. calf 1.53, comparing plicometer with ultrasound, respectively. In addition, the variables with small correlation (r = 0 - 0.25) were: triceps (r = 0.177); subscapular (r = 0.109); axillary (r = 0.005); iliac (r = 0.222); thigh (r = 0.044); calf (r = 0.097); variables with weak correlation (r = 0.26 - 0.5) were: abdominal (r = 0.343).

**CONCLUSIONS:** We conclude that there is a significant reduction in the thickness of the anatomical point collected by ultrasound and the skinfold thickness collected by the plicometer. Thus, we suggest that these differences at each anatomical point be taken into account when using a predictive equation to estimate body fat.

**3201** Board #22 May 29 1:30 PM - 3:00 PM  
**Comparison Of Waist And Hip Circumference Measures From 3-dimensional Technology And Manual Measurements**

Gabrielle J. Brewer, Malia N.M Blue, Katie R. Hirsch, Alyson G. Nelson, Abbie E. Smith-Ryan, FACSM. *University of North Carolina - Chapel Hill, Chapel Hill, NC.* (Sponsor: Abbie Smith-Ryan, FACSM)  
*(No relevant relationships reported)*

Three-dimensional (3D) scanning technology is becoming increasingly popular to obtain quick anthropometric and body composition measurements and may be a practical alternative to manual assessment methods. **PURPOSE:** To compare waist and hip circumferences measured from a 3D scan to manual measurements in healthy adults. **METHODS:** Data was collected on 66 healthy male (n=22) and female (n=44) young adults (Mean ± SD: Age: 20.6 ± 1.1 yrs, BMI: 22.6 ± 2.0 kg/m<sup>2</sup>). Manual measurement of the waist was assessed at the narrowest part of the trunk; hip circumference was measured at the widest region of the buttocks. Circumferences were measured twice by the same researcher and averaged. Measurements corresponding to the same waist and hip regions assessed manually were automatically determined by the 3D scanner software. Paired-samples t-tests were utilized to determine differences between methods for the total sample and each sex. Manual measurements were used as the criterion to evaluate prediction error (standard error of the estimate [SEE]). **RESULTS:** For the total sample, the 3D scan significantly underestimated waist (Mean difference (3D - manual) [MD]: MD: 6.3 ± 2.2 cm; p<0.001) and hip (MD: 2.8 ± 2.3 cm; p<0.001) circumferences compared to manual assessments. For the men, the 3D scanner significantly underestimated waist (MD: 6.6 ± 2.1 cm; p<0.001) and hip (MD: 2.2 ± 1.9 cm; p<0.001) circumferences. The same trend was seen for women for the waist (MD: 6.1 ± 2.2 cm; p<0.001) and hips (MD: 3.0 ± 2.5 cm; p<0.001). Prediction error of hip circumference was greater for women (SEE=2.42 cm) compared to men (SEE=1.94 cm); waist circumference error was similar for women (SEE=2.14 cm) and men (SEE =2.05 cm). **CONCLUSIONS:** 3D technology may underestimate

waist and hip circumference estimates compared to manual techniques in normal weight adults. However, 3D technology may be useful to provide quick anthropometric measurements.

**3202 Board #23 May 29 1:30 PM - 3:00 PM**  
**Reliability Of Seca® Medical Body Composition Analyzer (mbca) In Healthy Young Adults**

Chloe Y. Marr, Chandler Cornett, Kirsten Villanueva, Kent A. Lorenz, MiSook Kim, James R. Bagley. *San Francisco State University, San Francisco State University, CA.*  
 Email: cymarr@mail.sfsu.edu  
 (No relevant relationships reported)

**PURPOSE:** Bioelectrical impedance analysis (BIA) is an emerging method to measure body composition. The purpose of this study was to determine 1) baseline values of fat mass (FM), fat-free mass (FFM), skeletal muscle mass (SMM), total body water (TBW) extracellular water to total body water ratio (ECW/TBW), phase angle (PA), bioelectrical vector analysis (BIVA), and visceral adipose tissue (VAT), 2) any gender differences among measures, and 3) test-retest reliability on a newly obtained SECA® BIA device. **METHODS:** 37 young adults [22 males and 15 females; mean±SD, age 24.4±3.5; BMI 25.6±4.1 kg/m<sup>2</sup>] were measured in a single trial on the SECA® BIA machine having fasted overnight and abstaining from exercise for 12 hours. Multivariate analysis of variance was used to determine effects of gender on measures. To determine test-retest reliability, a subset of participants (26 healthy young adults) were measured 48 hours after the initial visit under the same conditions. Interclass correlation coefficients (ICC) were used to determine reliability of measures. **RESULTS:** Results: Males had higher (p<0.05) FFM, SMM, TBM, and VAT, whereas females had higher (p<0.05) FM, and ECW/TBW ratio. Correlation analysis revealed that all variables except ECW/TBW and BIVA were highly correlated between visit 1 and visit 2 (ICC>0.9) indicating reliability of measurements. **CONCLUSIONS:** Conclusion: SECA® scale measurements have high test-retest reliability. Future investigations should determine the validity of the SECA® compared to standard methods.

**3203 Board #24 May 29 1:30 PM - 3:00 PM**  
**Body Composition And Somatotype By Sex In Candidates That Apply To Dance And Theater University Degrees.**

Sergio Alejandro Copado-Aguila, Sayra Nataly Muñoz-Rodriguez, Alejandro Gaytan-Gonzalez, Zulema Getsemami Alfaro-Fregoso, Luis Abraham Zuñiga-Ramirez, Xochitl Citlalli Olivares-Ochoa, Juan Ricardo Lopez-Taylor. *Universidad de Guadalajara, Guadalajara, Mexico.*  
 (No relevant relationships reported)

**PURPOSE:** To determine and to compare the body composition and somatotype profiles with anthropometric methods by sex in Mexican candidates that apply to dance and theater university degrees at the University of Guadalajara. **METHODS:** 264 (95 males, 169 females) Mexican candidates that applied to dance and theater university degrees were evaluated anthropometrically by certified staff by the International Society for the Advancement of Kinanthropometry (ISAK). A complete profile anthropometric evaluation according to ISAK methodology was performed for each subject. We estimated body composition by four compartments according to Kerr equations (adipose, muscle, bone, and visceral tissues), and Somatotype was determined by the Heath and Carter method (decimal equations). The sample was divided by sex. Body composition values (adipose tissue, muscle, bone) and the somatotype components were expressed as mean, standard deviation, minimum and maximum. T-test for independent samples was performed to compare variables by sex. **RESULTS:** Subject's age, weight, height, and body mass index were: 19 ± 3 and 19 ± 2 years, 67 ± 13 and 57 ± 12 kg; 172 ± 8 and 160 ± 6 cm; and 22 ± 4 and 22 ± 4 kg/m<sup>2</sup>, for males and females, respectively. There were significant differences in all three compartments between males and females (percentage and mass). In the case of somatotype, we found that values of Endomorphy were lower and values of Ectomorphy were higher in males than females. Values of Mesomorphy were similar among sex. The mean value for males was Central (4-4-3), while in females was Mesomorphic Endomorph (5-4-2). **CONCLUSIONS:** In this study, we found that body composition, as well as somatotype, differs by sex. However, the sample was not divided by performing art (dance and theater), being able to find either similarities or differences with the existing literature.

Table 1. Body composition and somatotype profile of the evaluated subjects

| Variable            | Total (n=264)    | Males (n=95)     | Females (n=169)  | p-value |
|---------------------|------------------|------------------|------------------|---------|
| Adipose tissue (%)  | 27 ± 7.4 (8-40)  | 20 ± 5.7 (8-32)  | 31 ± 4.4 (19-40) | <0.001  |
| Adipose tissue (kg) | 16 ± 6.2 (3-36)  | 14 ± 6.2 (3-32)  | 18 ± 5.7 (7-36)  | <0.001  |
| Muscle mass (%)     | 35 ± 5.1 (25-50) | 40 ± 4.6 (29-50) | 33 ± 3.4 (25-41) | <0.001  |
| Muscle mass (kg)    | 21 ± 5.4 (13-43) | 26 ± 4.5 (16-43) | 18 ± 3.5 (13-40) | <0.001  |
| Bone mass (%)       | 16 ± 2.1 (10-23) | 17 ± 2.3 (10-23) | 15 ± 1.8 (10-20) | <0.001  |
| Bone mass (kg)      | 9 ± 1.7 (7-15)   | 11 ± 1.5 (7-15)  | 9 ± 1.1 (7-12)   | <0.001  |
| Endomorphy          | 4 ± 1.6 (1-8)    | 4 ± 1.5 (1-8)    | 5 ± 1.4 (2-8)    | <0.001  |
| Mesomorphy          | 4 ± 1.4 (1-11)   | 4 ± 1.3 (1-9)    | 4 ± 1.4 (1-11)   | 1.000   |
| Ectomorphy          | 2 ± 1.4 (0-8)    | 3 ± 1.5 (0-8)    | 2 ± 1.4 (0-6)    | <0.001  |

Data expressed as mean ± standard deviation (min-max)

**3204 Board #25 May 29 1:30 PM - 3:00 PM**  
**Cross-calibration Of Two Dual-energy X-ray Absorptiometry Systems For Body Composition Measurements In Young Adults**

Ana Mejia, Johnny Huatran, Erick Ramirez, Guillermo Escalante, Bryan Haddock, Zhaojing Chen. *California State University, San Bernardino, San Bernardino, CA.* (Sponsor: Bryan Haddock, FACSM)  
 (No relevant relationships reported)

Dual-energy X-ray absorptiometry (DXA) is one of the most accurate methods to measure body composition, and it has been widely used in both clinical and research settings such as the Appendicular Lean Mass (ALM) in sarcopenia. The body composition results on the same client may vary depending on the manufacture, model and software version of the DXA. Therefore, it is important to compare the measurements between different systems in longitudinal research studies and clinical practice. **PURPOSE:** To properly cross calibrate the body composition measurements between the Prodigy and iDXA in young adults. **METHODS:** Thirty healthy college students, including ten males (23.7 ± 1.9 years; 171.9 ± 6.7 cm; 81.8 ± 11.4 kg) and twenty females (23.1 ± 1.9 years; 161.8 ± 6.1 cm; 64.9 ± 15.3 kg) participated in the study. Body composition was measured using two DXA systems: Prodigy and iDXA, and analyzed by enCORE version 13 and 17, respectively by the same licensed DXA technician on the same day. Paired sample t-tests and regression analyses were performed to compare the body composition variables between the two systems. **RESULTS:** No significant differences were found in total body and leg percent fat (%fat), total and leg Fat Mass (FM), and total Bone Free Lean Mass (BFLM) (p > 0.05). However, there were statistically significant differences in total body and leg Bone Mineral Content (BMC) (p = 0.000), arm %fat (p = 0.012), arm FM (p = 0.000), arm and leg BFLM (ALM, p = 0.000) between the two systems (**Table 1**). **Conclusion:** Our results suggest that calibration equations are needed for the appendicular lean mass when comparing body composition between the Prodigy and iDXA in young adults. Further study in older adults is needed for the comparison of sarcopenia assessment using the two models of DXA.

Table 1. Comparison of Regional Body Composition Between iDXA and Prodigy

| Body Composition | iDXA       | Prodigy    | %Diff | P     |
|------------------|------------|------------|-------|-------|
| Arm BFLM (lbs)   | 12.3 ± 5.6 | 12.6 ± 5.8 | -2.37 | 0.012 |
| Arm FM (lbs)     | 5.3 ± 2.3  | 4.3 ± 2.3  | 22.68 | 0.000 |
| Leg BFLM (lbs)   | 35.6 ± 9.4 | 34.8 ± 9.4 | 2.23  | 0.000 |
| Leg FM (lbs)     | 17.5 ± 7.9 | 17.6 ± 9.1 | -0.34 | 0.83  |

BFLM: Bone Free Lean Mass; FM: Fat Mass

- 3205** Board #26 May 29 1:30 PM - 3:00 PM  
**The Effects Of Training Method And Experience Level On Measurement Error For Skinfold Thicknesses**  
 Laurie A. Milliken, FACSM<sup>1</sup>, Timothy G. Lohman<sup>2</sup>. <sup>1</sup>University of Massachusetts Boston, Boston, MA. <sup>2</sup>University of Arizona, Tucson, AZ.  
 Email: laurie.milliken@umb.edu  
 (No relevant relationships reported)

Accurate estimation of fatness from skinfolds is highly dependent on using the appropriate skinfold protocol, the methods of training and experience of the trainee. Purpose: To determine the effects of the type of training method and experience level on the accuracy of performing skinfold thickness measures at the triceps, subscapular and calf skinfold sites.

Methods: This study was designed to test the experience of the trainee using three different methods of training in a 2x3 factorial plan with a manual (M), audiovisual (AV) and in person (IP) training approach. Half of the trainees had no experience and half had some or considerable experience as judged by the number of subjects they had measured previously assessed by self report. Thirty subjects were randomly assigned to each of three methods in instruction (n=10/method). Half of the trainees were inexperienced in each training method. Three skinfolds (triceps, subscapular and calf) were measured using standardized procedures. To be trained on the skinfold measurement method, the M method group read a description of the skinfold method, the AV method group watched a training video, and the IP method group attended an IP workshop. All trainees measured the skinfolds of from 15 participants and were compared to an expert. An ANOVA was used to determine whether expert versus trainee systematic errors were different due to the method of training, experience level, or their interaction were significant.

Results: The mean systematic errors for the tricep were 1.0±0.9, 1.4±1.0, 1.0±0.6 for the M, AV and IP groups, respectively. For the calf, the mean errors were 1.4±0.7, 1.6±1.1, 0.7±0.3 for the M, AV and IP groups, respectively. For the subscapular, the mean errors were 1.1±1.0, 1.2±0.7, 0.8±0.7 for the M, AV and IP groups, respectively. There was no effect (p>0.05) of experience level or training method for all skinfolds except for the training method in the calf with the IP group trending toward the lowest error (p<0.10). The interaction between type of training and experience level was also not significant (p>0.05).

Conclusion: The systematic errors in measuring skinfolds were not influenced by experience level of the trainee or the training method however, outliers were found in every treatment group which contributed to the variability in the measures.

- 3206** Board #27 May 29 1:30 PM - 3:00 PM  
**Waist To Height Ratio: The Up To Date Method Of Predicting Chronic Disease Risk**  
 Sadie Engelken, Natalie Romenesko, Sydney Breitenbach, Bradley Koch, Rodney Pintang, Jessica M. Brown. Carroll University, Waukesha, WI.  
 (No relevant relationships reported)

Approximately 60-70% of the adult population is classified as overweight or obese, and it is estimated by 2030 adulthood obesity will increase by 33%. As obesity rates increase, there are associated increases of comorbidities such as cardiovascular disease, cancer, and type-2 diabetes. This increasing pandemic stresses the importance for healthcare professionals to efficiently and accurately measure body composition (BC), and most importantly determine chronic disease risk (CDR). Quantifiable values are important for exercise testing; however, CDR classifications may be more understandable to patients. There are many validated ways of obtaining BC and anthropometric measures (AM). Direct-segmental bioelectrical impedance analysis (DSM-BIA) directly measures both body and visceral fat (VF). AM aims to yield CDR by estimating fat, mainly in the splanchnic region. Although commonly used, inexpensive, and easy to perform, AM accuracy has been questioned. **PURPOSE:** The purpose of this study is to compare CDR between BC and AM techniques against DSM-BIA VF. **METHODS:** Males and females, 18 years and older, were recruited for a sample of 133. BC and AM were analyzed using body mass index (BMI), two waist circumference measurements: narrowest (nWC) and umbilicus (uWC), two waist-to-hip ratios: narrowest (nWHR) and umbilicus (uWHR), narrowest waist-to-height ratio (nWHtR), body fat percent (BF%) from three-site skinfold novice (nSK) and expert (eSK) trained clinicians, handheld bioelectrical impedance analysis (BIA), and DSM-BIA against DSM-BIA VF. Using consistent, numerical CDR stratification, the BC and AM values were assigned a classification. Paired sample t-tests were used to compare the CDR classifications between all measurements and DSM-BIA VF. **RESULTS:** When compared to DSM-BIA VF (1.30 ± 0.59), there was no statistical difference in CDR for nWHtR (1.37 ± 0.58), eSK (1.23 ± 0.54), and DSM-BIA BF% (1.37 ± 0.67) (p > 0.05). All other BC and AM were statistically different (p < 0.05) when compared to the DSM-BIA VF. **CONCLUSION:** VF is a key indicator of increased CDR and all-cause mortality. The DSM-BIA should be considered by clinicians due to

its accuracy in measuring both BF and VF. Our data suggests that out of all commonly used BC and AM, nWHtR, eSK, and DSM-BIA BF% predict CDR with equivalency to DSM-BIA VF.

- 3207** Board #28 May 29 1:30 PM - 3:00 PM  
**Association Between Television Viewing, Physical Fitness Markers, And Body Composition In College-Aged Adults**  
 Rachel N. Tauber, James R. Peterson, Rachel A. Kowal, Emerson Sebastião, Clayton L. Camic, Zachary Wahl-Alexander, Peter J. Chomentowski, III. Northern Illinois University, DeKalb, IL.  
 (No relevant relationships reported)

Obesity and sedentary behavior are major concerns in the United States. It has been observed that Americans who watch more television are at greater risk of becoming obese and have lower health-related fitness markers. Most literature, however, has not focused on college-aged adults. **PURPOSE:** The purpose of this study was to examine the association between daily screen time viewing (proxy of sedentary behavior) and health-related fitness markers in college-aged adults. **METHODS:** A total of one hundred and forty one college-aged subjects (mean age ± SD= 22.9 ± 2.6 years; percent body fat= 22.9 ± 10.3%) were separated into four groups in accordance to reported screen time (very low viewing time, low viewing time, moderate viewing time, and high viewing time) and participated in two data collection (screening & exercise) sessions. In the screening session, subjects completed an informed consent form, inclusion criteria form, screen time survey, and body composition assessment through a bioelectrical impedance analysis device. Seven days later, participants returned to complete a countermovement jump assessment of lower body anaerobic power and an aerobic capacity PACER test to assess cardiorespiratory fitness. **RESULTS:** Spearman rank-order correlation coefficient tests showed a significant positive correlation (p = 0.032, r = 0.352) between daily time spent watching television and vertical jump displacement for the very low viewing time group. A significant positive correlation (p = 0.022, r=0.402) between daily time spent watching television and PACER laps was found in the very low viewing time group as well as a significant negative correlation (p = 0.49, r = -0.340) in the high viewing group. However, there were no statistically significant associations between daily time spent watching television and percent body fat. A one-way ANOVA showed a statistically significant difference (p < 0.05) for viewing time groups. A Tukey post hoc analysis showed statistically significant differences (p < 0.001) between all viewing time groups. **CONCLUSION:** Lower amounts of daily television viewing in college-aged adults was associated with greater lower body power production and greater cardiorespiratory fitness. Higher amounts of daily television viewing were associated with decreased cardiorespiratory fitness.

- 3208** Board #29 May 29 1:30 PM - 3:00 PM  
**Three Methods Of Assessing Percent Body Fat In Healthy Older Adults**  
 Rolando T. Lazaro. California State University Sacramento, Sacramento, CA. (Sponsor: Rafael Escamilla, FACSM)  
 Email: rolando.lazaro@csus.edu  
 (No relevant relationships reported)

**PURPOSE:** We compared body fat using three different body fat percent methods that can be performed in 60 seconds or less. One hundred healthy older adults between 60 and 88 years old (mean: 72.28) served as subjects. **METHODS:** The three methods used to assess body fat were the following: skinfold calipers using regressive equations developed from seven skinfold sites; tape measure using regression equations developed from waist, abdominal, and hip circumference measurements and age, height, and weight; and body mass index (BMI), using regression equations developed from BMI, age, and gender. **RESULTS:** Significant differences were found in the calculation of percent body fat between the three methods (F = 143.30825, p<.01). **CONCLUSION:** While excessive body fat is correlated with several diseases in older adults such as cardiovascular disease, diabetes, and stroke and is an important aspect of all health/wellness programs, assessing body fat can be very expensive and time consuming. The three quick and inexpensive methods of calculating percentage body fat however produced significantly varied calculations of percentage body fat. More research is needed to compare these three methods to the gold standard of measuring percent body fat such as hydrostatic weighing and Dual-Energy X-Ray Absorptiometry (DEXA).

3209 Board #30 May 29 1:30 PM - 3:00 PM

**SOMATOTYPING IN COLLEGE TRACK & FIELD ATHLETES: EVALUATING CHANGE ACROSS A COMPETITIVE SEASON**

Whitley J. Stone<sup>1</sup>, Amanda J. Wakeman<sup>2</sup>, Matthew J. Garver<sup>2</sup>, Josie N. Hair<sup>2</sup>, Dustin W. Davis<sup>3</sup>, Eric J. Nehlsen<sup>2</sup>, Drake A. Grinde<sup>2</sup>, Shayne J. Allan<sup>2</sup>. <sup>1</sup>Western Kentucky University, Bowling Green, KY. <sup>2</sup>University of Central Missouri, Warrensburg, MO. <sup>3</sup>University of Nevada-Las Vegas, Las Vegas, NV. (Sponsor: T. Scott Lyons, FACSM)

(No relevant relationships reported)

Coaches may find value in following track and field athletes' anthropometrics as the extended competitive season requires a unique balance of peak and maintained preparation. Somatotyping may offer a more holistic metric compared with BMI, mass, or body fat percentage alone when tracking changes across competition mesocycles. **PURPOSE:** The purpose of this study was to record track and field athletes' somatotype scores to elucidate potential changes across the competitive season according to sex and/or age. **METHODS:** Division II track and field athletes ( $n=47$ ) were tested at the start and end of the outdoor season. Somatotype data were collected according to the Heath-Carter manual (skinfolds, girths, breadths, stature & mass). Raw data were converted to mesomorph, endomorph, and ectomorph scores. One-way RM ANOVAs with between subject variables (sex & age) were used to evaluate change in endomorphy, mesomorphy, and ectomorphy scores across the season. **RESULTS:** Scores for endomorphy ( $F(1,45)=117.9, p<.001, \eta^2=.072$ , males ( $M$ )= +3.2%, females ( $F$ )= -0.1%) and mesomorphy ( $F(1,45)=10.1, p=.003, \eta^2=.018$ ,  $M$ = -3.4%,  $F$ = +4.6%) differed across time by sex, but not ectomorphy ( $F(1,52)=0.03, p=.86, \eta^2=.001, M$ = -6.2%,  $F$ = -6.3%). Age did not influence somatotype scores across the season. **CONCLUSIONS:** The rigors of a competitive season may influence only certain sex-somatotype combinations. Influencing factors for the divergent changes in somatotype presently found should be identified to optimize training approaches.

3210 Board #31 May 29 1:30 PM - 3:00 PM

**Relationships Between Sport Nutrition Knowledge, Body Composition And Body Weight Goal In Female Soccer Players.**

Andrew Jagim<sup>1</sup>, Alexis Shafer<sup>2</sup>, Jordan Paisley<sup>2</sup>, Andrew Askow<sup>3</sup>, Joel Luedke<sup>2</sup>, Charles Nolte<sup>1</sup>, Jacob Erickson<sup>1</sup>. <sup>1</sup>Mayo Clinic Health System, Onalaska, WI. <sup>2</sup>University of Wisconsin - La Crosse, La Crosse, WI. <sup>3</sup>University of Illinois - Urbana-Champaign, Champaign, IL. Email: andrew.jagim@gmail.com

(No relevant relationships reported)

Sport nutrition knowledge may impact the quality of an athlete's dietary intake. It is currently unknown how sport nutrition knowledge (SNK) influences body composition and what factors may contribute to an athlete's body weight goal.

**PURPOSE:** To examine relationships between SNK and body composition and identify predictors of body weight goal in female collegiate soccer players.

**METHODS:** Twenty-six Division III female soccer athletes (height:  $1.61 \pm 0.30$  m; body mass:  $66.7 \pm 7.5$  kg; fat-free mass:  $50.3 \pm 6.5$  kg; body fat %:  $25.6 \pm 5.1$ %) participated in the current study. All players had body composition assessed using air displacement plethysmography and completed a validated questionnaire designed to assess sport nutrition knowledge. Athletes were also asked questions about perceived dietary requirements and body weight goal. Pearson correlation coefficients were assessed to examine relationships between SNK and body fat percentage (BF %), fat-free mass, fat-mass, body mass (BM), body mass index (BMI), and perceived dietary requirements. Multinomial logistic regression was used to identify predictors of body weight goal. Paired sample  $t$ -tests were used to compare differences between calculated and perceived dietary needs.

**RESULTS:** The mean number of questions answered correctly on the SNK questionnaire was  $44.5 \pm 11.2$  %. An inverse relationship was observed between BF % and SNK ( $r = -0.391; p=0.044$ ). Body mass, BMI and BF % were all significant predictors of body weight goal ( $p<0.05$ ). For every 1% increase in BF % and 1 kg increase in BM, athletes were 1.3 times more likely to want to lose weight. For every 1 unit increase in BMI, athletes were 2.7 times more likely to want to lose weight. All players significantly underestimated daily energy ( $-578 \pm 104.9$  kcal/d,  $p<0.001$ ) and carbohydrate ( $-283.7 \pm 141.8$  g/d,  $p<0.001$ ) requirements when compared to their calculated required daily intakes.

**CONCLUSIONS:** Division III female collegiate soccer players have a low sport nutrition knowledge base which was associated with a higher BF %. Players who had a higher BM, BF % and BMI were more likely to have weight loss as a body weight goal. Players also significantly underestimated their energy and carbohydrate requirements based on the demands of their sport. Players could likely benefit from a sport nutrition education intervention.

3211 Board #32 May 29 1:30 PM - 3:00 PM

**Body Composition Values Of Division 1 Men's Lacrosse Players Derived From Dual Energy X-ray Absorptiometry**

Kyle M. Leppert, Hannah A. Zabriskie, Nicolas D. Knuth, Devon A. Dobrosielski, FACSM, Peter Lisman. *Towson University, Towson, MD.*

(No relevant relationships reported)

Total and regional body compositions are key components of sport performance. Dual energy X-ray absorptiometry (DXA) allows for precise measurements of body composition parameters between athletes who experience different competitive demands. Yet, accurate interpretation of DXA data is dependent on the availability of reference values. Despite the widespread use of DXA to measure body composition in collegiate athletes, positional reference values for men's lacrosse do not exist.

**PURPOSE:** To generate descriptive data for total and regional body composition in men's collegiate lacrosse players using DXA, and examine differences between positions. **METHODS:** Members of an NCAA Division 1 Men's Lacrosse team underwent DXA scanning and were categorized according to position. Descriptive statistics were calculated for total and regional body composition measures and differences between positions were examined using a one-way ANOVA or a Kruskal-Wallis test. **RESULTS:** A total of 98 players (age:  $19.2 \pm 1.0$  yrs; height:  $181.1 \pm 7.0$  cm; total mass:  $82.4 \pm 9.2$  kg) completed the study (Attack;  $n=24$ , Midfield;  $n=44$ , Defense;  $n=25$ , Goalkeeper;  $n=6$ ). The mean total body fat percentage (BF%) was  $18.9 \pm 3.4$  % (range:  $11.0$ - $27.6$ ). No differences in BF% between positions were identified (Attack= $18.9 \pm 3.9$ %, Midfield= $18.8 \pm 4.2$ %, Defense= $18.9 \pm 3.7$ %, GK= $20.5 \pm 2.9$ %;  $p=0.79$ ). For the android region, no differences between positions were identified for fat mass (Attack= $1.0 \pm 0.5$  kg, Midfield= $1.0 \pm 0.5$  kg, Defense= $0.9 \pm 0.4$  kg, GK= $1.1 \pm 0.5$  kg;  $p=0.9$ ), or lean mass (Attack= $4.3 \pm 0.5$  kg, Midfield= $4.3 \pm 0.4$  kg, Defense= $4.4 \pm 0.3$  kg, GK= $4.4 \pm 0.8$  kg;  $p=0.7$ ). For the gynoid region, no differences between positions were noted for fat mass (Attack= $2.6 \pm 0.8$  kg, Midfield= $2.5 \pm 0.9$  kg, Defense= $2.7 \pm 0.8$  kg, GK= $0.3 \pm 1.1$  kg;  $p=0.48$ ), or lean mass (Attack= $10.3 \pm 1.6$  kg, Midfield= $10.4 \pm 1.0$  kg, Defense= $10.5 \pm 0.7$  kg, GK= $10.4 \pm 1.4$  kg;  $p=0.79$ ). **CONCLUSION:** Total and regional body composition measures did not vary across positions in a group of men's collegiate lacrosse players. These data suggest that the athletic demands across positions of men's collegiate lacrosse are not related to differences in body composition. Therefore, training programs tailored to specific positions may not be needed in order to achieve athletic success.

3212 Board #33 May 29 1:30 PM - 3:00 PM

**Somatotype Of Female And Male Field Athletes: Comparing Between Sexes And Among Select Events**

Matthew J. Garver<sup>1</sup>, Whitley J. Stone<sup>2</sup>, Amanda J. Wakeman<sup>1</sup>, Josie N. Hair<sup>1</sup>, Dustin W. Davis<sup>3</sup>, Drake A. Grinde<sup>1</sup>, Shayne J. Allan<sup>1</sup>, Eric J. Nehlsen<sup>1</sup>. <sup>1</sup>University of Central Missouri, Warrensburg, MO. <sup>2</sup>Western Kentucky University, Bowling Green, KY. <sup>3</sup>University of Nevada, Las Vegas, Las Vegas, NV. Email: Garver@ucmo.edu

(No relevant relationships reported)

Anthropometrics (e.g. BMI, mass, limb lengths) have their place in the discussion of sports performance, but their unidimensional view prevents whole-athlete evaluation. Classical somatotyping categorizes the human build into ectomorph (ECTO), mesomorph (MESO), and endomorph (ENDO) according to stature and mass distribution. Somatotyping may offer clues as to desirable physique when investigating human performance in a diverse athletic group like field athletes. **PURPOSE:** The aim was to compare the somatotype of Division II field athletes between sexes and among select events. **METHODS:** Somatotyping data were collected on competitive female ( $n=9$ , age:  $20.0 \pm 0.7$  yrs., ht.:  $173.4 \pm 6.5$  cm, body fat:  $18.8 \pm 5.2$ %) and male ( $n=16$ , age:  $19.9 \pm 1.1$  yrs., ht.:  $183.4 \pm 3.4$  cm, body fat:  $9.0 \pm 2.8$ %) field athletes nearing the conference championship; an assumption was made that athletes were in peak form. Raw data included stature (cm), mass (kg), skinfolds (mm), girths (cm), and breadths (cm) and were converted into ECTO, MESO, and ENDO scores. Independent  $t$ -tests were used to test significance. Data are represented as means and standard deviations. **RESULTS:** Data for female athletes were: ECTO= $2.76 \pm 1.30$ , MESO= $3.32 \pm 1.64$ , and ENDO= $8.02 \pm 1.04$  and for males were: ECTO= $2.78 \pm 0.74$ , MESO= $4.48 \pm 0.75$ , and ENDO= $5.00 \pm 0.96$ . Between the sexes, there was a difference for ECTO ( $t(23)=7.33, p<.000$ ), but not MESO ( $t(23)=-.05, p=.958$ ) or ENDO (equal variance not assumed;  $t(9.91)=-2.01, p=.073$ ) scores. Among the multi-field athletes (female heptathletes= $3$  and male decathletes= $5$ ) there were not any differences for ECTO ( $2.99 \pm 1.56$  vs.  $3.08 \pm 0.54, p=.907$ ) or MESO ( $2.91 \pm 1.43$  vs.  $4.13 \pm 0.73, p=.153$ ) scores, but there was a difference for ENDO ( $7.81 \pm 1.10$  vs.  $4.79 \pm 0.71, p=.003$ ) scores. The jumpers (long, high, and triple; females= $3$  and males= $7$ ) were not different on ECTO ( $3.27 \pm 0.65$  vs.  $2.81 \pm 0.76, p=.396$ ), but they differed on both MESO ( $2.77 \pm 0.94$  vs.  $4.54 \pm 0.72, p=.011$ ) and ENDO ( $7.00 \pm 0.42$  vs.  $5.28 \pm 0.96, p=.020$ ) scores. **CONCLUSIONS:** Evidence regarding somatotype among competitive athletes is interesting but

ambiguous. Investigating scores between multi-field athletes and uni-field athletes and aligning somatotype with performance data to ascertain potential predictive relationships are the next steps in this inquiry.

**3213** Board #34 May 29 1:30 PM - 3:00 PM  
**Somatotyping Male And Female Sprinters And Endurance Sprinters**

Josie N. Hair<sup>1</sup>, Matthew J. Garver<sup>1</sup>, Whitley J. Stone<sup>2</sup>, Amanda J. Wakeman<sup>1</sup>, Dustin W. Davis<sup>3</sup>, Drake A. Grinde<sup>1</sup>, Shayne J. Allan<sup>1</sup>, Eric J. Nehlsen<sup>1</sup>. <sup>1</sup>University of Central Missouri, Warrensburg, MO. <sup>2</sup>Western Kentucky University, Bowling Green, KY. <sup>3</sup>University of Nevada, Las Vegas, Las Vegas, NV. Email: jnh78100@ucmo.edu  
(No relevant relationships reported)

Coaches and athletes plan for peak physical condition to occur at specified times during the competitive season (e.g. conference championship). Depending upon the event, athletes may or may not have similar somatotypes (endomorph=Endo, ectomorph=Ecto, and mesomorph=Meso). It is currently unclear whether competitive, Division II sprinters and endurance sprinters differ in somatotype. **PURPOSE:** The aim was to calculate somatotype of male and female collegiate sprinters and endurance sprinters preceding their outdoor conference championship. **METHODS:** Athletes ( $n=18$ ) were tested near the end of their outdoor season. Somatotype data were calculated, for sprinters ( $n=10$ ; 100m and 200m) and endurance sprinters ( $n=8$ ; 400m), according to the Heath-Carter manual [breadths (cm), girths (cm), stature (cm), mass (kg), and skinfolds (mm)]. Comparisons were made by independent *t*-tests. Means and standard deviations are presented. **RESULTS:** Male sprinters ( $n=5$ , age:  $19.8 \pm .5$  yrs., ht.:  $180.3 \pm 10.5$  cm, wt.:  $73.2 \pm 10.2$  kg, body fat:  $6.1 \pm .9$  %) displayed as Endo= $4.74 \pm .69$ , Ecto= $3.09 \pm .92$ , and Meso= $3.71 \pm 1.03$  and endurance sprinters ( $n=4$ , age:  $19.5 \pm .6$  yrs., ht.:  $181.9 \pm 3.9$  cm, wt.:  $73.2 \pm 4.2$  kg, body fat:  $6.2 \pm 1.6$  %) displayed as Endo= $4.40 \pm .46$ , Ecto= $3.31 \pm .26$ , and Meso= $3.84 \pm .70$ . Male sprinters and endurance sprinters were not significantly different on Endo ( $t(7)=.85$ ,  $p=.424$ ), Ecto (equal variance not assumed;  $t(4.79)=-.52$ ,  $p=.628$ ), or Meso ( $t(7)=-.22$ ,  $p=.830$ ) scores. Female sprinters ( $n=5$ , age:  $19.2 \pm 1.3$  yrs., ht.:  $166.4 \pm 5.4$  cm, wt.:  $60.8 \pm 4.6$  kg, body fat:  $15.5 \pm 5.3$  %) displayed as Endo= $7.45 \pm 1.21$ , Ecto= $2.50 \pm .75$ , and Meso= $3.21 \pm .94$  and endurance sprinters ( $n=4$ , age:  $19.8 \pm 1.7$  yrs., ht.:  $167.9 \pm 5.0$  cm, wt.:  $58.6 \pm 2.7$  kg, body fat:  $15.8 \pm 5.5$  %) displayed as Endo= $7.39 \pm 1.37$ , Ecto= $3.13 \pm .74$ , and Meso= $2.70 \pm .67$ . Female sprinters and endurance sprinters were not significantly different on Endo ( $t(7)=.08$ ,  $p=.942$ ), Ecto ( $t(7)=-1.27$ ,  $p=.245$ ), or Meso ( $t(7)=.91$ ,  $p=.393$ ) scores. **CONCLUSIONS:** There was no difference in the somatotype of male and female sprinters and endurance sprinters. Further research should be conducted to analyze the relationships between early season somatotype, late season somatotype, and performance season long.

**3214** Board #35 May 29 1:30 PM - 3:00 PM  
**The Relation Of Body Composition Methodologies Between Sports In Division 1 Collegiate Athletes.**

Cullen Vincelle. Louisiana State University, Baton Rouge, LA. (Sponsor: Brian Irving, FACSM)  
Email: cvinc19@lsu.edu  
(No relevant relationships reported)

Body composition has a significant impact on athletic performance, as well as overall health and wellbeing. Athletes and coaches often attempt to optimize performance by changing body composition without sport specific guidelines. Several techniques for measuring body composition exist, but the validity compared to the DXA has not been fully elucidated in athletic populations in various sports. **PURPOSE:** The aim of this study is to examine the relationship of surrogate body composition methodologies in Division 1 NCAA men's and women's sports. **METHODS:** Student athletes from men's (baseball, swim and dive, track, and tennis) and women's (softball, soccer, basketball, swim and dive, track and, tennis) sports volunteered to participate in 3 measures of body composition including Dual Energy X-ray Absorptiometry (DEXA), Bioimpedance Analysis (BIA), and 3D body imaging (FIT-3D). **RESULTS:** 106 assessments were completed (age  $19.7 \pm 1.4$  y, mean $\pm$ SD) with 84 athletes (61 Female, 17 African American athletes). The average weight, lean mass (LM), and % body fat (%BF) by DXA for men were  $79.8 \pm 9.0$  kg,  $67.7 \pm 8.1$  kg, and  $15.9 \pm 1.5$  % and women were  $69.6 \pm 9.5$  kg,  $54.5 \pm 7.3$  kg; and  $25.5 \pm 3.9$  %, resp. Matched pairs analysis showed that compared to DXA, BIA underestimated LM and overestimated %BF in women ( $-1.9 \pm .3$  kg;  $P < 0.0001$ ;  $0.8 \pm .4$  %;  $P = 0.04$ ), but missed statistical significance in men ( $-1.2 \pm 1.1$  kg;  $P = 0.3$ ;  $1.5 \pm .7$  %;  $P = < 0.07$ ), resp. Likewise, the FIT-3D over estimated LM and underestimated %BF in women ( $0.4 \pm .4$  kg;  $P = 0.3$ ;  $-2.4 \pm .3$  %;  $P < .0001$ ), but not men ( $0.8 \pm 1.2$  kg;  $P = 0.6$ ;  $-0.8 \pm .5$  %;  $P = 0.2$ ), resp. compared to DXA LM and %BF. Linear regression analysis from the Bland-Altman analysis shows a significant bias for male BF% from the FIT-3D to DXA ( $r = 0.61$ ;  $P = 0.009$ ), as well as BIA to DXA ( $r = -0.80$ ;  $P < 0.0001$ ). **DISCUSSION:** This is an ongoing longitudinal study of which this cross-sectional data was used to examine the relationship between body composition methodologies. Understanding the sex specific mean differences and bias between

body composition methodologies may assist in the development of algorithms to improve the correlation between the criterion standard measure (DXA) and surrogate measures.

**3215** Board #36 May 29 1:30 PM - 3:00 PM  
**Evaluating Fat Free Mass Index For Sport Specific Performance Goals In Female Collegiate Athletes**

Louis-Philip Marc-Antoine Guindon, Patrick Delisle-Houde, Jessica A. Insogna, Adriana P. Sólomon, Ross E. Andersen, FACSM. McGill University, Montreal, QC, Canada.  
(No relevant relationships reported)

Fat free mass index (FFMI) in an athletic female population is computed as (bone mineral content + lean mass / height<sup>2</sup>). It has been associated with performance and training status in their relevant sport, collegiate female athletes need to optimize bone mineral density (BMD), and lean mass as multiple factors impact their levels, including: the type of sport, nutrition, menstrual cycle, training program variation, lifestyle habits, and genetics. **PURPOSE:** To compare FFMI and lower body BMD across female collegiate athletes and sedentary control considering their desired sport-specific performance and training. **METHODS:** A sample of 68 women (Mean $\pm$ SD; Age:  $20.89 \pm 1.91$  yrs, Height:  $1.65 \pm 0.07$  m, and Weight:  $62.25 \pm 10.11$  kg) including 43 females collegiate athletes ( $n = 23$  hockey players,  $n = 20$  synchronize swimmers) and 25 sedentary university students received a scan using dual-energy x-ray absorptiometry (DEXA). ANOVA was used to evaluate differences in: FFMI, and regional BMD in the spine and the femur. **RESULTS:** The FFMI of hockey players ( $18.11 \pm 1.33$  kg/m<sup>2</sup>), was significantly ( $p < .05$ ) higher than both the synchronized swimmers ( $15.43 \pm 1.25$  kg/m<sup>2</sup>) and the controls ( $14.99 \pm 1.45$  kg/m<sup>2</sup>). Hockey players, compared to synchronized swimmers and the control group, have a higher BMD of the spine,  $F(2, 65) = 13.391$ ,  $p < .05$ , FFMI,  $F(2, 66) = 37.06$ ,  $p < .05$ . BMD of the total femur in the hockey players was great than the controls,  $F(2, 65) = 4.06$ ,  $p < .05$ . Total lean mass of synchronized swimmers ( $40.77 \pm 3.67$  kg.) was greater ( $p < .05$ ) than the control group ( $36.65 \pm 5.30$  kg). **CONCLUSION:** BMD and FFMI of the control group compared to female athletes show how sports' demands influence bone's health in a female collegiate population. BMD and FFMI of hockey players compared to synchronized swimmers may demonstrate the importance of percussive activities for bone health in female athletes. Differences in FFMI between female hockey players and synchronize swimmers suggest that establishing sport-specific norms in this new measure may help coaches and strength specialists better tailor training programs to optimize performance and bone health in varsity athletes.

**3216** Board #37 May 29 1:30 PM - 3:00 PM  
**Validity Of The Portable Ultrasound Device To Estimate Body Fat Percentage.**

Yong Ik Kim<sup>1</sup>, Seung Yun Shin<sup>2</sup>, Seoung Ki Kang<sup>2</sup>, Jae Hyung Lee<sup>2</sup>, Byung Kwon Kim<sup>2</sup>, Jin Su Seok<sup>2</sup>, Seong Bong Hong<sup>3</sup>, Myoung-Won Seo<sup>4</sup>, Jung-Min Lee<sup>4</sup>. <sup>1</sup>Kook Min University, Seoul, Korea, Republic of. <sup>2</sup>Yong In University, Yongin, Korea, Republic of. <sup>3</sup>Sung Kyun Kwan University, Suwon, Korea, Republic of. <sup>4</sup>Kyung Hee University, Suwon, Korea, Republic of.  
Email: hyyongik@naver.com  
(No relevant relationships reported)

Many studies have performed to examine the validity of those tools to measure body composition, including DEXA (Dual-energy X-ray absorptiometry), underwater weighing (UWW), Skin-fold thickness (SFT), and Bioelectrical impedance analysis (BIA). Technological advances now permit the use of the portable ultrasound device for the field measures. But no information is available regarding the validity of the device in collegiate students. **Purpose:** The purpose of the present study was to examine the validity of Body Metrix™ ultrasound device for estimating percent body fat in normal and obese college-aged male participants, compared to DEXA. **Methods:** In total, ninety-eight (73 Normal, 25 Obese,  $20.11 \pm 2.13$  years,  $175.15 \pm 6.00$  cm,  $73.63 \pm 13.92$  kg) male collegiate students volunteered for this study. Height and weight were measured and participants' percent body fat was measured twice; 1) the DEXA (Dual-energy X-ray absorptiometry; GE Lunar, Madison, WI, USA) and 2) the BodyMetrix BX2000 (IntellaMetrix, Livermore, CA, USA) using Pollock three site technique (P3). For data processing, the average and standard deviation of the data were calculated by using SPSS 25.0 program and MedCalc program. Correlation analysis (*r*) and Bland & Altman were performed to examine the validity of the portable ultrasound device. Mean absolute percentage errors (MAPEs) were calculated as measurement errors. **Results:** There was a strong correlation between DEXA and Body Metrix™ ultrasound device (Normal,  $r = 0.84$ ,  $p = 0.001$ ); Obese,  $r = 0.80$ ,  $p = 0.001$ ). Bland-Altman analysis identified that 95% relative limits of agreement for the portable ultrasound device were again clinically acceptable in participants with BMI <25 and BMI  $\geq 25$  ( $-1.90\%$  to  $7.70\%$  and  $5.20\%$  to  $16.58\%$ , respectively). MAPEs were 20.3% and 36.3 for normal BMI and Obese participants, respectively. **Conclusion:** We found that the Body Metrix™ ultrasound device appears to be an

alternative measurement to estimate percent body fat. However, relatively large MAPEs indicated that Body Metrix™ ultrasound device requires careful interpretation to estimate percent body fat in clinically obese collegiate participants.

**3217 Board #38 May 29 1:30 PM - 3:00 PM**  
**Effects Of Blood Flow Restriction And Neuromuscular Electrical Stimulation On Muscle And Adipose Tissue Thickness Of The Calves**

Yaremi M. Ontiveros, Jonathan Aguilera, Neil Sundberg, Joshua A. Cotter, FACSM. *California State University Long Beach, Long Beach, CA.* (Sponsor: Joshua A. Cotter, FACSM)  
 Email: yaremi.ontiveros@student.csulb.edu  
 (No relevant relationships reported)

Accelerated muscle atrophy is an important factor to consider in several different environments such as spaceflight, paralysis, immobilization, and aging. Understanding optimal exercise countermeasures in such environments is therefore necessary to examine. **PURPOSE:** To assess muscle and adipose tissue thickness in the calves while using the unconventional training methods of blood flow restriction (BFR) and neuromuscular electrical stimulation (NMES). **METHODS:** Six sedentary participants (4 males and 2 females;  $20.5 \pm 1.4$  yrs,  $73.5 \pm 13.8$  kg) underwent 6 weeks of calf training with each leg randomly assigned to one of three conditions: 1) BFR ( $n=4$ ), 2) NMES ( $n=3$ ), and 3) combined BFR+NMES ( $n=5$ ). A control group of seven sedentary participants (4 males and 3 females;  $23.1 \pm 4.3$  yrs,  $75.1 \pm 12.2$  kg) were also used. Adipose tissue thickness was measured via ultrasound and skinfolds while muscle thickness of the gastrocnemius and soleus was assessed via ultrasound. Comparisons were made using separate two-way ANOVA's for each variable. **RESULTS:** A significant main effect of time was found for ultrasound measurements of the lateral ( $p = 0.0021$ ) and medial ( $p = 0.0467$ ) adipose tissue. A significant interaction effect was found for medial adipose tissue ( $p = 0.0282$ ) with post-hoc comparisons revealing a significant increase in medial adipose tissue thickness with the BFR ( $p = 0.0176$ ). No differences were found in muscle thickness for both the medial and lateral gastrocnemius, however, there was a significant main effect of time ( $p = 0.0025$ ) and interaction ( $p = 0.0013$ ) for soleus muscle thickness. Post-hoc comparisons showed a significant increase in soleus muscle thickness with the BFR+NMES condition ( $p = 0.0029$ ) only. **CONCLUSION:** These results suggest that a combined BFR+NMES training condition may be a feasible method for increasing soleus muscle thickness with 6 weeks of training. Additional research is warranted to elucidate the potential use of BFR and NMES for stimulating positive physiological change in the calves. Supported by National Institute of Health grants UL1GM118979; TL4GM118980; RL5GM118978.

**3218 Board #39 May 29 1:30 PM - 3:00 PM**  
**Development And Cross-validation Of A Bmi-based Equation For Percent Fat In Children With Intellectual Disability**

Fabio bertapelli<sup>1</sup>, Stamatis Agiovlatisis, FACSM<sup>2</sup>, Robert W. Motl<sup>3</sup>, Marcos M. de Barros-Filho<sup>1</sup>, Gil Guerra-Junior<sup>1</sup>.  
<sup>1</sup>University of Campinas, Campinas, Brazil. <sup>2</sup>Mississippi State University, Starkville, MS. <sup>3</sup>University of Alabama at Birmingham, Birmingham, AL. (Sponsor: Stamatis Agiovlatisis, FACSM)  
 Email: fbertapelli@gmail.com  
 (No relevant relationships reported)

Children with intellectual disability (ID) have higher rates of obesity than children without ID, and the management of obesity might be facilitated through simple and accurate methods for estimating percent body fat (%BF) in children with ID. **PURPOSE:** To develop and cross-validate an equation for estimating %BF from Body Mass Index (BMI), age, sex and other independent variables in children with ID. **METHODS:** Participants were 107 children (aged 6-15 years) with ID allocated to development ( $N = 81$ ; 50 boys; age  $12 \pm 3$  years) and cross-validation ( $N = 26$ ; 13 boys; age  $12 \pm 3$  years) samples. Dual-Energy X-Ray Absorptiometry (DXA) served as the criterion method for %BF determination. Candidate predictor variables for estimation of DXA-determined %BF were BMI, age, sex, disability status, ID level, ethnicity, and presence of diseases. Using the data from the development sample, we derived a %BF prediction equation with hierarchical linear regression. The performance of the equation was assessed in the cross-validation sample by comparing the actual (DXA-determined %BF) and predicted (Equation-determined %BF) values with paired-samples t-test, Pearson's correlation coefficient, mean absolute and root mean square errors, and Bland-Altman plot. **RESULTS:** BMI, age, and sex (0=boy; 1=girl) were significant predictors of %BF ( $p < 0.001$ ;  $R^2 = 0.66$ ;  $SEE = 5.95\%$  BF). Disability, ID level, ethnicity, and presence of diseases did not significantly contribute to the model ( $p > 0.05$ ). The equation was:  $\%BF = 15.269 + (1.412 \times BMI) - (1.350 \times age) + (5.362 \times sex)$ . The equation had high accuracy during cross-validation as indicated by: (i) strong correlation between actual and predicted %BF ( $r = 0.80$ ;  $p < 0.001$ ); (ii) non-significant difference between

actual and predicted %BF ( $30.2 \pm 7.1\%$  and  $28.6 \pm 9.6\%$ , respectively;  $p > 0.05$ ); (iii) mean absolute and root mean square error of  $4.4 \pm 4.1\%$  and  $5.6\%$ , respectively; and (iv) small mean overestimation of DXA-determined %BF but somewhat wide limits of agreement in the Bland-Altman plot (mean error:  $-1.53\%$ ; 95% CI:  $10.2\%$ ,  $-13.3\%$ ). **CONCLUSIONS:** BMI, age and sex significantly predicted %BF in children with ID. The developed equation was cross-validated for estimating %BF in children with ID. Supported by FAPESP Grants 2019/07103-6, 2018/02795-4, 2018/02677-1, and 2017/13071-4

**3219 Board #40 May 29 1:30 PM - 3:00 PM**  
**Development Of A Dxa-derived Body Volume Equation In Hispanic Adults For Administering In 4-compartment Models**

Brett S. Nickerson<sup>1</sup>, Kyung-Shin Park<sup>1</sup>, Michael V. Fedewa<sup>2</sup>, Cherylyn N. McLester<sup>3</sup>, John R. McLester, FACSM<sup>3</sup>, Michael R. Esco, FACSM<sup>2</sup>. <sup>1</sup>Texas A&M International University, Laredo, TX. <sup>2</sup>University of Alabama, Tuscaloosa, AL. <sup>3</sup>Kennesaw State University, Kennesaw, GA. (Sponsor: John McLester, FACSM)  
 Email: brett.nickerson@tamui.edu  
 (No relevant relationships reported)

**PURPOSE:** The purpose of the current study was two-fold: 1) to develop a new dual energy X-ray absorptiometry (DXA)-derived body volume (BV) equation with the GE-Lunar Prodigy while utilizing underwater weighing (UWW) as a criterion and 2) cross-validate 4-compartment(4C) models when utilizing the new DXA-derived BV equation (4C-DXA<sub>NICKERSON</sub>), Wilson DXA-derived BV equation (4C-DXA<sub>WILSON</sub>), and air displacement plethysmography (ADP)-derived BV (4C-ADP) in Hispanic adults. **METHODS:** 191 Hispanic adults (18-45yrs) participated in the current study. The development sample consisted of 60 females and 60 males whereas the cross-validation sample comprised of 41 females and 30 males. Criterion body fat percentage (BF%) and fat-free mass (FFM) were determined using a 4C model with UWW as a criterion for BV (4C-UWW). The new DXA-derived BV equation (Nickerson) was developed by linearly regressing UWW-derived BV with DXA fat mass (FM), lean mass (LM), and bone mineral content (BMC). 4C-DXA<sub>NICKERSON</sub>, 4C-DXA<sub>WILSON</sub> and 4C-ADP were compared against 4C-UWW in the cross-validation sample. **RESULTS:** The new DXA-derived BV equation (L) was generated in the development sample as follows:  $(FM/0.91) + (LM/1.06) + (BMC/16.95) + 0.268$ . 4C-DXA<sub>NICKERSON</sub>, 4C-DXA<sub>WILSON</sub>, and 4C-ADP all produced similar mean values (BF%=21.04±5.99, 22.23±6.93, and 20.62±6.26%, respectively) when compared to 4C-UWW (21.29±6.14%) in Hispanic males (all  $p > 0.05$ ). 4C-DXA<sub>NICKERSON</sub> also yielded similar BF% and FFM values as 4C-UWW when evaluating the constant error (CE) in Hispanic females (CE=-0.79% and 0.38kg;  $p=0.060$  and  $0.174$ , respectively). However, 4C-DXA<sub>WILSON</sub> produced significantly different BF% and FFM values (CE=3.22% and -2.20kg, respectively; both  $p < 0.001$ ). Additionally, 4C-DXA<sub>WILSON</sub> yielded significant proportional bias when estimating BF% (coefficient=0.226;  $p < 0.001$ ) whereas 4C-ADP produced significant proportional bias for BF% and FFM (coefficient=0.188 and -0.084; both  $p < 0.05$ ) when evaluated in Hispanic females. **CONCLUSIONS:** Current study findings demonstrate that 4C-DXA<sub>NICKERSON</sub> is a valid measure of BV in Hispanics and is recommended for use in clinics where DXA is the main body composition assessment technique.

**3220 Board #41 May 29 1:30 PM - 3:00 PM**  
**Physiological And Anthropometric Predictors Of Discrepancies Between Bioelectrical Impedance Analysis And Dual-energy X-ray Absorptiometry**

Patrick S. Harty<sup>1</sup>, Matthew T. Stratton<sup>1</sup>, Nelson Griffiths<sup>1</sup>, M. Lane Moore<sup>2</sup>, Marqui L. Benavides<sup>1</sup>, Jacob R. Dellinger<sup>1</sup>, Brian T. Adamson<sup>3</sup>, Grant M. Tinsley<sup>1</sup>. <sup>1</sup>Texas Tech University, Lubbock, TX. <sup>2</sup>Mayo Clinic Alix School of Medicine, Phoenix, AZ. <sup>3</sup>Texas Woman's University, Denton, TX.  
 (No relevant relationships reported)

Assessment methods such as dual-energy x-ray absorptiometry (DXA) and bioelectrical impedance analysis (BIA) are commonly used to determine molecular-level body composition estimates in both healthy and clinical populations. Though discrepancies in body composition estimates between BIA and DXA have been previously reported, virtually no investigations have explored potential predictor variables that may explain the disagreement between these methods. **PURPOSE:** To explore the physiological and anthropometric predictors of discrepancies between DXA and BIA total body composition estimates. **METHODS:** During a single visit, 103 female participants (Mean ± SD;  $33.4 \pm 15.9$  years;  $65.6 \pm 12.1$  kg;  $165.5 \pm 6.3$  cm;  $32.2 \pm 7.4$  DXA body fat percentage [BF%]) and 76 male participants ( $33.8 \pm 14.5$  years;  $83.9 \pm 15.1$  kg;  $178.8 \pm 6.6$  cm;  $22.9 \pm 8.0$  DXA BF%) underwent body composition assessment via DXA and 8-point single-frequency BIA. Potential predictors of the discrepancies between DXA and BIA body composition estimates were obtained during the same visit using air displacement plethysmography,

bioimpedance spectroscopy, and 3-dimensional optical scanning. Select DXA variables were also utilized as predictors. Ordinary least squares regression was conducted to predict the differences in total fat mass (FM) and total lean soft tissue (LST) between DXA and BIA. Standardized model coefficients ( $\beta$ ), p-values for coefficients, and  $R^2$  values were generated. **RESULTS:** For FM estimates, significant predictors ( $p \leq 0.01$ ) of the differences between DXA and BIA were hydration of LST (TBW:LST;  $\beta = -0.82$ ), height ( $\beta = -0.78$ ), percentage of TBW as extracellular fluid (%ECF;  $\beta = -0.36$ ), and the male sex ( $\beta = 0.26$ ). For LST, significant predictors of the errors between DXA and BIA were TBW:LST ( $\beta = 0.85$ ), height ( $\beta = 0.77$ ), %ECF ( $\beta = 0.40$ ), the male sex ( $\beta = -0.22$ ), and racial identification as Black ( $\beta = -0.09$ ). The  $R^2$  values for regression models predicting differences between DXA and BIA were 0.80 to 0.86 for FM and 0.73 to 0.87 for LST. **CONCLUSION:** Hydration variables and height are primary predictors of discrepancies between DXA and BIA total body composition estimates.

**3221** Board #42 May 29 1:30 PM - 3:00 PM  
**Explaining Segmental Lean Soft Tissue Discrepancies Between Bioelectrical Impedance Analysis And Dual-Energy X-Ray Absorptiometry**  
 Matthew T. Stratton<sup>1</sup>, Patrick S. Harty<sup>1</sup>, M. Lane Moore<sup>2</sup>, Nelson Griffiths<sup>1</sup>, Jacob R. Dellinger<sup>1</sup>, Marqui L. Benavides<sup>1</sup>, Brian T. Adamson<sup>3</sup>, Grant M. Tinsley<sup>1</sup>. <sup>1</sup>Texas Tech University, Lubbock, TX. <sup>2</sup>Mayo Clinic Alix School of Medicine, Phoenix, AZ. <sup>3</sup>Texas Woman's University, Denton, TX.  
 (No relevant relationships reported)

Interest in evaluating the composition of specific anatomical regions has become commonplace in a variety of settings. Appendicular lean soft tissue ( $A_{LST}$ ) estimates are considered in the diagnosis of sarcopenia. While dual-energy x-ray absorptiometry (DXA) is viewed as a reference method for regional assessments, its availability is limited. Thus, explaining discrepancies in regional body composition estimates between DXA and the more accessible bioelectrical impedance analysis (BIA) is of utmost importance. **PURPOSE:** To assess the anthropometric and physiological predictors of variations between BIA and DXA segmental lean soft tissue (LST) estimates. **METHODS:** During a single visit, 179 participants (103 females, 76 males; Mean  $\pm$  SD: 33.6  $\pm$  15.3 years; 73.4  $\pm$  16.2 kg; 171.2  $\pm$  9.2 cm; 28.2  $\pm$  8.9% DXA body fat %) underwent body composition assessments via DXA and 8-point single-frequency BIA. Potential predictors of discrepancies between DXA and BIA LST estimates were obtained from these methods and additional laboratory techniques. Specifically, air displacement plethysmography, 3-dimensional optical scanning, and bioimpedance spectroscopy were used to estimate body volume, anthropometrics, and hydration variables, respectively. Significant predictors ( $p \leq 0.05$ ) of the mean difference between DXA and BIA estimates of trunk LST ( $T_{LST}$ ) and  $A_{LST}$  were established using ordinary least squares regression. Standardized model coefficients, p-values for coefficients, and  $R^2$  values were generated. **RESULTS:** For both  $T_{LST}$  and  $A_{LST}$ , extracellular fluid percentage, LST hydration, height, total LST mass, the male sex, and racial identification as Black significantly predicted discrepancies between DXA and BIA. Additional predictors for  $T_{LST}$  discrepancies were DXA total fat mass (FM) to LST ratio and DXA  $T_{LST}$ , while additional predictors of  $A_{LST}$  discrepancies included DXA  $A_{LST}$ , DXA FM to LST ratio of the legs, DXA appendicular FM, and DXA-derived volume of the arms and legs. Regression models including these significant predictor variables produced  $R^2$  values of 0.92 and 0.95 for  $T_{LST}$  and  $A_{LST}$ , respectively. **CONCLUSIONS:** Hydration variables, the quantity of LST in the region of interest, and height were the most influential predictor variables for discrepancies between DXA and BIA segmental LST estimates.

**3222** Board #43 May 29 1:30 PM - 3:00 PM  
**Abstract Withdrawn**

**F-54** Free Communication/Poster - Training  
 Friday, May 29, 2020, 1:30 PM - 4:00 PM  
 Room: CC-Exhibit Hall

**3223** Board #44 May 29 1:30 PM - 3:00 PM  
**Effects Of Training With Blood Flow Restriction On Muscular Strength: Meta-analysis**  
 Kyungun R. Kim<sup>1</sup>, Katelyn G. Gear<sup>2</sup>, Kenda Maese<sup>2</sup>, Cindy Thinh<sup>2</sup>, Sukho Lee<sup>2</sup>. <sup>1</sup>University of Central Missouri, Warrensburg, MO. <sup>2</sup>Texas A&M-University San Antonio, San Antonio, TX. (Sponsor: Minsoo Kang, FACSM)  
 Email: kykim@ucmo.edu  
 (No relevant relationships reported)

Blood flow restriction (BFR) training has been a breakthrough in both practice and equipment used in the field of exercise science and rehabilitation. However, previous literature showed inconsistent findings regarding the effects of BFR training on muscle strength. **PURPOSE:** The purpose of this study was to analyze how different types of BFR training influence muscular strength by means of a meta-analysis. **METHODS:** The review was conducted according to the Preferred Reporting Items for Systematic Review and Meta-Analyses guidelines. The following databases were used to conduct the research: Academic Search Complete, Medline, Web of Science, SPORT-Discus, HealthSource: Consumer, and HealthSource: Nursing. Search words used included "blood flow restriction" \* AND strength\*. The following search limited to full text articles, peer-reviewed academic journals, and published in the English language. Out of 327 articles, 25 were eligible to be included where 47 ESs were calculated. Comprehensive meta-analysis v.3 software was used to examine a random effect model and moderator analysis of the collected data. **RESULTS:** The results showed that BFR training had positive effects on skeletal muscle strength. The overall effect size (Cohen's d) was .558 (95% CI=.385, .731) which yielded a medium effect. The moderator analysis identified a group difference in workload (15-60% (ES=.423, SE=.090), >60% (ES=1.004, SE=.181), Qbetween=9.008, df=2, p=.011. However, gender, intervention length, mode (upper body, lower body) and cuff type/pressure did not affect the muscular strength. **CONCLUSION:** This study confirmed that BFR training has a moderate impact on increase of skeletal muscle strength. Also, the study identified that more than 60% of workloads in exercise result in greater strength gain compared to 15 to 60% workloads. The results of this meta-analysis can help design optimal exercise interventions to maximize increases in muscle strength through BFR training.

**3224** Board #45 May 29 1:30 PM - 3:00 PM  
**Effects Of Blood Flow Restriction And Neuromuscular Electrical Stimulation On Strength Of The Plantar Flexors**  
 Jonathan A. Aguilera, Yaremi Ontiveros, John Poli, Joshua A. Cotter, FACSM. California State University, Long Beach, Long Beach, CA.  
 (No relevant relationships reported)

Exposure to a microgravity environment removes the frequent loading of postural, or antigravity muscles, such as those found in the calf. Due to this reduced stimulation, muscle mass and strength are greatly reduced. Blood flow restriction (BFR) and neuromuscular electrical stimulation (NMES) are unconventional training methods that have been shown to elicit growth in thigh and wrist musculature. However, the effects of these methods on the calves are unknown. **PURPOSE:** The purpose of this study was to explore the effectiveness of BFR and NMES individually and in combination for increasing calf strength. **METHODS:** Thirteen participants (9 males and 4 females; 20.15  $\pm$  1.72 yr, 69.95  $\pm$  11.45 kg) were recruited from California State University, Long Beach with each leg being randomized to one of three training conditions: 1) BFR only, 2) NMES only, or 3) BFR and NMES, for six weeks of training. Calf strength was measured using an isokinetic dynamometer to assess peak and average torque during maximal plantar flexion contractions through a range of velocities (0-210 deg/s). Comparisons were made using separate two-way ANOVA's for each variable. **RESULTS:** Average isometric torque during five second maximal plantar flexion contractions increased in the NMES (P=0.019) and BFRNMES groups (P=0.01), while peak isometric torque only increased in the NMES group (P=0.031). Peak torque at 30 deg/sec and 90 deg/sec increased only with BFRNMES (P=0.001 and P=0.008, respectively). A significant main effect for time was found at 60 deg/sec (P=0.014) and 210 deg/sec (P=0.019), with no differences found during post-hoc comparisons. No significant differences were found at the other velocities. **CONCLUSION:** NMES and BFRNMES conditions may have potential for increasing strength of the plantar flexors at slower velocities ( $\leq 90$  deg/sec). This study adds to the literature regarding the feasibility of these methods as alternative exercise countermeasures for promoting favorable adaptations in the calf musculature.

This research was supported by the National Institute of General Medical Sciences of the National Institutes of Health under Award Numbers; UL1GM118979; TL4GM118980; RL5GM118978.

**3225** Board #46 May 29 1:30 PM - 3:00 PM  
**Discomfort And Ratings Of Perceived Exertion To Practical Vs. Traditional Blood Flow Restriction Resistance Exercise**

Robert Thiebaud<sup>1</sup>, Takashi Abe<sup>2</sup>, Jeremy Loenneke, FACSM<sup>2</sup>, Tyler Garcia<sup>3</sup>, Yohan Shirazi<sup>3</sup>. <sup>1</sup>Brigham Young University-Idaho, Rexburg, ID. <sup>2</sup>The University of Mississippi, University, MS. <sup>3</sup>Texas Wesleyan University, Fort Worth, TX.  
 (No relevant relationships reported)

Elastic knee wraps are used to produce blood flow restriction (BFR) but it is unclear how discomfort and perceived exertion may compare to more traditional ways of producing BFR such as nylon cuffs where the pressure is known. **PURPOSE:** To investigate how elastic knee wraps (practical) compare in ratings of perceived exertion (RPE) and discomfort after exercising to failure when compared to nylon cuffs (traditional) or low and high loads without BFR.

**METHODS:** Nine participants (male=7, female=2) completed this study. The average age and body mass index were 22 (4) years and 25.4 (1.5) kg/m<sup>2</sup>. Each participant completed six conditions, in a randomized order, of unilateral knee extension exercise to failure for four sets. Two conditions (30% one-repetition maximum, 1-RM) included elastic knee wraps that were either stretched by two inches from resting length (Practical-Low) or they were stretched to a new length that was 85% of the thigh circumference (Practical-High). Two more conditions (30%-1RM) used nylon cuffs that were inflated to either 80% (BFR-High) or 40% (BFR-Low) of arterial occlusion pressure. The last two conditions had no restriction stimulus and were 30% 1-RM (LL) or 70% 1-RM (HL). Discomfort (0-10) and RPE (6-20) were measured before exercise and at the end of the four sets. The change scores from before exercise to the end of set 4 were used for analysis. Friedman's test and Conover's post hoc test were used to determine if there was a difference in discomfort and RPE between conditions. Statistical significance was set at p<0.05. **RESULTS:** Practical-High had larger changes in discomfort compared to HL (8 vs 6, p=0.007) and LL (8 vs 6, p=0.018). Practical-Low had a smaller change in discomfort compared to BFR-High (7 vs. 9, p=0.028) but it was not different from BFR-Low (7 vs. 7, p=0.450). No differences were found between Practical-High vs. BFR-High (8 vs. 9, p=0.211) or Practical-High vs. BFR-Low (8 vs 7, p=0.316). Practical-Low had smaller changes in RPE compared to BFR-High (12 vs 11, p=0.024) but there was no difference in RPE between Practical-High and the other conditions (p>0.05).

**CONCLUSIONS:** When exercising to failure, both discomfort and RPE are impacted by the pressure used and elastic knee wraps can produce changes in discomfort and RPE levels that are comparable to high pressure BFR.

**3226** Board #47 May 29 1:30 PM - 3:00 PM  
**Training-induced Changes In The Control Of Heart Rate Throughout A Competitive Season In Collegiate Female Swimmers.**

John L. Dobson, Loren Stroud. Georgia Southern University, Statesboro, GA.  
 Email: jdobson@georgiasouthern.edu  
 (No relevant relationships reported)

In competitive swimming, overload training is often used to elicit transient states of overreaching in the hopes that subsequent periods of taper will lead to performance supercompensation. However, if the overload stress is too great relative to the level of recovery, fatigue will accumulate and cause both a greater risk of injury and more prolonged decrements in performance. Measures of vagal control of the heart rate (HR) have been shown to reflect the balance between training-induced fatigue and recovery, and so those measures can provide valuable feedback to help guide coaches as they develop and revise training plans. **PURPOSE:** The purpose of the present study was to use three different indicators of vagal control of HR to investigate the impact of overload training and tapering in collegiate female swimmers. Those indicators were the resting logarithm of the root mean square of successive R-R intervals (lnRMSSD<sub>rest</sub>), HR responses to forced breathing (HR<sub>diff</sub>), and HR responses to one minute of sustained handgrip exercise (HR<sub>hg</sub>). **METHODS:** Thirteen female Division-I swimmers performed lnRMSSD<sub>rest</sub>, HR<sub>diff</sub>, HR<sub>hg</sub> assessments three times throughout their competitive season: 1. at the beginning of the season (BL), 2. eleven weeks later during a period of intense overload training (OL), and 3. another eleven weeks later and following a taper (TP). Differences in the cardiovascular variables during BL, OL, and TP were determined using repeated measures ANOVAs. **RESULTS:** Very large decreases in lnRMSSD<sub>rest</sub> (p<0.01) and increases in HR<sub>hg</sub> (p<0.05) occurred during OL, but those values then returned to BL levels during TP (p<0.05 and p<0.01, respectively). By contrast, HR<sub>diff</sub> values fell progressively throughout the season, and there was a large difference between the BL and TP measurements (p<0.05). **CONCLUSION:** Changes in all three variables demonstrated that OL impaired vagal

stimulation of the heart, and the bulk of evidence indicated that vagal stimulation was fully restored during TP. This was one of only a few longitudinal studies that have investigated the control of HR over the course of an entire competitive swim season, and it was the first study to demonstrate that overload training and taper can alter HR responses to both forced breathing and sustained handgrip exercise.

**3227** Board #48 May 29 1:30 PM - 3:00 PM  
**Peripheral Heart Action Training: A Metabolic Profile With Between Sex Comparison**

Zachary Aaron Mang, University of New Mexico, Albuquerque, NM.  
 Email: zmang@unm.edu  
 (No relevant relationships reported)

**ABSTRACT**

Peripheral heart action (PHA) is a time-efficient and under-researched style of circuit training that alternates upper and lower body exercises with minimal rest between sets. **Purpose:** To compare the metabolic profile of PHA to traditional (TRAD) resistance training (RT) and report sex-specific responses during each. **Methods:** In a repeated measures design, twenty resistance-trained individuals underwent two bouts of volume-matched RT: PHA and TRAD. For PHA, subjects executed 6 consecutive lifts (75% 10-RM, 12-15 repetitions) in circuit fashion with little rest between them. Four rounds were performed, and one minute of rest was allotted between rounds. Volume-load and intensity were matched for the subsequent bout of TRAD, during which straight-sets were performed and 90 seconds of rest was allotted between every set. Oxygen uptake (VO<sub>2</sub>), heart rate (HR), blood lactate concentration [La], rating of perceived exertion (RPE), and excess post-exercise oxygen consumption (EPOC) were measured. **Summary of Results:** PHA elicited significantly greater %VO<sub>2</sub>Max (45±7.1 vs. 28±4.3%, p<0.0001), %HRmax (80±4.0 vs. 61±9.1% p<0.0001), RPE (16±1.8 vs. 12±2.0, p<0.0001), and EPOC (9.6±2.4 vs. 7.1±1.4 ml/kg/min, p<0.0001) compared to TRAD. PHA was also completed in less time (20±3.2 vs. 46±3.8 min, p<0.0001). Compared to TRAD, [La] was significantly higher at mid-exercise (8.1±1.5 vs. 5.6 ±1.9 mmol/L, p<0.0001), post-exercise (10.5±2.8 vs. 5.2±1.8 mmol/L, p<0.0001), and 5-min post-exercise (10.3±3.0 vs. 4.5±1.9 mmol/L, p<0.0001) during PHA. There were no between sex differences for [La] at any time-point for TRAD. During PHA, [La] was significantly higher for males at mid-exercise (9.6±2.0 vs. 6.6±2.4 mmol/L, p = 0.008), post-exercise (12.1±2.0 vs. 8.9±2.5 mmol/L, p = .006), and 5-min post-exercise (12.2±2.1 vs. 8.4±2.4 mmol/L, p = .002). No between sex differences were detected for HR, VO<sub>2</sub>, or RPE for either style of RT. **Conclusion:** PHA is a time-effective and metabolically demanding circuit that may be employed to stimulate musculoskeletal and cardiorespiratory adaptations. Males produced more lactate than females during PHA, and one may speculate this was caused by discrepancies in total-body lean-mass, cross-sectional area per muscle fiber, or Type I fiber distribution.

**3228** Board #49 May 29 1:30 PM - 3:00 PM  
**Neuromuscular Training Intervention Developed To Combat The Effects Of Acute Fatigue In Collegiate Pivoting Athletes**

Julianna Harpine, Kevin Robinson, Craig Parker, Paige Koshar, Grace Webb, Glenn Fleenor, Shelby Martin, Dylan Green, Tyler Hoek, Pat Sells. Belmont University, Nashville, TN Email: julianna.harpine@pop.belmont.edu  
 (No relevant relationships reported)

**Purpose:** A large body of evidence has mounted supporting the efficacy of neuromuscular training (NMT) for prevention of anterior cruciate ligament (ACL) injury. Incorporation of NMT with athletes has been shown to improve biomechanics during dynamic pivoting movements. However, there is a lack of literature to date examining the influence of NMT on biomechanical measures during dynamic movements in a state of acute fatigue. This study examined strength, dynamic balance, and lower quarter biomechanics while performing functional movements succeeding a short-term fatigue protocol in collegiate soccer athletes before and after an eight-week NMT intervention. **Methods:** 28 Division II NCAA male and female soccer players ages 18-23 participated in the study. Hip strength was measured with hand dynamometry and single-leg stance modified balance (SLS<sup>M</sup>) was measured with eyes shut and in static heel rise. The Noraxon MyoMotion system assessed peak hip and knee excursion in three dimensions during select movement assessments following execution of the functional agility short-term fatigue protocol. Training consisted of 16 NMT sessions, performed over eight weeks, following which the tests were repeated. **Results:** Improvements post-intervention were found in hip abduction strength L (p=0.015), hip extension strength R (p=0.031) and L (p=0.013); SLS<sup>M</sup> with eyes-closed on R (p=0.000) and L (p=0.000); SLS<sup>M</sup> with heel rise bilaterally (p=0.000); peak ROM for L hip abduction (p=.025), R knee flexion (p=0.002), and L knee flexion (p=0.006) during single-leg squat; peak ROM for R hip flexion (p=0.033) during bilateral squat; peak ROM for L hip flexion (p=0.045) and L knee flexion (p=0.000) during single-leg jump assessment and peak ROM for R knee flexion

( $p=0.029$ ) and L knee flexion ( $p=0.045$ ) during bilateral jump. **Conclusions:** Following the NMT intervention, proximal hip strength, dynamic balance, and functional loading capacity significantly improved, illustrating positive neuromuscular adaptations in the lower quarter and nervous system. Enhanced kinematics during select sport-specific movement assessments were evident by the MyoMotion system following a fatigue protocol, defending the hypothesis that NMT can improve lower extremity biomechanics of collegiate pivoting athletes while acutely fatigued.

**3229** Board #50 May 29 1:30 PM - 3:00 PM

**The Effects Of Vertical And Horizontal Training On Sprint Ability In Athletes: a Systematic Review And Meta- Analysis**

Xiaochen Zhao<sup>1</sup>, Weimo Zhu, FACSM<sup>2</sup>, Qing Li<sup>1</sup>. <sup>1</sup>Tsinghua university, Beijing, China. <sup>2</sup>University of Illinois at Urbana-Champaign, Illinois, China.  
Email: 18614222993@163.com  
(No relevant relationships reported)

Plyometrics exercises are characterized by rapid stretch- shortening cycle (SSC) muscle actions. While studies have proved the effectiveness of plyometrics training on improving athletes' sprint ability, limited information is available on which specific method is more effective to athletes improve their sprint ability. **PURPOSE:** To examine the effect of vertical training (VT) and horizontal training (HT) on sprint ability in athletes. **METHODS:** Searched databases (MEDLINE, PubMed, websites of science core database) till Oct.1, 2019. Search keywords included: Vertical, horizontal, countermovement jumps (CMJ), sprint, and speed. The screening conditions were as follows: (a) Randomized controlled trials; (b) Participants were athletes, (c) VT or HT were the training method and there are at least 8 training lessons; (d) The study design consisted of an intervention group and a control group, or a vertical group and a horizontal group. (multiple training methods were excluded); (e) Other training courses (e.g. warm-up, technical, tactical, and strength training, volume, intensity); and (f) The final results of the study should include sprint ability test, and CMJ. **RESULTS:** A total of 340 articles were screened out and then removing the papers with duplicate titles and abstracts; as a result, 252 articles remained; additional 35 papers were removed after excluding the reviews and reading the abstracts; thereafter, 26 articles were read in full text according to the screening criteria; finally, 7 articles were included in the meta-analysis. The risk of bias was evaluated using the Cochrane collaboration's tools. Compared with VT, HT is more effective in improving athletes' sprint ability [0.84(95%CI =0.06,1.62),  $Z=2.10$  ( $P=0.04$ )], but there is no difference between VT and HT in improving CMJ [0.45 (95% = -0.05,0.94 ),  $Z=1.78$  ( $P=0.08$ )]. Through subgroup analysis of 10-M sprint time, the large number of training lessons ( $\geq 20$ ) had a significant effect; age (under 17 yr. old) and project soccer player (Others include basketball and handball) were no statistically significant. **CONCLUSION:** HT is more helpful to improve the sprint ability, but HT and VT were about the same in improving CMJ.

**3230** Board #51 May 29 1:30 PM - 3:00 PM

**Eight-week Aerobic Exercise Training Using Swiss-ball Improves Postural Stability Compared With Bicycle Ergometer Training.**

Toshihiro Wakimoto<sup>1</sup>, Tomomi Monri<sup>1</sup>, Hiroki Yajima<sup>2</sup>, Yoshiyuki Yamanaka<sup>3</sup>, Sohachi Fujimoto<sup>3</sup>, Toshihiro Takao<sup>3</sup>.  
<sup>1</sup>Kawasaki University of Medical Welfare, Kurashiki, Japan.  
<sup>2</sup>Kawasaki Medical School Hospital, Kurashiki, Japan.  
<sup>3</sup>Kawasaki Medical School Hospital, Kurashiki, Japan.  
Email: wakimoto@med.kawasaki-m.ac.jp  
(No relevant relationships reported)

**PURPOSE:** To compare the effect of aerobic training using Swiss-ball (SB) and aerobic training using bicycle on postural stability. **METHODS:** Sixteen healthy adults allocated into two group randomly: SB training group performed two-month aerobic training using SB and bicycle training group (Bike group) performed two-month aerobic training using bicycle ergometer. Subjects were asked to do the training for 30minute in a day and three days in a week. In each group, baseline and post intervention postural stability and peak oxygen consumption were measured. Postural stability was measured using stabilometric platform. During the assessment of stability, subjects were asked to close eyes and stay as still as possible for 30 seconds. Fundamental parameters obtained are: position of the body center of gravity, area and shape of sway density curve and velocity variables. **RESULTS:** All results show mean (SD). There was no main effect on peak oxygen consumption and no difference between training group (SB group: 33.1(5.0) ml/kg/min to 32.9(5.4) ml/kg/min, Bike Group: 32.2(7.6) ml/kg/min to 35.5(8.0) ml/kg/min). On the other hand, significantly interaction was found on some postural stability measurement: area in which the center of gravity (SB group: 2.3(0.4) cm<sup>2</sup> to 3.0(1.3) cm<sup>2</sup>, Bike Group: 1.9(1.0) cm<sup>2</sup> to 2.4(1.4) cm<sup>2</sup>: no significantly interaction), total length of center of gravity displacement ((SB group: 55.3(9.9) cm to 46.4(8.4) cm, Bike Group: 39.9(11.6) cm to 43.3(13.1) cm: interaction  $p<0.05$ ), velocity of center

of pressure ((SB group: 1.8(0.3) cm/sec to 1.6(0.3) cm/sec, Bike Group: 1.3(0.4) cm/sec to 1.4(0.4) cm/sec: interaction  $p<0.05$ ). **CONCLUSIONS:** SB training shows no significantly effect on peak oxygen consumption. On the other hand, SB training improved postural stability compared with bicycle ergometer training.

**3231** Board #52 May 29 1:30 PM - 3:00 PM

**Effects Of A 10-week Physical Activity Intervention Among Seminary Students**

Sara Ness<sup>1</sup>, Lesley M. Scibora<sup>1</sup>, Angela Effertz<sup>2</sup>. <sup>1</sup>University of St. Thomas, St Paul, MN. <sup>2</sup>Normandale Community College, Bloomington, MN.  
(No relevant relationships reported)

**PURPOSE:** While the number of overweight and obese Americans increases, fewer people meet recommended physical activity levels. Among Americans, 32 - 56% of Christian clergy have obesity and associated chronic diseases. Seminarians are an optimal group to introduce interventions to decrease the prevalence of obesity, as they have the power to improve both their own health as well as the health of those in their congregation. This study aims to determine whether a physical activity intervention in a seminary population is an effective way to improve physical fitness and body composition, in an effort to decrease obesity and related diseases. **METHODS:** 59 male seminary students (age range 22 - 66 years; mean age 30.12 years) participated in a 10-week physical activity intervention, attending two trainer-led exercise sessions per week for 10 weeks, which including cardiorespiratory and resistance training components. Pre- and post-intervention anthropometric measures included weight, BMI, waist-to-hip ratio, and body fat (%). Physical fitness assessments included the Rockport Walk test, cardiorespiratory endurance, and flexibility. Blood panels included a lipid and glucose panel. **RESULTS:** Results are shown in Table 1 (not all data shown). Body weight, BMI, triglycerides and LDL cholesterol did not change as a result of the intervention. Mean waist circumference decreased 3 cm ( $p < 0.001$ ). Significant improvements were observed in all physical fitness assessments (all  $p < 0.05$ ). Mean total cholesterol increased 8.7 mg/dL, HDL cholesterol increased 5 mg/dL, and blood glucose decreased 10 mg/dL (all  $p < 0.05$ ). **CONCLUSIONS:** The results of this study show that a 10-week physical activity intervention in seminary students was effective in improving body composition, physical fitness and blood cholesterol and glucose measures. Results of this study suggest that seminarians may be an optimal group for future interventions to improve overall health and fitness.

Table 1. Pre- and post-intervention anthropometric, fitness and blood panel outcomes

| Variable                      | n  | Pre-Pre-TestMean (±SD) | Post-TestMean (±SD) | p-value |
|-------------------------------|----|------------------------|---------------------|---------|
| <b>Anthropometrics</b>        |    |                        |                     |         |
| Weight (kg)                   | 51 | 89.7 (±17.9)           | 89.2 (±17.8)        | 0.161   |
| Waist Circumference (cm)      | 51 | 94.5(±13.1)            | 91.5 (±11.3)        | 0.000   |
| Hip Circumference (cm)        | 50 | 106.2 (±8.9)           | 104.9 (±8.7)        | 0.041   |
| <b>Physical Fitness Tests</b> |    |                        |                     |         |
| Push-up Test (n)              | 51 | 20.1 (±12.0)           | 23.9 (±11.1)        | 0.000   |
| Curl-up Test (n)              | 51 | 33.9 (±19.5)           | 47.1 (±22.6)        | 0.000   |
| Trunk Flexion (cm)            | 51 | 25.4 (±9.9)            | 28.6 (±10.6)        | 0.000   |
| <b>Blood Panel</b>            |    |                        |                     |         |
| Glucose (mg/dL)               | 43 | 94.7 (±31.1)           | 84.7 (±13.2)        | 0.005   |
| Total Cholesterol (mg/dL)     | 44 | 175.9 (±32.2)          | 184.6 (±29.3)       | 0.018   |
| HDL (mg/dL)                   | 44 | 48.1 (±13.1)           | 53.2 (±14.5)        | 0.000   |
| LDL (mg/dL)                   | 44 | 105.7 (±25.9)          | 110.3 (±24.2)       | 0.109   |

3232 Board #53 May 29 1:30 PM - 3:00 PM

**Acute Response Of Biochemical And Hematological Markers After A Crossfit® Training Session.**

Andreia Gomes Naves<sup>1</sup>, Lilian Cardoso Vieira<sup>1</sup>, Mariane Iori<sup>1</sup>, Franz H P Burini<sup>2</sup>, Lazaro Alessandro Soares Nunes<sup>3</sup>. <sup>1</sup>NutreeX, Sao Paulo, Brazil. <sup>2</sup>CeMENutri – UNESP Medical School, Botucatu, Brazil. <sup>3</sup>Faculty of Pharmacy, Unimetropcamp Wyden, Campinas, Brazil.

Email: andrea.naves@nutreeX.com.br

(No relevant relationships reported)

Crossfit® is a strength and conditioning program recognized as one of the most popular and practiced types of high-intensity functional training today. The goal of participants is to optimize physical conditions in some fitness domains: strength, flexibility, power, cardiovascular or respiratory endurance, coordination, and agility. The exercises are executed quickly, repetitively in a high intensity with little or no recovery time between sets. **PURPOSE:** This study aimed to verify muscle damage and immune markers parameters in the response of the Crossfit® training session. **METHODS:** Sixteen male recreational Crossfit® practitioners (Mean± SD: 29.4 ± 5.3 years old) performed a single session of AMRAP (means as many rounds as possible) for 12 minutes. This session followed a sequence of 12 box jumps, 6 thrusters and 6 burpees facing bar. After the rest of 3 minutes, participants were instructed to complete a Wingate test on a cycle ergometer in the fastest time possible. Blood samples were collected immediately before the session of AMRAP (PRE) and after Wingate test (POST). Were analyzed white blood cells and platelet count in EDTA samples. Creatine kinase, C-reactive protein and uric acid were quantified in serum samples. The paired t test was applied to verify PRE and POST statistical differences. Values of  $P < 0.05$  were considered significant. **RESULTS:** The data are presented as mean and SE. There was significant increases in leukocytes (PRE 7.6 ± 0.4 and POST 15.0 ± 0.8x10<sup>9</sup>/L,  $p < 0.001$ ); neutrophils (PRE 4.3 ± 0.4 and POST 6.2 ± 0.6x10<sup>9</sup>/L,  $p < 0.001$ ); lymphocytes (PRE 2.5 ± 0.1 and POST 6.9 ± 0.4 10<sup>9</sup>/L,  $p < 0.001$ ) and platelets counts (PRE 271 ± 6 and POST 344 ± 12 x10<sup>9</sup>/L,  $p < 0.001$ ); Creatine Kinase (PRE 363 ± 94 and POST 452 ± 114 U/L,  $p < 0.001$ ) and C-reactive Protein (PRE 7.1 ± 0.9 and POST 8.0 ± 1.1 mg/L,  $p < 0.001$ ). Uric acid concentrations were not different (PRE 4.7 ± 0.3 and POS 5.0 ± 0.2 mg/L,  $p 0.184$ ). **CONCLUSION:** In conclusion, these results indicate that the AMRAP session associated with the Wingate test elicits an acute immune response, including neutrophils, lymphocytes, and platelets. Besides, this protocol acutely increase muscle damage and inflammatory markers. These blood parameters could be analyzed in the recovery strategies in Crossfit® practitioners.

3233 Board #54 May 29 1:30 PM - 3:00 PM

**A Comparison Of Functional Movement Between CrossFit Trained, Recreationally Trained And Sedentary Individuals**

Kelsey Ede, Laurel Hill, Shelby Moreno, Natalia Traverzo, Shelly Weise, Teresa Huckaby. *Angelo State University, San Angelo, TX.*

(No relevant relationships reported)

CrossFit programs focus on performance of aerobic and strengthening exercises which incorporate multi-joint, functional movements. These variables combine to enhance athletic performance and improve an individual's ability to perform daily functional movement. A limited amount of research has compared CrossFit with other training groups regarding aerobic capacity, muscular strength, and body composition. A smaller percentage of research has compared functional movement variables. **PURPOSE:** Current research supports that CrossFit athletes demonstrate high symmetry of functional movement patterns. The primary aim of this study was to determine if CrossFit training was more beneficial to functional movement as compared to a standard exercise regimen. **METHODS:** This investigation was an exploratory cross-sectional study. Sixty (28 males, 32 females) healthy adults (age, 25±5 yr; ht, 170.5±10.3 cm; wt, 79.2±20.0 kg; BIA 23.10±8.44%) participated. Participants were recruited from the community and assigned to three groups based on their reported exercise lifestyle: CrossFit trained (CF), recreationally trained (RT), and sedentary (SD). The 60 participants underwent a series of tests including a functional movement assessment (FMS components), a maximal strength test (Deadlift 1-Rep Max assessment; kg deadlift/kg body wt), and an estimated aerobic capacity assessment (Astrand-Rhyming Cycle Ergometer Test; LO<sub>2</sub>/min). Exclusion criteria, anthropometric data and vital signs were assessed in all patients. **RESULTS:** The CF group (6.97±1.13) was significantly higher than the sedentary group (5.73±1.41) in the FMS components score. The CF group deadlift score (1.90±0.40) was significantly higher than both the SD (1.18±0.36) and RT groups (1.47±0.51). For aerobic capacity, both the CF (3.09±1.00) and RT (2.84±0.67) groups were significantly higher than the SD group (1.96±1.17). All testing significance was set at  $p \leq 0.05$ . **CONCLUSION:** CrossFit training provided improved fitness and functional performance parameters as compared to sedentary counterparts. For muscular strength, CrossFit was associated

with higher scores as compared to recreationally trained individuals. CrossFit and recreationally trained groups scored evenly for aerobic fitness and components of functional movement patterns.

3234 Board #55 May 29 1:30 PM - 3:00 PM  
**Stretching Training Can Change Shoulder And Neck Function In Middle-aged Women With Upper Crossed Syndrome**

chaoming Wu<sup>1</sup>, junzhi Sun<sup>1</sup>, yanxia Zhao<sup>2</sup>. <sup>1</sup>Chengdu sport university, chengdu, China. <sup>2</sup>Chongqing university, chongqing, China.

Email: 834791487@qq.com

(No relevant relationships reported)

**PURPOSE:** Upper Crossed Syndrome (UCS) is a syndrome of abnormal movement patterns of the upper limbs. To judge the improvement of shoulder and neck function, the changes in shoulder joint function and shoulder cervical spine angle after 8 weeks of stretching training was observed in middle-aged women with.

**METHODS:**

12 middle-aged women (Table 1) were selected for a detailed assessment of upper crossover syndrome included in Acromion height test, the distance from the medial margin of the inferior angle of scapula to the spine, measurement of range of motion of shoulder joint, cervical the vertebra and stretching training program.

**RESULTS:**

1. The angles related to the range of motion of the cervical vertebrae were measured and the results were shown in Table 2. It was found that the average range of movement of the cervical spine after training was significantly higher than that before training, and the difference was significant before and after training.
2. The angle related to the range of motion of the shoulder was measured, and the results shown in Table 3. It found that the average amplitudes of shoulder flexion, extension, abduction, adduction, and abduction and horizontal abduction in patients with superior crossover syndrome after training was significantly higher than those before training, and there was a significant difference before and after training ( $P < 0.05$ ).
3. The height of the acromion and the distance between the inferior angle of the scapula and the spine before and after training was compared (Table 4), and the results were shown in Table 3.

**CONCLUSION:** A long-term sedentary lifestyle may lead to muscle imbalance, weakening the primary motor function of the body, and increasing the risk of soft tissue injury. Stretching training has a significant effect on the shoulder and neck function of patients with UCS. The right joint function sequence can reduce the asymmetry of the body, prevent and reduce bone and joint wear.

Table 1. Subject characteristics

| Subject | Age (y)    | Height (cm) | Weight (kg) |
|---------|------------|-------------|-------------|
| 12      | 45.17±7.83 | 157.83±2.23 | 55.57±2.23  |

Table 2. Comparison of ROM of cervical before and after training

| Cervical ROM  |   | Pre        | Post        |
|---------------|---|------------|-------------|
| Flexion       |   | 32.33±6.71 | 42.67±2.73* |
| Extension     |   | 31.83±1.47 | 41.50±2.51* |
| Lateroflexion | L | 31.83±2.93 | 38.83±3.43* |
|               | R | 32.83±6.01 | 40.83±2.14* |
| Rotation      | L | 43.83±8.30 | 54.50±3.21* |
|               | R | 44.50±6.22 | 56.50±2.07* |

Data are presented as means ± SD. \*Significant difference

Table 3. Comparison of ROM of shoulder joint before and after training

| ROM                    | L            |               | R            |              |
|------------------------|--------------|---------------|--------------|--------------|
|                        | Pre          | Post          | Pre          | Post         |
| Flexion                | 150.17±11.70 | 163.33±7.34*  | 150.50±3.94  | 162.33±3.83* |
| Extension              | 30.00±7.24   | 44.67±10.91*  | 26.00±5.37   | 42.00±9.19*  |
| Adduction              | 34.17±6.94   | 39.00±2.45    | 30.17±8.98   | 37.00±7.80   |
| Abduction              | 129.33±31.78 | 164.67±13.06* | 142.67±18.04 | 169.50±6.16* |
| Adduction and internal | 51.50±8.92   | 53.00±6.00    | 53.67±5.82   | 53.67±4.84   |
| Adduction and external | 54.83±11.86  | 65.50±10.52*  | 61.33±10.65Δ | 70.00±9.07*  |
| Horizontal abduction   | 25.67±3.67   | 35.67±4.13*   | 24.00±7.10   | 36.50±4.09*  |

Data are presented as means ± SD. \*Significant difference. Δ standard compression left and right P<0.05; ▲standard compression ipsilateral P<0.05.

Table 4. Comparison of acromial height and distance from the inferior angle of the scapula to the spine before and after training

|   | L          |            | R          |            |
|---|------------|------------|------------|------------|
|   | Pre        | Post       | Pre        | Post       |
| Acromial height (cm)  | 10.15±0.95 | 7.03±0.47* | 11.12±0.87 | 7.48±0.77* |
| Distance from the inferior angle of the scapula to the spine (cm) | 8.55±0.67  | 7.10±0.66* | 9.37±0.89  | 7.70±0.81* |

Data are presented as means ± SD. \*Significant difference.

**3235** Board #58 May 29 1:30 PM - 3:00 PM  
**Physiological Adaptations To A Concurrent Exercise Training Program In Physically Inactive Women**  
 Mynor G. Rodriguez-Hernandez<sup>1</sup>, Lorena Huffman<sup>2</sup>, James McDonald<sup>2</sup>, Danielle D. Wadsworth<sup>2</sup>. <sup>1</sup>University of Costa Rica, San Ramon, Costa Rica. <sup>2</sup>Auburn University, Auburn, AL.  
 (Sponsor: David D Pascoe, FACSM)  
 Email: mynor.rodriguez@ucr.ac.cr  
 (No relevant relationships reported)

**PURPOSE:** To assess the effect of a 10-week, high-intensity concurrent exercise training program on body composition, bone density and muscular strength in physically inactive aging women.  
**METHODS:** 53 inactive women (age 40-64) were randomized into two sprint interval training (SIT) programs, 0% incline (age 51.9 ± 6.6) and 6% incline (age 53.4 ± 7.6). SIT was performed to achieve 95% of each participant's age-predicted maximal heart rate for 40 seconds followed by 20 seconds of passive recovery for approximately 15 minutes. Additional, each group performed a resistance training protocol, alternating between two programs: back squat, bent over row, bench press; and squat jumps, weighted lunges, standing press, back extensions. Participants attended 30 workouts over the course of 10 weeks. DXA scans assessed body composition and bone density of the femoral neck. IRM was performed to assess muscular strength changes in bench press and back squat. A repeated measure ANOVA examined group (0% incline and 6% incline) by time interactions.  
**RESULTS:** There was no significant effect of group (p>.05). Significant decreases in fat mass (p = .02), visceral adipose tissue (p = .048) and significant increases in muscular strength for both bench press (p<.0001) and back squat (p<.0001) occurred for both groups. No significant differences were found for lean body mass (p=.872) and bone density of the femoral neck (p=.092).  
**CONCLUSIONS:** A SIT and resistance training program is an effective strategy to improve fat mass and muscular strength in inactive, aging women. Muscular strength improvements resulting from this intervention are particularly important as muscular strength losses are strong predictors of morbidity and mortality.

**3236** Board #57 May 29 1:30 PM - 3:00 PM  
**Comparison Of Upper-Body Strength Changes With Different Training Modalities Among Women Of Different Body Builds**

Jana L. Arabas<sup>1</sup>, Jerry L. Mayhew<sup>1</sup>, William F. Brechue, FACSM<sup>2</sup>, Monica L. Hunter<sup>1</sup>, Bryan Mann<sup>3</sup>. <sup>1</sup>Truman State University, Kirksville, MO. <sup>2</sup>A. T. Still University, Kirksville, MO. <sup>3</sup>University of Miami, Miami, FL.  
 Email: jlarabas@truman.edu  
 (No relevant relationships reported)

Previous investigation has noted that neither body build nor initial strength level appear to influence upper-body strength gains resulting from a short-term resistance training (RT) program in young men. Such information is lacking in young women. With increasing interest of women in RT, it would be beneficial to determine if the same outcome as noted in men is operating in women. **PURPOSE:** To determine the influence of body build on changes in upper-body strength resulting from different modes of RT in college women.  
**METHODS:** College women (n = 708, age = 19.0 ± 0.9 yrs, Ht = 165.0 ± 6.0 cm, Wt = 62.6 ± 10.7 kg) self-selected to train with free weights or machine weights during 12 weeks of periodized RT 3 days/week. 1RM press was measured with free weights (FW, n = 170), supine vertical machine weight (SVP, n = 284), and seated horizontal machine weight (n = 232) before and after training. Fat mass (FM) and fat-free mass (FFM) were determined from a gender-specific skinfold %fat equation. Body build was determined by regressing FFM/Ht<sup>2</sup> on FM/Ht<sup>2</sup>. Body build was partitioned into thirds as slender (SL, n = 231), average (AV, n = 239), and solid (SO, n = 232) groups.  
**RESULTS:** The SVP group had a significantly greater initial 1RM (37.8 ± 8.5 kg) than the FW (35.6 ± 7.8 kg) and SHP (35.6 ± 7.8 kg) groups. SO body type (36.6 ± 8.3 kg) had a greater initial 1RM than SL (35.8 ± 8.0 kg) and AV (35.1 ± 8.4 kg) body types. Mode x body type ANOVA indicated that SVP (9.5 ± 6.2 kg) and SHP (8.8 ± 5.1 kg) made significantly greater 1RM gains than FW (4.9 ± 3.9 kg), while SO (9.3 ± 6.2 kg) and AV (8.8 ± 5.1 kg) body types made significantly greater gains than SL (6.9 ± 5.0 kg), with no significant interaction. Absolute strength gains had low correlations with initial strength in all modes (r = -0.08 to -0.26), accounting for no more than 7% of the common variance. Body type also had low correlations with absolute strength gains (r = 0.11 to 0.25). **CONCLUSIONS:** Young women appear to make slightly better initial strength gains using machine weights compared to FW. Body type does not appear to influence training potential to gain strength in women from RT using either mode. Thus, when beginning RT, young women of any body size or initial strength level can make significant gains using either free weights or machine weights.

**3237** Board #58 May 29 1:30 PM - 3:00 PM  
**Use Of Pool Bottom Mirror In Coaching Front Crawl Stroke Correction**  
 Boram Lee, Somi Yun, Heejin Lee, Yunbin Lee, Ah-Reum Jung, Dae Taek Lee. Kookmin University, Seoul, Korea, Republic of.  
 Email: lbr0424@gmail.com  
 (No relevant relationships reported)

**PURPOSE:** The mirror can provide visual information about the learner's body movement instantaneously and allow immediate error detection followed by appropriate correction. This study analyzed whether coaching recreational swimmers using pool bottom mirror for correcting front crawl stroke is effective in achieving an intended stroke. **METHODS:** Thirty adults who enrolled swimming lessons for more than 1 year participated and were randomly divided into two groups; mirror group (MG: 12 men; 32.3±8.2 yrs, 175.0±5.5 cm, 70.9±9.2kg; 3 women; 37.6±13.7 yrs, 160.0±3.4 cm, 55.6±3.5 kg) and control group (CG: 7 men; 28.7±6.1 yrs, 176.2±3.7 cm, 72.4±14.4 kg; 8 women; 38.8±14.6 yrs, 162.1±4.4 cm, 54.1±7.3 kg). They performed front crawl twice in a swimming flume (2.43 × 4.57 × 1.37 meter) at their chosen speed (pace of 87.9±4.2 for men, 102.7±4.7 sec/100 meter for women). Their stroke was video recorded by an underwater camera (xnb-6001, Samsung, Korea) and dry land camera (gnd-6020R, Samsung, Korea). After their first trial and recording, individual stroke was evaluated and verbal feedback was given for correction targeting full arm range stroking. During second trial, MG had a mirror (81 × 151 cm) installed under the bottom of flume so that they could check their stroke. CG did not use mirror during second trial. An image analyzer (Dartfish, Swiss) was used to analyze the distance between reference point (RP: where fingertip was reached over Vastus lateralis during standing till on land) and fingertip as well as stroke time (time between left hand immersion cycle). Stroke frequency was counted cycles of both arms. Two trials were compared. **RESULTS:** The distance between RP and fingertip was 7.7±3.3 and 2.5±3.5 cm in MG in 1st and 2nd trial, respectively (p<0.001) while it was 6.0±4.0 and 5.1±3.8 cm in CG. The stroke frequency was 60.7±7.3 in MG and 57.7±6.8 freq/min in CG at 1st trial. It was decreased to 53.7±5.4 in MG (p<0.001), but not in CG (56.3±6.6 freq/min). The stroke time was increased from 2.1±0.3 to 2.4±0.3 sec in MG (p<0.01), but it was not changed in CG (2.1±0.2 vs. 2.2±0.3 sec). **CONCLUSION:** The results

suggest that a pool bottom mirror is an effective tool in coaching for correction of front crawl stroke. Both verbal and visual instruction is valuable in correcting stroke of recreational swimmers and it can be achieved by the mirror.

**3238** Board #59 May 29 1:30 PM - 3:00 PM  
**Effects Of Unilateral Resistance Training On Muscular Strength, Power, And Measures Of Core Stability In Trained Individuals**

Anthony Duong, Andrew J. Carnes, Thomas Wójcicki.  
*Bellarmine University, Louisville, KY.* (Sponsor: Sara E. Mahoney, FACSM)  
 Email: aduong01@bellarmine.edu  
 (No relevant relationships reported)

**PURPOSE:** This study examined the effects of unilateral resistance training on lower body muscular strength and power, and measures of core stability in resistance-trained college students.

**METHODS:** Participants (N=22) underwent either 10 sessions of lower body unilateral (URT) or bilateral (BRT) resistance training on three non-consecutive days per week for three weeks. Training sessions consisted of three sets of five repetitions of 80% 1-RM for each exercise. BRT exercises included the barbell back squat, deadlift, and weighted jump squat. URT exercises included the Bulgarian split squat, single leg of Romanian deadlift, and single leg weighted jump squat. Outcome measures were a one repetition maximum (1-RM) leg press for lower body strength, standing vertical jump (VJ) for lower body power, and double leg lowering (DLL), hip abduction isometric strength (HAIS), and Sorensen (SOR) tests for core stability.

**RESULTS:** Training elicited a positive main effect of time for all variables ( $p < 0.05$ ). Both groups improved pre to post training in 1-RM ( $297 \pm 95.4$  to  $373 \pm 114$  kg), VJ ( $56.5 \pm 15.0$  to  $62.2 \pm 10.8$  cm), DLL ( $33.9 \pm 14.9$  to  $43.6 \pm 13.2$  deg), HAIS ( $29.6 \pm 8.86$  to  $32.6 \pm 10.1$  kg), and SOR ( $91.4 \pm 33.1$  to  $112 \pm 36.7$  sec). The magnitude of change was similar between groups for all variables except HAIS, in which the UL group demonstrated significantly ( $p=0.0155$ ) greater improvement (14.3% vs. 5.3%). However, the effect size was larger in UL for all variables except VJ (Cohen's  $d = 0.86$  vs. 0.61 for 1-RM, 0.92 vs. 0.55 for DLL, 0.64 vs. 0.19 for HAIS, 0.90 vs. 0.36 for SOR).

**CONCLUSIONS:** Relative to bilateral training, unilateral resistance training produced similar improvements in measures of lower body strength and power in trained subjects. Additionally, these data suggest that unilateral training may potentially offer the benefit of enhanced core stability.

**3239** Board #60 May 29 1:30 PM - 3:00 PM  
**Effect Of Core Strength Exercise On Colon Transit Time In Female University Students**

Yeon Soo Kim<sup>1</sup>, Dongsuk Han<sup>1</sup>, Angelique G. Brellenthin<sup>2</sup>, Bong Kil Song<sup>2</sup>. <sup>1</sup>*Sports science, Seoul, Korea, Republic of.* <sup>2</sup>*Physical activity epidemiology lab, ames, IA.*  
 Email: kys0101@snu.ac.kr  
 (No relevant relationships reported)

**PURPOSE:** To evaluate the benefit of core strength exercise (CSE) on colonic transit time (CTT) for female university students. **METHODS:** Eighty women were enrolled and randomly assigned to participate in a 12-week instructor-led group CSE program (exercise group;  $n = 40$ ) or to maintain their ordinary daily activities (control group;  $n = 40$ ). The final groups were composed of 27 participants (age: 22.9 years) in the exercise group and 21 participants (age: 22.9 years) in the control group (CG). The CSE program consisted of 60 minute sessions, two days a week for 12 weeks. Each session included a 10-minute warm-up, 40-minute core strengthening exercises, and 10-minute cool-down. Body composition, Trunk muscle power and endurance, physical fitness and CTT were measured twice before and twice after the exercise program. CTT was measured using a multiple marker technique with a radio-opaque marker. Data were analyzed with a 2-way, repeated measures ANOVA. **RESULTS:** After the 12-wk core exercise intervention, decreased intestinal transit time was observed in segment CTT of the exercise group, including the right CTT (exercise:  $9.0 \pm 1.8$  vs  $6.4 \pm 1.5$ , control:  $5.3 \pm 1.3$  vs  $6.5 \pm 1.5$ ), left CTT (exercise:  $10.9 \pm 2.0$  vs  $6.9 \pm 1.8$ , control:  $10.6 \pm 2.3$  vs  $8.7 \pm 1.5$ ), recto-sigmoid CTT (exercise:  $17.4 \pm 2.9$  vs  $12.1 \pm 2.0$ , control:  $8.7 \pm 2.3$  vs  $11.9 \pm 2.8$ ), and total colonic transit time (TCTT) (exercise:  $37.5 \pm 4.4$  vs  $25.5 \pm 3.8$ , control:  $24.7 \pm 4.8$  vs  $27.2 \pm 4.8$ ). After the 12-wk core exercise period, LCTT (mean difference,  $-3.7$  h; 95% confidence interval [CI],  $-6.9$  to  $-0.6$  h;  $P=0.02$ ) and TCTT (mean difference,  $-9.4$  h; 95% CI,  $-16.4$  to  $-2.4$  h;  $P=0.01$ ) was significantly shortened within the exercise group in mean changes from baseline to 12wk follow-up. **CONCLUSIONS:** The CTT was reduced due to increased physical activity via a 12-wk CSE program. In addition to eating habits, water intake, and fiber intake, the increased physical activity level as a result of the 12-wk CSE reduced the CTT. Further prospective studies will need to study the effects on CTT according to dose-response, type of exercise, and intensity.

**3240** Board #61 May 29 1:30 PM - 3:00 PM  
**Chronic Influence Of Inspiratory Muscle Training At Different Intensities On The Serum Metabolome**

Ettore Signini<sup>1</sup>, Camila Sakaguchi<sup>1</sup>, Raphael Abreu<sup>1</sup>, Claudio Silva<sup>1</sup>, Patricia Rehdher-Santos<sup>1</sup>, Carla Dato<sup>2</sup>, Maria Carosio<sup>1</sup>, Roberta Maria<sup>1</sup>, David Nieman<sup>3</sup>, Tiago Venâncio<sup>1</sup>, Antônio Ferreira<sup>1</sup>, Aparecida Catai<sup>1</sup>. <sup>1</sup>*Federal University of São Carlos, São Carlos, Brazil.* <sup>2</sup>*Central Paulista University Center, São Carlos, Brazil.* <sup>3</sup>*North Carolina Research Campus, Appalachian State University, Kannapolis, NC.*  
 (No relevant relationships reported)

**PURPOSE:** To investigate the chronic effect of inspiratory muscle training (IMT) on the human serum metabolome in healthy male recreational cyclists. **METHODS:** This study employed a randomized, parallel group design. Recreational male cyclists ( $n=23$ , 20-40 y, BMI < 30 kg/m<sup>2</sup>) were randomized to three IMT groups: low intensity (6 cm H<sub>2</sub>O) (LI,  $n=7$ ); moderate intensity or 60% of maximal inspiratory pressure (MI,  $n=10$ ) and high intensity, the critical inspiratory pressure ( $\approx 85-90\%$  of maximal inspiratory pressure) (HI,  $n=11$ ). The IMT was performed for 11 weeks, 3 times per week (3 sets of 15 minutes/session). Another group of participants under the same conditions, who did not perform the IMT but participated in all assessments and procedures, was included as controls (CG,  $N=6$ ). Blood samples were collected one week before and one week after 11 weeks of IMT and analyzed using 1H NMR spectroscopy. Statistical analysis included a 4 (group) x 2 (time) repeated measures ANOVA using the general linear model (GLM), and multivariate Principal Component Analysis (PCA). **RESULTS:** The targeted metabolomics analysis of serum samples identified 23 metabolites, including amino acids, lipids, and tricarboxylic acid cycle intermediates. No significant interaction effects from GLM were found for the 23 metabolites, and this was confirmed by PCA. **CONCLUSION:** These data indicate that IMT at three intensity levels did not alter the serum metabolome relative to the control group. These results are consistent with other exercise training studies showing negligible alterations in the serum metabolome compared to the large but transient perturbations linked to prolonged and intensive exercise.

**3241** Board #62 May 29 1:30 PM - 3:00 PM  
**Cardiorespiratory And Metabolic Responses Of High Intensity Yoga-surya Namaskar Session**

Angela Tsopanidou, Fotini Venetsanou, George Dallas, Ioannis Stavridis, Elias Zacharogiannis. *National and Kapodistrian University of Athens, Greece, ATHENS, Greece.*  
 Email: angelatsopanidou@hotmail.com  
 (No relevant relationships reported)

The recent global rise in obesity appears to be a threat to public health as it is connected with various cardiovascular and metabolic diseases. Surya Namaskar (SN), a component of Vinyasa yoga, consisted of a specific sequence of 12 yoga postures performed with controlled breath, is often used as an alternative of a typical fitness program to improve overall health, including body weight management. However, research data studying high intensity SN (HSN) are limited. **PURPOSE:** The aim of the present study was to assess cardiorespiratory and metabolic demands of HSN performed with 3 s/pose. **METHODS:** Heart rate (HR) response of twenty-four moderately trained subjects (12 males and 12 females; mean  $\pm$  sd age:  $39 \pm 7.33$  years, body stature:  $167.38 \pm 9.32$  cm, body mass:  $66.60 \pm 14.07$  kg, % body fat:  $23.30 \pm 5.86$ ;  $\dot{V}O_{2peak}$ :  $45.48 \pm 7.12$  ml.kg<sup>-1</sup>.min<sup>-1</sup> and HRmax:  $183.54 \pm 10.13$  bpm) was recorded during two-15 min sessions HSN practice 7 days apart. Maximal oxygen uptake ( $\dot{V}O_{2peak}$ ) and maximum HR (HRmax) had been estimated earlier, after an incremental test to exhaustion.  $\dot{V}O_2$  during HSN was estimated from individual regression equations using the relationship of  $\dot{V}O_2$  and HR values derived from  $\dot{V}O_{2peak}$  test, while the metabolic rate (kcal.min<sup>-1</sup>) was calculated from the relationship of HR and kcal.min<sup>-1</sup>. Total HSN energy consumption was the average value of the two-15 min sessions. **RESULTS:** Mean  $\pm$  sd values of the %HRmax, % $\dot{V}O_{2max}$  and rate of energy expenditure during HSN were  $71.7 \pm 7.5\%$ ,  $59.9 \pm 10.3$  and  $8.9 \pm 3.3$  kcal.min<sup>-1</sup> ( $7.9 \pm 2.0$  METs) respectively. Total session energy expenditure was  $133.04 \pm 50.14$  kcal. **CONCLUSIONS:** The results of the present study confirm that an HSN session may produce a sufficient training stimulus to promote cardiorespiratory fitness and favor weight loss in moderate trained adults.

**3242** Board #63 May 29 1:30 PM - 3:00 PM  
**Low Volume Bodyweight Interval Training Improves  
 Cardiorespiratory Fitness: A Contemporary Application  
 Of The 5BX Approach**

Linda R. Archila<sup>1</sup>, William Bostad<sup>1</sup>, Michael J. Joyner<sup>2</sup>, Martin J. Gibala<sup>1</sup>. <sup>1</sup>McMaster Univ., Hamilton, ON, Canada. <sup>2</sup>Mayo Clinic, Rochester, MN. (Sponsor: Stuart Phillips, FACSM)  
 (No relevant relationships reported)

Brief vigorous exercise training can improve cardiorespiratory fitness. Few studies, however, have examined the efficacy of basic bodyweight exercises that can be performed in a small space, without the need for specialized equipment. Practical, time-efficient approaches of this sort have been advocated for decades, including the 11-minute "Five Basic Exercises" (5BX) program developed by the Canadian government in the 1960s. **PURPOSE:** We determined the effect of a 5BX-style program on peak oxygen uptake ( $VO_{2peak}$ ) in inactive but healthy young men and women ( $20 \pm 1$  y; body mass index:  $20 \pm 5$  kg/m<sup>2</sup>; mean $\pm$ SD). **METHODS:** Participants were randomized to a training group that performed 18 sessions over six weeks (n=9), or a non-training control group (n=10). Each session involved a 1-minute warm-up (jumping jacks), followed by 1-minute bouts of five exercises (burpees, high knees, split squat jumps, high knees, squat jumps), each interspersed with 1-minute of active recovery (walking around the room). Participants were instructed to complete as many repetitions per bout as possible, at a self-determined "challenging" pace. All sessions were supervised and compliance was 100%. **RESULTS:** Mean intensity during training was  $82 \pm 5\%$  of maximal heart rate. Borg Scale ratings of perceived exertion for the five exercises ranged from  $12 \pm 2$  to  $15 \pm 3$  out of 20. ANCOVA revealed a significant difference between groups after the intervention, such that  $VO_{2peak}$  was higher in the training group compared to control ( $34.2 \pm 6.4$  vs  $30.3 \pm 11.1$  ml/kg/min;  $P=0.03$ ). Peak power output during the  $VO_{2peak}$  test was also higher after training compared to control ( $211 \pm 43$  vs  $191 \pm 50$  W,  $p=0.004$ ). There were no changes in leg muscular endurance, handgrip strength or vertical jump height in either group. **CONCLUSIONS:** A simple bodyweight interval training program, requiring 11 minutes per session, increased cardiorespiratory fitness in previously sedentary young adults when performed three times per week for six weeks. Supported by NSERC.

**3243** Board #64 May 29 1:30 PM - 3:00 PM  
**Biomechanics And Energetics Of Curved Treadmills**

Dustin Durke, Kellie Walters, Kevin Valenzuela, Jill Crussemeyer. California State University Long Beach, Long Beach, CA.  
 Email: dustindurke159@gmail.com  
 (No relevant relationships reported)

**PURPOSE:** This study aims to examine the biomechanical and energetic differences between the non-motorized curved treadmill and the motorized flat (i.e., traditional) treadmill (TM). We hypothesize that, when compared to TM, CT will result in significantly higher EE, percentage of  $VO_2$  max and trunk flexion under all testing conditions.

**METHODS:** Data collection included two sessions. In session one, participants filled out an informed consent, health questionnaire, and anthropometric data was collected. After, the participants underwent a 20-minute resting energy expenditure test to gather baseline metabolic data and the session concluded with a Bruce  $VO_2$  max test. In session two, participants were connected to a metabolic cart to measure metabolic costs and outfitted with reflective markers to capture 3D kinematic data.)

**RESULTS:** There was not a significant increase in the amount of trunk flexion under any of the conditions between treadmills. There was a significant increase in the amount of EE from the TM to the CT across all six speeds. At 15% above their self-selected jogging (SSJ) speed, EE was  $10.00 \pm 1.32$  kcal/min and  $8.74 \pm 1.34$  kcal/min for the CT and TM, respectively ( $p=.002$ ). At 15% slower than SSJ speed, participants' EE was  $8.44 \pm 1.16$  kcal/min and  $7.36 \pm 1.05$  kcal/min ( $p=.005$ ) for the CT and TM, respectively. At SSJ speeds, participants EE was  $8.94 \pm 1.17$  kcal/min and  $7.47 \pm 1.13$  kcal/min for the CT and TM, respectively ( $p<0.001$ ). At 15% above participants' self-selected walking (SSW) speed, EE was  $5.35 \pm 1.18$  kcal/min and  $3.38 \pm 0.68$  kcal/min on the CT and TM, respectively ( $p<0.001$ ). At 15% slower than SSW, participants EE was  $4.34 \pm 0.92$  kcal/min and  $2.93 \pm .47$  kcal/min on the CT and TM, respectively ( $p<0.001$ ). At SSW speeds, participants EE was  $4.66 \pm 1.00$  kcal/min and  $3.18 \pm 0.62$  kcal/min on the CT and TM, respectively ( $p<0.001$ ).

**CONCLUSIONS:** Our findings suggest that female athletes may benefit from using CTs over TMs because of the increased EE utilization but further research needs to be conducted to assess the viability of CTs as a safe option with respect to musculoskeletal structures.

**3244** Board #65 May 29 1:30 PM - 3:00 PM  
**Aerobic Fitness Changes In Trained And Untrained  
 Subjects Following A Three Week Cycling Course**

Kyle Farmer, Marlene Wentz. Alma College, Alma, MI.  
 (Sponsor: Alexander HK Montoye, PhD, FACSM)  
 (No relevant relationships reported)

The health and fitness related benefits of endurance training are numerous and well documented. As training progresses, however, the window for training-specific improvement narrows, making continued performance gains challenging. **Purpose:** The purpose of this study was to compare changes in aerobic fitness between endurance-trained athletes (ET), power-trained athletes (PT), and non-athletes (NON) before and after completing a 3 week college cycling course. It was hypothesized that improvement in aerobic fitness would be greatest for NON and least for ET. **Methods:** 19 subjects (12 male, 7 female; mean age  $20 \pm 0.5$  yr.) enrolled in a cycling course at Alma College participated in the study. Participants were categorized into 3 groups (ET, PT, or NON) based on their sport-specific training prior to taking the course. Training for this study consisted of cycling an average of 5 days/week for 18-44 miles/day for 3 weeks, with mileage and course difficulty increasing throughout the training. Participants performed a 5-mile time trial pre- and post-training utilizing a standardized cycle trainer and road bike. Time to completion and average power (Watts) were recorded for each participant and utilized to compare fitness changes among groups. One-way ANOVAs were used to compare the change in time to completion and power pre-to-post training among groups (ET, PT, NON), and paired t-tests were used to compare pre-training to post-training. **Results:** There was no significant difference in time to completion ( $p=0.81$ ) or average power ( $p=0.43$ ) on the 5-mile time trial among groups, although all groups decreased time to completion by  $0.98 \pm 0.92$  minutes ( $p<0.01$ ) and increased average power by  $13.5 \pm 20.9$  Watts ( $p=0.01$ ). **Conclusions:** An intensive, 3-week cycling training program elicited similar improvements in aerobic fitness in a sample of college students, regardless of prior training status.

**3245** Board #66 May 29 1:30 PM - 3:00 PM  
**Psychological Responses To Acute Exercise: A  
 Comparison Of Lower Body Positive Pressure  
 Treadmill And Cycling**

Lindsey Siska, James Davis, Siby Varghese, Samantha King, Eric Hall, FACSM, Srikanth Vallabhajosula, Shefali Christopher. Elon University, Elon, NC. (Sponsor: Dr. Eric Hall, FACSM)  
 Email: lsiska@elon.edu  
 (No relevant relationships reported)

Acute aerobic exercise has been shown to improve mood and affect in active adults. Lower body positive pressure treadmills (LBPTT) have been utilized to reduce loading on the musculoskeletal system and to provide an alternative to running and cross-training. While the biomechanical and physiological responses to the LBPTT have been well-researched, little is known about psychological responses and how this compares to other forms of exercise. **PURPOSE:** To investigate mood, affect, and self-efficacy, following an acute, hard-intensity exercise session and compare these responses between three modalities: cycling, LBPTT running and treadmill running (NT). **METHODS:** 10 active adults (average age = 30 years, SD = 10.4 years) completed a 30min, high-intensity exercise session on each of three modalities in a randomized order: bike, LBPTT, and NT. Intensity was determined as 85% age-predicted maximum heart rate. Before and after each session, feeling, arousal, affect and self-efficacy were determined using the Feeling and Arousal scale (FAS), Activation-Deactivation Adjective Checklist (ADACL), and Generalized Self-efficacy survey (GSE). **RESULTS:** From baseline to post-exercise, there was a significant increase in feeling ( $2.4 \pm 0.31$  vs.  $3.33 \pm 0.29$ ,  $p=0.021$ ), arousal ( $3.23 \pm 0.23$  vs.  $4.07 \pm 0.31$ ,  $p=0.006$ ), and self-efficacy ( $31.83 \pm 0.83$  vs.  $33.97 \pm 1.16$ ,  $p=0.013$ ) across all three modalities. However, when compared among the three modalities, there was no observed significant change in self-efficacy values from baseline to post-exercise ( $p=0.708$ ). For affect (ADACL), there was an observed significant increase in energetic arousal ( $25.9 \pm 1.12$  vs.  $29.43 \pm 1.36$ ,  $p=0.023$ ) and a decrease in state anxiety ( $20.93 \pm 1.73$  vs.  $17.367 \pm 1.08$ ,  $p=0.041$ ) from baseline to post-exercise across all modalities, however, this did not significantly differ among the modalities. There were no other significant changes in affect observed. **CONCLUSION:** Self-efficacy, feeling, energetic arousal, and anxiety improves following acute, hard intensity exercise sessions; however, these changes do not differ based on exercise modality. Psychological responses to acute exercise differs between runners and non-runners. Future research should investigate how these responses may differ between the two groups based on modality.

**3246** Board #67 May 29 1:30 PM - 3:00 PM  
**Interlimb Asymmetries With High And Low External Training Loads In Male Collegiate Basketball Athletes**

Brady S. Brown, Aaron D. Heishman, Ryan M. Miller, Eduardo D.S. Freitas, Keldon M. Peak, Michael G. Bembem, FACSM. *University of Oklahoma, Norman, OK.* (Sponsor: Michael G. Bembem, FACSM)  
 Email: brownbrady3@ou.edu  
 (No relevant relationships reported)

Tracking and monitoring bilateral limb asymmetries is an increasingly common practice to provide information associated with athlete performance, injury risk, as well as guiding return-to-play or return-to-performance protocols following injury. It is speculated external training loads (eTL) during sport specific practice may influence subsequent changes in inter-limb asymmetries. **PURPOSE:** Therefore, the purpose of the present study was to evaluate acute differences in lower inter-limb asymmetries during a bilateral countermovement jump (CMJ) immediately following high versus low eTL basketball practices in a group of NCAA men's collegiate basketball players. **METHODS:** Twelve NCAA Division I collegiate men's basketball players performed three CMJs on dual cell force platforms immediately prior to and immediately following basketball practices of high and low eTL. A dependent T-test was used to determine mean differences in practice intensities. A 2-way (condition x time) repeated measures analysis of variance (ANOVA) was performed to examine differences in Concentric Impulse (ConcImp), Concentric Peak Force (ConcPF), Eccentric Peak Force (EccPF), Takeoff Peak force (TakeoffPF), and Peak Landing Force (PeakLandF) captured during the CMJ between conditions and across time, with significance set at  $p \leq 0.05$ . **RESULTS:** There was a significant difference in practice intensities (High: PlayerLoad/min =  $5.3 \pm 0.9$ , Low: PlayerLoad/min =  $4.7 \pm 1.4$ ;  $p \leq 0.001$ ). There were no significant condition or time main effects ( $p > 0.05$ ), and there were no significant condition by time interactions for ConcImp, ConcPF, EccPF, TakeoffPF, and PeakLandF ( $p > 0.05$ ). **CONCLUSION:** Although there were significant differences experienced in eTL intensities between practices (PL/min), these differences did not result in alteration of acute lower inter-limb asymmetries during the bilateral CMJ.

**3247** Board #68 May 29 1:30 PM - 3:00 PM  
**Use Of Plyometric Training To Offset Fatigue In Division I Collegiate Female Volleyball Players**

Taylor C. Robertson, Gabe Galindo, Paul L. O'Connor. *Central Michigan University, Mount Pleasant, MI.*  
 Email: rober2tc@cmich.edu  
 (No relevant relationships reported)

Volleyball is a demanding sport consisting of multiple passages of play with a high priority on jumping, including attacking, blocking, jump serving and setting. Heavy resistance training and plyometric training have been shown to increase vertical jump in volleyball players, as well as high intensity interval training to increase conditioning, however, there is a lack of information on the use of plyometric training to decrease indexes of fatigue. **PURPOSE:** To determine if plyometric training can decrease repeated jump fatigue in NCAA Division I female college volleyball players. **METHODS:** 8 female collegiate volleyball players (Age:  $18.4 \pm 0.7$ , height:  $179.7 \pm 9.2$ cm, weight:  $71.8 \pm 10.0$ kg), cleared of injuries completed a vertical jump test, squat jump test, repeat squat jump, and repeat block jump test while wearing velocity and height measuring devices. Participants were split into a control group (CON) and a plyometric group (PLYO), which completed a 3 day a week/ 8 week program consisting of dot drill and box drop jump exercise variations. After 8 weeks, participants were retested. Fatigue Index for the repeat tests were analyzed for statistical significance,  $[(\text{Initial Jump}-\text{Final Jump})/\text{Initial Jump}] \times 100$ . **RESULTS:** Significant differences were seen in the PLYO group in the repeat squat jump test at posttest compared to the CON ( $10.98 \pm 4.69$  vs  $-5.41 \pm 4.65$   $p < .015$ ), and in the repeat block jump test compared to pretesting values within the PLYO group ( $6.41 \pm 8.47$  vs  $-4.24 \pm 14.77$ ,  $p < .042$ ). **CONCLUSIONS:** Utilization of plyometric training may help offset fatigue as seen in multiple jump bouts in volleyball players, potentially attributing to increased athletic performance.

**3248** Board #69 May 29 1:30 PM - 3:00 PM  
**Study On Kayak Sprint Specific Core Instability Training**

Meng Li. *Chengdu Sports University, Chengdu, China.*  
 Email: limeng\_1222@163.com  
 (No relevant relationships reported)

**PURPOSE:** In this study, Surface Electromyography (sEMG) and Saturation of Muscle Oxygen ( $\text{SmO}_2$ ) indexes were used to explore the influence of the introduction of special core instability training in kayak training on the special sports ability.

**METHODS:** Using 14 elite kayak athletes as subjects, performed an 8-week specific core instability training intervention. Before and after 8-weeks training, data of sEMG,  $\text{SmO}_2$ , paddle power, velocity, stroke distance, and heart rate(HR), blood lactate(Bla), max stroke frequency (Max SPM) of relevant muscles in the process of full paddling were collected for comparative analysis. Combined with the change of special performance on water, the influence of adding special core training on technical movements and special performance was explained.

**RESULTS:** After 8-weeks special core instability training intervention, we found that during Max SPM paddling test, both side of Rectus Femoris (RF)'s iEMG decreased ( $L: 9.92 \pm 0.33$  vs.  $6.66 \pm 5.87$ ,  $P < 0.05$ ;  $R: 8.49 \pm 0.73$  vs.  $5.67 \pm 0.7$ ,  $P < 0.05$ ), both Erector Spinae(ES)'s iEMG significantly enhanced ( $L: 4.04 \pm 0.71$  vs.  $5.81 \pm 0.7$ ,  $P < 0.05$ ;  $R: 3.13 \pm 0.52$  vs.  $5.51 \pm 1.13$ ,  $P < 0.05$ ). Meanwhile,  $\text{SmO}_2$  of left Triceps Brachii(TB) decreased ( $42.54 \pm 1.83$  vs.  $28.06 \pm 5.18$ ,  $P < 0.001$ ), right TB decreased ( $48.76 \pm 8.33$  vs.  $31.77 \pm 4.24$ ,  $P < 0.01$ ), left Latissimus Dorsi (LD) decreased ( $40.19 \pm 5.58$  vs.  $32.56 \pm 3.68$ ,  $P < 0.01$ ), right LD decreased ( $35.38 \pm 4.19$  vs.  $28.39 \pm 3.55$ ,  $p < 0.05$ ). Both side paddle power enhanced ( $L: 196.17 \pm 11.63$  vs.  $294.38 \pm 15.58$ ,  $P < 0.01$ ;  $R: 210 \pm 19.13$  vs.  $319.83 \pm 15.15$ ,  $P < 0.01$ ), velocity enhanced ( $L: 4.43 \pm 0.06$  vs.  $5.64 \pm 0.14$ ,  $p < 0.01$ ;  $R: 4.22 \pm 0.07$  vs.  $5.68 \pm 0.13$ ,  $p < 0.01$ ), paddle distance increased ( $L: 2.86 \pm 0.16$  vs.  $4.08 \pm 0.16$ ,  $p < 0.001$ ;  $R: 2.77 \pm 0.4$  vs.  $4.12 \pm 0.38$ ,  $p < 0.001$ ), with higher BLA ( $7.133 \pm 2.014$  vs.  $8.769 \pm 2.359$ ,  $P < 0.05$ ), also reached a higher Max SPM ( $141.14 \pm 11.06$  vs.  $149.14 \pm 6.248$ ,  $P < 0.05$ ).

**CONCLUSION:** 1) Kayak special core instability training enhance the capacity of maintain balance by trunk, which create stable condition for power force of movement, and allow athletes increase their arm muscles force during paddle movement on an instable plane, and enhance symmetry of power force from both side of body efficiently. 2) 8-weeks specific core instability training produced a positive effect on kayaking performance.

**3249** Board #70 May 29 1:30 PM - 3:00 PM  
**Abstract Withdrawn**

**3250** Board #71 May 29 1:30 PM - 3:00 PM  
**Anthropometric Characteristics And Training Behaviors In Advanced And Elite Rock Climbers**

Abigail J. Larson<sup>1</sup>, Lanae M. Joubert<sup>2</sup>, Gina Blunt-Gonzalez<sup>3</sup>.  
<sup>1</sup>Southern Utah University, Cedar City, UT. <sup>2</sup>Northern Michigan University, Marquette, MI. <sup>3</sup>Morehead State University, Morehead, KY  
 Email: abigail Larson@suu.edu  
 (No relevant relationships reported)

**PURPOSE:** The purpose of this study was to quantify training volumes and modalities in a sample of advanced and elite climbers. **METHODS:** An online survey was distributed through various climbing-related social media platforms. Questions included demographics, climbing ability and style, training modalities used, and weekly volumes of training. **RESULTS:** Of 595 initial participants, 92 boulderers (B) (63 men, 29 women) and 71 sport-lead (SL) climbers (49 men, 22 women) were identified as advanced or elite (A/E) using the IRCRA (International Rock Climbing Research Association) Red Point Scale of which 69% had entered at least one competition. Among A/E women and men SL climbers there was a moderate inverse relationship between BMI and SL climbing ability ( $r = -0.56$  and  $r = -0.39$ , respectively), this was not observed among women B and diminished in men B ( $r = 0.12$  and  $r = -0.25$ ). Anthropometric and training data is reported in Table 1. Mean exercise volume among A/E was  $470 \pm 263$  min/week, with  $333 \pm 202$  min/week as climbing specific training. Women SL climbers reported spending more time each week training specifically for climbing compared to women B ( $p < 0.05$ ) but total training time did not differ between groups or genders ( $p > 0.05$ ). 70% and 35% of A/E climbers reported weekly aerobic and resistance exercise, respectively, with no differences between genders or SL and B. **CONCLUSION:** To our knowledge, this was the first study to quantify training volume and modalities in A/E climbers. *Table 1.* Characteristics of advanced/elite (A/E) women and men boulderers (B) compared to A/E women and men sport lead (SL) climbers (mean  $\pm$  standard deviation).

| Characteristic  | A/E B n=29(w); n=63(m)                          | A/E SL n=23(w); n=49(m)                      |
|---|---|--|
| Age (years)   | 28.8 ± 7.1*; 29.5 ± 7.1**                       | 37.6 ± 8.3; 35.6 ± 8.8                       |
| Height (cm)   | 165.9 ± 6.7*; 178 ± 5.8                         | 160.8 ± 6.1; 179 ± 6.3                       |
| Weight (kg)   | 57.9 ± 7.4*; 69.9 ± 9.3                         | 52.7 ± 5.9; 69.3 ± 6.2                       |
| BMI (kg/m <sup>2</sup> )                                    | 21.0 ± 2.2; 22 ± 2.3                            | 20.3 ± 1.6; 21.5 ± 1.1                       |
| Years climbing  | 6.9 ± 5.8*; 10.1 ± 8.9**                        | 12.1 ± 7.9; 14.1 ± 8.8                       |
| IRCRA boulder ability                                       | 20.1 ± 2.6; 23.2 ± 2.3                          | 20.7 ± 3.4; 23 ± 2.5                         |
| IRCRA sport-lead ability                                    | 14.8 ± 5.4*; 19.5 ± 4.3**                       | 22.0 ± 3.2; 24 ± 1.9                         |
| Climbing volume (min p/ week)                               | 278 ± 187*; 305 ± 201                           | 378 ± 220; 376 ± 198                         |
| Indoor climbing (% total climbing)<br>Total exercise volume | 80% ± 19%*; 74% ± 25%**<br>421 ± 251; 438 ± 269 | 50% ± 27%; 37% ± 31%<br>504 ± 237; 523 ± 268 |
| % Participating in aerobic exercise                         | 69%; 70%  | 64%; 75%                                     |
| % Participating in anaerobic exercise                       | 17%; 24%  | 32%; 31%                                     |
| % Participating in resistance exercise                      | 41%; 33%  | 36%; 31%                                     |

BMI, body mass index; IRCRA B and IRCRA SL, bouldering and sport lead climbing ability, respectively, based on International Rock Climbing Research Association conversion scale.\* Significant difference between groups within females; \*\* significant differences between groups within males p<0.05.

**3251 Board #72 May 29 1:30 PM - 3:00 PM**

**The Immediate Effects Of Abdominal And Core Exercise On Balance For College-age Dancers**

Jill M. Lucas, Katharine T. Cusack, Jason E. Grandeo, Sean M. Collins. *University of Lynchburg, Lynchburg, VA.*  
(No relevant relationships reported)

Balance is defined as the ability to maintain a stable position while remaining steady. Balance is extremely important to dancers to help prevent injury and to maximize aesthetic and athletic performance. While other studies support the improvement of balance among dancers following a core exercise training program, the effects immediately following one core exercise session are less clear. **PURPOSE:** The purpose of this study was to examine the immediate effects of a core and abdominal exercise program on balance for dancers, with the hypothesis that a core exercise program would cause an immediate improvement in balance for college-aged dancers. **METHODS:** Eighteen female collegiate dancers (19.83 ± 1.58 years, 7-18 years of dance experience) completed two sets of eight exercises, engaging the upper and lower abdominal, obliques, gluteals, and erector spinae muscles. Two static balance tests, the Balance Error Scoring System (BESS) test and the Stork Balance Standing test, and two dynamic balance tests, the Y Balance test and the Pirouette test, were conducted prior to and after the core exercises. **RESULTS:** The core exercise program significantly improved balance results for the Y Balance Test composite score (86.0 ± 6.3% pre vs 88.4 ± 5.3% post, p<0.05) and the BESS Test (22.7 ± 8.0 errors pre vs 16.1 ± 7.0 errors post, p<0.05). There were no significant differences between pre and post intervention scores of the Stork Balance Standing test or the Pirouette test. **CONCLUSIONS:** Including core exercises in a dancer's warm-up before practices and performances may have an acute positive effect on balance for dancers, which could translate to improvements in performance. It is unclear if a core exercise program can acutely improve dance skill-specific balance, such as during pirouettes.

**3252 Board #73 May 29 1:30 PM - 3:00 PM**

**Weighting The Swing: The Mechanical Changes That Emerge When Loads Are Applied To Baseball Bats**

Alexia E. Amo, William P. Lydon, Cynthia Villalobos, J Mark VanNess, Jacob M. Cunha, Courtney D. Jensen. *University of the Pacific, Stockton, CA.*  
(No relevant relationships reported)

Success in baseball batting relies on a union of swing power and accuracy. Off the field, training commonly employs weighted loads replicating hitting mechanics. On the field, immediately prior to a plate appearance, batters sometimes place a weighted ring on the bat to warm up their swing. Although common, these traditional training methods lack investigation. **PURPOSE:** To observe differences of baseball swing characteristics in response to applied bat resistance. **METHODS:** We tested 14 NCAA baseball athletes using Proteus technology (Proteus Motion, USA). Participants completed 5 sets of 6 swings at increasing loads of magnetic resistance. Each set

increased in weight by 2 lbs, ranging from 1-9 lbs. Measurements computed by Proteus were peak power, peak force development rate (PFDR), braking, consistency, endurance, velocity, and range of motion (ROM). Paired-samples t-tests compared swing characteristics of the 1 lb resistance to the mean of 3, 5, 7, and 9 lb. MANOVA with repeated measures observed the differences of swing variables in response to resistance increases. Linear regression tested the effect of different loads on performance parameters. **RESULTS:** The 1 lb resistance differed from the mean resistance in peak power (p<0.001), PFDR (p<0.001), braking (p<0.001), ROM (p=0.017), and velocity (p=0.063), but not in consistency (p=0.110) or endurance (p=0.375). The mean values of consistency (p=0.985) and endurance (p=0.530) could not predict outcomes for 1 lb performance, but did predict ROM (p=0.002) and braking, power, PFDR, and velocity (p<0.001). As resistance levels increased, there were significant differences in swing power (F=317.297, p<0.001), PFDR (F=141.797, p<0.001), braking (F=91.011, p<0.001), ROM (F=6.067, p=0.013), and velocity (F=2.5122, p=0.039), but not measurements of consistency (F=0.911, p=0.480) or endurance (F=2.156, p=0.070). **CONCLUSIONS:** As bat resistance increased, players made acute responses that compromised recruitment characteristics (consistency and endurance). Training and warm-up techniques that employ loaded swings may alter mechanics accordingly.

**F-55 Free Communication/Poster - Blood Flow Restriction**

Friday, May 29, 2020, 1:30 PM - 4:00 PM  
Room: CC-Exhibit Hall

**3253 Board #74 May 29 2:30 PM - 4:00 PM**

**The Acute Effects Of Volume-Matched Resistance Exercise With Blood Flow Restriction Versus Traditional Exercise On Arterial Elasticity And Hemodynamic Variables**

Danny D. Dominguez, Patrick Gage Murphy, Murat Karabulut, FACS. *University of Texas at Rio Grande Valley, Brownsville, TX.*  
Email: danny.dominguez01@utrgv.edu  
(No relevant relationships reported)

**PURPOSE:** To investigate the acute effects of varying intensities of volume-matched lower body resistance exercise sessions with and without blood flow resistance (BFR) on hemodynamic variables and arterial compliance.

**METHODS:** Seventeen males and fifteen females completed six separate volume-matched sessions of lower body resistance exercise of 4 sets of leg curl and leg extension at 40 (T40), 60 (T60), and 80% (T80) of 1RM without BFR and 25 (BFR25), 35 (BFR35), and 50% (BFR50) with BFR. Blood pressure, arterial elasticity, and hemodynamic variables (mean arterial pressure (MAP), stroke volume (SV), stroke volume index (SVI), cardiac output (CO), cardiac index (CI), large arterial elasticity (LAE), small arterial elasticity (SAE), systemic vascular resistance (SVR), total vascular impedance (TVI) and cardiac ejection time (CET)) were measured at baseline, immediately postexercise, 10 min, 20 min, and 30 min-post exercise using a oscillometric blood pressure module and a piezoelectric pressure sensor.

**RESULTS:** One-way ANOVA found no significant differences between group means at baseline resting values. Repeated measures ANOVA found significant condition main effects (p<0.05) for HR, LAE, SAE, and TVI post exercise. Post-hoc pairwise comparisons found that BFR25 caused significantly greater HR than BFR50 (p<0.04) at 10 min-post exercise and T80 at 0 and 10 min-post exercise (p<0.02). BFR25 also resulted in significantly greater (p<0.03) LAE compared to BFR50 at 10 min-post exercise (20.8 ± 1.7 vs. 16.4 ± 0.7 ml/mmHg × 10). SAE was significantly lower (p<0.05) following BFR50 (8.4 ± 0.4 ml/mmHg × 10) compared to T40 (10.7 ± 0.7 ml/mmHg × 10). TVI was found to be significantly lower in BFR25 than BFR50 (p<0.01) and BFR35 (p<0.02) at 10 min-post exercise (87.2 ± 5.9 vs. 111.2 ± 5.8 and 103.7 ± 5.8 dyne·sec·cm<sup>-5</sup>, respectively).

**CONCLUSIONS:** The current results indicate that higher intensity BFR groups may not be favorable for acute post exercise arterial elasticity. The changes in hemodynamic and arterial elasticity responses to volume-matched lower load exercise during the BFR25 session demonstrate the possibility of improving cardiovascular health and function. Future studies should determine the effects of BFR and non-BFR training methodologies on chronic adaptations in cardiovascular system.

**3254** Board #75 May 29 2:30 PM - 4:00 PM  
**Cardiovascular Response To Unilateral, Bilateral, And Alternating Exercises With Blood Flow Restriction**

Daphney M. Stanford<sup>1</sup>, Joonsun Park<sup>2</sup>, Raymond Jones<sup>2</sup>, Matthew B. Jessee<sup>1</sup>. <sup>1</sup>The University of Mississippi, University, MS. <sup>2</sup>The University of Southern Mississippi, Hattiesburg, MS. (No relevant relationships reported)

The cardiovascular response induced by resistance exercise with blood flow restriction (BFR) seems to be lower or comparable to traditional exercise in healthy individuals. However, the potential for BFR to be used for at risk populations highlights a need to further attenuate the cardiovascular response, potentially via the modality of exercise. **PURPOSE:** To compare the cardiovascular response to unilateral (UN), bilateral (BI), and alternating (AL) BFR exercise. **METHODS:** 13 males and 7 females performed four sets (30 seconds rest) of UN, BI, and AL knee-extensions to failure with 30% one-repetition maximum and 40% arterial occlusion pressure. Pulse wave analysis was measured before and after exercise. Data, presented as mean (SD), were analyzed using Bayesian RMANOVA. **RESULTS:** AL caused greater changes in: aortic systolic [ $\Delta$ mmHg: AL=21 (8); UN=13 (10); BI=15 (7); BF<sub>10</sub>=29.63], diastolic [ $\Delta$ mmHg: AL=13 (8); UN=7 (10); BI=8 (7); BF<sub>10</sub>=5.13], and mean arterial [ $\Delta$ mmHg: AL=19 (8); UN=11 (10); BI=13 (7); BF<sub>10</sub>=48.39] blood pressures. Brachial [ $\Delta$ mmHg\*bpm: AL=4945 (2340); UN=3218 (1412); BI=3461 (1430); BF<sub>10</sub>=31.74] and aortic [ $\Delta$ mmHg\*bpm: AL=6134 (2479); UN=4200 (1722); BI=4525 (1664); BF<sub>10</sub>=114.83] rate pressure product as well as heart rate [ $\Delta$ bpm: AL=26 (14); UN=18 (8); BI=19 (11); BF<sub>10</sub>=5.82] were also greatest with AL. Augmentation pressure [ $\Delta$ mmHg: UN=-3 (5); BI=-2 (6); AL=-1 (6); BF<sub>10</sub>=0.19], pulse pressure [ $\Delta$ mmHg: UN=6 (6); BI=7 (7); AL=8 (5); BF<sub>10</sub>=0.27], augmentation index [ $\Delta$ %: UN=-6 (12); BI=-7 (11); AL=-6 (16); BF<sub>10</sub>=0.16], wave reflection magnitude [ $\Delta$ %: UN=-5 (8); BI=-5 (7); AL=-4 (7); BF<sub>10</sub>=0.15], forward wave height [ $\Delta$ mmHg: UN=8 (6); BI=8 (6); AL=8 (4); BF<sub>10</sub>=0.15], and reflected wave height [ $\Delta$ mmHg: UN=1 (3); BI=2 (4); AL=3 (3); BF<sub>10</sub>=0.31] were not different between conditions. Exercise volume was greater in AL [kg: AL=1835 (1725); UN=915 (312); BI=893 (313); BF<sub>10</sub>=29.17]. Ratings of perceived exertion (BF<sub>10</sub>=3.99e+144) and discomfort (BF<sub>10</sub>=2.0e+73) increased with sets. AL had an elevated discomfort (BF<sub>10</sub>=5548.97). **CONCLUSION:** The greater cardiovascular response following alternating BFR exercise in healthy individuals, suggests those at risk of a cardiovascular event should choose unilateral or bilateral BFR exercise until further work determines the degree to which this modality can be tolerated.

**3255** Board #76 May 29 2:30 PM - 4:00 PM  
**Effect Of Aerobic Exercise With Blood Flow Restriction On Substrate Utilization And Energy Expenditure**

Nathen A. Andrews, Chase P. Harris, Kelly E. Johnson, Justin P. Guilkey, Jakob D. Lauver. Coastal Carolina University, Conway, SC. Email: naandrews@coastal.edu (No relevant relationships reported)

Blood flow restriction (BFR) added to aerobic exercise has the potential to elicit physiological adaptations. However, the acute effects of BFR on substrate utilization and energy expenditure (EE) remains unclear. **PURPOSE:** The purpose of this study was to examine the effects of intermittent BFR compared to low- (LIIE) and high-intensity interval exercise (HIIE) on EE and substrate utilization during exercise and recovery. **METHODS:** Participants randomly performed 3 interval (INT) exercise protocols: BFR, LIIE and HIIE. BFR and LIIE consisted of 10 INTs of 2-min of work at 70% of ventilatory threshold (VT) and 1-min of recovery (20 watts; W). During BFR, the cuffs were inflated to 80% of limb occlusion pressure (154 ± 17 mmHg) during each work INT and deflated during each recovery INT. HIIE consisted of 5 INTs at 140% of VT and 1-min of recovery (20 W). Breath by breath pulmonary oxygen uptake (VO<sub>2</sub>) and carbon dioxide production (VCO<sub>2</sub>) were recorded during a 15-min seated rest, exercise, and a 180-min seated recovery. Excess post exercise oxygen consumption (EPOC) magnitude was calculated as area under the curve from netVO<sub>2</sub> (VO<sub>2</sub> - VO<sub>2</sub> at rest) during the first 90 minutes post-exercise. EE was calculated from VO<sub>2</sub> during exercise and recovery. Fat oxidation (FatOx) and carbohydrate oxidation (CarbOx) rates were calculated from VO<sub>2</sub> and VCO<sub>2</sub> at rest, 1, 2 and 3 hrs post-exercise. Enjoyment was assessed post-exercise using the physical activity enjoyment scale (PACES). **RESULTS:** EPOC magnitude was similar among trials (LIIE = 4.87 ± 2.60 L\*min<sup>-1</sup>, BFR = 6.59 ± 2.33 L\*min<sup>-1</sup>, HIIE = 6.56 ± 2.01 L\*min<sup>-1</sup>; p = 0.06). Total EE was different between BFR (321.6 ± 30.1 kcal), HIIE (254.5 ± 33.5 kcal), and LIIE (287.1 ± 25.5 kcal) (p<0.05). FatOx in BFR (1hr = 0.14 ± 0.01 g\*min<sup>-1</sup>, 3hr = 0.11 ± 0.01 g\*min<sup>-1</sup>) was greater than LIIE (1hr = 0.08 ± 0.02 g\*min<sup>-1</sup>, 3hr = 0.9 ± 0.02 g\*min<sup>-1</sup>), but not different from HIIE (1hr = 0.12 ± 0.02 g\*min<sup>-1</sup>, 3hr = 0.09 ± 0.01 g\*min<sup>-1</sup>) (main effect of trial; p<0.05). CarbOx during BFR (3hr = 0.16 ± 0.03 g\*min<sup>-1</sup>) was less than LIIE (3hr = 0.19 ± 0.03 g\*min<sup>-1</sup>) and HIIE (3hr = 0.23 ± 0.05 g\*min<sup>-1</sup>) (main effect of trial). There were no differences in PACES scores.

**CONCLUSIONS:** This study suggests that the addition of intermittent BFR to LIIE may result in greater EE but similar substrate utilization and enjoyment as HIIE, albeit at a lower work rate.

**3256** Board #77 May 29 2:30 PM - 4:00 PM  
**Physiological Responses To Intermittent Blood Flow Restriction During Cycling Exercise**

Chase P. Harris, Nathen A. Andrews, Kelly E. Johnson, Jakob D. Lauver, Justin P. Guilkey. Coastal Carolina University, Conway, SC. Email: cpharri2@coastal.edu (No relevant relationships reported)

Aerobic exercise with the addition of blood flow restriction (BFR) has the potential to elicit physiological adaptations. However, the acute physiological and perceptual responses during aerobic exercise with intermittent BFR remains unclear. **PURPOSE:** The purpose of this investigation was to examine the physiological and perceptual responses to intermittent BFR compared to low- (LIIE) and high-intensity interval exercise (HIIE). **METHODS:** Participants randomly performed 3 interval (INT) exercise protocols: BFR, LIIE and HIIE. BFR and LIIE consisted of 10 INTs of 2-min of work at 70% of ventilatory threshold (VT) and 1-min of recovery (20 W). During BFR, the cuffs were inflated to 80% of limb occlusion pressure (154 ± 17 mmHg) during each work INT and deflated during recovery INTs. HIIE consisted of 5 INTs at 140% of VT and 1-min of recovery (20 W). Pulmonary VO<sub>2</sub> and respiratory exchange ratio (RER) were recorded and tissue oxygen saturation (StO<sub>2</sub>) was assessed by near-infrared spectroscopy. The level of perceived exertion (RPE) was assessed at the end of each INT. INTs 2, 4, 6, 8, and 10 during BFR and LIIE were used for comparison with INTs 1-5 during HIIE. The last 30 seconds of each INT were used for analysis. StO<sub>2</sub> during each condition is expressed as change from baseline cycling (20W) (arbitrary units; AU). Two-way (INT x trial) ANOVAs analyzed differences. Significance was established if p<0.05. **RESULTS:** There was a main effect of trial for VO<sub>2</sub> and RER. VO<sub>2</sub> was greater in HIIE (INT 5 = 2.12 ± 0.56 L\*min<sup>-1</sup>) than BFR (INT 10 = 1.41 ± 0.21 L\*min<sup>-1</sup>) and LIIE (INT 10 = 1.28 ± 0.27 L\*min<sup>-1</sup>). RER was lower in LIIE (INT 10 = 0.93 ± 0.01) compared to BFR (INT 10 = 0.94 ± 0.06) and HIIE (INT 5 = 0.99 ± 0.03). At all points, HR was lower in LIIE (INT 10 = 110 ± 10 bpm) than BFR (INT 10 = 155 ± 24 bpm) and HIIE (INT 5 = 154 ± 14 bpm). There were no differences in HR between BFR and HIIE. Delta StO<sub>2</sub> was greater during BFR (INT 10 = -37.5 ± 15.6 AU) and HIIE (INT 5 = -34.2 ± 6.5 AU) compared to LIIE (INT 10 = -14.6 ± 8.67 AU). During all points, RPE was greater in BFR (INT 10 = 15.0 ± 2.4) and HIIE (INT 5 = 14.3 ± 1.3) compared to LIIE (INT 10 = 9.3 ± 0.4). **CONCLUSIONS:** This study suggests that cycling with the addition of intermittent BFR at an intensity equivalent to 70% of VT may provide similar cardiovascular and local physiological stress to traditional HIIE, albeit at a lower work rate.

**3257** Board #78 May 29 2:30 PM - 4:00 PM  
**MEASURING LIMB OCCLUSION PRESSURE USING DIFFERENT VASCULAR DOPPLERS**

Kiara B. Barrett<sup>1</sup>, Logan B. Page<sup>1</sup>, Marcin K. Szczygowski<sup>2</sup>, Tyler D. Martin<sup>1</sup>, J. Grant Mouser<sup>1</sup>. <sup>1</sup>Troy University, Troy, AL. <sup>2</sup>University of Miami, Miami, FL. (No relevant relationships reported)

**PURPOSE:** Blood flow restriction (BFR) in physical therapy settings requires personalized restriction pressures in order to remain a safe rehabilitation modality. Measuring limb occlusion pressure (LOP) is one method of setting the pressure relative to each patient and is performed with a vascular doppler and inflatable cuff. Several dopplers are available, but have not been compared. This study was performed to compare the Hokanson MD6 and the Edan SonoTrax vascular dopplers in measuring LOP.

**METHODS:** In a randomized crossover design, 20 participants (women=10, men=10) visited the laboratory once. Arm and thigh circumferences were measured. After 10min of rest, LOP was measured in the arm and leg with 5cm and 10cm wide inelastic cuffs, respectively. Measurements were repeated every 5min until LOP was measured in both limbs with both dopplers. Bland-Altman analyses (MD6 - SonoTrax) were performed and limits of agreement (LOA) calculated. Two one-sided tests of equivalence with lower and upper equivalence bounds of -5 mmHg to 5 mmHg were calculated. Results are reported as mean (95%CI) for Bland-Altman analyses and mean (90%CI) for equivalence testing.

**RESULTS:** Arm LOP measurement showed a mean bias of 0.6 (-1.3 - 2.4) mmHg, with upper and lower LOA of 8.4 (5.1 - 11.7) mmHg and -7.3 (-10.6 - -4.0) mmHg, respectively. Thigh LOP measurements showed a mean bias of -1.5 (-4.4 - 1.4) mmHg with upper and lower LOA of 10.5 (5.5 - 15.5) mmHg and -13.5 (-18.5 - -8.5) mmHg, respectively. Equivalence testing determined that both doppler measurements were equivalent in the arm (0.55 (-0.99 - 2.1) mmHg, p = .547) and leg (-1.5 (-3.87 - 0.87) mmHg, p = .288).

**CONCLUSIONS:** The SonoTrax measured LOP equivalently to the MD6. Physical therapists wanting to use BFR therapy should feel comfortable using either vascular doppler in their clinic.

**3258 Board #79 May 29 2:30 PM - 4:00 PM**  
**Endothelial-dependent Cutaneous Vasodilatory Responses To Single Bout Of Remote Ischemic Preconditioning**

Jahyun Kim, Sydney Barlow, Warren Franke, FACSM, James Lang, Iowa State University, Ames, IA. (Sponsor: Warren D. Franke, FACSM)  
 Email: jaykim@iastate.edu  
 (No relevant relationships reported)

**Endothelial-Dependent Cutaneous Vasodilatory Responses to a Single Bout of Remote Ischemic Preconditioning**

Jahyun Kim, Sydney E. Barlow, Warren D. Franke FACSM, and James A Lang Iowa State University, Ames, IA, 50010  
 Remote ischemic preconditioning (RIPC) induces protective effects from endothelial ischemic reperfusion injury in two phases. Initial protection occurs in the first 1-2 hrs post-RIPC and disappears after 4 hrs. Delayed protection occurs ~24 hours after RIPC and lasts for 2-3 days in human conduit arteries. The extent to which this timeline occurs in human cutaneous microvasculature is not clear. **Purpose:** To assess the timeline of skin microvascular functional changes after a single bout of RIPC. **Methods:** Sixteen participants (23-4 yrs; 7 males, 9 females) underwent a single bout of RIPC. Using laser speckle contrast imaging, acetylcholine (Ach)-mediated skin blood flow responses were assessed immediately prior to RIPC as well as 24 hr, 48 hr, 72 hr, and a week afterwards. RIPC consisted of 4 repetitions of 5 min of arm blood flow occlusion interspersed by 5 min reperfusion. Ach was prepared with saline solution (2% Ach) and administered by iontophoresis (20 µA for 200 s). Skin blood flow was expressed as cutaneous vascular conductance (CVC; perfusion units/mean arterial pressure, PU-mmHg<sup>-1</sup>). Ach-induced CVC changes throughout this timeline were analyzed by one-way repeated ANOVA and post hoc tests were conducted by the SNK method to locate significant differences. **Results:** Ach-mediated CVC increased during the time line (p<0.05). However, CVC was significantly increased only 48 hours after the single bout of RIPC (0.71±0.07 vs. 0.94±0.12 PU-mmHg<sup>-1</sup>, p<0.05, pre-RIPC vs. 48 hrs), returning to baseline levels after a week (0.61±0.10 PU-mmHg<sup>-1</sup>, p>0.7). **Conclusion:** Responses to Ach infusion are an indicator of global endothelial cell function and reflects endothelial dependent vasodilation. These data suggest that a single bout of RIPC induces a response to Ach-induced endothelial dependent-cutaneous vasodilation that peaks at 48 hours post-RIPC. This response to a single bout of RIPC does not persist a week afterwards. Thus, a single bout of RIPC elicits a delayed window response of endothelial dependent vasodilation in human skin microvasculature.

**3259 Board #80 May 29 2:30 PM - 4:00 PM**  
**Feasibility And Effectiveness Of High-intensity Interval Training With Blood Flow Restriction In Heart Failure**

Molly M. Baldwin, Karen M. Birch, FACSM, Bryan J. Taylor, John Geirula, Maria F. Paton, Judith E. Lowry, Mark T. Kearney, Klaus K. Witte, Carrie Ferguson. University of Leeds, Leeds, United Kingdom.  
 Email: spl12mmb@leeds.ac.uk  
 (No relevant relationships reported)

Reduced aerobic capacity ( $\dot{V}O_{2peak}$ ) is a key characteristic of heart failure with reduced ejection fraction (HFrEF). Peripheral vascular dysfunction, the result of an imbalance between endothelial damage and endogenous repair mechanisms, is both a precursor to and a consequence of HFrEF. This may contribute to the reduction in  $\dot{V}O_{2peak}$  by increasing peripheral vascular resistance, impairing blood flow distribution and reducing O<sub>2</sub> delivery to locomotor muscles. High-intensity interval training (HIIT) can ameliorate vascular dysfunction and increase  $\dot{V}O_{2peak}$  in HFrEF. Whether the effectiveness of HIIT can be increased by combining it with leg blood flow restriction (BFR), a novel technique that alters peripheral vascular shear stress and augments the intramuscular metabolic stress of a given exercise protocol, is unknown.

**PURPOSE:** To investigate the feasibility and effectiveness of HIIT vs. HIIT with BFR to improve CD34+/KDR+ progenitor cell number (marker of vascular repair), exercise tolerance and  $\dot{V}O_{2peak}$  in HFrEF.

**METHODS:** 13 males with HFrEF (72 ± 11 y; LVEF 35 ± 9 %) completed HIIT (5 x 2 min cycling bouts at 80 % ramp-incremental peak power, separated by 2 min recovery) twice per week for 4 weeks, either with BFR (HIIT+BFR; n = 7; thigh cuff pressure 100 mmHg) or without BFR (HIIT; n = 6; thigh cuff pressure 10 mmHg). CD34+/KDR+ number (flow cytometry), exercise tolerance and  $\dot{V}O_{2peak}$  (ramp-incremental exercise test), and quality of life (QoL) were measured pre- and post-training.

**RESULTS:** All HIIT+BFR participants tolerated 100 mmHg cuff pressure. There was a pre- to post training increase in CD34+/KDR+ number (HIIT: 78 ± 11 vs. 88 ± 28 per 10<sup>6</sup> total events; HIIT+BFR: 67 ± 21 vs. 102 ± 44 per 10<sup>6</sup> total events; time effect,

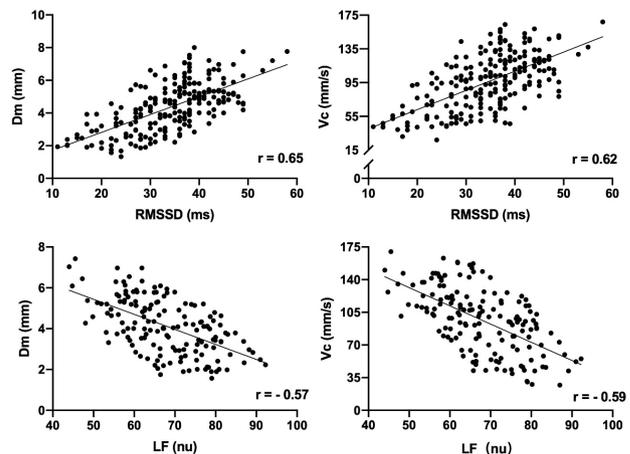
P < 0.05) and ramp-incremental exercise tolerance (HIIT: 494 ± 160 vs. 537 ± 162 s; HIIT+BFR: 469 ± 136 vs. 529 ± 108 s; time effect, P < 0.05). However, the effect of training was not different for HIIT vs. HIIT+BFR.  $\dot{V}O_{2peak}$  was unchanged with training (HIIT: 16.7 ± 8.5 vs. 18.7 ± 9.8 ml/min/kg; HIIT+BFR: 17.0 ± 3.8 vs. 16.4 ± 3.7 ml/min/kg; time effect, P > 0.05). QoL was also unchanged with training.

**CONCLUSIONS:** HIIT+BFR is feasible in HFrEF. However, the increases in CD34+/KDR+ progenitor cell number and exercise tolerance following HIIT+BFR are not greater than the increases conferred by HIIT alone in HFrEF.

**3260 Board #81 May 29 2:30 PM - 4:00 PM**  
**Effects Of Exercise Under Different Levels Of Blood-flow Restriction On Autonomic Modulation And Muscular Fatigue**

Ying Pan, Yan Zhao, Yixin Tian, Xiaohuan Ma, Yu Guo. Nanjing Sport Institute, Nanjing, China.  
 Email: 850773340@qq.com  
 (No relevant relationships reported)

**PURPOSE:** To assess the acute cardiac autonomic and peripheral muscular responses to eccentric exercise combined with different levels of blood flow restriction (BFR) in young women. **METHODS:** Twenty-five women (21.22±0.61 year) performed 4 sets of leg extension (30 + 15 + 15 + 15 repetitions) at 20 % one repetition maximum, with four different BFR conditions (0, 40, 60, and 80 %). Restrictive pressures were calculated based on blood-flow measurements taken at rest on each subject. Heart rate variability (HRV) and muscle fatigue were recorded at rest and during 24 hour of recovery by calculating time (RMSSD) and frequency domain (LF nu, HF nu, LF/HF) indices and analyzing muscle displacement (Dm) and contraction velocity (Vc) values, respectively. **RESULTS:** All parameters in CON (0%BFR) did not significant change (P>0.05). In BFR<sub>40%</sub> there was a slight reduction in RMSSD (18.51%) and HF nu (12.19%) compared to CON (P<0.05). In BFR<sub>60%</sub>, RMSSD and HF nu decreased 27.91% and 13.98% while LF nu increased 13.77% compared to CON (P<0.05), and LF/HF recovered within 30min post exercise (P>0.05). In BFR<sub>80%</sub>, LF nu increased 16.43% while RMSSD, HF nu, Dm and Vc dramatically declined 39.92%, 15.41%, 37.34% and 48.85% respectively when compared to CON (P<0.01), so it took longer time to restore LF/HF balance (within 24 hours). Correlation analysis showed that RMSSD was positively correlated with Dm (r = 0.65) and Vc (r = 0.62), respectively (P<0.05), while LF nu was negatively correlated with Dm (r = - 0.57) and Vc (r = - 0.59) (P<0.05). **CONCLUSION:** On the basis of low load resistance exercise, 40% BFR can withdraw vagal regulation, but sympathetic activity and sympathetic/parasympathetic balance can be enhanced when the restriction increased to 60%BFR. Peripheral muscular fatigue can just be obviously evoked in 80% BFR, and this fatigue is highly related to cardiac autonomic modulation. Therefore, we do not recommend 80% BFR for women with cardiovascular risk.



**3261 Board #82 May 29 2:30 PM - 4:00 PM**  
**Femoral Blood Flow During Blood Flow Restriction In Males And Females**

Pat R. Vehrs, FACSM, Nicole Tafunai, Eric Cruz, Kylie Martin, Olivia Warren, Parker Jensen, Sadie Deem. Brigham Young University, Provo, UT.  
 (No relevant relationships reported)

Use of blood flow restriction (BFR) during strength training results in an increase in muscle strength and mass when using light loads (20-30% of 1 RM). Only a few studies have reported actual arterial blood flow characteristics during BFR. In addition,

research reporting blood flow characteristics in the dominant and non-dominant limb in both males and females is lacking. **PURPOSE:** This study compared femoral artery occlusion pressure (AOP) and femoral artery blood flow characteristics at different percentages of AOP between both legs in males and females. **METHODS:** Participants in this study included 31 physically active and healthy males (n=18) and females (n=13) years of age. Blood flow in the superficial femoral artery (SFA) was measured using Doppler ultrasound and BFR was controlled using a Hokanson E20 Rapid Cuff Inflator with a 10 cm cuff placed on the upper thigh. After measuring the AOP of the SFA, blood flow was measured in a random order at 0%, 20%, 40%, 60%, 80%, and 100% of AOP. This was repeated in the opposite leg. Blood flow was recorded in absolute (mL/min) and relative terms (% unoccluded bloodflow). **RESULTS:** There was significant difference ( $p<0.008$ ) in the AOP in the dominant leg (234 vs 188 mmHg) and nondominant leg (206 vs 177 mmHg) between males and females, respectively. After accounting for differences in leg circumference ( $p<0.001$ ), sex remained a significant ( $p=0.0001$ ) factor in accounting for differences in AOP. The difference in AOP between the dominant and nondominant leg in males (234 vs 206 mmHg) and females (188 vs 177) were not significant ( $p=0.123$ ). At each of the occlusion pressures (0%, 20%, 40%, 60%, 80%, 100% of AOP), there were no differences in absolute or relative blood flow between males and females. The relationship between SFA blood flow at occlusion pressures between 0 and 100% of the AOP was curvilinear in both males and females. Blood flow at occlusion pressures between 40% and 80% of AOP was relatively constant. **CONCLUSIONS:** Significant differences in AOP in males and females can be attributed, in part to differences in leg circumference and sex. The curvilinear relationship between blood flow and occlusion pressure indicates that BFR during exercise can be equally effective a lower pressures (40% AOP) as at higher pressures (80% AOP).

## F-56 Free Communication/Poster - Vascular Function II

Friday, May 29, 2020, 1:30 PM - 4:00 PM  
Room: CC-Exhibit Hall

3262 Board #83 May 29 2:30 PM - 4:00 PM

### The Effect Of The Somatosensory Afferent On Hemodynamic Transmission From The Aorta To The Brain

Marina Fukuie. *Tsukuba university, Ibaraki, Japan.*  
(No relevant relationships reported)

**PURPOSE:** This study aimed to reveal whether the somatosensory input from lower extremities can affect hemodynamic transmission from the aorta to the brain during orthostatic stimulation.

**METHODS:** Thirteen young adults (5 women, mean age 25±5 yrs.) underwent two consecutive 6-min orthostatic stimulations with lower body negative pressure (LBNP) (-30 mmHg and -50 mmHg) under following two conditions in random order: (1) placing feet on the wood board with slight knee flexion (RESISTED) and (2) feet untouched using a harness (FREE) inside the LBNP chamber. Heart rate (HR), aortic pressure, stroke volume (SV), cardiac output (CO), and cerebral blood flow velocity (CBFV) from the middle cerebral artery were continuously recorded. Hemodynamic transmission (i.e., admittance) from the aorta to the brain was evaluated by transfer function analysis.

**RESULTS:** HR was significantly higher, and SV and CO were significantly lower during -50 mmHg LBNP stimulation than baseline values irrespective of foot conditions. Aortic mean pressure and mean CBFV were not affected by the leg-condition. In contrast, aortic pulse pressure and pulsatile CBFV were significantly reduced during -50 mmHg LBNP with the degree of reduction (from baseline to -50 mmHg LBNP) smaller in the RESISTED condition than in the FREE condition (aortic pulse pressure: -17 % vs. -35 %,  $P=0.047$ ; CBFV: -15 % vs. -26 % vs.  $P=0.09$ , respectively). Transfer function gain at the first harmonic from the aortic pressure to the CBFV was not affected significantly by LBNP stimulation or the somatosensory input. The transfer function normalized gain by mean CBFV was significantly increased with LBNP ( $1.3±0.1$  vs.  $1.5±0.1$  cm/s/mmHg,  $P=0.048$ ) but did not differ by the somatosensory input.

**CONCLUSIONS:** These results suggest that the aorta-brain admittance at the first harmonic is augmented with the LBNP stimulation but not altered by the somatosensory input from the lower limbs.

3263 Board #84 May 29 2:30 PM - 4:00 PM

### Arduino-based Impedance Spectroscopy: An Open-source Platform For Physiological Impedance Spectroscopy Measurements In Rats

Andrew L. Allison, Lorian M. Clark, William D. Howell, William L. Sexton, FACSM. *A.T. Still University of Health Sciences, Kirksville, MO.*  
Email: sa200988@atsu.edu

(No relevant relationships reported)

Assessment of body water and compartmentalization is an important experimental outcome in many studies. Whole-body impedance spectroscopy permits assessment of body water and composition; however the expense of commercially available systems can be prohibitive. **PURPOSE:** The purpose of this project was to develop an affordable, open-source, and precise system to perform whole-body impedance spectroscopy in rats. **METHODS:** Commercially validated circuit components, as described in the literature, were evaluated and compiled. An impedance spectroscopy system was designed using KiCad. Simulation and modeling of the circuit and instrumentation output was performed using LTSpice. The software was developed using Python, Arduino IDE. The system includes an internal per measurement calibration system and a constant current supply. The system was tested using serially-diluted KCl cells and an equivalent thorax circuit (RRC circuit). Validation studies were performed in anesthetized rats (2% isoflurane in 95% O<sub>2</sub>, 5% CO<sub>2</sub>) rats *in-vivo* (n=4, ~350 g). **RESULTS:** The impedance spectroscopy system was based on a built-in Arduino-Mega and AD5933 integrated circuit (Analog Devices) using open-source software. The system includes an internal per measurement calibration and constant current supply, and was able to stably iterate through excitation frequencies from 1 to 300 kHz. Admittance data obtained from rats were plotted in a complex plane. After least-squared semicircular regression analysis, there were consistent correlations within rats (triplicate) and among individual rats (n=4) on consecutive days. Total costs of the system was less than \$250. **CONCLUSION:** We developed an affordable (open-source platform that precisely and repeatably provides whole-body impedance spectroscopy measurements in rats. The rat impedance results were qualitatively consistent with published data. This system can also be reprogrammed and reconfigured for use in other physiologic applications.

3264 Board #85 May 29 2:30 PM - 4:00 PM

### Water Immersion Skin Wrinkling: The Influence Of Age, Sex, And Adiposity

Jonathon Kava<sup>1</sup>, Daroonwan Suksom<sup>2</sup>, Hirofumi Tanaka, FACSM<sup>1</sup>. <sup>1</sup>The University of Texas at Austin, Austin, TX. <sup>2</sup>Chulalongkorn University, Bangkok, Thailand. (Sponsor: Hirofumi Tanaka, FACSM)  
Email: jon.kava@utexas.edu

(No relevant relationships reported)

From the evolutionary perspective, water immersion skin wrinkling (WISW) is the perceived water drainage to enhance grip in wet conditions. In modern medicine, it is a noninvasive test of limb sympathetic function and can be used to assess peripheral neuropathy. WISW occurs as sympathetically-mediated contraction of subcutaneous glomus bodies after perturbation of ion concentration in palmar sweat glands. This phenomenon has not been studied well and it is not clear if common demographic variations (e.g. age, sex, and adiposity) that impact overall cardio-autonomic health status also affect WISW. **Purpose** The purpose of the present study is to determine if peak WISW is modulated by age, sex, and body adiposity, additionally, we addressed if this phenomenon is associated with osmotic reactions or edema. **Methods** So far 12 apparently healthy adults (5 females) aged 34.5±17.6 years were studied. Participants hands were submerged in 40°C water for 30 minutes with degree of wrinkling being assessed via 5-point scale (0 to 4) at 10-minute intervals. Final ratings for digits 2-5 were summed and used to determine peak WISW with a score of 16 being the highest and 0 being the lowest possible scores. Additionally, hand and forearm volume were measured via water displacement before and after submersion to quantify hand volume expansion. **Results** Peak WISW ranged from 5 to 16 with the mean (±SEM) score of 13.2±1.3. Peak WISW was moderately correlated with age ( $r=-0.54$ ), BMI ( $r=-0.39$ ), body fat percentage ( $r=-0.51$ ). Males demonstrated a greater degree of WISW with a mean rating of 16 compared with females with a mean rating of 9 ( $p<0.01$ ). Hand and forearm volume did not change with water immersion (497±29 vs. 500±30 ml). Changes in hand and forearm volume were not associated with peak WISW ( $r=-0.03$ ). **Conclusion** The preliminary results indicate that water immersion skin wrinkling varies widely with age, sex, and body adiposity and is not associated with edema or osmotic reactions.

**3265** Board #88 May 29 2:30 PM - 4:00 PM  
**An Assessment Of The Potential For Standardizing Various Measures Of Arterial Stiffness**  
 Taha Alhalimi, Jisok Lim, Hirofumi Tanaka, FACSM. *University of Texas, AUSTIN, TX.* (Sponsor: Hirofumi Tanaka, FACSM)  
 Email: halimitaha@hotmail.com  
 (No relevant relationships reported)

Arterial stiffness is an independent risk factor for cardiovascular disease. Different measures of arterial stiffness have been used to assess the impacts of exercise training interventions. One of the primary problems faced by investigators conducting systematic reviews and meta-analyses is the lack of standardized methodology to evaluate and compare efficacies of the existing and newly conducted exercise interventions on arterial stiffness. The reference standard measure of arterial stiffness is pulse wave velocity (PWV) while other commonly-used methodologies are ultrasound-derived arterial compliance and distensibility. **PURPOSE:** To describe standardized equations to convert common ultrasound-based measures of arterial stiffness (arterial compliance, distensibility,  $\beta$ -stiffness index, elastic modulus) to local PWV. **METHODS:** We first conducted a literature search to derive conversion equations. For measures of arterial stiffness that conversion equations cannot be used, we generated regression equations using the accumulated dataset available in the laboratory. Subsequently, these equations were cross-validated in a well-controlled laboratory-based study, in which all measures of arterial stiffness were collected in 49 apparently healthy participants. **RESULTS:** The literature search revealed that some measures of arterial stiffness such as distensibility coefficient (DC) can be converted to local PWV using the Bramwell-Hill model ( $PWV = [pDC]^{1/2}$ ) with an assumption of  $\rho = 1059 \text{ kg/m}^3$ . Ultrasound-based measures of arterial stiffness were strongly and significantly associated with local PWV with Pearson  $r$  ranging from 0.74 to 0.99 ( $p < 0.01$ ). Converted local PWV using regression models were correlated with each other ( $r = 0.73$  to  $0.99$ ,  $p < 0.01$ ). The correlations between converted local PWV and directly measured carotid-femoral PWV ranged from weak to moderate correlations with the range of  $r$  from 0.08 to 0.41. **CONCLUSION:** Our findings indicate that commonly-used measures of ultrasound-based arterial stiffness can be converted to local PWV and can be compared with a reference standard measure. These conversions can be used in systematic reviews and meta-analyses to synthesize evidence across studies to detect effects.

**3266** Board #87 May 29 2:30 PM - 4:00 PM  
**Interrupting Prolonged Sitting With Different Walking Intensities And Durations: Effects On Resting Blood Pressure**  
 Waris Wongpipit<sup>1</sup>, Masashi Miyashita<sup>2</sup>, Stephen Heung-Sang Wong, FACSM<sup>1</sup>. <sup>1</sup>*The Chinese University of Hong Kong, Hong Kong, Hong Kong.* <sup>2</sup>*Waseda University, Saitama, Japan.*  
 Email: waris.w@link.cuhk.edu.hk  
 (No relevant relationships reported)

**BACKGROUND:** Greater time spent in sedentary behaviour is associated with an increased risk of cardiovascular disease, type-2 diabetes, and mortality. Regularly interrupting prolonged sitting with 2-min light-intensity and 2-min moderate-intensity walking every 20 minutes without matching for energy expenditure has been shown to reduce resting blood pressure. However, little is known whether interrupting prolonged sitting with 3-min light-intensity walking and 1.5-min brisk walking every 30 min when the energy expenditure of these trials is matched provides similar benefits on resting blood pressure. **PURPOSES:** To compare the effects of 1.5-min moderate-intensity walking every 30 minutes and 3-min light-intensity walking every 30 minutes on resting blood pressure in young men with central obesity when the energy expenditure of these trials is matched. **METHODS:** Sixteen East-Asian men with central obesity (mean age:  $22.3 \pm 4.2$  years; body mass index:  $29.9 \pm 1.7 \text{ kg}\cdot\text{m}^{-2}$ ; waist circumference:  $100.3 \pm 5.9 \text{ cm}$ ) completed three, 7-h laboratory-based conditions in a randomised order: 1) prolonged sitting (SIT), 2) 3-min (at 20 - 39% of  $\text{VO}_2$  reserve) and 3) 1.5-min (at 40 - 59% of  $\text{VO}_2$  reserve). Each trial was separated by a 6-day washout period. Resting blood pressure was measured hourly using automated sphygmomanometer in a seated position (mean of two recordings,  $\geq 15$ -min post-activity). Generalised Estimating Equations were used to examine differences among the three conditions. **RESULTS:** Resting systolic blood pressure (SBP) reduced in the 3-min condition (mean  $\pm$  SEM;  $119 \pm 2 \text{ mmHg}$ ) but not in 1.5-min condition ( $120 \pm 2 \text{ mmHg}$ ) when compared with SIT condition ( $123 \pm 3 \text{ mmHg}$ ,  $P = 0.028$ ). Resting diastolic blood pressure (DBP) reduced in both 3-min ( $75 \pm 2 \text{ mmHg}$ ) and 1.5-min ( $75 \pm 2 \text{ mmHg}$ ) conditions compared with SIT condition ( $76 \pm 2 \text{ mmHg}$ ,  $P = 0.024$  and  $P = 0.001$ , respectively). **CONCLUSIONS:** Interrupting prolonged sitting with 3-min of light-intensity walking every 30 minutes is more effective on reducing resting blood pressure when compared to the trial with 1.5-min of moderate-intensity walking every 30 minutes in young East-Asian men with central obesity.

**3267** Board #88 May 29 2:30 PM - 4:00 PM  
**Seasonal Variation In Sunlight Exposure, Nitric Oxide Metabolites, And Blood Pressure**  
 Chris Easton<sup>1</sup>, Luke Liddle<sup>1</sup>, Christopher Monaghan<sup>1</sup>, Mia C. Burleigh<sup>1</sup>, Katarzyna Baczynska<sup>2</sup>, David J. Mugggeridge<sup>3</sup>.  
<sup>1</sup>*University of the West of Scotland, Blantyre, United Kingdom.*  
<sup>2</sup>*Public Health England, London, United Kingdom.* <sup>3</sup>*University of the Highlands and Islands, Inverness, United Kingdom.*  
 (Sponsor: Jason Allen, FACSM)  
 Email: chris.easton@uws.ac.uk  
 (No relevant relationships reported)

A reduced exposure to ultraviolet (UV) radiation in winter can decrease 25-hydroxyvitamin D (25(OH)D) levels, increase cardiovascular risk factors, and inhibit athletic performance. Exposing skin to UV-A light in the laboratory has also been shown to release nitric oxide (NO) metabolites into the circulation; molecules known to regulate multiple cardiovascular and metabolic processes. However, it is presently unclear whether NO availability is influenced by the seasonal variation in UV exposure. **PURPOSE:** To compare UV exposure, serum 25(OH)D, plasma nitrate and nitrite, and blood pressure between the summer and winter months. **METHODS:** Thirty-four healthy adults (21 males) residing in Scotland ( $\sim 55.8^\circ \text{N}$ ,  $4.1^\circ \text{W}$ ) were monitored for 7 days in the summer (June - August) and winter (December - February) in a randomised order. Participants wore a personal UV monitor on the wrist throughout each monitoring phase before visiting the laboratory to provide a venous blood sample and to have blood pressure measured. Serum levels of 25(OH)D were measured using an enzyme-linked immunosorbent assay and plasma nitrate and nitrite analysed using gas-phase chemiluminescence. **RESULTS:** Total UV-A exposure was higher in summer ( $17 \pm 21 \text{ J}\cdot\text{cm}^{-2}$ ) compared to winter ( $2.5 \pm 3.0 \text{ J}\cdot\text{cm}^{-2}$ ,  $P < 0.001$ ). Plasma nitrate did not differ between seasons ( $P = 0.57$ ) but nitrite ( $137 \pm 31 \text{ nM}$ ) and serum 25(OH)D ( $22 \pm 8 \text{ ng/ml}$ ) were lower (both  $P < 0.001$ ) in the winter compared to summer ( $200 \pm 56 \text{ nM}$  and  $35 \pm 13 \text{ ng/ml}$ , respectively). Blood pressure was higher in winter (systolic  $126 \pm 13 \text{ mmHg}$ ; diastolic  $76 \pm 9 \text{ mmHg}$ ) than in summer (systolic  $119 \pm 11 \text{ mmHg}$ ; diastolic  $67 \pm 8 \text{ mmHg}$ ; both  $P < 0.001$ ). UV-A exposure was positively associated with plasma nitrite ( $R = 0.41$ ,  $P < 0.01$ ) and 25(OH)D ( $R = 0.43$ ,  $P < 0.01$ ). Plasma nitrite was negatively associated with systolic ( $R = -0.5$ ,  $P < 0.01$ ) and diastolic blood pressure ( $R = -0.4$ ,  $P < 0.01$ ). **CONCLUSIONS:** In a similar fashion to 25(OH)D, circulating levels of plasma nitrite, a marker of NO bioavailability, appear to be influenced by seasonal variations in UV exposure. The negative association between nitrite and blood pressure suggest that a reduced level of NO may increase cardiovascular risk factors in the winter months.

**3268** Board #89 May 29 2:30 PM - 4:00 PM  
**Abstract Withdrawn**

**3269** Board #90 May 29 2:30 PM - 4:00 PM  
**Sex And Fiber-type Differences: Vascular ATP-sensitive  $\text{K}^+$  ( $\text{K}_{\text{ATP}}$ ) Channels Support Critical Speed And Interstitial  $\text{PO}_2$**   
 Trenton D. Colburn, Ramona E. Weber, Kiana M. Schulze, K. Sue Hageman, Timothy I. Musch, FACSM, David C. Poole, FACSM. *Kansas State University, Manhattan, KS.* (Sponsor: David C. Poole, FACSM)  
 (No relevant relationships reported)

Glibenclamide (GLI), prescribed to Type II diabetes patients, enhances insulin release by inhibiting pancreatic  $\text{K}_{\text{ATP}}$  channels.  $\text{K}_{\text{ATP}}$  channels support maximal aerobic capacity ( $\text{VO}_{2\text{max}}$ ) and blood flow during treadmill running in male rats. Whether high-intensity exercise tolerance (i.e. critical speed, CS) and muscle  $\text{O}_2$  delivery-utilization matching (interstitial  $\text{PO}_2$ ,  $\text{PO}_{2\text{is}}$ ) is impaired, and whether sex differences exist in  $\text{K}_{\text{ATP}}$  function, are unknown. **PURPOSE** We hypothesized that systemic inhibition of  $\text{K}_{\text{ATP}}$  channels via GLI would decrease  $\text{VO}_{2\text{max}}$  and CS, while local inhibition would decrease contracting  $\text{PO}_{2\text{is}}$  and blood flow within fast-twitch oxidative (mixed gastrocnemius (MG)) and slow-twitch oxidative (soleus (SOL)) muscles with females (F and F+OVX) expressing the greatest reduction. **METHODS:** Male ( $n = 12$ ), female ( $n = 10$ , proestrus) and ovariectomized female (F+OVX;  $n = 12$ ) Sprague-Dawley rats with and without GLI ( $10 \text{ mg}\cdot\text{kg}^{-1}$  in DMSO i.p.).  $\text{VO}_{2\text{max}}$  and CS were assessed using state-of-the-art techniques on a motorized treadmill.  $\text{PO}_{2\text{is}}$  was determined, before and after GLI superfusion ( $5 \text{ mg}\cdot\text{kg}^{-1}$ ), via phosphorescence quenching (G4) in the exposed MG and SOL muscles during electrically-induced contractions and blood flow by fluorescent-labeled microspheres ( $15 \mu\text{m}$ ). **RESULTS:** GLI decreased  $\text{VO}_{2\text{max}}$  in female ( $71.5 \pm 1.0$  vs  $67.9 \pm 1.5$ ) and F+OVX ( $76.8 \pm 1.4$  vs  $74.4 \pm 1.4$ ;  $p < 0.05$  for both) but not males ( $81.5 \pm 2.0$  vs  $80.8 \pm 2.0 \text{ mL}\cdot\text{O}_2\cdot\text{min}^{-1}\cdot\text{kg}^{-1}$ ;  $p > 0.05$ ). CS was reduced equivalently in all groups (8-11%;  $p < 0.05$ ). GLI reduced MG blood flow (female:  $49 \pm 9$  vs  $34 \pm 5$ ; male:  $50 \pm 5$  vs  $35 \pm 4$ ) and  $\text{PO}_{2\text{is}}$  (female:  $7.3 \pm 0.5$  vs  $6.1 \pm 0.5$ ; male:  $8.9 \pm 1.1$  vs  $7.2 \pm 0.5$ ), but not SOL, of female and male rats ( $p < 0.05$ ). Conversely, in F+OVX,  $\text{PO}_{2\text{is}}$  was reduced in the SOL ( $14.5 \pm 1.5$  vs  $10.2$

$\pm 1.1$ ;  $p < 0.05$ ), but not MG. **CONCLUSION:** These data support the role of vascular  $K_{ATP}$  channels in exercise tolerance (i.e. CS) by matching  $O_2$  delivery-utilization with ovariectomy shifting  $K_{ATP}$  channel effects from fast- to slow-twitch muscles. Supported by NIH Grants: HL108328 and F31HL145981

3270 Board #91 May 29 2:30 PM - 4:00 PM

### Dose-response Impact Of Resistance Training Frequency On Arterial Stiffness

Nicholas M. Beltz, Paige Ahrens, Mallory Daniels, Hannah Koch, Joey Lange, Garrett Janicki, Bryana Petersin, Elizabeth Schwab, Megan Werch. *University of Wisconsin-Eau Claire, Eau Claire, WI.*

Email: beltznm@uwec.edu

(No relevant relationships reported)

Arterial stiffness (AS) has been shown to underpin the development and progression of many cardiovascular diseases. Regular exercise promotes favorable changes in arterial health; however, investigations on the impact of resistance training (RT) alone on AS have shown mixed results. Moreover, the frequency design in which an RT program is completed on a weekly basis (i.e., the 'weekend warrior' approach) may impact overall changes to arterial health.

**PURPOSE:** We sought to examine the dose response impact of RT frequency over a 4-week period on arterial stiffness and blood pressure in college-aged resistance trained individuals. **METHODS:** Twenty-seven resistance trained males ( $n=16$ ) and females ( $n=11$ ) were randomized into three training groups differing in weekly RT frequency: a) 1-day (1D) per week ( $n=8$ ), b) 2-days (2D) per week ( $n=9$ ), or c) 3-days (3D) per week ( $n=9$ ). Resistance training exercises included: dumbbell chest press, seated cable row, leg press, calf raise, lateral pulldown, seated shoulder press, seated leg extension, and prone leg curl. Exercises were completed either two (3D), three (2D), or six (1D) sets of 10 repetitions at 65% 1-repetition max, depending on group. Arterial stiffness indices (augmentation index (AIx75), pulse pressure (PP), and augmentation pressure (AP)) were measured at baseline, midpoint, and after completing the 4-weeks using the SphygmoCor XCEL. A two-way (group x time) ANOVA with repeated measures was employed to examine differences in AS indices between groups. **RESULTS:** Total weekly load volumes were similar ( $p = 0.996$ ) across groups. There were no differences between 1D, 2D, and 3D for AIx75 ( $p = 0.429$ ), PP ( $p = 0.646$ ), and AP ( $p = 0.247$ ). **CONCLUSION:** Given no differences between groups, a total weekly load volume of RT can be completed in a single weekly session or across multiple sessions without any negative or favorable impact on AS.

3271 Board #92 May 29 2:30 PM - 4:00 PM

### Pulse Wave Velocity And Pulmonary Function Testing As Markers Of Cardiovascular Disease In Females

Eóin Durkan, Kevin O'Brien, Aidan J. Brady, Niall M. Moyna. *Dublin City University, Dublin, Ireland.*

Email: eoin.durkan@dcu.ie

(No relevant relationships reported)

**PURPOSE:** To assess the association of dynamic lung function, namely forced vital capacity (FVC) and forced expiratory volume in 1 sec ( $FEV_1$ ) and diffusing capacity for carbon monoxide with markers of cardiovascular disease in a cohort of asymptomatic female smokers. Cardiovascular disease is a major health problem worldwide, poor lung function has been associated with increased mortality in cardiovascular disease patients. Both are linked to smoking. Poor scores in arterial stiffness have been linked to restrictive pattern on spirometry. Relatively little is known about the association of other pulmonary function test scores to arterial stiffness. **METHODS:** 35 female participants, age  $51 \pm 9$  yrs,  $VO_{2peak}$   $22.5 \pm 4.7$  ml/kg/min,  $FEV_1/FVC$ :  $0.78 \pm 0.08$ ,  $FEV_1\%pred$   $88.9 \pm 17.85$ ,  $DLCO\%pred$   $79.05 \pm 14.43$  were recruited as part of a North East Inner City Dublin City Council 'Change for Life' exercise programme. Patients performed spirometry, and diffusing capacity for carbon monoxide (DLCO) was assessed. Body mass index (BMI) and waist:hip (W:H) ratio were calculated. EC was assessed via cardiopulmonary exercise test (CPET) upper body strength via handgrip dynamometer (HG) and lower body strength via 30 sec sit to stand test (30STS). Carotid-Femoral (caPWV) and Brachial-Ankle (baPWV) pulse wave velocity were assessed with the Vicorder unit. Continuous data are presented as mean  $\pm$  SD. Associations between continuous variables were scored using Pearson's r. **RESULTS:** Significant negative correlations were observed between caPWV and baPWV and  $FEV_1/FVC$ ,  $r = -.55$  and  $r = -.51$ . EC showed positive correlations with  $FEV_1$ ,  $r = .35$ , and FVC =  $.44$ , and negative correlations with baPWV,  $r = -.35$ . No association was seen between arterial stiffness measures and DLCO.

**CONCLUSIONS:** Female patients with significant smoking history and preserved pulmonary function may display signs of cardiovascular disease as evidenced by increased arterial stiffness.

3272 Board #93 May 29 2:30 PM - 4:00 PM

### EXERCISE TRAINING AMELIORATES CEREBROVASCULAR DYSFUNCTION IN ALZHEIMER'S DISEASE; A ROLE OF P2Y2 RECEPTOR AND ENDOPLASMIC RETICULUM STRESS

JUNYOUNG HONG<sup>1</sup>, Soon-Gook Hong<sup>2</sup>, Jonghae Lee<sup>1</sup>, Joon Young Park<sup>2</sup>, Jason Eriksen<sup>1</sup>, Yoonjung Park<sup>1</sup>. <sup>1</sup>UNIVERSITY OF HOUSTON, HOUSTON, TX. <sup>2</sup>Temple University, Philadelphia, PA.

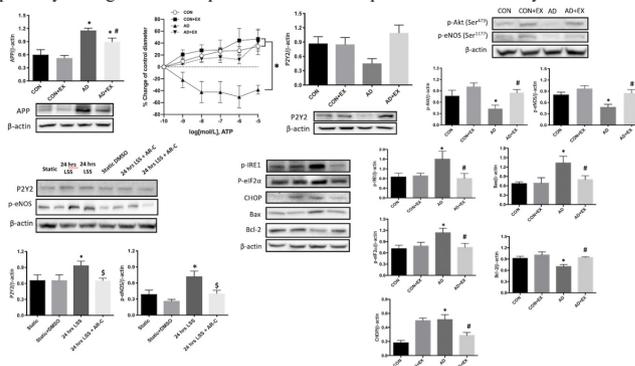
(No relevant relationships reported)

**PURPOSE:** To determine the protective effect of exercise training on P2Y2 receptor-mediated and ER stress-associated cerebrovascular dysfunction in AD.

**METHODS:** We used the control mice (CON; C57BL/6), CON with exercise training (CON+EX), AD mice (AD; APP/PS1) and AD with EX (AD+EX). At 7 to 9 months of age, CON+EX and AD+EX mice underwent 10-12 weeks of aerobic exercise training on the treadmill, running for an hour at 15m/min at a 5% grade for 5 days a week. To test the purinergic receptor-dependent vasoreactivity, a posterior cerebral artery (PCA) was isolated and pressurized, and then ATP (2-MeS-ATP, 1 nmol/L to 10  $\mu$ mol/L)-induced dose-dependent vasoreactivities were determined at 10-12 months of age. Human brain micro endothelial cells (HBMECs) were exposed to laminar shear stress (LSS) at 20 dyne/cm<sup>2</sup> for 30 mins, 2 hrs, and 24 hrs. Western blotting was utilized to analyze the expression of P2Y2 receptors, endothelial nitric oxide synthesis (eNOS), and ER stress signaling to define the effect of exercise training on cerebrovascular dysfunction.

**RESULTS:** ATP-induced vasodilation in PCA from CON mice, but it caused vasoconstriction in PCA from AD mice. Notably, exercise training reversed ATP-induced vasoconstriction in PCA from AD mice to vasodilation (AD+EX) comparable to CON mice. Exercise training reduced the elevation of APP expression and increased P2Y2 receptor and Akt/eNOS expression in AD mice brain. Also, LSS increased the expression of P2Y2 receptor and eNOS in HBMECs, but these increases were blunted by P2Y2 receptor inhibitor (AR-C) in HBMECs. Exercise training normalized the abnormal expression of ER stress markers; p-IRE1, p/t-eIF2 $\alpha$ , CHOP, and ER stress-associated apoptosis; Bax and Bcl-2 in AD mice brain.

**CONCLUSION:** Exercise training improves the cerebrovascular dysfunction in AD possibly through P2Y2 receptor-and ER stress-dependent endothelial dysfunction.



3273 Board #94 May 29 2:30 PM - 4:00 PM

### Dietary Nitrate Intake Improves Vascular Function And Walking Capacity In Patients With Peripheral Artery Disease

TeSean K. Wooden, Elizabeth J. Pekas, Ronald J. Headid, III, Won-Mok Son, Song-Young Park. *University of Nebraska at Omaha, Omaha, NE.*

Email: tesseanwooden@gmail.com

(No relevant relationships reported)

Peripheral artery disease (PAD) is the manifestation of atherosclerosis in the arteries of the legs, which reduces blood flow to the lower extremities and impairs walking capacity. Dietary nitrate has been used to reduce blood pressure (BP) and increase exercise tolerance in PAD. However, a standard dose, body mass normalized nitrate, for PAD has yet to be determined.

**PURPOSE:** To elucidate the impacts of a body mass-normalized dose of nitrate (0.11 mmol nitrate/kg) in the form of beetroot juice on resting heart rate (RHR), central and peripheral BP, vascular function, and exercise tolerance in patients with PAD.

**METHODS:** In a randomized crossover design, 10 patients with PAD (stage II-III) received either the nitrate supplement or placebo. At each visit, measures of RHR, central and peripheral BP, brachial and popliteal artery endothelial function (flow-

mediated dilation, FMD), arterial stiffness (pulse-wave velocity, PWV), augmentation index (AIx)), maximal walking capacity, and time to claudication (COT) were measured before and after nitrate and placebo.

**RESULTS:** There were significant group by time interactions ( $p < 0.05$ ) for systolic BP, endothelial function, and maximal walking distance. Systolic BP was significantly reduced ( $p < 0.05$ ) while popliteal FMD, brachial FMD, and maximal walking time significantly increased ( $p < 0.05$ ). Nitrate intake reduced central systolic BP and increased maximal walking time ( $p < 0.05$ ). There were trends for decreased diastolic BP ( $p = 0.15$ ), central diastolic BP ( $p = 0.06$ ), and central pulse pressure ( $p = 0.17$ ). There were no changes in RHR, deceleration time, max dP/dt, carotid-to-radial PWV, carotid-to-femoral PWV, carotid-to-ankle PWV, AIx, or COT ( $p > 0.05$ ).

**CONCLUSIONS:** These results indicate that a dose of nitrate ( $\sim 0.11$  mmol nitrate/kg) seems to be an effective dose for improving BP, vascular function, and walking capacity in patients with PAD.

**3274** Board #95 May 29 2:30 PM - 4:00 PM  
**Effects Of Aquatic Vs Land Based Exercise Training On Vascular Function In Peripheral Artery Disease Patients**

Kook-Eun Seo<sup>1</sup>, Elizabeth Pekas<sup>2</sup>, Song-young Park<sup>3</sup>. <sup>1</sup>Pusan National University, Busan, Korea, Republic of. <sup>2</sup>University of Nebraska- Omaha, Omaha, NE. <sup>3</sup>University of Nebraska- Omaha, Omaha, NE.

(No relevant relationships reported)

Peripheral artery disease (PAD) is an atherosclerotic disease that is associated with poor vascular function, walking impairment, and reduced quality of life. Walking is frequently recommended to improve vascular function and reduce symptoms; however, the efficacy of land-based walking training (LET) versus heated-water walking training (HWET) in PAD patients had not been elucidated. **Purpose:** We sought to compare effects of LET to HWET on vascular function, resting heart rate (RHR), exercise tolerance [6-min walking distance (6MWD), time to onset of claudication (COT)], muscular strength, physical function, body composition, and resting metabolic rate (RMR) in PAD patients. **METHODS:** PAD patients ( $n = 53$ ) were recruited and randomly assigned to a LET group ( $n = 25$ ) or HWET group ( $n = 28$ ). The LET group performed a treadmill walking program while the HWET group performed a heated-water walking program for 12-weeks. Leg arterial stiffness (femoral-to-ankle pulse-wave velocity, legPWV), blood pressure (BP), ankle-brachial index (ABI), RHR, 6MWD, COT, muscular strength, physical function, body composition, and RMR were assessed before and after 12-weeks. **RESULTS:** There were significant group by time interactions ( $p < 0.05$ ) for legPWV, BP, RHR, 6MWD, COT, leg strength, body mass, body fat percentage, and RMR. Both groups significantly reduced ( $p < 0.05$ ) legPWV, BP, RHR, body mass, and body fat percentage, and HWET was significantly lower than LET ( $p < 0.05$ ). Both groups significantly increased ( $p < 0.05$ ) 6MWD, COT, leg strength, and RMR, and HWET group was significantly greater than LET ( $p < 0.05$ ). There were no significant changes ( $p > 0.05$ ) in ABI, grip strength, physical function, body mass index, or lean mass after 12 weeks. **CONCLUSIONS:** These results suggest that although treadmill walking may help improve vascular function, exercise tolerance, muscular strength, and body composition, heated-water walking may improve these measures to a greater extent in patients with PAD.

**3275** Board #96 May 29 2:30 PM - 4:00 PM  
**Comparison Of Whole-forearm And Skin Post-occlusive Reactive Hyperemia As Indices Of Microvascular Function**

Hugo Gravel, Nicholas Ravanelli, Parya Behzadi, Daniel Gagnon. *Montreal Heart Institute, Montreal, QC, Canada.*

(No relevant relationships reported)

**BACKGROUND:** Post-occlusive reactive hyperemia (PORH) is often used as a test of microvascular function. However, the method of PORH measurement and the reporting of PORH values varies widely between studies, from measurements on the skin or whole-forearm to reporting peak or cumulative PORH values. As such, the optimal measurement and reporting of PORH values remains unclear.

**PURPOSE:** To compare whole-forearm and skin PORH between older adults with conditions typically associated with microvascular dysfunction (type 2 diabetes, T2D), macrovascular dysfunction (non-diabetic coronary artery disease, CAD) and healthy controls (CTRL).

**METHODS:** We retrospectively analyzed data obtained from 13 T2D patients (61 ± 9 years, 6 M; 7 W), 21 CAD patients (65 ± 9 years, 18 M; 3 W) and 13 CTRL (65 ± 7 years, 9 M; 4 W). Forearm vascular conductance (FVC, duplex ultrasound) and cutaneous vascular conductance (CVC, laser-Doppler) were measured simultaneously before and for 3 minutes after 5 minutes of forearm ischemia. PORH was quantified as: absolute peak (Peak), change from baseline to peak ( $\Delta$ ) and area under the curve above baseline (AUC).

**RESULTS:** Baseline FVC ( $P = 0.84$ ) and CVC ( $P = 0.31$ ) were similar between groups. Peak FVC was similar between groups ( $P = 0.24$ ), while  $\Delta$ FVC tended to be reduced in

T2D compared to CAD ( $P = 0.06$ ) and CTRL ( $P = 0.07$ ). FVC AUC was reduced in T2D compared to CTRL ( $P = 0.03$ ), while values in CAD did not differ from T2D or CTRL. Peak CVC (T2D:  $P = 0.04$ , CAD:  $P = 0.02$ ) and  $\Delta$ CVC (T2D:  $P = 0.03$ , CAD:  $P = 0.01$ ) were reduced in T2D and CAD. There was a trend for CVC AUC to differ between groups ( $P = 0.06$ ). The different indices of PORH for a given measurement (forearm vs skin) were strongly correlated ( $r = 0.755$  to  $0.906$  between FVC descriptors,  $r = 0.768$  to  $0.991$  between CVC descriptors, all  $P < 0.001$ ). However, FVC indices of PORH weakly correlated with CVC indices ( $r = 0.237$  to  $0.374$ ,  $P = 0.01$  to  $0.11$ ).

**CONCLUSIONS:** Whole-forearm and skin PORH provide different information on microvascular function in older adults. A decreased PORH in the whole-forearm appears to be a feature of T2D and not CAD, while a decreased PORH in forearm skin seems to be detectable in both T2D and CAD.

**3276** Board #97 May 29 2:30 PM - 4:00 PM

**Role Of Akt And Mapk Signals Balancing In The Exercise-regulated Phenotype-switching In Spontaneously Hypertensive Rats**

Lin Zhang, Lijun Shi. *Beijing Sport University, Beijing, China.*  
 Email: zhanglinbsu@126.com

(No relevant relationships reported)

The mechanisms regulating vascular smooth muscle cell (VSMC) phenotype switching and the critical signal modulation affecting the VSMCs remain controversial. Multiple studies have shown that physical exercise acts as an effective drug in preventing elevated blood pressure and improving vascular function.

**PURPOSE:** This study was designed to explore the influence of aerobic exercise on the suppression of VSMC phenotype switching by balancing of the Akt (protein kinase B) and mitogen-activated protein kinase (MAPK) signaling pathways. **METHODS:** Twelve-week old spontaneously hypertensive rats (SHRs) and age-matched normotensive rats (WKYs) were subjected to exercise (SHR-EX and WKY-EX) and sedentary (SHR-SED and WKY-SED) treatment for 8 weeks before measuring the vascular morphological and structural performances. **RESULTS:** (1) The thickness of thoracic aortas was significantly increased in the SHR-SED versus the WKY-SED ( $99.4 \pm 1.97$  vs  $83.12 \pm 1.45$   $\mu$ m,  $p < 0.01$ ). Physical exercise significantly suppressed the thickening of the blood vessel wall in the SHR-EX compared to SHR-SED ( $92.5 \pm 1.52$  vs  $99.4 \pm 1.97$   $\mu$ m,  $p < 0.05$ ). (2) Exercise training induced reverse expression of VSMC protein markers in SHR-EX group versus SHR-SED group ( $\alpha$ -SM-actin:  $0.91 \pm 0.04$  vs  $0.71 \pm 0.03$ ,  $p < 0.05$ ; calponin:  $0.97 \pm 0.05$  vs  $0.76 \pm 0.05$ ,  $p < 0.05$ ; and OPN:  $1.83 \pm 0.16$  vs  $2.32 \pm 0.18$ ,  $p < 0.05$ ). (3) The phosphorylated Akt was significant upregulated in SHR-EX group versus SHR-SED group ( $0.98 \pm 0.05$  vs  $0.75 \pm 0.04$ ,  $p < 0.05$ ). However, the expression of phosphorylated ERK ( $1.34 \pm 0.12$  vs  $1.69 \pm 0.09$ ), and phosphorylated p38 MAPK ( $1.06 \pm 0.04$  vs  $1.25 \pm 0.03$ , both  $p < 0.05$ ) were significant downregulated in the SHR-EX versus the SHR-SED. (4) VSMCs and whole vessels were treated by inhibitors, p-Akt inhibitor, p-ERK inhibitor and p-p38 MAPK inhibitor, respectively. It is important to note that a significant reverse regulatory relationship was observed between the expression levels of MAPK and contractile markers in both normotensive and spontaneously hypertensive rats. **CONCLUSION:** Aerobic exercise regulates VSMC phenotype switching by balancing the Akt and MAPK signaling pathways in SHRs.

**3277** Board #98 May 29 2:30 PM - 4:00 PM  
**Preliminary Study: Effect Of Body Fat Percentage On Arterial Stiffness In Young Healthy Hispanic Males**

Rachel C. Reyes, Nolan Mackey, Sang Ouk Wee. *California State University, San Bernardino, San Bernardino, CA.*

Email: 005907859@coyote.csusb.edu

(No relevant relationships reported)

**Introduction:** Obesity is a serious health concern worldwide and it is a common health condition in Hispanic population. High body fat percentage is inversely related to aerobic fitness and increased arterial stiffness, which is an independent CVD risk factor. However, there is

limited data about the effects of body fat percentage on arterial stiffness in Hispanic population. **Purpose:** To investigate the effects of Body Fat Percentage (BFP) on arterial stiffness in young healthy Hispanic males. **Methods:** Ten young (5 in each group, age: Low Fat group (LF, BFP < 25%) =  $23.2 \pm 1.8$  yrs, High Fat group (HF, BFP > 25%) =  $22.8 \pm 4.3$  yrs) healthy, casually active Hispanic males volunteered for the study. Aerobic capacity ( $VO_{2peak}$ ) was measured by metabolic cart during graded exercise testing on the treadmill. Hemodynamic variables including

blood pressure (BP) and heart rate were measured in supine position by automated BP monitor. BFP was measured by Dual-Energy X-ray Absorptiometry (DXA) and arterial stiffness indices including heart rate normalized augmentation index (AIx@75) and Pulse Wave Velocity (PWV)

were acquired by tonometer and ambulatory BP monitor, respectively. **Results:** HF group exhibited significantly lower aerobic capacity ( $41.64$  ml/kg/min) when compared to LF group ( $48.86$  ml/kg/min) ( $p < 0.05$ ). However, there was no significant

difference in hemodynamic variables including systolic BP, diastolic BP and HR ( $p > 0.05$  for all). In addition, PWV (HF vs. LF;  $5.5 \pm 0.5$  m/s vs.  $5.3 \pm 0.4$  m/s) and  $AIx@75$  (HF vs. LF:  $0.0\% \pm 13.8\%$  vs.  $-8.8\% \pm 5.3\%$ ) were not statistically different between groups ( $p > 0.05$  for both) **Conclusion:** Although HF group exhibited significantly lower aerobic capacity, BFP does not affect arterial stiffness in young casually active Hispanic males. Future study with more participants will be needed.

**3278** Board #99 May 29 2:30 PM - 4:00 PM  
**Impact Of Smoke Exposure On  $VO_{2max}$  And Arterial Stiffness In Wildland Firefighters: A Pilot Study**

Zachary Zeigler, Laura Verdusco, Payton Greer, Devin Vigneault, Greta Gardner, Lourdes Herrera, Justin Mcelfresh, Trevor Nordin. *Grand Canyon University, mesa, AZ.*  
 Email: zachary.zeigler@gcu.edu  
 (No relevant relationships reported)

**Purpose:** Inhalation of wildfire smoke can cause reduced lung function, chest pain, fatigue, and depressed respiratory immune defenses. Those at increased risk for these adverse effects would be wildland firefighters (WLF). Aerobic fitness is a key component of WLF performance. Additionally, it is known that higher levels of aerobic fitness correlate with lower levels of cardiovascular (CV) morbidity and mortality. The impact of wildland smoke exposure on CV health among WLF is unknown.

**Methods:** WLF from the Arizona high country were recruited for this study. WLF were asked to come to the lab at Grand Canyon University before and after fire season. WLF were asked to fill out a survey assessing the number of seasons they have actively engaged in wildland firefighting. Following anthropometric measurements, subjects had their carotid-femoral Pulse Wave Velocity (cfPWV) and  $VO_{2peak}$  measured. Identical measurements were taken before and after fire season. Hierarchical regression was completed to assess the relationship between the number of fire seasons completed and  $VO_{2peak}$ . Paired t-test was completed for pre-post testing.

**Results:** Twenty-eight subjects completed initial testing while 22 returned for post-testing. Subjects were  $31.0 \pm 5.7$  yrs., with a BMI of  $25.7 \pm 3.0$  kg/m<sup>2</sup>,  $VO_{2peak}$  of  $55.4 \pm 6.6$  mL/kg/min and completed on average  $10.6 \pm 5.8$  seasons of wildland firefighting. Hierarchical regression was conducted with age in model one and number of seasons in model two,  $VO_{2peak}$  was the criterion variable. Model one was not a significant predictor of  $VO_{2peak}$ . Model two significantly explained 23% of the variance in  $VO_{2peak}$  ( $P=0.044$ ). Significant reduction in absolute  $VO_{2peak}$  ( $4.3 \pm 6$  vs  $3.2 \pm 1.9$  L/min,  $P<0.04$ ) and significant increases in cfPWV ( $6.0 \pm 1$  vs.  $6.6 \pm 7$  m/s,  $P<0.042$ ) were seen following fire season.

**Conclusion:** This pilot study suggests that the duration of a WLF career may negatively impact CV health.

**3279** Board #100 May 29 2:30 PM - 4:00 PM  
**Exercise Mediates Epigenetic Suppression Of LTCC And  $BK_{Ca}$  Channel In Mesenteric Arteries Of Hypertensive Rats**

Lijun Shi, Yanyan Zhang. *Beijing Sport university, Beijing, China.*  
 Email: l\_j\_shi72@163.com  
 (No relevant relationships reported)

Regular exercise is a lifestyle intervention for controlling hypertension and has an improving effect on vascular function. Voltage-gated L-type  $Ca^{2+}$  (LTCC) and large-conductance  $Ca^{2+}$ -activated  $K^{+}$  ( $BK_{Ca}$ ) channels are two principal mediators of vascular smooth muscle contractility and arterial tone. Exercise-induced LTCC and  $BK_{Ca}$  channel alterations in arterial myocytes may contribute to the improvement of vascular function in pathological conditions. However, the mechanism underlying the functional changes of these ion channels is still unclear but critical for understanding the mechanistic basis of reliable arterial performance. **PURPOSE:** To investigate the role of DNA methylation in exercise-induced reprogramming of LTCC and  $BK_{Ca}$  channel in mesenteric arteries from spontaneously hypertensive rats (SHRs). **METHODS:** Twelve-week-old male SHRs and normotensive Wistar-Kyoto rats (WKYs) were assigned into sedentary and exercise groups. Exercise groups were performed a moderate-intensity treadmill running (about 55-65% of maximal aerobic velocity, 20 m/min, 0% grade, 60 min, 5 days/week). After 12 weeks, patch clamp study, Western blot, qPCR and bisulfite sequencing PCR were used to detect the LTCC and  $BK_{Ca}$  channel currents, protein expression and mRNA level of LTCC  $\alpha 1c$  and  $BK_{Ca}$   $\beta 1$  subunits, DNA methylation level of  $\alpha 1c$  and  $\beta 1$  gene promoter region. **RESULTS:** Exercise training significantly decreased the systolic blood pressure in both WKYs ( $139.5 \pm 0.48$  vs.  $132.3 \pm 0.56$  mmHg,  $P<0.05$ ) and SHRs ( $199.4 \pm 0.45$  vs.  $191.2 \pm 0.71$  mmHg,  $P<0.05$ ). Exercise inhibited hypertension-induced upregulation of LTCC ( $-16.0 \pm 1.6$  vs.  $-11.4 \pm 1.5$  pA/pF,  $P<0.05$ ) and  $BK_{Ca}$  ( $43.7 \pm 2.8$  vs.  $23.1 \pm 1.6$  pA/pF,  $P<0.05$ ) channel current density of mesenteric arterial myocytes by repressing LTCC  $\alpha 1c$  ( $2.8 \pm 0.3$  vs.  $1.7 \pm 0.2$ ,  $P<0.05$ ) and  $BK_{Ca}$   $\beta 1$  ( $1.7 \pm 0.3$  vs.  $0.8 \pm 0.2$ ,  $P<0.05$ ) subunit expression. DNA bisulfite sequencing PCR showed that chronic exercise increased CpG methylation at  $\alpha 1c$  ( $81.3 \pm 1.6$  vs.  $87.9 \pm 0.8\%$ ,  $P<0.05$ ) and  $\beta 1$  ( $17.7 \pm 0.4$

vs.  $25.2 \pm 2.0\%$ ,  $P<0.05$ ) gene promoter in SHR mesenteric arteries. **CONCLUSION:** Exercise suppresses LTCC and  $BK_{Ca}$  channel function via hypermethylation of  $\alpha 1c$  and  $\beta 1$  subunits, which contributes to the restoration of mesenteric arterial function and vasodilation during hypertension.

**3280** Board #101 May 29 2:30 PM - 4:00 PM  
**Evaluation Of Functional Sympatholysis Occurring Within Contracting Skeletal Muscle Microvasculature In Humans**

Masashi Ichinose<sup>1</sup>, Mikie Nakabayashi<sup>2</sup>, Nozaki Kanichiro<sup>2</sup>, Shotaro Sasaki<sup>2</sup>, Yumie Ono<sup>2</sup>. <sup>1</sup>Meiji University, Tokyo, Japan. <sup>2</sup>Meiji University, Kanagawa, Japan.  
 Email: ichinose@meiji.ac.jp  
 (No relevant relationships reported)

The ability of contracting skeletal muscle to blunt sympathetic vasoconstriction, termed functional sympatholysis, is thought to contribute to supplying adequate blood to the exercising muscle despite increased sympathetic tone. However, previous studies in humans primarily investigated vascular responses of exercising limb as a whole that reflects not only responses of contracting skeletal muscles but also responses of inactive tissues such as skin, adipose and bones. **PURPOSE:** We aimed to more directly investigate the functional sympatholysis occurring within exercising skeletal muscle in humans. **METHODS:** In 26 healthy male volunteers, we examined the effects of acute sympathoexcitation by 90-s forehead cooling at rest and during dynamic handgrip exercise at 10% and 30% of maximum voluntary contraction (10%Ex and 30%Ex), respectively. The handgrip exercises were continued 3 min and forehead cooling was applied at latter half of the exercise period. The subjects also performed handgrip exercises without forehead cooling as control conditions. We employed near-infrared diffuse correlation spectroscopy, an emerging optical technique for noninvasive measurement of deep tissue hemodynamics, to continuously measure the microcirculatory blood flow index (BFI) within the flexor digitorum superficialis muscle, the muscle primarily responsible for handgrip. **RESULTS:** The acute sympathoexcitation induced significant decrease in vascular conductance (BFI / mean arterial pressure) at rest (baseline vs. forehead cooling:  $1.00 \pm 0$  vs.  $0.75 \pm 0.03$  AU,  $p < 0.05$ ) and during 10%Ex (control vs. forehead cooling:  $1.66 \pm 0.08$  vs.  $1.32 \pm 0.10$  AU,  $p < 0.05$ ), but not during 30%Ex (control vs. forehead cooling:  $4.00 \pm 0.56$  vs.  $3.66 \pm 0.50$  AU,  $p > 0.05$ ). In addition, the percentage reduction in vascular conductance by forehead cooling was significantly decreased during 30%Ex compared to rest ( $-25.2 \pm 2.5$  vs.  $-4.9 \pm 5.1\%$ ,  $p < 0.05$ ). **CONCLUSIONS:** Our study demonstrated the functional sympatholysis occurring within the contracting skeletal muscle microvasculature in humans. Furthermore, our results revealed the clear intensity-dependent response such that mild exercise hardly interferes with sympathetic vasoconstriction, whereas moderate exercise substantially attenuates it.

**3281** Board #102 May 29 2:30 PM - 4:00 PM  
**Continuous Physical Activity Modulates Arterial Stiffening In Young People: A Prospective Longitudinal Observational Study**

Masato Nishiwaki<sup>1</sup>, Naoyuki Matsumoto<sup>2</sup>. <sup>1</sup>Osaka Institute of Technology, Osaka, Japan. <sup>2</sup>Prefectural University of Kumamoto, Kumamoto, Japan.  
 Email: masato.nishiwaki@oit.ac.jp  
 (No relevant relationships reported)

**PURPOSE:** Higher physical activity is well known to prevent age-related increases in arterial stiffness in middle-aged and older people. However, no data are available concerning prospective longitudinal studies between physical activity and arterial stiffness, especially in young people. Therefore, this prospective longitudinal observational study aimed to examine the effects of continuous physical activity on arterial stiffening in young people.

**METHODS:** The data of the longitudinal study analyzed from 79 normal healthy young men and women ( $19.2 \pm 0.2$  years at baseline). At baseline (pre) and after 4-year follow-up (post), arterial stiffness, which was measured by using Cardio-Ankle Vascular Index (CAVI) and regular physical activity levels, which were measured by using International Physical Activity Questionnaire (IPAQ), were assessed. At each time point, participants were classified as having high (H) or low (L) physical activity based on the Physical Activity Reference for Health Promotion 2013 in Japan (23 Metabolic Equivalent Tasks-h/week), and then were finally divided into LL, HL, or HH groups.

**RESULTS:** After follow-up period, in addition to body weight, body mass index, and blood pressure, CAVI values of all participants significantly increased (Pre,  $5.7 \pm 0.1$  unit; Post,  $6.1 \pm 0.1$  unit). There were no significant differences in baseline CAVI values across the groups (LL,  $5.7 \pm 0.1$  unit; HL,  $5.7 \pm 0.1$  unit; HH,  $5.8 \pm 0.1$  unit). However, the changes in CAVI from pre to post were significantly lower in HH group than in LL group ( $P < 0.05$ ). With the status of continuous physical activity increasing, significant decreasing trends were observed in CAVI (LL,  $0.6 \pm 0.1$  unit; HL,  $0.4 \pm 0.1$  unit; HH,  $0.1 \pm 0.1$  unit,  $P < 0.05$ ).

**CONCLUSIONS:** These findings indicate that age-related increase in arterial stiffness is observed even in young healthy people. However, continuous higher physical activity can prevent this age-related arterial stiffening in young people.

**3282** Board #103 May 29 2:30 PM - 4:00 PM

**The Diversity Effect Of Exercise On Endothelialfunction In Postmenopausal Women With ACE D/I Polymorphism**

Yuanyuan LYU<sup>1</sup>, Lingxiao HE<sup>2</sup>, Kaiyu XIONG<sup>1</sup>, Li Zhao<sup>1</sup>.  
<sup>1</sup>Beijing Sport University, Beijing, China. <sup>2</sup>Catholic University of Leuven, Leuven, Belgium.  
Email: lvyuanyuan2938@aliyun.com  
(No relevant relationships reported)

**PURPOSE:** Increased incidences of cardiovascular disorder and metabolic syndrome particularly in postmenopausal women have raised curiosity for the underlying factors. One potential mechanism by which endothelial dysfunction may promote early arterial stiffness is by causing estrogen deficiency. It is reported that physical exercise counteracts the occurrence of above disorders, while a few others show no change. The training response differs among individuals partly due to genetic composition. Angiotensin-converting enzyme (ACE) insertion/deletion (D/I) polymorphism related to physical performance in athletes has been well-reported. The present study was to observe the effects of 12 weeks exercise (aerobic exercise and resistance training) on endothelial function in postmenopausal women with different D/I polymorphism of ACE gene.

**METHODS:** 122 postmenopausal women aged 45-75 years were randomly divided into aerobic exercise group (DI/II=65, DD=6) and resistance training group (DI/II=42, DD=9). Body composition, TC, HDL, LDL, endothelial function, endothelium-derived relaxing factor and contracting factor were analyzed.

**RESULTS:** TC, blood lipid abnormality rate, blood glucose and visceral fat in DI/II type were decreased more significantly after aerobic exercise compared with DD type. Aerobic exercise showed markedly positive effects in LDL, hyperglycemia, overweight/obesity, high body fat rate, abnormal waist-hip ratio and visceral fat in DI/II, while resistance training in LDL, blood glucose (5.34±0.73 vs 4.46±0.34mmol/l, P<0.01), waist-hip ratio and visceral fat (96.60±13.84 vs 61.33±8.65cm<sup>2</sup>, P<0.05) in DD type. Aerobic exercise showed more obviously increased FMD (9.65±1.85 vs 11.00±1.99%, P<0.05), NO (68.31±4.67 vs 76.38±4.01umol/l, P<0.05), NO/ET-1 (0.91±0.11 vs 1.04±0.11, P<0.05) and decreased SBP (123.84±15.98 vs 109.89±13.56mmHg, P<0.05), DBP in DI/II than in DD type. Resistance training increased FMD (7.12±0.70 vs 9.56±0.78%, P<0.05), NO/ET-1 and decreased SBP, DBP, baPWV, ET-1, AngII more significantly in DD type than in DI/II type.

**CONCLUSIONS:** Exercise positively influences endothelial functions, independent of ACE D/I polymorphism; and DI/II carriers show a better response to aerobic exercise, while DD carriers to resistance exercise.

**3283** Board #104 May 29 2:30 PM - 4:00 PM

**Endothelial Function In Young Adults Reporting Histories Of Chronic Resistance Activity**

Dustin W. Davis<sup>1</sup>, Matthew J. Garver<sup>2</sup>, Whitley J. Stone<sup>3</sup>, Meera Penumetcha<sup>2</sup>, Josie N. Hair<sup>2</sup>, Nicolas M. Philipp<sup>2</sup>. <sup>1</sup>University of Nevada, Las Vegas, Las Vegas, NV. <sup>2</sup>University of Central Missouri, Warrensburg, MO. <sup>3</sup>Western Kentucky University, Bowling Green, KY.  
Email: dustin.wyatt.davis@gmail.com  
(No relevant relationships reported)

Endothelial dysfunction is a risk factor for cardiovascular disease (CVD) and is predictive of adverse events. However, endothelial function is rarely measured in apparently healthy, asymptomatic individuals that may benefit from early detection. Chronic cardiorespiratory endurance (CRE) activity appears to improve endothelial function and decrease CVD risk, but the role of chronic resistance activity is less clear. **PURPOSE:** The primary aim of this study was to describe endothelial function in young adults reporting histories of chronic resistance activity and minimal CRE activity. **METHODS:** Eight males (23.8 ± 2.2 yrs., 180.3 ± 7.6 cm, 100.8 ± 18.1 kg) and five females (24.6 ± 3.1 yrs., 164.9 ± 4.0 cm, 68.5 ± 4.2 kg) volunteered for digital peripheral arterial tonometry (PAT) and a one-repetition maximum (1-RM) barbell bench press. Endothelial function was measured as the logarithmic function of the reactive hyperemia index (LnRHI). Absolute strength was measured as the highest successful 1-RM lift (kg), and relative strength was measured as the bench press to body weight ratio (1-RM in kg / body mass in kg). Before PAT, participants fasted for 4 h and forwent alcohol, tobacco, vitamins, and ergogenic aids for 8 h. Before the 1-RM, participants fasted for 3 h, forwent the aforementioned substances for 8 h, and abstained from vigorous physical activity for 12 h. Independent *t*-tests compared the LnRHI between sexes. Effect size was calculated as Cohen's *d*. Pearson's *r* evaluated the relationships between absolute and relative strength and the LnRHI. Alpha level was set to .05 for all statistical tests. **RESULTS:** Males' LnRHI was significantly lower than females' (0.36 ± 0.12 vs. 0.84 ± 0.22);  $t(5.739) = -4.462, p = .005, d = -2.61$

and abnormal according to the manufacturer (LnRHI > 0.51 is normal and ≤ 0.51 is abnormal). There were significant, moderate, and negative correlations between the 1-RM and the LnRHI ( $r = -.60, p = .03$ ) and between the bench press to body weight ratio and the LnRHI ( $r = -.66, p = .01$ ). **CONCLUSIONS:** Endothelial function was lower in males than in females reporting chronic resistance activity and minimal CRE activity. Males who develop considerable upper-body strength via chronic resistance activity may exhibit endothelial dysfunction as young adults. More research is warranted.

**3284** Board #105 May 29 2:30 PM - 4:00 PM

**Vascular And Blood Flow Responses To Upper Limb Exercise In Individuals With Posttraumatic Stress Disorder**

Jennifer B. Weggen<sup>1</sup>, Aaron S. Autler<sup>1</sup>, Gina Tuzzolo<sup>1</sup>, Austin C. Hogwood<sup>2</sup>, Ashley M. Darling<sup>1</sup>, Kevin P. Decker<sup>1</sup>, Ryan S. Garten<sup>1</sup>. <sup>1</sup>Virginia Commonwealth University, Richmond, VA. <sup>2</sup>University of Virginia, Charlottesville, VA.  
Email: weggenjb@vcu.edu  
(No relevant relationships reported)

The physiological manifestations of posttraumatic stress disorder (PTSD) have been associated with an increase in risk of cardiovascular disease (CVD) independent of negative lifestyle factors. Peripheral vascular dysfunction may be a mechanism by which PTSD increases CVD risk. **PURPOSE:** This study sought to determine if blood flow regulation and peripheral vascular function are altered during exercise in individuals PTSD when compared to age-matched controls. **METHODS:** Sixteen individuals with PTSD (10 women, 6 men; age 24 ± 4 years), and twenty-four age- and sex-matched healthy controls (CTRL); 15 women, 9 men, 24 ± 4 years), participated in the study. Upper limb vascular function and blood flow was assessed during rhythmic, progressive handgrip exercise (at rest, 3 and 6 kilograms (kg)) with Doppler ultrasonography. Exercise-induced changes in mean arterial pressure (MAP), brachial artery (BA) flow mediated dilation (normalized for BA shear rate), BA blood flow, and arm vascular conductance (VC) were quantified at each workload. **RESULTS:** Although no significance was noted in MAP, BA flow mediated dilation, or blood flow between groups, the PTSD group reported significantly lower VC at the highest exercise workload (6 kg - PTSD: 2.04 ± 0.9; CTRL: 2.87 ± 1.0 mL·min<sup>-1</sup>·mmHg<sup>-1</sup>;  $p = 0.008$ ), when compared to the CTRL group. **CONCLUSION:** This study revealed that individuals with PTSD reported lower vascular conductance during upper limb arm exercise when compared to healthy controls. Further research is needed to determine if this finding translates to larger muscle mass exercise, potentially leading to exercise intolerance, as well as the potential mechanisms may be driving this dysfunction in individuals with PTSD, such as augmented sympathetic activity during exercise and/or microvascular dysfunction.

**3285** Board #106 May 29 2:30 PM - 4:00 PM

**Impaired Cardiovascular Responses To Acute Exercise In Adults With Cerebral Palsy**

Gustavo Aldama, Allison T. Bui, Ramon C. Ronquillo, Areum K. Jensen. San Jose State University, San Jose, CA.  
(No relevant relationships reported)

Cerebral palsy (CP) is a non-progressive and permanent neurological disorder leading to musculoskeletal dysfunction and immobility. A major clinical problem with CP is early development of cardiovascular diseases with increased rates of mortality. Due to the inevitability of motor dysfunction adults with CP can develop health risk factors, such as obesity and hypertension, at a higher rate compared to the general population. To date, the physiological basis for CP has not been established; how cardiovascular dynamics, such as heart rate (HR), blood pressure (BP), and blood flow (BF), are controlled in individuals with CP has never been identified. **PURPOSE:** To determine differential cardiovascular responses to acute dynamic exercise in adults with CP. **METHODS:** Total of ten adults with and without CP participated in the study. HR from ECG, beat-to-beat arterial BP from Finapres and brachial BP, and respiration via pneumobelt were continuously measured before, during and after 2 minutes of dynamic handgrip exercise at 35% and 50% of maximal voluntary contraction. In addition, diameter, blood velocity, and flow of the brachial artery were measured using Doppler ultrasound on the contracting arm throughout the experiment. **RESULTS:** HR was significantly increased to exercise from rest in both groups with no group differences (Δ9.8±1.2 control vs. Δ10.1±8.4 CP, bpm). Both control and CP groups had increases in BF during exercise compared to at rest (Δ132±22 control vs. Δ75±32 CP, ml/min). Mean BP was significantly increased to exercise from rest in control; however, there were only minor changes in BP to exercise from rest in CP group (Δ7.2±1.6 control, Δ2.2±0.1 CP, mmHg). **CONCLUSION:** While HR and BF increased to exercise from rest in similar fashion, BP did not change to exercise in adults with CP. Our preliminary data speculate that other mechanisms, possibly vascular contribution from non-contracting limbs, may contribute to impaired BP response during exercise in CP. Supported by CASA RSCA Infusion, Central RSCA, and Undergraduate Research Grant, SJSU

**3286** Board #107 May 29 2:30 PM - 4:00 PM  
**VALIDATION OF HEART-FEMORAL PULSE WAVE VELOCITY AS A MEASURE OF CENTRAL ARTERIAL STIFFNESS**  
 Lewis Fanney<sup>1</sup>, Elizabeth Kelsch<sup>1</sup>, Katie Burnet<sup>1</sup>, Gabe Zieff<sup>1</sup>, Daniel Credeur<sup>2</sup>, Keeron Stone<sup>3</sup>, Craig Paterson<sup>3</sup>, Simon Fryer<sup>3</sup>, Lee Stoner, FACSM<sup>1</sup>. <sup>1</sup>UNC Chapel Hill, Chapel Hill, NC. <sup>2</sup>University of Southern Mississippi, Hattiesburg, MS. <sup>3</sup>University of Gloucestershire, Gloucester, United Kingdom. (Sponsor: Lee Stoner, FACSM)  
 (No relevant relationships reported)

**BACKGROUND:** Central Pulse Wave Velocity (PWV) is the gold-standard measure of arterial stiffness and an important clinical parameter for evaluating cardiovascular risk. The most frequently used measure of central PWV is carotid-femoral PWV (cfPWV); however, cfPWV may be unsuitable for use in patients who are obese, have had an ischemic stroke, or those with advanced carotid artery atherosclerosis. A potential alternative is heart-femoral PWV (hfPWV), which is simpler to conduct as the measurement does not require assessment of the carotid artery. The aims of this study were to determine (1) the strength of the association between cfPWV and hfPWV; and (2) determine whether change in cfPWV is associated with change in hfPWV. **METHODS:** Thirty healthy participants (23.5 y ± 2.9, 53% F, BMI 24.1 ± 2.3) were recruited for Aim 1, and 20 participants (24.1 ± 3.1, 55% F, BMI 23.9 ± 2.5) for Aim 2. Using Doppler ultrasound, cfPWV was measured using the foot-foot method on ECG-gated doppler waveforms captured from the common carotid and superficial femoral arteries. hfPWV was measured using the R wave to the foot of the superficial femoral artery doppler waveform. To induce change in cfPWV (Aim 2) the upper leg was occluded to 60 mm Hg. To estimate inter-individual associations between cfPWV and hfPWV (Aim 1), Pearson's product moment correlation was used. To estimate intra-individual associations between change (cuff vs. baseline) in cfPWV and change in hfPWV (Aim 2), the repeated measures correlation package for R was used. **RESULTS:** There was a large positive correlation ( $r = 0.72$ , 95% CI 0.48-0.86,  $P < 0.001$ .) between hfPWV and cfPWV (Aim 1). There was also a large positive correlation between change in cfPWV and change in hfPWV ( $r = 0.83$ , 95% CI 0.61-0.93,  $P < 0.001$ ). **CONCLUSION:** The current findings indicate that cfPWV and hfPWV are strongly associated, and that change in cfPWV is strongly associated with change in hfPWV.

**3287** Board #108 May 29 2:30 PM - 4:00 PM  
**Exaggerated Pulsatility During Exercise Is Associated With Reduced Muscle Strength And Quality In Elderly Hypertensives**  
 Stephen Fischer, Arun Maharaj, Arturo Figueroa, FACSM. *Texas Tech University, Lubbock, TX.* (Sponsor: Arturo Figueroa, FACSM)  
 Email: stephen.fischer@ttu.edu  
 (No relevant relationships reported)

It is well-established that hypertensive individuals have an exaggerated systolic blood pressure in response to exercise. Leg muscle weakness is related to greater left ventricular (LV) mass in hypertensive individuals via exaggerated increases in blood pressure during aerobic exercise. Pulse pressure (PP) is an indicator of LV pulsatile hemodynamic load. Increased PP is associated with LV hypertrophy and dysfunction in older adults. **PURPOSE:** To determine differences in PP responses to resistance exercise in normotensive versus hypertensive older adults and the influence of lean mass and strength on these responses. **METHODS:** Nine normotensive (NTN) and 11 hypertensive (HTN) older adults (NTN aged 66 ± 3, HTN aged 68 ± 5) performed plantar flexion exercise at progressively increasing intensities (5, 15 and 30% of estimated calf flexion 1RM). During exercise, blood pressure was recorded in the right arm using an automated oscillometric device. Body composition was measured using dual-energy x-ray absorptiometry. Leg strength was measured using the leg press 10 repetition maximum (10RM). Leg muscle quality (LMQ) was calculated as leg strength (kg)/leg lean mass (kg). **RESULTS:** PP response to plantar flexion exercise at 30% of 1RM was significantly greater in the HTN (15 ± 1 mmHg) compared to NTN (6 ± 4 mmHg,  $p = .02$ ). LMQ was significantly greater in the NTN (5.85 ± .75 kg/kg) compared to the HTN (5.00 ± 1.0 kg/kg,  $p = .05$ ). Leg lean mass was not significantly different between groups. PP response at 30% was negatively correlated with LMQ ( $r = -.570$ ,  $p = .009$ ) and leg strength ( $r = -.465$ ,  $p = .039$ ). **CONCLUSIONS:** Hypertensive older adults have a greater pulse pressure response to calf flexion exercise when compared to normotensives. Reduced leg muscle strength and quality, but not mass, may contribute to the exaggerated pulse pressure response to calf flexion exercise in older adults with hypertension.

**3288** Board #109 May 29 2:30 PM - 4:00 PM  
**Abstract Withdrawn**

**3289** Board #110 May 29 2:30 PM - 4:00 PM  
**Endothelial Function Contributes To Acute Changes In Pulse Wave Velocity**  
 Kathleen Stanford<sup>1</sup>, Jade Blackwell<sup>1</sup>, Daniel Credeur<sup>2</sup>, Jake Diana<sup>1</sup>, Craig Paterson<sup>3</sup>, Keeron Stone<sup>3</sup>, Gabriel Zieff<sup>3</sup>, Simon Fryer<sup>3</sup>, Lee Stoner, FACSM<sup>1</sup>. <sup>1</sup>University of North Carolina at Chapel Hill, Chapel Hill, NC. <sup>2</sup>University of Southern Mississippi, Hattiesburg, NC. <sup>3</sup>University of Gloucestershire, Gloucester, United Kingdom. (Sponsor: Lee Stoner, FACSM, FACSM)  
 (No relevant relationships reported)

**BACKGROUND:** Pulse-wave velocity (PWV) can potentially be used to assess acute change in endothelial function. Previous studies have reported that increasing or decreasing nitric oxide bioavailability results in reciprocal changes to PWV. However, nitric oxide is not the only molecule regulating endothelial function and at this time, no in-vivo studies have examined whether PWV changes in acute, non-specific endothelial dysfunction. **PURPOSE:** Determine effects of acute endothelial dysfunction on PWV. In this study, retrograde shear stress was induced by increasing retrograde flow for 30 minutes. Our hypothesis is that acute endothelial dysfunction will result in decreased in PWV. **METHODS:** Twenty-two young, healthy adults (23.8 years [SD 4.1], 16 F, BMI 22.8 kg/m<sup>2</sup> [SD 2.8]) were recruited. PWV and flow-mediated dilation (FMD) were measured at baseline and immediately following the endothelial dysfunction protocol. FMD was measured to confirm the presence of endothelial dysfunction. PWV was measured between the upper arm and wrist using an oscillometric device, and brachial FMD using ultrasound. The association between PWV and FMD was assessed using Pearson's product moment correlation. Linear mixed models were used to assess baseline versus endothelial dysfunction protocol changes in PWV and FMD, controlling for within-subject changes in mean arterial pressure and the shear rate area under the curve, respectively. **RESULTS:** At baseline, there was a large association between FMD and PWV ( $r = 0.60$ , 95%CI: 0.23, 0.81). Following the endothelial dysfunction protocol, there was a moderate significant increase in PWV ( $\Delta = 0.38$  m/s, 95%CI: 0.07, 0.69, ES = 0.5) and a large significant decrease ( $\Delta = -3.10$ , 95%CI: -4.15, -2.05, ES = -1.3) in FMD. **CONCLUSIONS:** Acute change in PWV is at least partially driven by changes in endothelial function, indicating that PWV could be a useful tool for assessing endothelial function changes.

**3290** Board #111 May 29 2:30 PM - 4:00 PM  
**Validation Of Flow-mediated Slowing As A Measure Of Endothelial Function**  
 Alex N. Pomeroy<sup>1</sup>, Keeron Stone<sup>2</sup>, Jade Blackwell<sup>1</sup>, Jake C. Diana<sup>1</sup>, Simon Fryer<sup>2</sup>, Daniel Credeur<sup>3</sup>, Craig Paterson<sup>2</sup>, Gabriel Zieff<sup>3</sup>, Lee Stoner, FACSM<sup>1</sup>. <sup>1</sup>University of North Carolina at Chapel Hill, Chapel Hill, NC. <sup>2</sup>University of Gloucestershire, Gloucester, United Kingdom. <sup>3</sup>University of Southern Mississippi, Hattiesburg, MS. (Sponsor: Lee Stoner, FACSM)  
 (No relevant relationships reported)

**BACKGROUND:** Flow-Mediated Slowing (FMS) is a potentially simple, automated and user-objective test for assessing endothelial function. FMS can be defined as the minimum pulse wave velocity (PWV<sub>min</sub>) during reactive hyperemia. **PURPOSE:** The purpose of this study was to determine the effects of acute endothelial dysfunction on PWV<sub>min</sub>. It was hypothesized that endothelial dysfunction would increase PWV<sub>min</sub>. **METHODS:** 22 young, healthy adults (23.8 yrs ± 4.1, 73% F, 22.8 kg/m<sup>2</sup> ± 2.8) underwent simultaneous assessment of Flow-Mediated Dilation (FMD) and PWV<sub>min</sub> at baseline and immediately following 30min of an endothelial dysfunction protocol. FMD is the current gold-standard test of endothelial function and was used to confirm endothelial dysfunction. Endothelial dysfunction was induced by increasing retrograde shear stress in the brachial artery via inflation of a pneumatic tourniquet to 75 mm Hg around the forearm. PWV was measured from the upper-arm to the wrist using an oscillometric-based device, and brachial FMD was measured using duplex Doppler ultrasound. FMD (%) was calculated as the mean increase in diameter during reactive hyperemia, and PWV<sub>min</sub> as the minimum pulse wave velocity during reactive hyperemia. Linear mixed models were used to assess baseline versus endothelial dysfunction changes in PWV<sub>min</sub> and FMD, controlling for within-subject changes in mean arterial pressure. Inter-individual associations between baseline PWV<sub>min</sub> and FMD were examined using Pearson's product moment correlation, and intra-individual associations between change (baseline vs. endothelial dysfunction) in PWV and change in FMD using the repeated measures correlation package for R. **RESULTS:** The endothelial dysfunction protocol resulted in large effect size (ES) decrease in FMD ( $\Delta = -3.10$ , 95%CI: -4.15, -2.05, ES = -1.3), and a moderate significant

increase in PWV<sub>min</sub> ( $\Delta = 0.16$ , 95%CI: 0.05, 0.28, ES = 0.6). There was a moderate inter-individual association between FMD and PWV<sub>min</sub> ( $r = 0.46$ ), and a large intra-individual association between FMD and PWV<sub>min</sub> ( $r = -0.61$ ). **CONCLUSIONS:** Acute changes in PWV<sub>min</sub> may be a user-objective, automated, and viable tool for monitoring acute changes in endothelial function.

**3291** Board #112 May 29 2:30 PM - 4:00 PM  
**Can Racial Differences In Endothelial Dysfunction Be Explained By Mirnas?**

Dulce H. Gomez, Maitra Aldokhayyil, Adelola Adeyemo, Michael D. Brown, FACSM. *Auburn University, Auburn, AL.*  
(Sponsor: Michael D. Brown, FACSM)  
Email: dhg0008@auburn.edu  
(No relevant relationships reported)

MicroRNAs (miRs) are short noncoding RNAs that regulate gene expression post-transcriptionally. It is well documented that exercise improves endothelial function, possibly, by modifying flow-responsive miR expression (e.g. miRs-126\*, -92-a and -21). MiR-126\* is an anti-atherogenic miR that regulates vascular integrity, angiogenesis, and inflammation. Whereas, miR-92a and -21 are pro-atherogenic miRs that result in a reduction in endothelial nitric oxide synthase (eNOS) activity. MiR-92a targets the transcription factor Kruppel-like factor 4 (KLF4) leading to lower eNOS expression. Whereas miR-21 targets phosphatase and tensin homologue (PTEN) to inhibit activation of the PI3K/Akt signaling pathway involved in activating eNOS. We have shown that African Americans (AA) exhibit a low grade of chronic systemic inflammation, exaggerated response to inflammatory cytokines, and a higher prevalence of endothelial dysfunction compared to Caucasians (CA). **PURPOSE:** To investigate potential racial differences in miRs expression and downstream target proteins in activated endothelial cells (EC). **METHODS:** Human Umbilical Vein Endothelial Cells ( $n=6$  cell lines; 3 CA & 3 AA) were cultured under two conditions: Control or TNF- $\alpha$  (10 ng/mL) for 4 hours. Protein expression was measured for PTEN, KLF4, p-eNOS<sup>ser-117</sup> and eNOS. Total RNA was harvested to measure miR-21, miR-126\*, and miR92a. A two-way ANOVA was used to assess the effects of race and condition. **RESULTS:** No racial differences were found in protein expression of PTEN, KLF4, and eNOS at baseline or with TNF- $\alpha$  stimulation. AA had lower p-eNOS expression ( $p=0.008$ ) compared to CA ECs under both conditions. No racial differences were found in miR-126 and miR-21 in either condition. However, AA were trending towards higher miR-92a expression ( $p=0.07$ ) compared to CA ECs under both conditions. **CONCLUSIONS:** Although we show significantly lower levels of p-eNOS and higher miR-92a expression in activated ECs of AA compared to CA, KLF4 protein levels were not significantly different. Therefore, the specific miRs studied do not explain the racial differences observed in endothelial dysfunction in an inflammation model. Future research should investigate potential racial differences in how miRs respond to high laminar shear stress, as an exercise memetic.

**3292** Board #113 May 29 2:30 PM - 4:00 PM  
**Acute Hypotension Blunts Brachial Flow-mediated Dilatation In Young Healthy Men**

Yutaka Yamada<sup>1</sup>, Erika Iwamoto<sup>1</sup>, Rintaro Sakamoto<sup>1</sup>, Toru Neki<sup>1</sup>, Jun Sugawara<sup>2</sup>, Masaki Katayose<sup>1</sup>, Shigehiko Ogoh, FACSM<sup>3</sup>. <sup>1</sup>Sapporo Medical University, Sapporo, Japan. <sup>2</sup>National Institute of Advanced Industrial Science and Technology, Tsukuba, Japan. <sup>3</sup>Toyo University, Kawagoe, Japan.  
Email: yutaka.y.swim.8842@outlook.jp  
(No relevant relationships reported)

Recent clinical studies using a vasovagal syncope suggest that endothelial function is a key factor controlling blood pressure (BP) regulation during acute hypotension. Acute increase in BP is known to attenuate brachial flow-mediated dilatation (FMD). However, the influence of acute hypotension on peripheral FMD remains unclear. **PURPOSE:** To test the hypothesis that acute hypotension blunts brachial FMD, an index of endothelial function, in young healthy humans. **METHODS:** Twelve healthy men (21.8 $\pm$ 1.6 yrs; body mass index: 22.2 $\pm$ 1.6 kg/m<sup>2</sup>, mean $\pm$ standard deviation) underwent 3 trials of brachial FMD measurement. The trials involved a standardized FMD protocol (control trial), a trial with an abrupt decrease in BP via both thigh-cuff inflation and the deflation method (hypotension trial), and a trial with a decrease in shear rate (SR) via a shortened occlusion time for 3 min without a change in BP (SR reduction trial). Trials were randomized with 30-min intervals during a single visit. Duplex ultrasound was employed to measure brachial diameter and blood velocity. BP and heart rate were continuously measured using a non-invasive beat-to-beat BP monitoring system. To adjust the effect of SR area under the curve (SR<sub>AUC</sub>) on FMD, normalized FMD were calculated. **RESULTS:** There was a marked fall in mean arterial pressure during reactive hyperemia in the hypotension trial ( $-24\pm 6$  mmHg), but not in the control and SR reduction trials. SR<sub>AUC</sub> was attenuated in the SR reduction trial ( $p<0.001$ ), but not in the hypotension trial ( $p=0.316$ ), compared with the control trial. Thus, FMD was

attenuated in the hypotension and SR reduction trials compared with the control trial ( $p=0.003$  and  $p=0.043$ , respectively). The attenuation in FMD was greater in the hypotension trial than in the SR reduction trial ( $p=0.006$ ; control, 6.9% $\pm$ 3.5%; hypotension, 3.5% $\pm$ 1.7%; SR reduction, 5.0% $\pm$ 2.2%). After adjusting FMD using SR<sub>AUC</sub>, the normalized FMD remained attenuated in the hypotension trial ( $p=0.014$ ), but not in the SR reduction trial ( $p>0.05$ ). **CONCLUSION:** Current findings indicate that BP could be an important determinant of FMD. Blunted FMD of the peripheral arteries may be a physiological response to restore BP and/or prevent a further reduction in BP following acute hypotension in healthy humans.

**3293** Board #114 May 29 2:30 PM - 4:00 PM  
**The Association Between Physical Inactivity And Vascular Dysfunction May Be Related To Low Testosterone Concentrations**

Matthew C. Babcock, Jennifer M. Blankenship, Ashley Brubaker, Teresa L. Witten, Kerry L. Hildreth, Kerrie L. Moreau. *University of Colorado Anschutz Medical Campus, Aurora, CO.*  
(Sponsor: William Farquhar, FACSM)  
Email: matthew.babcock@cuanschutz.edu  
(No relevant relationships reported)

Increased sitting time is associated with increased arterial stiffness, poor cardiometabolic health outcomes, increased risk of developing cardiovascular disease, and all-cause mortality. Further, excess sitting time likely reduces aerobic capacity and increases adiposity, which have been shown to be related to low testosterone (T) in young men. Low T has been linked to increased arterial stiffness, however, it remains unclear how T may contribute to the associations between physical inactivity, adiposity, aerobic capacity, and vascular health. **PURPOSE:** To determine the influence of T on the relationships between VO<sub>2</sub>max, body composition, physical activity, endothelial function, and arterial stiffness. **METHODS:** 87 healthy male adults aged 18-75 years (mean $\pm$ SD; 53 $\pm$ 14 years, BMI=27.6 $\pm$ 4.4 kg/m<sup>2</sup>) underwent VO<sub>2</sub>max testing, physical activity monitoring (accelerometry), body composition (DXA), and vascular (endothelial function via brachial artery flow-mediated dilation, FMD; arterial stiffness via pulse wave velocity, PWV) testing. Serum T was measured under fasted conditions in the morning. **RESULTS:** Bivariate correlation analysis indicated that VO<sub>2</sub>max ( $p=0.003$ ,  $R=0.33$ ), body fat ( $p<0.001$ ,  $R=-0.42$ ), sitting time ( $p=0.020$ ,  $R=-0.28$ ), PWV ( $p=0.049$ ,  $R=-0.22$ ), and FMD ( $p=0.046$ ,  $R=0.24$ ) were related to T concentrations. Body fat ( $p<0.001$ ,  $R=-0.39$ ), VO<sub>2</sub>max ( $p<0.001$ ,  $R=0.41$ ), and sitting time ( $p=0.029$ ,  $R=0.24$ ) were correlated with PWV. Body fat ( $p=0.001$ ,  $R=0.44$ ) and VO<sub>2</sub>max ( $p=0.001$ ,  $R=0.41$ ), but not sitting time ( $p=0.185$ ,  $R=-0.17$ ), were related to FMD. After controlling for T using partial correlation analysis, sitting time was no longer significantly related to PWV ( $p=0.297$ ,  $R=0.141$ ), however correlation coefficients between PWV and VO<sub>2</sub>max or body fat were unchanged. **CONCLUSIONS:** These data indicate that the association between physical inactivity may be related to low T concentrations.

**3294** Board #115 May 29 2:30 PM - 4:00 PM  
**Preliminary Study Of Ethnic Differences In Hemodynamic Responses Following High Intensity Exercise: Wave Separation Analysis**

Sang Ouk Wee, Rachel C. Reyes, Zhaojing Chen, Jason Ng. *California State University San Bernardino, SAN BERNARDINO, CA.*  
Email: sangouk.wee@csusb.edu  
(No relevant relationships reported)

The Hispanic population is at a high risk of developing cardiovascular disease (CVD), especially cerebrovascular disease. High blood pressure (BP) and inadequate BP regulation are related to future CVD events. Sympathoexcitatory stimulation through high intensity exercise temporarily increases risk of cardiovascular events and alters hemodynamics. It is unknown whether there is an ethnic difference in the regulation of BP and pulse wave characteristics—including forward or reflected pressure waves—between Hispanic and White populations. **PURPOSE:** To investigate the ethnic differences in BP and pulse wave characteristics measured with wave separation analysis in response to high intensity exercise. **METHODS:** 10 male volunteers (9 Hispanic; 23  $\pm$  3 yr, 1 White; 21 yr) completed the study. Aerobic capacity was measured by indirect calorimetry and a treadmill graded exercise test (GXT). Brachial BP was measured by an automated BP monitor. Central hemodynamic variables and pulse waves were obtained by tonometer at baseline, 15-minute, and 30-minute after high intensity treadmill exercise (GXT). Pulse waves were further separated into forward pulse height (FH) and reflected pulse height (RH) for analysis. A 2 x 3 repeated measure analysis of variance was performed to investigate ethnic differences in BP and pulse wave responses to high intensity exercise. **RESULTS:** (See table 1) There were no significant ethnic differences in brachial systolic BP, brachial diastolic BP, aortic systolic BP, aortic diastolic BP, and aortic mean arterial pressure ( $p > 0.05$  for all). Furthermore, FH and RH were not statistically different between Hispanic and White males at rest and following high intensity exercise ( $p > 0.05$ ). **CONCLUSION:**

Results suggest that blood pressure, forward and reflected pulse height exhibited similar at rest and following high intensity exercise in young, healthy, casually active Hispanic and white males.

**Table 1. Blood pressure and pulse wave characteristic responses to high intensity exercise in**

|                   | Baseline   | Hispanic (N = 9) |             | White (N = 1) |             |             |
|-------------------|------------|------------------|-------------|---------------|-------------|-------------|
|                   |            | 15 min post      | 30 min post | Baseline      | 15 min post | 30 min post |
| Aortic SBP (mmHg) | 98 ± 9     | 97 ± 9           | 94 ± 8      | 100 ± N/A     | 100 ± N/A   | 99 ± N/A    |
| Aortic DBP (mmHg) | 67 ± 8     | 66 ± 10          | 66 ± 7      | 63 ± N/A      | 68 ± N/A    | 68 ± N/A    |
| Aortic MAP (mmHg) | 80 ± 9     | 79 ± 9           | 78 ± 7      | 81 ± N/A      | 82 ± N/A    | 80 ± N/A    |
| FH (mmHg)         | 28.7 ± 2.8 | 29.5 ± 2.9       | 26.2 ± 3.5  | 29.0 ± N/A    | 31.5 ± N/A  | 27.5 ± N/A  |
| RH (mmHg)         | 12.8 ± 2.8 | 9.9 ± 2.6        | 9.3 ± 3.0   | 16.5 ± N/A    | 12.5 ± N/A  | 10.0 ± N/A  |

Mean ± SD. Significant at  $p < 0.05$

**3295 Board #116 May 29 2:30 PM - 4:00 PM**  
**Age- And Sex-related Differences In Skeletal Muscle Oxygen Consumption Rate And Microvascular Reactivity**

Hannah F. Bryan, Nile F. Banks, Emily M. Rogers, Claire M. Smith. *-Oklahoma State University, -Stillwater, OK.*

*(No relevant relationships reported)*

**Purpose:** To examine the influence of age and sex on non-invasive measurements of oxygen consumption rate and microvascular reactivity. **Methods:** Seven young females (YF; mean ± SD, age = 20.9±2 y), 6 older females (OF; 57.5±10 y), 14 younger males (YM; 22.2±2 y), and 8 older males (OM; 59.5±5 y) visited the laboratory on one occasion during which skeletal muscle oxygen utilization and microvascular function were assessed following a 10-h fast using the near-infrared spectroscopy with vascular occlusion test (NIRS-VOT). During the NIRS-VOT, tissue saturation (StO<sub>2</sub>) was monitored, and the rate of decrease in StO<sub>2</sub> (Slope 1) during cuff inflation (i.e., ischemia) was quantified, as were the reperfusion magnitude (Rep<sub>MAG</sub>), rate of increase in StO<sub>2</sub> (Slope 2), and the reperfusion area under the curve (StO<sub>2AUC</sub>) following cuff deflation. Two-way (age × sex) ANOVAs were used to examine the differences in Slope 1, Rep<sub>MAG</sub>, Slope 2, and StO<sub>2AUC</sub> among the YW, OW, YM, and OM. Means ± 95% CIs are reported. **Results:** There were significant age and sex effects for Slope 1 ( $p = 0.01$  and  $0.02$ , respectively), which was more negative (i.e., steeper) in males versus females ( $-0.132 \pm 0.12$  vs.  $-0.108 \pm 0.15$  %·s<sup>-1</sup>) and in the young versus older adults ( $-0.133 \pm 0.13$  vs.  $-0.107 \pm 0.14$  %·s<sup>-1</sup>). There was an age effect for Rep<sub>MAG</sub> ( $p < 0.001$ ), which was greater in the younger than older adults ( $50.7 \pm 4.0$  vs.  $38.5 \pm 4.6$ %). While there was no effect of age on Slope 2, Slope 2 was steeper ( $p = 0.002$ ) in males than females ( $1.71 \pm 0.24$  vs.  $1.06 \pm 0.34$  %·s<sup>-1</sup>). Finally, there were age ( $p = 0.02$ ) and sex ( $p = 0.03$ ) main effects for StO<sub>2AUC</sub>, which was greater in males versus females ( $1228.5 \pm 148.8$  vs.  $960.1 \pm 178.9$  %·s) and in the young versus older adults ( $1240.7 \pm 148.8$  vs.  $947.9 \pm 178.9$  %·s). **Conclusions:** Overall, our results suggest that there are age and sex-related differences in skeletal muscle oxygen consumption rate and microvascular reactivity, as assessed using the NIRS-VOT technique. However, because the degree of tissue desaturation is the stimulus for subsequent reperfusion responses and the rate of desaturation was greater in the younger than older adults and in males than females, it is not clear if the differences in Slope 2 and StO<sub>2AUC</sub> reflect differences in microvascular reactivity, per se. Additional studies are needed to more fully explore this interplay.

**3296 Board #117 May 29 2:30 PM - 4:00 PM**  
**Altered Microvascular Reactivity In Young Healthy Adults With A Family History Of Hypertension**

Evan L. Matthews<sup>1</sup>, John J. Guers<sup>2</sup>, Peter A. Hosick<sup>1</sup>. <sup>1</sup>Montclair State University, Montclair, NJ. <sup>2</sup>Rider University, Lawrenceville, NJ.

Email: matthewse@montclair.edu

*(No relevant relationships reported)*

Young healthy adults with a family history of hypertension (+FHH) display some of the phenotypic characteristics of adults with established hypertension. These similarities may serve as early warning signs for the development of hypertension, and therefore, should be examined. **Purpose:** To determine if, like hypertensives, normotensive +FHH adults display lower conduit artery function and microvascular reactivity than normotensive adults without a family history of hypertension (-FHH). **Methods:** Healthy normotensive adults self-reported if a first degree relative had been diagnosed with hypertension. A forearm vascular occlusion test was performed while resting in the supine position. An ultrasound probe placed on the brachial artery

above the occlusion cuff was used to assess flow mediated dilation (FMD); a test of conduit artery function. Simultaneously, a near infrared spectroscopy (NIRS) sensor placed on the anterior forearm measured skeletal muscle oxygen saturation (SmO<sub>2</sub>). SmO<sub>2</sub> kinetics were examined to evaluate microvascular function. **RESULTS:** Twenty-one participants were included in this investigation (-FHH = 12, +FHH = 9). Groups were young (-FHH 24±5, +FHH 24±6yr;  $p = 0.756$ ), with a non-significant trend towards higher mean arterial pressure in the +FHH group (-FHH 82±10, +FHH 89±8mmHg;  $p = 0.082$ ). There were no group differences in baseline brachial artery diameter (-FHH 0.247±0.164, +FHH 0.325±0.119cm;  $p = 0.234$ ), total shear (-FHH 53244±55326, +FHH 34430±36875AUC;  $p = 0.384$ ), and vessel dilation (-FHH 6.92±4.55, +FHH 6.97±6.65Δ%  $p = 0.984$ ). Baseline SmO<sub>2</sub> (-FHH 69±9, +FHH 64±13%;  $p = 0.271$ ), and the 30s peak desaturation slope obtained during vascular occlusion (-FHH -0.38±0.12, +FHH -0.42±0.14%/s;  $p = 0.393$ ), were also not different between groups. Following cuff release the resaturation slope (1<sup>st</sup> 10s, -FHH 2.90±1.96, +FHH 5.00±2.51%/s  $p = 0.046$ ), and the SmO<sub>2</sub> overshoot (-FHH 1177±719, +FHH 2024±974AUC;  $p = 0.029$ ) were greater in the +FHH group. **CONCLUSIONS:** Contrary to our hypothesis, the +FHH group displayed greater NIRS reperfusion microvascular reactivity than the -FHH group. This may be due to a greater perfusion pressure in the +FHH group as evidenced by a trend for greater mean arterial pressure.

**3297 Board #118 May 29 2:30 PM - 4:00 PM**  
**Abstract Withdrawn**

**3298 Board #119 May 29 2:30 PM - 4:00 PM**  
**Self-reported Sleep Habits Are Related To Arterial Stiffness In Apparently Healthy Individuals**

Meral N. Culver, Sean P. Langan, Bryan L. Riemann, Andrew A. Flatt, Gregory J. Grosicki. *Georgia Southern University-Armstrong Campus, Savannah, GA.*

Email: mc28967@georgiasouthern.edu

*(No relevant relationships reported)*

Insufficient sleep is associated with cardiovascular disease. Whether this relationship is mediated through decrements in vascular function has yet to be fully elucidated. **Purpose:** This study investigated relationships between self-reported sleep habits and vascular health in apparently healthy individuals. **Methods:** Thirty-one individuals (14 females/17 males, 30±10 yrs, 24.7±3.2 kg/m<sup>2</sup>) free of cardiovascular disease, diabetes, and not using medications were enrolled. Subjective sleep habits were characterized using the Pittsburgh Sleep Quality Index to generate a composite score (PSQI score) ranging from 0 (better) to 21 (worse). Vascular health including brachial and aortic pressures, pulse pressure, and augmentation pressure (a measure of arterial stiffness) was quantified via arterial pressure waveforms. **Results:** Mean PSQI score was 4±3, where a score >5 is deemed to be "poor" sleep quality. Initial regression models for age, gender, body mass index, and PSQI score predicted ( $P < 0.01$ ) pulse pressure (31.2±5.9 mmHg) and augmentation pressure (2.4±3.7 mmHg). The final model including only significant predictors for pulse pressure ( $P < 0.01$ ,  $R^2 = 0.38$ ) included PSQI score ( $\beta = 0.47$ ,  $P < 0.01$ ) and BMI ( $\beta = 0.38$ ,  $P = 0.02$ ). Meanwhile, the final model for augmentation pressure ( $P < 0.01$ ,  $R^2 = 0.31$ ) included PSQI score ( $\beta = 0.34$ ,  $P = 0.04$ ), BMI ( $\beta = 0.36$ ,  $P = 0.03$ ), and gender ( $\beta = 0.46$ ,  $P = 0.01$ ). PSQI score was not associated ( $P > 0.05$ ) with brachial or aortic systolic (123±11 and 108±10 mmHg) or diastolic (76±9 and 77±9 mmHg) pressures. **Conclusions:** These data demonstrate that self-reported sleep habits, quantified via PSQI score, are related to indices of arterial stiffness (i.e., pulse pressure and augmentation pressure) in apparently healthy individuals. Large artery stiffening resulting from sleep deficiency may play a role in the development of hypertension and cardiovascular disease.

**3299 Board #120 May 29 2:30 PM - 4:00 PM**  
**Mitochondrial Targeted Antioxidant Intake Improves Vascular Function And Exercise Tolerance In Peripheral Artery Disease Patients**

Elizabeth J. Pekas, Won-Mok Son, Ronald J. Headid, III, TeSean K. Wooden, Song-Young Park. *The University of Nebraska at Omaha, Omaha, NE.*

Email: lizpekas@unomaha.edu

*(No relevant relationships reported)*

Peripheral artery disease (PAD) is a manifestation of atherosclerosis in the lower leg arteries, which causes reduced blood flow and leg pain. This may be in part due to excessive mitochondria-produced reactive oxygen species (ROS) and attenuated mitochondrial respiratory function. Mitoquinol mesylate, a mitochondrial-targeted antioxidant, has been shown to scavenge ROS and improve vascular function in older adults and animal models. However, the impacts of mitoquinol on vascular function in patients with PAD are unknown. **Purpose:** To examine the impacts of acute mitoquinol intake (80mg) on endothelial function (flow mediated dilation, FMD), resting heart rate (RHR), blood pressure (BP), arterial stiffness (pulse wave velocity, PWV), and exercise tolerance in patients with PAD. **Methods:** 10 patients with

PAD (stage II-III) received either mitoquinol or placebo in a randomized crossover design. At each visit, measurements of RHR, central and peripheral BP, brachial and popliteal artery FMD, PWV, augmentation index (AIx), maximal walking capacity, and time to claudication (COT) were measured before and after mitoquinol and placebo. **RESULTS:** There were significant group by time interactions ( $p < 0.05$ ) for brachial FMD, popliteal FMD, and COT, which significantly increased ( $p < 0.05$ ). There were trends for decreases in diastolic BP ( $p = 0.10$ ), carotid-to-ankle PWV ( $p = 0.08$ ), and increases in maximal walking time ( $p = 0.06$ ), and maximal walking distance ( $p = 0.06$ ). There were no changes in RHR, systolic BP, central BP, deceleration time, max dP/dt, carotid-to-radial PWV, carotid-to-femoral PWV, or AIx ( $p > 0.05$ ). **CONCLUSIONS:** Mitoquinol intake may be an effective strategy for targeting mitochondrial ROS, which may be useful for treating endothelial dysfunction, leg pain, and improving walking time in patients with PAD.

**3300** Board #121 May 29 2:30 PM - 4:00 PM

### **AUTONOMIC AND CARDIOVASCULAR RESPONSES TO ACUTE EXERCISES IN CHILDREN WITH AUTISM SPECTRUM DISORDER**

Allison T. Bui, Gustavo Aldama, Ashley J. Castle, Kauionalani P. Kekuawela, Jacob A. Manriquez, Areum K. Jensen. *San Jose State University, San Jose, CA.*  
(No relevant relationships reported)

Autism Spectrum Disorder (ASD) is a complex neurological disorder identified in early childhood and is characterized by impaired social interaction and atypical behaviors. Limited studies reported that children with ASD tend to have higher heart rate (HR) and blood pressure (BP) at rest compared to typically developing children (TDC). Previously, we reported that HR and blood flow (BF) did not alter while BP increased from rest to acute exercise in ASD. Thus, we thought that ASD may have impaired autonomic nervous system activity to differentially control HR and stroke volume (SV) to regulate BP through changes in cardiac output. **PURPOSE:** To determine autonomic and cardiovascular responses to acute dynamic exercise in children with ASD. **METHODS:** 36 adults, TDC and children with ASD participated in the study. HR from ECG, beat to beat arterial BP from Finapres and brachial BP, and SV from Modelflow, were continuously measured before, during and after 2 minutes of dynamic handgrip exercise at 35% and 50% of maximal voluntary contraction. Diameter, blood velocity, and flow of the brachial artery were measured using Doppler ultrasound on the contracting arm throughout the experiment. Time and frequency domains of HR variability indexes were used. **RESULTS:** Mean BP was significantly increased to exercise from rest in all groups with no group differences ( $\Delta 9.8 \pm 1.8$  adults,  $\Delta 8.3 \pm 1.2$  TDC, and  $\Delta 6.9 \pm 1.8$  ASD, mmHg). HR was significantly increased to exercise from rest in adults and TDC; however, there was no change in HR to exercise from rest in ASD ( $\Delta 11 \pm 1$  adults,  $\Delta 7 \pm 1$  TDC, and  $\Delta 1 \pm 1$  ASD, bpm). SV was unaltered from rest to exercise in all groups. Both adults and TDC had similar increase in BF during exercise compared to rest ( $\Delta 17 \pm 3$  adults vs.  $\Delta 14 \pm 2$  TDC cm/s); however, BF did not change from rest to exercise ( $\Delta 0.6 \pm 2.2$  ASD cm/s) in ASD. The rMSSD and high frequency of HRV were similar in all groups while very low frequency HRV was significantly lower in ASD. **CONCLUSION:** While HR and BF were altered to exercise in both adults and TDC groups in similar fashion, HR and BF did not change in ASD children indicating impaired autonomic and vascular function. Higher total peripheral resistance may contribute to increase BP during exercise in ASD children without a significant contribution of cardiac output.

**3301** Board #122 May 29 2:30 PM - 4:00 PM

### **ET<sub>B</sub> Receptor Responses In Young Women With A Family History Of Hypertension**

Shane J. McGinty, Laura M. Welti, Andrew V. Kuczmarski, Sangeetha Nathaniel, Megan M. Wenner. *University of Delaware, Newark, DE.*  
(No relevant relationships reported)

Endothelin-1 (ET-1) contributes to endothelial dysfunction, a primary driver of hypertension and cardiovascular disease. Young women with a family history of hypertension (+FH), a group at risk for developing hypertension, display elevated resting plasma ET-1. Our lab has previously shown that in healthy young women, the ET<sub>B</sub> receptor mediates vasodilation. However, the function of ET<sub>B</sub> receptors has yet to be determined in young women +FH. **PURPOSE:** The purpose of this study was to test the hypothesis that +FH young women display attenuated ET<sub>B</sub>-mediated vasodilation. **METHODS:** Eight young women without a family history of hypertension (-FH; 23±2 yrs, 24±1 kg/m<sup>2</sup>) and 8 women +FH (23±2 yrs, 22±1 kg/m<sup>2</sup>) completed the study. Family history status was self-reported on a medical history questionnaire. Cutaneous vasodilatory responses to local heating were measured using laser doppler flowmetry during microdialysis perfusions of lactated Ringer's (Control) and ET<sub>B</sub> receptor blockade (BQ-788, 300nM). Cutaneous vascular conductance (CVC) was calculated during the plateau phase of local heating (42°C), and normalized to maximal vasodilation achieved by perfusion of sodium nitroprusside (28mM) and heating to 43°C. A two-way ANOVA was performed to compare the impact of familial

history of hypertension on vasodilatory responses. Threshold for significance was set a priori at  $P < 0.05$ . Data are presented as mean ± SEM. **RESULTS:** Resting mean arterial pressure (-FH: 80±3 vs. +FH: 85±2 mmHg,  $P = 0.25$ ) and plasma ET-1 (-FH,  $n = 5$ : 1.2±0.2 vs. +FH,  $n = 6$ : 1.5±0.2 pg/mL,  $P = 0.43$ ) were similar between groups. There was a trend for a significant group x time interaction for cutaneous vasodilatory responses (Drug:  $P = 0.33$ , Group:  $P = 0.63$ , Interaction:  $P = 0.09$ ); vasodilatory responses to Control tended to be lower in +FH (-FH: 95±1 vs. +FH: 89±4 %CVC max). Furthermore, blockade of ET<sub>B</sub> receptors tended to reduce vasodilation in -FH (Control: 95±1 vs. 87±3 %CVC max) but not +FH (Control: 89±4 vs. 91±2 %CVC max). **CONCLUSION:** These preliminary data suggest that in young, otherwise healthy women, ET<sub>B</sub> receptor function may be altered based on hypertensive family history status; however additional data are needed. Furthermore, data in +FH young men are needed given the known sex differences in the ET-1 system. Supported by: NIH R01 HL 146558, P20 GM 113125.

**3302** Board #123 May 29 2:30 PM - 4:00 PM

### **Higher Aortic Stiffness Is Related With Lower Physical Fitness In Older Adults**

Lucimere Bohn, Alinne Nascimento, Duarte Barros, Joana Carvalho, José Oliveira. *Faculty of Sports, University of Porto, Porto, Portugal.*  
Email: lucimerebohn@fade.up.pt  
(No relevant relationships reported)

**PURPOSE:** To compare physical fitness levels according to arterial stiffness reference values in older adults. **METHODS:** This is a cross-sectional study comprising 156 (75.24 ± 6.5 years; 69.2% female) apparently healthy older adults. Carotid-femoral pulse wave velocity (cfPWV) was assessed through applanation tonometry and classified as  $<$  or  $\geq$  10 meters per second (m/s). Physical fitness was assessed through the Senior Fitness Test [cardiorespiratory fitness (6-Min Walk), agility (8-foot Up and Go), upper (30-second Arm Curl) and lower body strength (30-second Chair Stand), and flexibility tests (Chair Sit & Reach and Back Scratch)]. A Z-score including all physical fitness components was computed as a global index of physical fitness. Total physical activity was objectively measured and recorded as counts per minute. Between-group comparisons were performed through ANCOVA. **RESULTS:** Eighty-five (59.1%) of the subjects had cfPWVs  $\geq$  10 m/s. After adjusting for age and total physical activity, compared to the cfPWV  $<$  10m/s group, the cfPWV  $\geq$  10 m/s group exhibited significantly lower physical fitness scores ( $0.355 \pm 0.074$  vs.  $0.076 \pm 0.077$ , respectively;  $p = 0.017$ ). **CONCLUSION:** Seniors with higher levels of arterial stiffness present lower values of physical fitness. Strategies to improve physical fitness might be important to prevent the rapid augmentation of arterial stiffness.

**3303** Board #124 May 29 2:30 PM - 4:00 PM

### **Test-Reliability Of Blood Pressure Criteria For Defining An Exaggerated Blood Pressure Response To Exercise**

Kayla M. Soave, Katharine D. Currie. *Michigan State University, East Lansing, MI.*  
(No relevant relationships reported)

Exaggerated blood pressure responses (EBPR) during exercise are associated with increased risk of mortality. Due to the prognostic value of EBPR, it is important to evaluate the reliability of criteria used to define this response. **PURPOSE:** This study assessed the test-retest reliability of two different criteria used to define EBPR: the maximal systolic blood pressure (SBP) and the SBP/METs-slope which is the ratio of the change in SBP to the change in the metabolic equivalents of task (METs). **METHODS:** Twenty healthy, normotensive adults (8 males: 21±1 years, 12 females: 21±1 years) completed two identical modified Bruce treadmill tests on separate days. Blood pressure was measured using an automated motion-tolerant auscultatory device at rest (i.e., standing on treadmill) and during the last minute of each exercise stage. For each test, maximal SBP was identified, METs were estimated, and the change in these indices (i.e., maximal - rest) were calculated to determine the SBP/METs-slope. Test-retest reliability of the two criteria were assessed using intraclass correlation coefficients (ICC), with an ICC  $>$  0.60 considered reliable. **RESULTS:** Total exercise time was similar between visits (1000±123 s vs. 1005±128 s,  $P = 0.33$ ). Reliability of the EBPR criteria are presented as (ICC; 95% confident intervals). Maximal SBP (0.45; 0.02-0.74) and SBP/METs-slope (0.29; -0.16-0.64) were not reliable. Participants were then separated based on sex. In males, maximal SBP (0.85; 0.44-0.97) was reliable while the SBP/METs-slope only demonstrated moderate reliability (0.59; -0.13-0.90). In females, both maximal SBP and the SBP/METs-slope were not reliable (ICCs  $<$  0.17). Using the criteria of a maximal SBP 210 and 190 mmHg for males and females respectively, 50% of males and 33% of females had EBPR on both visits. **CONCLUSION:** Criteria used to define EBPR are only reliable in males. Further investigation is warranted to understand the potential sex effects on the SBP responses to maximal exercise testing.

3304 Board #125 May 29 2:30 PM - 4:00 PM

**Effects Of Resistance Exercise Training On Estradiol, Gh, Igf-1, Dhea-s, And Blood Pressure In Postmenopausal Women With Stage 1 Hypertension**Jung-Jun Park<sup>1</sup>, Song-Young Park<sup>2</sup>, Kook-Eun Seo<sup>1</sup>, Liz Pekas<sup>2</sup>, Won-Mok Son<sup>2</sup>. <sup>1</sup>*Pusan National University, Busan, Korea, Republic of.* <sup>2</sup>*University of Nebraska at Omaha, Omaha, NE.*  
Email: jjparkpnu@pusan.ac.kr*(No relevant relationships reported)*

**PURPOSE:** Menopause is often accompanied by decreased estradiol, growth hormone (GH), insulin-like growth factor-1 (IGF-1) and dehydroepiandrosterone sulfate (DHEA-s) and increased blood pressure (BP), which may collectively increase risks for cardiovascular disease (CVD). It is important to combat the negative effects on estradiol, GH, IGF-1, DHEA-s, and BP by incorporating appropriate lifestyle interventions, such as exercise. We sought to examine the effects of resistance exercise training program on estradiol, GH, IGF-1, DHEA-s, and BP in postmenopausal with stage 1 hypertension.

**METHODS:** Postmenopausal women ( $n=20$ ) were recruited and randomly assigned to a resistance exercise group (EX,  $n=10$ ) or control group (CON,  $n=10$ ). The EX group performed a total-body resistance band exercise training program for 12 weeks. Levels of estradiol, GH, IGF-1, DHEA-s, as well as BP were assessed before and after 12 weeks

**RESULTS:** There were significant group by time interactions ( $p<0.05$ ) for estradiol ( $\Delta 0.8\pm 0.0$ ), GH ( $\Delta 0.5\pm 0.1$ ), IGF-1 ( $\Delta 5.7\pm 1.2$ ), and DHEA-s ( $\Delta 10.4\pm 5.5$ ) which significantly increased ( $p<0.05$ ), and systolic BP ( $\Delta 3.0\pm 1.7$ ) which significantly decreased ( $p<0.05$ ) after exercise training compared to no changes in CON. There were no significant differences ( $p>0.05$ ) in diastolic BP after 12 weeks

**CONCLUSIONS:** These results indicate that resistance exercise training may be an effective, easily accessible, and cost efficient intervention for improving estradiol, GH, IGF-1 and DHEA and decline BP in postmenopausal women with stage 1 hypertension

3305 Board #126 May 29 2:30 PM - 4:00 PM

**Blood Flow And Arterial Stiffness In Amputated Subjects.**Anna Pedrinolla, Valentina Cavedon, Chiara Milanese, Massimo Venturelli. *University of Verona, Verona, Italy.*  
Email: anna.pedrinolla@univr.it*(No relevant relationships reported)*

**PURPOSE:** To investigate arterial adaptations in amputated soccer players of the Italian National Amputated team. **METHODS:** Basal blood flow (BF, corrected for muscle volume), and pulse wave velocity (PWV) were measured in 11 amputated soccer players (35±13 years; 14±8 years from the amputation) of the Italian National Amputated team. BF and PWV were measured right and left-hand at carotid arteries, brachial arteries, radial arteries, common femoral arteries, and superficial femoral arteries. Basal BF and PWV of amputated limbs were compared with the non-amputated limbs. **RESULTS:** Basal BF was found to be reduced in amputated limbs compared with the contralateral non-amputated limbs (-30%,  $p<0.05$ ). However, PWV was not found to be statistically different between amputated and non-amputated limbs (3%,  $p=0.32$ ). **CONCLUSIONS:** Although an adaptation of basal BF seems to take place in amputated limbs, PWV seems to be unaltered in the amputated side in national soccer players. Since PWV reflects cardiovascular risk and vascular adaptation, based on this results we can speculate that soccer training served as a good stimulus to maintain vascular health even in amputated subjects.

3306 Board #127 May 29 2:30 PM - 4:00 PM

**Reliability Of Non-invasive Vascular Function Tests And Their Responsiveness To A High-fat Meal In Females**Emily M. Rogers, Nile F. Banks, Hannah F. Bryan, Claire M. Smith, Nathaniel D.M. Jenkins. *Oklahoma State University, Stillwater, OK.**(No relevant relationships reported)*

**PURPOSE:** To examine the reliability of non-invasive assessments of micro- and macrovascular function and their responsiveness to a high-fat meal (HFM) in females.

**METHODS:** During 2 visits (T1 and T2) separated by  $28 \pm 2$  days, 11 women (age =  $30.7 \pm 17.2$  y, BMI =  $24.4 \pm 3.1$  kg/m<sup>2</sup>) consumed a standardized HFM (12 kcal/kg body weight; 63% fat) after a 10-h fast. Before (BL) and 3-h after the HFM, blood triglyceride (TG) levels were measured to quantify the lipemic response, and micro- and macrovascular function were assessed using the NIRS-VOT and FMD technique, respectively. During the NIRS-VOT assessment, the occlusion slope (Slope 1), the minimum tissue saturation (StO<sub>2MIN</sub>), the reperfusion slope (Slope 2), and the reperfusion area under the curve (StO<sub>2AUC</sub>) were calculated. Reliability was assessed

on BL values using one-way ANOVAs, intraclass correlation coefficients, and standard errors of measurement reported as coefficients of variation (CV). We also examined the responsiveness of each of the assessments to a HFM, as well as repeatability of the response by examining differences and relationships between the 3-h values at T1 and T2 for each of the variables. **RESULTS:** The reliability of each of the variables is reported in Table 1. All variables demonstrated moderate to strong relative reliability, although the CVs for TG, StO<sub>2MIN</sub>, and FMD were moderately high. Interestingly, only TG responded to the HFM at 3-h. There were also no differences between the 3-h values at T1 versus T2 for any of the dependent variables (all  $p > 0.05$ ), which were moderately to strongly ( $r = 0.66 - 0.72$ ,  $p \leq 0.04$ ) related, except for StO<sub>2AUC</sub> and FMD ( $r = 0.46 - 0.47$ ,  $p \geq 0.16$ ). **CONCLUSION:** Each of the variables assessed displayed sufficient repeatability and were similarly (non-)responsive to a HFM before and after a 28-day period. Further, it appears that StO<sub>2AUC</sub> and FMD may display lower absolute reliability and studies may require greater sample sizes when using these as outcomes in intervention studies.

|                     | T1 Mean        | T2 Mean        | ICC (95% CI)          | CV (%) | p-value |
|---------------------|----------------|----------------|-----------------------|--------|---------|
| TG                  | 104.0 ± 75.8   | 87.3 ± 40.9    | 0.757 (0.321 - 0.928) | 31.4   | 0.221   |
| Slope 1             | -0.128 ± 0.03  | -0.119 ± 0.03  | 0.578 (0.019 - 0.865) | 17.4   | 0.385   |
| StO <sub>2MIN</sub> | 28.0 ± 11.9    | 23.8 ± 12.2    | 0.577 (0.046 - 0.862) | 29.7   | 0.231   |
| Slope 2             | 1.10 ± 0.45    | 1.12 ± 0.48    | 0.688 (0.165 - 0.906) | 24.2   | 0.820   |
| StO <sub>2AUC</sub> | 1068.7 ± 368.6 | 1016.7 ± 355.9 | 0.645 (0.102 - 0.891) | 20.9   | 0.592   |
| FMD (%)             | 5.3 ± 3.3      | 5.0 ± 3.4      | 0.668 (0.134 - 0.899) | 38.1   | 0.705   |

3307 Board #128 May 29 2:30 PM - 4:00 PM

**Impacts Of Prolonged Sitting With Mild Hypercapnia In Healthy Adults**Ronald J. Headid, III, Elizabeth J. Pekas, TeSean K. Wooden, Won-Mok Son, Song-Young Park. *University of Nebraska at Omaha, Omaha, NE.*

Email: rheadid@unomaha.edu

*(No relevant relationships reported)*

Previous research suggests that prolonged sitting attenuates vascular function. It is common for people to sit for prolonged periods of time in places such as offices and classrooms which are accompanied by mild hypercapnic conditions due to poor ventilation. However, the effects of prolonged sitting with mild hypercapnic conditions on vascular function has not been investigated. **PURPOSE:** The purpose of this study is to investigate the responses in heart rate (HR), blood pressure (BP), vascular function, and autonomic function in healthy young adults to a single bout of prolonged sitting in mild hypercapnic conditions. **METHODS:** In a randomized crossover design, 12 subjects (6M/6F) sat for 2.5 hours in a control condition (PSIT) or a mild hypercapnic condition (HCAP, CO<sub>2</sub>=1,500 ppm). During each visit, HR, central and peripheral BP, brachial and popliteal artery endothelial function (flow-mediated dilation, FMD), arterial stiffness (pulse-wave velocity (PWV), augmentation index (AIx)), and heart rate variability (HRV) were assessed before and after prolonged sitting. **RESULTS:** Both brachial and popliteal FMD were significantly reduced ( $p<0.05$ ) in HCAP and PSIT, and the reduction in popliteal FMD was significantly greater in HCAP than PSIT ( $p<0.05$ ). Additionally, there were trends for increased carotid-to-distal (cd) PWV ( $p=0.083$ ) in HCAP compared to PSIT. HR was significantly reduced ( $p<0.05$ ) and carotid-to-radial (cr) deceleration time (DT) and cdDT were significantly increased ( $p<0.05$ ) in HCAP. There were also trends for reduced augmentation pressure (AP) ( $p=0.07$ ) and LF/HF ratio ( $p=0.09$ ). AP, AIx, AIx normalized to 75 beats per minute, and crAIx were all significantly reduced ( $p<0.05$ ) in PSIT. There were no significant changes in BP and HRV in either group ( $p>0.05$ ). **CONCLUSIONS:** These results indicate that prolonged sitting in mild hypercapnic conditions attenuate endothelial function to a greater extent than prolonged sitting in normal atmospheric conditions. Our findings suggest that mild hypercapnic conditions in our daily life exacerbate the negative effects of prolonged sitting.

**3308** Board #129 May 29 2:30 PM - 4:00 PM  
**Reproducibility Of The Impact Of Menstrual Phase On Arterial Stiffness Over Two Consecutive Menstrual Cycles**

Lindsay A. Lew, Kaitlyn R. Liu, Amanda C. Byrne, Tarrah S. Ethier, Hashim Islam, Kyra E. Pyke. *Queen's University, Kingston, ON, Canada.*

(No relevant relationships reported)

Chronic increases in arterial stiffness are associated with increased risk of cardiovascular disease. Estrogen (E2), the primary female sex hormone, has been found to have cardioprotective effects, with several but not all, studies reporting a reduction in arterial stiffness in the late follicular (high E2; LF) phase compared to the early follicular (low E2; EF) phase of the menstrual cycle. Individual heterogeneity in the impact of phase on arterial stiffness and the consistency of these responses across consecutive cycles has yet to be explored. **PURPOSE:** to determine the impact of menstrual phase E2 fluctuations on arterial stiffness over two consecutive cycles. **METHODS:** 13 premenopausal women completed 4 experimental visits over 2 menstrual cycles (EF<sub>visit 1</sub>, LF<sub>visit 2</sub>, EF<sub>visit 3</sub>, LF<sub>visit 4</sub>). Central (CF) and peripheral (FF) PWV were measured twice during each visit using arterial tonometry. Participants were classified as positive, negative or non-responders, wherein positive responders experienced a reduction in PWV from EF to LF and negative responders experienced an increase in PWV from EF to LF that was greater than 2\*typical error. **RESULTS:** At the group level, CF PWV did not differ between phases (p=0.11) or cycles (p=0.18; EF<sub>visit 1</sub> =5.8±0.8, LF<sub>visit 2</sub> =5.6±0.5, EF<sub>visit 3</sub> =5.9±0.6, LF<sub>visit 4</sub> =5.8±0.7). Likewise, FF PWV did not differ between phases (p=0.979) or cycles (p=0.58; EF<sub>visit 1</sub> =8.1±1.0, LF<sub>visit 2</sub> =8.1±1.1, EF<sub>visit 3</sub> =7.9±1.4, LF<sub>visit 4</sub> =8.0±1.3). Phase changes in E2 were not associated with phase changes in PWV in cycle 1 (CF: r=0.38, p=0.20; FF: r=0.11, p=0.73) or cycle 2 (FF: r=0.38, p=0.36). Classification of individuals as responders or non-responders revealed that no participants were consistently positive or negative responders for both cycles. **CONCLUSION:** At the group level, arterial stiffness was not impacted by menstrual phase over two cycles. Individual changes in arterial stiffness were inconsistent, with phase changes in cycle 1 not reflecting phase changes in cycle 2. Variability in phase changes in arterial stiffness does not appear to be driven by inter-individual differences in E2 fluctuation across phase. Future research is needed to investigate the mechanisms resulting in inter-individual variability in arterial stiffness and inconsistency between cycles.

Funded by NSERC

**F-57** Free Communication/Poster - Basic Science  
**Applications in Skeletal Muscle**

Friday, May 29, 2020, 1:30 PM - 4:00 PM  
 Room: CC-Exhibit Hall

**3309** Board #130 May 29 1:30 PM - 3:00 PM  
**The Impact Of CD146<sup>+</sup> Serum Extracellular Vesicles On Recovery Of Skeletal Muscle Following Hindlimb Immobilization**

Svyatoslav Dvoretzkiy, Yu-Fu Wu, Christian Konopka, Gabriela Garcia, Eric Jung, Megan Kalinowski, Noah Kim, Lawrence W. Dobrucki, Marni D. Boppart, FACSM. *University of Illinois at Urbana-Champaign, Urbana, IL.*  
 Email: sdvoret@gmail.com

(No relevant relationships reported)

Our laboratory recently reported a significant decline in muscle-resident pericyte quantity following hindlimb immobilization, and subsequently demonstrated the capacity for pericyte transplantation to accelerate recovery of skeletal muscle mass during the rehabilitation period. **PURPOSE:** The purpose of this study was to determine the extent to which pericyte-derived extracellular vesicles (EVs) effectively recover skeletal muscle mass following hindlimb immobilization. **METHODS:** Two groups of donor mice (n=6/group) were used to isolate serum EVs before ("Pre") and after ("Post") an acute bout of contraction using a sciatic nerve stimulation procedure. Serum EVs were isolated using ultracentrifugation followed by magnetic bead sorting to isolate CD146<sup>+</sup> EVs and CD146<sup>-</sup> EVs. Five groups of mice (n=4/group) underwent unilateral hindlimb immobilization for 14 days. At 14 days, the mice were intramuscularly (tibialis anterior) injected with 1) PBS, 2) CD146<sup>+</sup>Pre EVs 3) CD146<sup>+</sup>Post EVs, 4) CD146<sup>-</sup>Pre EVs, or 5) CD146<sup>-</sup>Post EVs (in 40 µL of PBS), then remobilized for 2 weeks to determine therapeutic capacity. **RESULTS:** A significant decrease in serum CD146<sup>+</sup> EVs was observed following 14 days of hindlimb immobilization (p<0.05). CD146<sup>-</sup>Post EVs demonstrated significant recovery of myofiber cross-sectional area compared to PBS control (p<0.05). CD146<sup>+</sup>Pre and CD146<sup>+</sup>Post EVs significantly restored capillary density compared to PBS control

(p<0.05). CD146<sup>-</sup>Pre EVs recovered capacity for collagen remodeling compared to PBS control (p<0.05). **CONCLUSIONS:** The results from this study suggest that CD146<sup>+</sup> serum EVs positively benefit regrowth of skeletal muscle following a period of disuse. Additionally, CD146<sup>+</sup> serum EVs enhance skeletal muscle capillarization. Overall, a combination of both EV fractions may optimize recovery of skeletal muscle mass following disuse. Supported by NIH NIAMS R01 AR072735 (to MDB) and ACSM NASA Space Physiology Research Grant (to SD).

**3310** Board #131 May 29 1:30 PM - 3:00 PM  
**PHITE: Precision High Intensity Training Through Epigenetics**

Jeremy McAdam<sup>1</sup>, Kristie Williams<sup>1</sup>, Craig Tuggle<sup>1</sup>, John Reams<sup>1</sup>, Brandon Peoples<sup>1</sup>, Grace Cunningham<sup>1</sup>, Gina Seay<sup>1</sup>, Derek Wiggins<sup>1</sup>, Christian Kelley<sup>1</sup>, Kaleen Lavin<sup>1</sup>, Inmaculada Aban<sup>1</sup>, Billy Tingle<sup>1</sup>, Michael Downes<sup>2</sup>, Jin Zhang<sup>3</sup>, Cesar Barragan<sup>2</sup>, Madhavi Kadakia<sup>3</sup>, Ron Evans<sup>2</sup>, Joseph Ecker<sup>2</sup>, Timothy Broderick<sup>4</sup>, Marcas Bamman, FACSM<sup>1</sup>. <sup>1</sup>University of Alabama at Birmingham, Birmingham, AL. <sup>2</sup>Salk Institute for Biological Studies, San Diego, CA. <sup>3</sup>Wright State University, Dayton, OH. <sup>4</sup>Florida Institute for Human & Machine Cognition (IHMC), Pensacola, FL. (Sponsor: Marcas Bamman, FACSM)  
 Email: jmcadam@uab.edu

(No relevant relationships reported)

**Purpose:** To investigate and mechanistically link acute molecular changes in the mRNA transcriptome and splice variant profile, miRNA profile, DNA methylome, and histone acetylation profile to changes in performance from exercise training. **PHITE** will: (1) Reveal potential molecular mechanisms underlying training and detraining adaptations; (2) Differentiate molecular responses to moderate vs. high intensity training, and identify potential underpinnings of inter-individual response heterogeneity; (3) Perform a rigorous proof-of-concept epigenomic biomarker study that scales to and improves Navy physical training. **Methods:** This is an ongoing single-blind randomized trial of 18-27 y/o untrained adults. Participants are randomized to moderate or high intensity combined training 3 d/wk x 12 wk, followed by a 4-wk detraining period. Participants perform an acute exercise bout at wks 0 and 12 to assess acute molecular responses to exercise in untrained and trained states with serial biospecimen (muscle, blood) collections; repeated after 4 wk of detraining. Performance/phenotyping at wks 0 and 12 include aerobic power (VO<sub>2peak</sub>), strength, anaerobic power, explosive power, body composition (DXA), and phenotyping of blood and muscle. Because the trial is ongoing, randomized assignment remains blinded as groups A and B. Blinded phenotyping data were analyzed using repeated measures ANOVA for the effects of time (T), dose (A vs. B) and dose x time interaction. **Results:** Phenotyping data on the first 51 completed participants confirm significant training effects and early indices of differential adaptations by exercise dose, along with substantial inter-individual response heterogeneity. Differential molecular mapping responses demonstrate sensitivity to exercise dose (A vs. B), timing of sample collection post-exercise, and training state (untrained vs trained vs detrained). **Conclusion:** Molecular response patterns to dose A vs. dose B share limited commonality, and differential responses across individuals provide novel preliminary evidence that dose-specific and individual-specific molecular response patterns may enable discrimination of adaptability.

**3311** Board #132 May 29 1:30 PM - 3:00 PM  
**Mitochondrial Biogenesis Is Dysregulated In Thyroid Hormone Depleted Muscle Cells Despite Stimulatory Effects Of Formoterol**

Emily L. Zumbro, Gena D. Guerin, Ryan A. Gordon, Chase M. White, Dreanna M. McAdams, Matthew L. Sokoloski, David L. Nichols, FACSM, Anthony A. Duplanty. *Texas Woman's University, Denton, TX.* (Sponsor: David L. Nichols, FACSM)

(No relevant relationships reported)

Skeletal muscle (SKM) is an important regulator of metabolism and adaptations from exercise training influences mitochondrial function. Thyroid hormone (TH) is a regulator of SKM processes, including mitochondrial biogenesis. **PURPOSE:** To use an in vitro model of hypothyroidism to test the hypothesis that SKM cells will have dysregulated mitochondrial homeostasis. Additionally, the exercise mimetic, formoterol, was used to determine the effects of exercise signaling on mitochondrial biogenesis. **METHODS:** Human SKM myoblasts (n = 6 per group) were cultured and differentiated until mature myotube formation (Day 6). Groups included control cells (CON), TH depleted cells (ThD), and TH depleted cells plus formoterol stimulation (ThD+F; 30nM for 3h). Total RNA was extracted during mid-myogenesis (Day 4) and at terminal differentiation (Day 6). Gene expression for Peroxisome

Proliferator-Activated Receptor Gamma Coactivator-1 Alpha (PGC-1 $\alpha$ ), Mitochondrial Transcription Factor A (TFAM), and Nuclear Respiratory Factor 1 (NRF1) was determined by qPCR. Data was analyzed by repeated measures ANOVA.

**RESULTS:** Significant differences between conditions and time points are detailed in Table 1.

**CONCLUSION:** ThD media resulted in reduced NRF1 signaling in both D4 and D6 with a subsequent decrease in D6 only for TFAM. Formoterol resulted in the expected stimulation of PGC-1 $\alpha$  at both D4 and D6, but subsequent signaling for genes associated with mitochondrial biogenesis common to PGC-1 $\alpha$  stimulation were lost as a result of TH depletion at D6 only for TFAM and both D4 and D6 for NRF1.

This work was supported by a Texas ACSM SRDA grant. Table 1.

| Gene           | Comparison          | Fold Change | P Value |
|----------------|---------------------|-------------|---------|
| PGC-1 $\alpha$ | D4 ThD < D4 ThD+F   | -4.6        | <0.05   |
|                | D4 ThD+F > D4 CON   | 4.6         | <0.05   |
|                | D6 CON < D6 ThD+F   | -2.9        | <0.05   |
|                | D6 ThD < D6 ThD+F   | -3.7        | <0.05   |
| TFAM           | D4 ThD+F > D4 CON   | 3.6         | <0.05   |
|                | D4 ThD+F > D6 ThD+F | 3.6         | <0.05   |
|                | D6 ThD < D6 CON     | -0.55       | <0.05   |
|                | D6 ThD+F < D6 CON   | -0.63       | <0.05   |
| NRF1           | D4 ThD < D4 CON     | -0.31       | <0.001  |
|                | D4 ThD > D4 ThD+F   | 0.36        | <0.001  |
|                | D4 ThD > D6 ThD     | 0.17        | <0.05   |
|                | D4 ThD+F < D4 CON   | -0.67       | <0.001  |
|                | D6 CON < D4 CON     | -0.18       | <0.05   |
|                | D6 ThD < D6 CON     | -0.3        | <0.001  |
|                | D6 ThD+F < D6 CON   | -0.42       | <0.001  |

**3312** Board #133 May 29 1:30 PM - 3:00 PM

**Age-dependent Skeletal Muscle Outcomes Following Resistance-type Training Improve With Pit1 Mutation And Training Frequency Modulation**

Erik P. Rader, James Ensej, Marshall A. Naimo, Brent A. Baker. CDC/NIOSH, Morgantown, WV. (Sponsor: Stephen E. Alway, PhD, FACSM)

Email: wlz4@cdc.gov

(No relevant relationships reported)

Delayed aging in various tissues has been observed for Snell dwarf mice (*Pit1<sup>dw/dw</sup>*) yet muscular performance has not been characterized for this model. **PURPOSE:** The purpose of the present study was to characterize muscle mass and performance for 3 months old and 12 months old Snell dwarf mice in non-trained and resistance-trained states. **METHODS:** Muscles of Snell dwarf mice and their wild-type littermates were exposed to 1 month of stretch-shortening contraction training. **RESULTS:** For non-trained muscles at both ages, muscles of Snell dwarf mice exhibited 70% less mass and 85% less isometric force relative to those of control mice. At young age, training 3 days per week had no effect regardless of mouse strain. With aging, 3 days per week training decreased muscle mass and isometric force by 12% and 25%, respectively, for control mice while no such decreases were observed for Snell dwarf mice. For control mice, training 2 days per week increased isometric force by 20% at young age with no training-induced decrements with aging. **CONCLUSIONS:** While Snell dwarf mice exhibit a trade-off between longevity and muscular performance, the *Pit1* mutation counters age-related maladaptation to training. For wild-type muscle, modulation of frequency is a means for offsetting the maladaptive training response.

**3313** Board #134 May 29 1:30 PM - 3:00 PM

**Effects Of Angiotensin Receptor Blockade On Overload-induced Muscle Growth And Function In Mice**

Kimberly Huey, FACSM<sup>1</sup>, MacKenzie Temperly<sup>1</sup>, Zachary Conroy<sup>1</sup>, Ken Echevarria<sup>2</sup>, Rudy Valentine<sup>2</sup>. <sup>1</sup>Drake University, Des Moines, IA. <sup>2</sup>Iowa State University, Ames, IA.

Email: kimberly.huey@drake.edu

(No relevant relationships reported)

Muscle hypertrophy induced by functional overload (FO) provides an *in vivo* model to study muscle growth. Angiotensin II (ANG II) has been associated with muscle

atrophy and reduced growth hormone levels while ANG II Receptor Blockers (ARBs) may protect against atrophy and restore insulin-like growth factor 1 (IGF-1) signaling. However, the effects of ARB during muscle growth is unclear. **PURPOSE:** It was hypothesized that ARB treatment would positively impact skeletal muscle growth as evidenced by greater hypertrophy, increased growth factor levels, and improved contractile function compared to placebo.

**METHODS:** Mice underwent FO of the plantaris or sham surgery. *In vivo* plantaris force and fatigue resistance (% of max force after 10 contractions) were measured 14 days after FO or sham in mice receiving daily candesartan (6 mg/kg body mass) or placebo (n=7-9/group). IGF-1 and fibroblast growth factor (FGF) were measured in the plantaris by ELISA. Data were analyzed with 2-way ANOVAs.

**RESULTS:** FO increased plantaris mass in both groups; however, ARB attenuated hypertrophy compared to placebo (Placebo: 13  $\pm$  0.5 vs. 26  $\pm$  2 mg and ARB: 13  $\pm$  0.6 vs. 20  $\pm$  1 mg, for sham and FO, respectively, p<0.05). Maximal force relative to body mass was unchanged with FO, independent of ARB. However, force tended to decrease only in placebo group with FO compared to sham. Fatigue resistance was increased with FO compared to sham, independent of treatment (Placebo: 53  $\pm$  6 vs. 65  $\pm$  5% and ARB: 48  $\pm$  4 vs. 61  $\pm$  4%, for sham and FO, respectively, p<0.05). Plantaris IGF-1 levels were increased with FO, with a significantly greater response in ARB than placebo (Placebo: 51  $\pm$  7 vs. 109  $\pm$  12 pg/mg protein and ARB: 36  $\pm$  3 vs. 148  $\pm$  17 pg/mg protein, for sham and FO, respectively, p<0.05). Plantaris FGF levels were increased with FO in ARB group only (Placebo: 788  $\pm$  88 vs. 901  $\pm$  88 pg/mg protein and ARB: 649  $\pm$  31 vs. 1075  $\pm$  104 pg/mg protein, for sham and FO, respectively, p<0.05).

**CONCLUSIONS:** The hypertrophic response to FO was attenuated with ARB in spite of greater IGF-1 and FGF responses compared to placebo. Comparing FO-associated changes in muscle force between treatments suggests ARB may positively impact muscle specific tension which could be associated with the augmented growth factor responses with ARB.

Supported by Iowa Space Grant Collaborative Research Grant to KH and RV

**3314** Board #135 May 29 1:30 PM - 3:00 PM  
**Skeletal Muscle Phenotype Is Augmented Through The Epigenomic Regulation Of Myogenic Transcription Factors**

Marshall A. Naimo, James Ensej, Erik P. Rader, Brent A. Baker. CDC/NIOSH, Morgantown, WV. (Sponsor: Stephen E. Alway, PhD, FACSM)

Email: ydv5@cdc.gov

(No relevant relationships reported)

**Purpose:** Recently, a training-retraining (TRT) paradigm in which 3 month old rodents underwent an initial cycle of SSC RTET followed by another bout at 6 months led to increases in isometric/dynamic peak force and muscle mass relative to naïve 6 month old rats, thus augmenting the trainability of muscle into adulthood. However, the molecular underpinnings of this response is unknown. Therefore, we sought to determine whether this TRT paradigm has positive effects on transcription factor (TF) methylation and expression in adult skeletal muscle. **Methods:** F344xBN hybrid rats were SSC RTET on an *in vivo* dynamometer 3 days/week for 1 month at 3 months and again at 6 months of age (TRT), or just at 6 months (T). Gene expression and DNA methylation were quantified via PCR Arrays (Qiagen®). **Results:** TRT group had 17 significantly differentially expressed genes (SDEGs) in the TF pathway, including Myf5; T expressed only 3 SDEGs. TRT had decreased TF methylation compared to T (4.1 $\pm$ 0.01 vs. 2.6 $\pm$ 0.01%; p<0.05). **Conclusions:** Adaptive benefits at adulthood following an initial SSC RTET stimulus are supported by altered TF methylation and gene expression. These results advocate RTET at early life to preserve muscle as one ages through an epigenomic muscle memory.

**3315** Board #136 May 29 1:30 PM - 3:00 PM

**Leucine Supplementation Exacerbates Atrophy In Cancer Cachectic Mice**

Wesley S. Haynie, Kyle L. Rankin, Megan E. Rosa-Caldwell, Katarina A. Bejarano, Seongkyun Lim, Nicholas P. Greene, Tyrone A. Washington. University of Arkansas, Fayetteville, AR. (Sponsor: Nicholas Greene, FACSM)

(No relevant relationships reported)

Nearly 80% of cancer patients are afflicted with cachexia, which is defined by wasting of lean body mass and associated with increased morbidity and mortality. The amino acid leucine has been shown to promote muscle growth by augmenting protein synthesis through mTOR activation. Therefore, supplementation of leucine could prove beneficial for mitigating skeletal muscle wasting during cancer cachexia. **PURPOSE:** To determine the effect of leucine supplementation on cancer cachexia in APC<sup>Min/+</sup> (APC) mice. **METHODS:** 18 male APC (n=9) and wildtype (WT, n=9) littermate mice were used in this study. Within each of these two groups, 4 were given water (NL) and 5 were given 1.5% leucine-supplemented water (L), with *ad libitum* access to food and water. Gastrocnemius (GA) muscle and tibias (TL) were extracted at ~14-21 weeks

of age—when mice became moribund. Muscle tissue was homogenized and analyzed for gene expression via RT-qPCR. Gene expression data were analyzed via Two-Way ANOVA, followed by a Fisher's LSD post-hoc to determine between group differences when significant F-ratios were found. The relative frequency of tumor polyp size was analyzed via a Student's t-test. Significance set at  $p < 0.05$ . **RESULTS:** Body weight for APC-NL mice was ~14% lower than both WT-NL and WT-L ( $p < 0.05$ ). Body weight for APC-L mice was ~25% lower than all WT, and ~13% lower than APC-NL ( $p < 0.05$ ). There were main effects of APC genotype and L supplementation for lower GA mass and GA/TL ( $p < 0.05$ ). In APC mice, there was a ~20% increase in the relative frequency of polyps <1mm in diameter, and a ~15% decrease in the relative frequency of polyps 1-2mm in diameter due to L supplementation ( $p < 0.05$ ). There was no difference in the relative frequency of polyps >2mm. There was a main effect for APC mice to have elevated expression of *IL-6*, *IL-1 $\beta$* , *Atrogin-1*, and *MuRF-1* when compared to WT mice ( $p < 0.05$ ). **CONCLUSION:** Surprisingly, leucine supplementation appeared to exacerbate cancer cachexia. Cancer cachexia has previously shown marked increases in skeletal muscle atrophy, commonly through atrophy and inflammatory related markers such as *Atrogin-1*, *MuRF-1*, *IL-6* and *IL-1 $\beta$* . Leucine supplementation may not influence these markers directly, but may alter the cachectic environment to induce greater overall wasting.

**3316** Board #137 May 29 1:30 PM - 3:00 PM  
**Abstract Withdrawn**

**3317** Board #138 May 29 1:30 PM - 3:00 PM  
**Dysregulated Thyroid Hormone Metabolism Following Formoterol Stimulation In Thyroid Hormone Depleted Skeletal Muscle**

Gena D. Guerin, Emily L. Zumbro, Ryan A. Gordon, Chase M. White, Dreanna M. McAdams, Matthew L. Sokoloski, David L. Nichols, FACSM, Anthony A. Duplanty. *Texas Woman's University, Denton, TX.* (Sponsor: David L. Nichols, FACSM) (No relevant relationships reported)

In skeletal muscle (SKM), signal transduction of thyroid hormone (TH) exerts subcellular downstream effects by influencing mechanisms of gene expression. People with hypothyroidism commonly experience SKM pain, fatigue, and intolerance to exercise, which may be driven by dysregulated TH metabolism.

**Purpose:** To use an in vitro model of hypothyroidism to test the hypothesis that SKM cells will have dysregulated TH metabolism. Additionally, the exercise mimetic, formoterol, was used to determine the effects of exercise signaling on TH depleted cells.

**Methods:** Human SKM myoblasts ( $n = 6$  per group) were cultured and differentiated until mature myotube formation (Day 6). Groups included control cells (CON), TH depleted cells (ThD), and TH depleted cells plus formoterol stimulation (ThD+F; 30nM for 3h). Total RNA was extracted during mid-myogenesis (Day 4) and at terminal differentiation (Day 6). Gene expression for Thyroid Hormone Receptor Alpha (THR $\alpha$ ), Deiodinase 2 (DIO2), and Deiodinase 3 (DIO3) was determined by qPCR. Data were analyzed by repeated measures ANOVA.

**Results:** Significant differences between conditions and time points are detailed in Table 1.

**Conclusion:** THR $\alpha$  was reduced by ThD and further decreased by ThD+F, suggesting that the combination of ThD+F is highly suppressive of this receptor. Intracellular activation of TH (T3) by DIO2 stimulates nuclear transcripts leading multiple cellular functions. Formoterol stimulation increased DIO2 but was decreased in the ThD group, indicating a potential lower availability of T3. Interestingly, DIO3 was also increased by formoterol stimulation, which could counteract availability of T3 via conversion to reverse T3. More research addressing hypothyroidism and exercise is warranted as there may be negative consequences regarding exercise mode and intensity. This work was supported by a Texas ACSM SRDA grant.

Table 1.

| Gene         | Comparison          | Fold Change | P Value |
|--------------|---------------------|-------------|---------|
| THR $\alpha$ | D4 ThD < D4 CON     | -0.35       | <0.001  |
|              | D4 ThD > D4 ThD+F   | 0.34        | <0.001  |
|              | D4 ThD+F < D4 CON   | -0.69       | <0.001  |
|              | D4 ThD+F < D6 ThD+F | -0.17       | <0.05   |
|              | D6 ThD < D6 CON     | -0.31       | <0.05   |
|              | D6 ThD > D6 ThD+F   | 0.18        | <0.05   |
| DIO2         | D6 ThD+F < D6 CON   | -0.49       | <0.001  |
|              | D4 ThD < D4 ThD+F   | -1.59       | <0.001  |
|              | D4 ThD > D6 ThD     | 0.70        | <0.05   |
|              | D4 ThD+F > D4 CON   | 1.6         | <0.001  |
|              | D4 ThD+F > D6 ThD+F | 1.4         | <0.001  |
|              | D6 ThD < D6 CON     | -0.78       | <0.05   |
| DIO3         | D6 ThD < D6 ThD+F   | -0.55       | <0.05   |
|              | D4 ThD+F > D4 CON   | 12.25       | <0.05   |
|              | D4 ThD+F > D6 ThD+F | 12.17       | <0.05   |

**3318** Board #139 May 29 1:30 PM - 3:00 PM  
**Mitochondrial Health During The Development Of Cancer Cachexia In Female Mice**

Lauren C. Westervelt<sup>1</sup>, Seongkyun Lim<sup>1</sup>, Megan E. Rosa-Caldwell<sup>1</sup>, Wesley S. Haynie<sup>1</sup>, Kirsten R. Dunlap<sup>1</sup>, Lisa T. Jansen<sup>1</sup>, Michael P. Wiggs<sup>2</sup>, Tyrone A. Washington<sup>1</sup>, Nicholas P. Greene, FACSM<sup>1</sup>. <sup>1</sup>University of Arkansas, Fayetteville, AR. <sup>2</sup>University of Texas at Tyler, Tyler, TX. (Sponsor: Dr. Nicholas Greene, FACSM) Email: lcwester@uark.edu (No relevant relationships reported)

Cancer-cachexia is a syndrome characterized by weight loss, anemia, and skeletal muscle wasting. Muscle mass in males and females is a strong predictor of quality of life and morbidity during cancer treatment. Mitochondrial dysfunction during cancer-cachexia has been well described in males, specifically our laboratory has found mitochondrial deteriorations to precede muscle loss in male models of cachexia. However, if these aberrations are conserved between biological sexes has yet to be investigated. **PURPOSE:** To investigate muscle mitochondrial health during cancer-cachexia development in female mice. **METHODS:** ~40 female C57BL/6J mice were implanted with ~1X10<sup>6</sup> Lewis Lung Carcinoma (LLC) cells in the right hind flank. Tumors were allowed to develop up to 4 weeks. After 3-4 weeks of tumor development, a clear dichotomy was noted in tumor burden. As such, tumor injected females were divided into high tumor (HT, tumor size > 2000 mg) and low tumor groups (LT, tumor size < 1300 mg). CON animals were age-matched to tumor mice and injected with phosphate buffered saline (PBS); therefore creating 3 experimental groups HT, LT, and CON ( $n = 12-14$ /group). Mitochondrial health was measured by fluorescent histology of pMitoTimer. Results were analyzed by one-way ANOVA with Tukey's post hoc when significant F ratios were found ( $p < 0.05$ ). **RESULTS:** Tibialis anterior, plantaris and gastrocnemius muscle masses were ~10%, ~11% and ~5% lower in HT compared to LT and CON. Analysis of pMitoTimer demonstrated no differences between groups. Circulating progesterone and estrogen were ~42% and ~60% lower in HT and LT animals compared to CON with no differences between HT and LT. **CONCLUSION:** LT had negligible muscle wasting when compared to HT, these differences in muscle loss did not correspond to alterations in mitochondrial health. This directly contrasts prior literature in male models of cancer-cachexia suggesting divergent mechanisms between males and females in the development of cancer-cachexia. As such, further examination of why females had a dichotomy in tumor development and subsequent wasting mechanisms are necessary in order to further understand mechanisms contributing to development of cancer-cachexia. This study was funded by the National Institutes of Health, Award: R15 AR069913/AR/NIAMS.

3319 Board #140 May 29 1:30 PM - 3:00 PM

**A New Muscle Disuse Model Using A Removable Tissue-engineering Muscle**

Takeshi Sugimoto<sup>1</sup>, Shoma Imai<sup>2</sup>, Koki Sakushima<sup>1</sup>, Maki Yoshikawa<sup>1</sup>, Toshiya Fujisato<sup>2</sup>, Tomohiro Nakamura<sup>2</sup>, Takeshi Hashimoto, FACSM<sup>1</sup>. <sup>1</sup>Ritsumeikan University, Kusatsu, Shiga, Japan. <sup>2</sup>Osaka Institute of Technology University, Osaka, Osaka, Japan. (Sponsor: Takeshi Hashimoto, FACSM)  
Email: sh0150rs@ed.ritsumeikan.ac.jp

(No relevant relationships reported)

**PURPOSE:** Physical inactivity and subsequent skeletal muscle disuse may cause muscle atrophy, which is associated with a reduction in muscle function, physical performance, quality of life, and loss of independence, particularly in elderly. Traditionally, 2D muscle cell cultures (e.g. C2C12) have been used to study biological processes and identify and validate pharmacological and/or nutritional compounds to treat skeletal muscle disease including muscle atrophy. However, cell culture studies basically use a pharmacological method to induce muscle atrophy, and not an actual muscle disuse induced by a reduction of mechanical stress (i.e., mechanical unloading). Previously Nakamura et al. (2017) developed 3D engineered muscle (OITem: Osaka institute technology engineered muscle) with artificial tendons at both ends of the muscle, which is removable, thereby allowing us to mechanically release muscle tension by taking off (removing) one side of the muscle. Therefore, the purpose of the present study was to investigate whether removable tissue-engineering muscle effectively induce muscle atrophy, and thus is useful for muscle disuse model.

**METHODS:** OITem was made from C2C12 skeletal muscle cells and a cold type-I collagen gel and placed between two artificial tendons (Nakamura et al., 2017). OITem was differentiated for 2-weeks and then divided into two groups: 1-week stretched on control group (CON: n = 6) in which the both ends of the muscle fixed with tendons, and 1-week stretched off group (OFF: n = 6) in which the one side of the muscle was removed. We analyzed expressions of muscle atrophy-related proteins MuRF-1 and Atrogin-1, and myogenesis-related protein myogenin using Western blotting. As well, we analyzed expression of MHC-fast or -slow (fast- or slow-twitch muscle fiber specific myosin heavy chain (MHC), respectively). **RESULTS:** The protein expression of MuRF-1 and myogenin was significantly lower in the OFF than those in the CON ( $P < 0.05$ ). Moreover, the protein expression of MHC-fast and -slow was significantly lower in the OFF than those in the CON ( $P < 0.01$ ). However, the protein expression of Atrogin-1 did not differ between two groups.

**CONCLUSIONS:** The present findings suggest that OITem may be useful model for muscle disuse.

3320 Board #141 May 29 1:30 PM - 3:00 PM

**Abstract Withdrawn**

3321 Board #142 May 29 1:30 PM - 3:00 PM

**Insulin Resistance, Skeletal Muscle Extracellular Matrix Remodeling, And The Effect Of Exercise**

Dongmei Liu<sup>1</sup>, Carl Bender<sup>1</sup>, JunJun Lv<sup>2</sup>, Min Sun<sup>2</sup>, Paul Gordon, FACSM<sup>1</sup>. <sup>1</sup>Baylor University, Waco, TX. <sup>2</sup>Shanghai University of Sport, Shanghai, China. (Sponsor: Paul Gordon, FACSM)

Email: dongmei\_liu@baylor.edu

(No relevant relationships reported)

**Abstract**

Extracellular matrix (ECM) remodeling in skeletal muscle is a potential mechanism linking obesity with metabolic dysfunction. It is also a constructive feature of skeletal muscle adaptation to exercise training.

**Purpose:** To test the hypothesis that skeletal muscle ECM remodeling associated with insulin resistance can be minimized by exercise training.

**Methods:** Six-week-old male C57/BL6J mice (n=48) were divided into two groups, high-fat (60% calories from fat) diet (HF, n=36) and normal chow-fed control (C, n=12) group. After 12 weeks of feeding, HF mice developed insulin resistance, as confirmed by insulin and glucose tolerance tests (ITT and GTT). HF mice were then randomly assigned to three groups: high-fat diet only group (HFS, n=12), high-fat diet + aerobic exercise group (HF+AE, n=12), high-fat diet + resistance training group (HF+RT, n=12). The HF+AE and HF+RT groups were subject to aerobic (treadmill running) and resistive (vertical ladder climbing) training, for 12 weeks. After training, gastrocnemius muscle was harvested and analyzed for ECM factors using immunohistochemistry, ECM PCR array, and western blotting. ANOVA was performed to test the significance of group differences at  $p < 0.05$ .

**Results:** High-fat feeding induced higher deposition of collagens (COL1, III and IV) in the skeletal muscle of HFS group, and increased gene and protein expression of MMP3, CDH1, ITGAL and SELL and decreased the expression of TIMP3 in HFS group, as compared to group C. These changes were minimized even reversed by either

aerobic or resistance exercise training (mRNA fold change relative to C in HF+AE and HF+RT vs. HFS: MMP3, 1.1 and 1.6 vs. 2.6; CDH1, 1.7 and 1.1 vs. 2.0; ITGAL, 1.9 and -1.0 vs. 2.0;

SELL, 1.4 and 1.0 vs. 2.1; TIMP3, 1.2 and -1.0 vs. -1.2;  $p < 0.05$ ). These effects were accompanied by a significant improvement in insulin sensitivity (GTT AUC glucose in mmol/l x 120 min: C, 27.2±3.0; HFS, 39.7 ± 7.0; HF+AE, 32.4± 7.5; HF+RT, 30.3± 6.1;  $p < 0.05$ ).

**Conclusion:** Both aerobic and resistive exercise training can minimize changes in skeletal muscle ECM associated with insulin resistance. Skeletal muscle ECM remodeling may play a significant role in mediating the metabolic benefits of exercise training.

This study was supported by National Nature Science Foundation of China (31470060).

3322 Board #143 May 29 1:30 PM - 3:00 PM

**Exercise Reverses Disuse Atrophy In Rat Gastrocnemius Muscle**

Huayu Shang, Zhifei Ke, Jing Zhao. Chengdu Sport University, Chengdu, China. (Sponsor: Tongjian You, FACSM)

(No relevant relationships reported)

**PURPOSE:** To investigate the effects of different exercise interventions on disuse atrophy and atrophy-related proteins in rat gastrocnemius muscle.

**METHODS:** Male Sprague-Dawley rats were randomly divided into a control group (C, n=16) and a suspension group (T, n=40). Rats in the T group were suspended by a tail suspension system for two weeks. Rats in the C group were further divided into a post-suspension blank group (C1) and a post-exercise blank group (C2), and rats in the T group were further divided into a post-suspension control group (T1), a post-exercise control group (T2), an endurance exercise group (TA), a resistance exercise group (TR) and a combined endurance and resistance exercise group (TAR). Rats in the TA, TR, and TAR groups were subjected to exercise training for four weeks. Body weight and wet weight of gastrocnemius muscle were measured immediately after suspension or at 24 hours after the last training session. Protein expression levels of Muscle Ring Finger 1 (MURF1), Muscle Atrophy F-Box (MAFbx), Insulin-Like Growth Factor-1 (IGF-1) and CysteinyL Aspartate Specific Protease-3 (Caspase-3) in gastrocnemius muscle were determined by western blot. Student t-tests and one-way ANOVAs were used for data analysis.

**RESULTS:** After suspension, body weight and wet weight of gastrocnemius muscle in the T1 group were significantly lower than those in the C1 group ( $p < 0.05$  to  $p < 0.01$ ). After exercise intervention, body weight, wet weight of gastrocnemius muscle, and the protein expression levels of MAFbx in the TA, TR, and TAR groups were significantly higher than those in the T2 and C2 groups, the protein expression levels of Caspase-3 in the TA, TR and TAR groups were significantly lower than those in the T2 and C2 groups, and the protein expression levels of MURF1 in the TA and TR groups were significantly lower than those in the T2 group ( $p < 0.05$  to  $p < 0.01$ ).

**CONCLUSIONS:** Exercise interventions, such as endurance exercise, resistance exercise, and combined endurance and resistance exercise, can effectively reverse disuse atrophy of gastrocnemius muscle in rats, which may be through altering the expression levels of several atrophy-related proteins.

3323 Board #144 May 29 1:30 PM - 3:00 PM

**Resistance Exercise-Induced Hormone Change Promotes Autophagy Response In Untrained Women**

Casey Robert Appell<sup>1</sup>, Travis Rai<sup>1</sup>, Matthew T. Stratton<sup>1</sup>, Mohamed Fokar<sup>1</sup>, Jakob Vingren, FACSM<sup>2</sup>, Hui Ying Luk<sup>1</sup>. <sup>1</sup>Texas Tech University, Lubbock, TX. <sup>2</sup>University of North Texas, Denton, TX. (Sponsor: Jakob Vingren, FACSM)

Email: casey.appell@ttu.edu

(No relevant relationships reported)

**Introduction:** Autophagy is a catabolic process for maintaining skeletal muscle homeostasis by recycling malfunctioning protein aggregates. Evidence suggests that hormones (e.g., cortisol) promote autophagic activity in muscle cells; however, no prior study has examined the effect of resistance exercise (RE)-induced hormonal response on the autophagic response.

**Purpose:** To determine the effect of an acute RE-induced hormonal response on the autophagic response after muscle damage in untrained young women.

**Methods:** Untrained women (n=8, 20 ± 1y; height: 164.1 ± 9.2 cm; weight 60.7 ± 7.8 kg) completed 2 sessions of 80 unilateral maximal eccentric knee extensions followed by either an upper body RE protocol (EX; aimed to induce an increase in cortisol) or a 20-min rest (CON). Muscle samples were collected and analyzed for markers of autophagic initiation signaling (FOXO3A, AKT, MTOR), phagophore initiation (ATG5, ULK1, BECN1), elongation (ATG7, LC3A, LC3B), and autolysosomal degradation (SQSTM1/p62) by real-time PCR at before exercise (PRE), 12 hours (+12h) and 24 hours (+24h) after exercise.

**Results:** A significant ( $p < 0.05$ ) time x condition effect was found for ULK1. At +24h (0.81 ± 0.26-fold), ULK1 gene expression was greater in EX than CON. A significant

time effect was found for FOXO3A. FOXO3A expression decreased at +12h (0.33 ± 0.07-fold) and +24h (0.25 ± 0.07-fold) from PRE. A trend was found for BECN1 (p=0.055) towards an increased in expression from PRE to +12h (1.94 ± 0.65-fold). A significant time effect was found for the AUC of cortisol with a greater AUC of cortisol for EX than CON.

Conclusion: These results suggest that the RE-induced hormone response can be important to the initiation of the phagophore after muscle damage in untrained young women.

**3324** Board #145 May 29 1:30 PM - 3:00 PM

**Myogenic Regulatory Factor Expression Is Downregulated Following Formoterol Stimulation In Thyroid Hormone Depleted Skeletal Muscle**

Ryan A. Gordon, Gena D. Guerin, Emily L. Zumbro, Chase M. White, Dreanna M. McAdams, Matthew L. Sokoloski, David L. Nichols, FACSM, Anthony A. Duplanty. *Texas Woman's University, DENTON, TX.* (Sponsor: David L. Nichols, FACSM) (No relevant relationships reported)

In skeletal muscle (SKM), gene expression of transcription factors regulating myogenesis are dependent on thyroid hormone (TH) signal transduction. Expression of myogenic regulatory factors may be altered due to dysregulated TH metabolism, which may result in SKM dysfunction and intolerance to exercise in individuals with hypothyroidism.

**PURPOSE:** To use an in vitro model of hypothyroidism to test the hypothesis that SKM cells will have dysregulation in transcription factors regulating myogenesis. Additionally, the exercise mimetic, formoterol, was used to determine the effects of exercise signaling during myogenesis.

**METHODS:** Human SKM myoblasts (n = 6 per group) were cultured and differentiated until mature myotube formation (Day 6). Groups included control cells (CON), TH depleted cells (ThD), and TH depleted cells plus formoterol stimulation (ThD+F; 30nM for 3h). Total RNA was extracted during mid-myogenesis (Day 4) and at terminal differentiation (Day 6). Gene expression for myogenic regulatory factors (Myf5, MyoD, MyoG) was determined by qPCR. Data were analyzed by repeated measures ANOVA.

**RESULTS:** Significant differences between conditions and time points are detailed in Table 1.

**CONCLUSION:** TH depletion had no effect on MyoG but did reduce the expression of both Myf5 and MyoD at both D4 and D6. Additionally, ThD+F resulted in the lowest expression of MyoG and MyoD for both time points. These results indicate TH depletion and formoterol stimulation may inhibit myotube maturation.

This work was supported by a Texas ACSM SRDA grant.

Table 1.

| Gene | Comparison          | Fold Change | P Value |
|------|---------------------|-------------|---------|
| Myf5 | D4 ThD < D4 Con     | -0.36       | <0.001  |
|      | D4 ThD < D4 ThD+F   | -0.32       | <0.05   |
|      | D4 ThD+F > D6 ThD+F | 0.21        | <0.05   |
|      | D6 ThD < D6 CON     | -0.31       | <0.001  |
|      | D6 ThD+F < D6 CON   | -0.19       | <0.05   |
|      | D4 ThD > D4 ThD+F   | 0.36        | <0.001  |
| MyoD | D4 ThD > D4 ThD     | 0.32        | <0.001  |
|      | D4 ThD+F < D4 CON   | -0.91       | <0.001  |
|      | D4 ThD+F < D4 ThD   | -0.36       | <0.001  |
|      | D6 ThD < D6 CON     | -0.13       | <0.001  |
|      | D6 ThD > D6 ThD+F   | 0.09        | <0.001  |
|      | D6 ThD+F < D6 CON   | -0.22       | <0.001  |
|      | D6 CON < D4 CON     | -0.75       | <0.001  |
|      | D4 ThD > D4 ThD+F   | 0.77        | <0.001  |
| MyoG | D4 ThD > D6 ThD     | 0.42        | <0.05   |
|      | D4 ThD+F < D4 CON   | -0.75       | <0.001  |
|      | D4 ThD+F < D4 ThD   | -0.77       | <0.001  |
|      | D6 ThD < D4 ThD     | -0.42       | <0.05   |
|      | D6 ThD > D6 ThD+F   | 0.37        | <0.001  |
|      | D6 ThD+F < D6 CON   | -0.40       | <0.001  |
|      | D6 ThD+F < D6 ThD   | -0.37       | <0.001  |
|      | D6 CON < D4 CON     | -0.38       | <0.05   |

**3325** Board #146 May 29 1:30 PM - 3:00 PM

**The Immunoproteasome, A Potential Link To The Loss Of Muscle Mass In Diet-induced Obesity**

Emma Fletcher, Paul M. Gordon, FACSM. *Baylor University, Waco, TX.*  
Email: Emma\_Fletcher1@Baylor.edu  
(No relevant relationships reported)

**PURPOSE:** Obesity is associated with reductions in muscle mass and regeneration. Although chronic inflammation and oxidative stress may play a role, the way in which these processes regulate catabolism in obese muscle is unclear. Since the catalytic subunit of the immunoproteasome (LMP7) is increased in muscle of other atrophic diseases, we sought to determine the impact of diet-induced obesity (DIO) on muscle mass, LMP7 protein content, and regeneration in response to exercise-induced muscle damage (EIMD) in mice. Intramuscular levels of pro-(CD11b and CD38) and anti-(CD206 and EGR2) inflammatory macrophages and oxidative stress (8-isoprostane) were also assessed. **METHODS:** Sixty male C57BL/6J mice (4 weeks old) were randomly assigned to either a high-fat diet (HFD, 45% fat) or lean diet (LD, 10% fat). After 12 weeks of feeding, the mice were randomly subdivided into EIMD or non-exercise, no muscle damage (NMD) control groups. EIMD was achieved via a downhill treadmill run at 13-14m/min for 68min. The gastrocnemius muscle (GS) was excised 1 or 5 d after EIMD, resulting in 6 experimental groups (n = 10/group) at study completion. **RESULTS:** Total body mass was greater (HFD 43.3 ± .6 g vs LD 30.8 ± .6 g, p = .000), however, GS mass relative to body mass was lower (HFD 4.1 ± .1 mg/g vs LD 5.3 ± .1 mg/g, p = .000) in mice with DIO. Despite no change in pro- or anti-inflammatory macrophages (p > .05), GS oxidative stress was increased in mice with DIO (HFD 46.0 ± 5.1 pg/ml, vs LD 29.2 ± 4.6 pg/ml, p = .029). Oxidative stress was enhanced 1 d post-EIMD, but only in DIO mice (HFD 77.9 ± 8.6 pg/ml vs LD 31.4 ± 3.3 pg/ml, p = .015). Muscle LMP7 was also elevated with DIO (HFD 3.6 ± .2 ng/ml vs LD 2.6 ± .1 ng/ml, p = .000), and increased 5 d post-EIMD (3.5 ± .2 ng/ml) when compared to NMD (2.7 ± .1 ng/ml, p = .005). However, the response of LMP7 to EIMD did not differ between obese or lean mice (p = .504). When controlling for muscle damage group assignment, LMP7 was correlated with 8-isoprostane (r = .39, p = .027) and both markers were inversely correlated with relative GS mass (r = -.48 (LMP7), -.62 (8-isoprostane), p = .000). Muscle regeneration (myogenic differentiation protein) was unaltered by DIO (p = .741) or EIMD (p = .455). **CONCLUSIONS:** The immunoproteasome may be a critical link between obesity-induced oxidative stress and diminished muscle mass.

**3326** Board #147 May 29 1:30 PM - 3:00 PM

**An Evaluation Of Skeletal Muscle Aging Using A Novel Guinea Pig Model**

Maureen A. Walsh, Robert V. Musci, Raoul F. Reiser, II, Kelly S. Santangelo, Karyn L. Hamilton, FACSM. *Colorado State University, Fort Collins, CO.* (Sponsor: Karyn Hamilton, FACSM)  
Email: maureen.walsh@colostate.edu  
(No relevant relationships reported)

Maintenance of the musculoskeletal system is critical to prevent falls and loss of mobility with aging. Sarcopenia, the age-related loss of muscle mass and function, affects 10% of those over 65 years and as much as 50% of people over 80 years of age. Aging is a major risk factor for osteoarthritis (OA) which is characterized by a concomitant loss of skeletal muscle, further contributing to decreased mobility. The "inflammatory" phenotype, (i.e., age-related increases in low-grade inflammation and oxidative stress) is common to both OA and sarcopenia. While progress has been made in understanding the mechanisms of sarcopenia a preclinical model that recapitulates human conditions is lacking. Dunkin Hartley (DH) guinea pigs rapidly and spontaneously develop primary knee OA beginning at about 4 months of age. Thus, we speculate that DH guinea pigs may also be a valuable model of sarcopenia. **PURPOSE:** To determine if DH guinea pigs can serve as a model to understand human skeletal muscle aging. **METHODS:** We compared skeletal muscle age-related changes in the gastrocnemius (GAS) and soleus (SOL) from 5, 9, and 15-mo DH guinea pigs. We also compared these changes to a strain of guinea pig, strain 13, that does not develop knee OA at an early age. Magnetic resonance imaging was used to examine volume and then used to calculate muscle density. Immunofluorescent histochemistry was used to assess myofiber size distribution. Formalin fixed muscles were stained in India ink to measure pennation angle. Fibrosis was assessed using muscles paraffin embedded and stained with Masson's Trichrome to quantify % collagen. Analyses are ongoing to identify if DH pigs are characterized by an inflammatory phenotype similar to aging human muscle. **RESULTS:** DH guinea pigs had a significant decrease in GAS density between 5 and 15-mo that was not present in the SOL (p<0.05). Both in the GAS and SOL, DH guinea pigs also demonstrated a shift towards a smaller average myofiber size with age. However, there were no age-related changes in pennation angle or fibrosis. **CONCLUSION:** Based on these analyses, the DH guinea pig appears to be a potentially valuable model

of musculoskeletal aging. Identifying a model to study muscular aging that mimics human conditions but in a shortened time frame, will potentially allow for effective screening and treatment interventions.

**3327** Board #148 May 29 1:30 PM - 3:00 PM  
**Skeletal Muscle Transcriptome Profiling: Investigating Regulators Of Temporal Improvements In Glucose Metabolism Following Muscle Contraction**

Steven Carter<sup>1</sup>, Thomas Solomon<sup>2</sup>. <sup>1</sup>University of Birmingham, Birmingham, United Kingdom. <sup>2</sup>Other, London, United Kingdom. (Sponsor: Professor Janice L Thompson, FACSM)  
 (No relevant relationships reported)

Exercise-induced improvements in skeletal muscle glucose metabolism follow a distinct time-course profile, with immediate increases in glucose uptake followed by improved insulin sensitivity. Molecular mediators controlling this temporal effect could be targeted to optimise the efficacy of exercise in preventing insulin resistance and associated metabolic abnormalities. **PURPOSE:** To characterise the transcriptional changes associated with time-dependent changes in glucose metabolism following muscle contraction. **METHODS:** C2C12 myotubes were exposed to either 24 h of contractile activity (electrical pulse stimulation; EPS) or rest (no EPS), followed by a further 0, 6, 18 or 24 h rest (no EPS). Temporal profiling of the contraction-mediated responses in functional (basal and insulin-stimulated glucose uptake) and transcriptional (RNA sequencing and bioinformatics) outcomes was evaluated at all time points. Data are presented as mean ± SEM. **RESULTS:** Compared to time-matched control cells (no EPS), contraction-mediated glucose uptake (i.e. without insulin) was increased 0 h post-EPS only (162 ± 28 % relative to control, P<0.05), whereas insulin sensitivity was increased at 24 h post-EPS only (163 ± 35 % relative to control, P<0.05). This distinct temporal profile for contraction-induced changes in muscle glucose metabolism was associated with a similarly distinct temporal transcriptional profile. Firstly, EPS-induced improvements in contraction-mediated glucose uptake (0 h post-EPS) and insulin sensitivity (24 h post-EPS) coincided with differential expression of 143 (76 up-regulated; 67 down-regulated) and 145 transcripts (71 up-regulated; 74 down-regulated), respectively. Notably, only 35 were differentially regulated at both 0 and 24 h post-EPS. Of these, only 20 were regulated in the same direction (e.g. miR-206, miR-207), with the remaining 15 oppositely regulated (e.g. miR-99b, miR-6790). **CONCLUSION:** Similar to exercise *in vivo*, our model of *in vitro* skeletal muscle contraction induced distinct temporal profiles for contraction-mediated glucose uptake and insulin sensitivity. These time-dependent changes in skeletal muscle glucose metabolism are associated with an equally distinct contraction-specific transcriptional profile. Supported by: The Physiological Society

**3328** Board #149 May 29 1:30 PM - 3:00 PM  
**Comparison Of Exercise-induced Regulation Of Skeletal Muscle Hif-1α Between Endurance Trained And Untrained Individuals**

Roberto C. Nava, Zachary Fennel, Zachary McKenna, Anna Welch, Quint Berkemeier, Ann Gibson, FACSM, Christine Mermier. University of New Mexico, Albuquerque, NM. (Sponsor: Ann Gibson, FACSM)  
 Email: rnavabjj@unm.edu  
 (No relevant relationships reported)

The regulation of gene transcription is essential for muscle adaptations resulting from endurance exercise training. Recent findings implicate hypoxia inducible factor 1α (HIF-1α) in this adaptive process as it regulates genes involved in O<sub>2</sub> homeostasis and substrate utilization. Athletes have greater resting levels of muscle HIF-1α inhibitors than untrained individuals, suggesting that suppression of HIF-1α underlies skeletal muscle adaptations to endurance training. However, it is unknown if the *exercise-induced* expression of HIF-1α and its inhibitors differs between trained and untrained individuals. Further, differences in expression of HIF-1α target genes following acute exercise between trained (ET) and untrained (UT) individuals have yet to be examined. **PURPOSE:** To compare regulation of HIF-1α and HIF-1α-target genes between ET and UT individuals following acute exercise. **METHODS:** Five ET and five UT subjects performed an acute bout of cycling consisting of twenty, 10s sprints. Muscle samples were collected pre, post and 3 hours (3H) after exercise and analyzed for HIF-1α, the HIF-1α regulators: PHD2, FIH, VHL and SIRT6, and HIF-1α target genes (BNIP3, PINK1, VEGF, PDK-M, GLUT4, GAPDH). **RESULTS:** 2x3 repeated measures ANOVA revealed that post-exercise HIF-1α protein was greater in UT compared to ET individuals (.310 ± .020 vs .244 ± .001 AU, p<.05). PHD2 (.056 ± .012 vs .032 ± .023 AU), FIH (.008 ± .001 vs .004 ± .002 AU) and SIRT6 (.04 ± .001 vs .002 ± .001 AU) levels were higher in ET compared to the UT individuals at 3H post exercise (p<.05). Post-exercise fold change values for PDK (2.2 ± 1.2 vs .90 ± .21) and BNIP3 (2.2 ± 1 vs .94 ± .16) were greater in UT compared to ET (p<.05). **CONCLUSION:** Exercise-induced expression of HIF-1α is blunted in ET individuals compared to UT individuals. This is due to the greater post-exercise expression of

HIF-1α regulating proteins. The suppression of HIF-1α in response to exercise in ET individuals is evident at the transcriptional level, as expression of PDK and BNIP3 are lower in ET individuals compared to UT. This suggests that endurance training suppresses transcription of PDK, facilitating ATP-resynthesis via oxidative phosphorylation. The suppression of BNIP3 may reflect a reduction in mitophagy, further supporting mitochondrial function in ET individuals.

**3329** Board #150 May 29 1:30 PM - 3:00 PM  
**Diurnal Physical Activity Regulates Skeletal Muscle Ulk-1 Phosphorylation In Tumor Bearing Male Mice**

Brittany Counts, Jessica Halle, James Carson, FACSM. University of Tennessee Health Science Center, Memphis, TN. (Sponsor: James A. Carson, FACSM)  
 Email: bcounts1@uthsc.edu  
 (No relevant relationships reported)

**Introduction:** Cancer cachexia is characterized by severe muscle mass loss associated with increased autophagy. Unc-51 like kinase 1 (ULK1) plays a primary role in initiating autophagy. Under conditions of energetic stress, AMPK activates ULK1 at serine 555 to initiate autophagosome formation for removal of damaged proteins. Daily physical activity and feeding behaviors in mice exhibit diurnal fluctuations that can impact skeletal muscle ULK1 activation. **Purpose:** We investigated the effect of diurnal regulation of skeletal muscle ULK1 phosphorylation in tumor bearing mice. We also examined the impact of increased physical activity on skeletal muscle ULK1 phosphorylation in the cancer environment. **Methods:** Free living male C57BL/6 (B6; N=24) and *Apc<sup>Min/+</sup>* (MIN; N=22) mice were single housed without wheel access. An additional cohort of B6 (B6+W;N=16) and MIN (MIN+W;N=19) mice were given wheel access for 2-weeks. To examine diurnal fluctuation, all mice were sacrificed at 7:00AM or 7:00PM under *ad libitum* conditions. ULK1 was measured in the gastrocnemius muscle as phosphorylation to total ratio at serine 555 by western blot. **Results:** Free living MIN mice exhibited body weight loss (p<0.001) and reduced gastrocnemius mass (p<0.001) when compared to B6 mice. In the MIN free living mouse, ULK1 phosphorylation was associated with greater body weight loss (R= -0.505; p=0.023) and reduced cage activity (R= -0.548; p=0.012). ULK1 phosphorylation in MIN and MIN+W mice exhibited diurnal fluctuation, being increased at 7AM when compared to 7PM. This diurnal variation was not present in B6 or B6+W mice. Interestingly, regardless of sacrifice time ULK1 phosphorylation was inversely related to total wheel distance (R=-0.498; p=0.049). **Conclusion:** ULK1 demonstrated diurnal fluctuation in MIN mice but not in B6 mice. This change in ULK1 phosphorylation was associated to body weight loss and reduced activity. These data suggest that ULK1 phosphorylation is dependent on the time of day in the tumor environment, further research is warranted to examine if this induction of ULK1 is sufficient to induce autophagy.

**3330** Board #151 May 29 1:30 PM - 3:00 PM  
**The Role Of Omi/htra2 During Autophagy In Skeletal Muscle Induced By Exercise Injury**

Zhang Xin<sup>1</sup>, Shang Hua yu<sup>2</sup>, Wang Rui yuan<sup>3</sup>. <sup>1</sup>Nanjing Sport Institute, Nanjing, China. <sup>2</sup>Chengdu Sport Institute, Chengdu, China. <sup>3</sup>Beijing Sport University, Beijing, China.  
 Email: 664191763@qq.com  
 (No relevant relationships reported)

Omi/HtrA2 is known to be a pro-apoptotic protein and also participates in the regulation of autophagy. Previous studies have found that centrifugal exercise can induce an increase in Omi/HtrA2 protein expression in damaged skeletal muscle cells. Omi/HtrA2-Hax1-Beclin1, as the newly discovered autophagy signaling pathway in cells since 2010, has not been reported whether can be specifically expressed in injured skeletal muscle.

**Purpose:** This study was designed to explore the role of Omi/HtrA2 during autophagy in skeletal muscle induced by centrifugal exercise injury. **Methods:** 168 SD rats were randomly divided into control group (C), dummy control group (D), ucf-101 group (U), exercise group (E) and exercise+ucf-101 group (EU). The U group was injected with ucf-101, a specific inhibitor of Omi/HtrA2; D injection of equal amount of normal saline; for group E with acute heavy load treadmill exercise, the slope was -16°, the speed was 16m/min, and the continuous exercise was 90 min; the EU group performed the same exercise after injection of ucf-101. Soleus muscle was taken from the rats at 0h, 12h, 24h, 48h and 72h after intervention. Ultrastructural changes of autophagosomes in soleus muscle cells were observed by TEM; the expressions of Omi/HtrA2, hax-1 and Beclin1 were detected by Western Blot; the position and content of LC3 were observed by immunofluorescence technique; The binding levels of Hax-1 and Beclin1 were determined by immunoprecipitation. **Results:** The expression of Omi/HtrA2 protein was increased in group E (0h, 2.056±0.114, P<0.05), and the binding of Hax-1 and Beclin1 protein was weakened (0h, 0.805±0.095, P<0.05). The expression of Omi/HtrA2 protein was decreased in the U group (0h, 0.406±0.178, P<0.01), and the binding of Hax-1 and Beclin1 protein was enhanced (0h, 1.536±0.051, P<0.05; 24h, 8.000±0.197, P<0.01). Compared with group E, autophagy in EU group was

decreased, Beclin1 expression was inhibited, and LC3 fluorescence intensity was decreased(Beclin1,  $U_0=0.718\pm0.039$ ,  $E_0=1.870\pm0.291$ ,  $EU_0=0.871\pm0.096$ ). **Conclusion:** A high-load centrifugal exercise can induce autophagy in skeletal muscle, which may enhance the cutting effect of Omi/HtrA2 on Hax-1 through exercise, reduce the binding inhibition level of the latter on Beclin1, and finally enhance autophagy.

**3331 Board #152 May 29 1:30 PM - 3:00 PM**  
**Effects Of 16 Weeks Hiit And Vitamin E On The Ros-nfkb-bnip3 Pathway In Aging Rat Muscle**

ZHONG-YE JIANG, HAO SU, GUO-HUAN CAO, TIAN-HAO WEN, JIA SHAO, ZHENG-SONG WANG. *Beijing Sport University, Beijing, China.*  
 (No relevant relationships reported)

The effect of high intensity interval exercise (HIIT) combined with Vitamin E(VE) in the intervention of aging degeneration of skeletal muscle is still unclear. **PURPOSE:** In this study, the effects of 16-week HIIT intervention and VE supplementation on the mitochondrial autophagy related Ros-NFκB-Bnip3 pathway and the number of mitochondria in aged rat skeletal muscle were observed. To provide theoretical basis for delaying sarcopenia by means of exercise and nutrition. **METHODS:** 60 male Wistar rats aged 8 months were randomly divided into the control group (C, n=20), the HIIT intervention group (H, n=20) and the HIIT group supplemented with VE (EH, n=20) according to the random number table. H and EH adjusted the exercise intensity with the results of the  $VO_{2max}$  test every two weeks. The EH was given VE gavage according to 50mg/kg body weight everyday at 1 hour before each training. Rats were taken from each group randomly at the basic state, week 8 and 16 for sampling. During sampling, the soleus muscle of rats was removed. The mitochondria were photographed using a transmission electron microscope, the fluorescence intensity of ROS was measured by Multifunctional enzyme marker, The NF-κB, beclin-1 and Bnip3 were measured by Western blot. The data were analyzed by multivariate ANOVA.

**RESULTS:** At 8 weeks, the number of mitochondrial in H and EH were increased ( $P=0.033$ ,  $P=0.001$ ) and higher than that in C ( $P=0.046$ ,  $P=0.003$ ). At 16 weeks, H was higher than C ( $P=0.004$ ), EH ( $P=0.01$ ) and baseline ( $P=0.046$ ). ROS in C and EH increased at 8 weeks ( $P=0.024$ ,  $P=0.001$ ). C and EH were higher than H ( $P=0.018$ ,  $P=0.002$ ). At 16 weeks, H and EH were higher than baseline values ( $P=0.027$ ,  $P=0.010$ ). Although the content of NF-κB changed in each group, no significant difference occurred. At week 16, beclin-1 expression of soleus muscle in H increased ( $P=0.036$ ). EH was lower than H and C ( $P=0.004$ ,  $P=0.002$ ). The expression of Bnip3 in soleus muscle in C increased at 8 weeks and 16 weeks ( $P=0.030$ ,  $P=0.001$ ). H increased at 8 and 16 weeks ( $P=0.001$ ,  $P=0.001$ ), and was higher in H than in EH ( $P=0.006$ ,  $P=0.020$ ).

**CONCLUSIONS:** The 16 week HIIT intervention and the combined effect of HIIT and VE to alleviate the reduction of mitochondrial number caused by aging may be due to the delayed protein expression of the Ros-NFκB-Bnip3 pathway in the soleus muscle of rats.

**3332 Board #153 May 29 1:30 PM - 3:00 PM**  
**Akt-FOXO1 Takes Part In Regulating Protein Metabolism During Resistance Training At Hypoxia**

Jiabei Yu<sup>1</sup>, Yang Hu<sup>2</sup>, Yanchun Li<sup>2</sup>, Lijing Gong<sup>2</sup>. <sup>1</sup>Beijing Institute of Sports Science, Beijing, China. <sup>2</sup>Beijing Sport University, Beijing, China.  
 Email: bsuyjb@163.com  
 (No relevant relationships reported)

**PURPOSE:** To research the effects of resistance training on skeletal muscle at hypoxia and Akt-FoxO1 pathway regulatory role during this process. **METHODS:** 40 male Sprague-dawley rats were divided into four groups randomly and were raised at normoxia and hypoxia (12.4% O<sub>2</sub>) respectively. Two groups were trained to climb ladder (height 1.2m, inclined at 85°) with load every other day lasting 4-week. Other two groups were quiet control group. Body composition was tested by using DEXA. Isolated extensor digitorum longus (EDL), biceps and soleus were made HE stained paraffin section to analyze muscle fibre cross section area (CSA). Total protein and RNA were abstracted to detect Akt, FoxO1, FoxO1 (S256) and downstream E3 ligase (MuRF1 and Atrogin-1) transcription and expression level. **RESULTS:** Rats lean body mass and CSA of EDL and soleus were decreased significantly ( $P<0.05$  and  $P<0.05$ ) after 4-week hypoxic exposure. Akt and FoxO1 (S256) expression were decreased, while the expression of FoxO1, MuRF1 and Atrogin-1 were increased ( $P<0.05$ ). Relatively, resistance training could effectively reduce this atrophy and stimulate rat biceps and EDL hypertrophy ( $P<0.05$  and  $P<0.05$ ). Meanwhile, Akt and FoxO1(S256) expression were higher than hypoxia training group ( $P<0.05$ ). **CONCLUSIONS:** Akt-FoxO1 pathway plays an important role in regulating muscle protein during resistance training in hypoxia. Akt activation lead to the nuclear exclusion of phosphorylated FoxO1, which is an important mechanism of resistance training alleviate muscle atrophy.

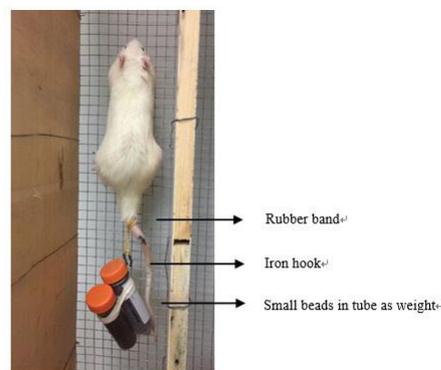


Fig 1. A photograph of climbing ladder with weight attached tail of rat.

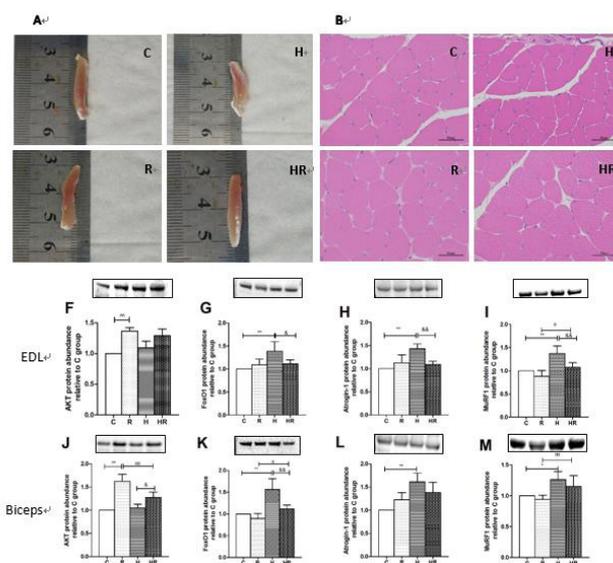


Fig 2. A-B: photographs and HE stained images of muscle (EDL). F-M: Western blot was used to detect protein relative expression of EDL and Biceps after hypoxia exposure and resistance training.

**3333 Board #154 May 29 1:30 PM - 3:00 PM**  
**Single Cell RNA Sequencing Of Regenerating Skeletal Muscle Reveals A Senescence Response Which Is Necessary For Optimal Muscle Repair**

Adam Johnston, Alasdair Cameron, Michel Arsenaault, Laura Young. *University of Prince Edward Island, Charlottetown, PE, Canada.*  
 Email: adjohnston@upeci.ca  
 (No relevant relationships reported)

Satellite cells drive skeletal muscle regeneration, a process regulated by factors released into the local muscle environment; however the source of this trophic support is poorly defined. In this regard, recent work has identified a supportive role for cells commonly associated with aging and pathology, termed "senescent cells". The **PURPOSE** of this study was to determine the function of cellular senescence in normal skeletal muscle repair in rodents. **METHODS:** The tibialis anterior (TA) of C57BL6 mice was injured with cardiotoxin (CTX) and collected across a time-course. To examine senescent cell function during muscle repair, mice were treated with the senolytic compound (ABT-263) to selectively ablate senescent cells. **RESULTS:** The number of senescent cells (SA-β-gal+ cells) rapidly increased following injury ( $p < 0.05$ ) which returned to baseline by 21 days post-CTX. SA-β-gal+ cells displayed other markers consistent with senescence such as a lack of proliferation (EDU-) and the presence of DNA damage (γH2AX). qPCR analysis of putative senescence pathways including p16, p21 and p53 as well as factors commonly secreted by senescent cells were significantly upregulated in CTX-injected muscle in comparison to uninjured muscle ( $p < 0.05$ ). To identify the cell types which become senescent, single-cell RNA sequencing (scRNAseq) was performed on 5-day post CTX skeletal muscle which revealed that fibrogenic-adipogenic progenitors (FAPs), endothelial cells and macrophages

demonstrated increased expression of the senescence markers *Glb1*, *CDKN1A* and *Trp53* while no satellite cells become senescent. These findings were confirmed *in vivo* through IHC analysis of SA- $\beta$ -gal and marker specific analysis of FAPs (PDGFR $\alpha$ ), endothelial cells (CD31) and macrophages (F4/80). Importantly, senolytic treatment during regenerative myogenesis *in vivo* reduced the number of SA- $\beta$ -gal+ cells by 44% which coincided with significant reductions in muscle fibre cross-sectional area (25%) and the number of nuclei/fibre (12%). **CONCLUSION:** A transient wave of cellular senescence contributes to endogenous muscle repair to influence muscle fibre size following injury.

**3334** Board #155 May 29 1:30 PM - 3:00 PM

**Inhibiting Drp1-Mediated Mitochondrial Fission Attenuates High-Fat Diet Induced Skeletal Muscle Insulin Resistance**

Benjamin A. Kugler<sup>1</sup>, Wenqian Deng<sup>2</sup>, Abigail Duguay<sup>1</sup>, Meaghan Nasta<sup>1</sup>, Kai Zou<sup>1</sup>. <sup>1</sup>University of Massachusetts Boston, Boston, MA. <sup>2</sup>Chengdu Sport Institute, Chengdu, China. Email: Benjamin.Kugler002@umb.edu  
(No relevant relationships reported)

Dynamins-related protein 1 (Drp1) is a critical mediator of mitochondrial fission. Recent studies have reported increased Drp1 activation in obese skeletal muscle, which is associated with reduced mitochondrial function and insulin sensitivity. **PURPOSE:** To determine if inhibiting Drp1-mediated mitochondrial fission by a pharmacologic inhibitor attenuates skeletal muscle insulin resistance induced by a high-fat diet (HFD) in mice. **Methods:** 6-week old male C57BL/6J mice (n=9/group) were assigned to either a HFD (45% Fat) or low-fat diet (LFD, 10% Fat) group for a total of 5-weeks. A subgroup of HFD-fed mice received intraperitoneal injections of Mitochondrial Division Inhibitor 1 (MDIVI-1) (20 mg/kg) while the other mice received saline every other day for the last week of diet intervention. A glucose tolerance test was performed after 4 hours of fasting. Twenty-four hours after the final injection, quadriceps and gastrocnemius muscles were collected for further analysis. H<sub>2</sub>O<sub>2</sub> levels were detected using Amplex Red Hydrogen Peroxide kit. Insulin signaling and protein markers of mitochondrial dynamics were measured by immunoblot analysis. **Results:** HFD significantly increased glucose area under the curve (AUC) than LFD mice (19074  $\pm$  2137 vs. 10726  $\pm$  1254; p < 0.05), but MDIVI-1 treatment attenuated glucose AUC in HFD-fed mice (15354  $\pm$  1278). MDIVI-1 treatment reduced Drp1 expression in mitochondrial fraction from HFD-fed mice when compared to the saline-treated counterparts (0.003  $\pm$  0.001 vs. 0.012  $\pm$  0.003; p < 0.05). The mitochondrial fraction Drp1 expression was positively associated with glucose AUC (r = 0.497, p = 0.042). Insulin-stimulated Akt<sup>ser473</sup> phosphorylation was reduced in insulin-stimulated skeletal muscle from HFD-fed mice compared to mice fed with LFD (0.70  $\pm$  0.22 vs. 2.21  $\pm$  0.39; p < 0.05), but no difference was found between HFD-fed mice treated with MDIVI-1 and LFD-fed mice. HFD had a significant increase in H<sub>2</sub>O<sub>2</sub> than LFD-fed mice (0.351  $\pm$  0.046  $\pm$  0.186  $\pm$  0.043; p < 0.05), while MDIVI-1 treatment reduced H<sub>2</sub>O<sub>2</sub> production in HFD-fed mice (0.351  $\pm$  0.046 vs. 0.215  $\pm$  0.364; p < 0.05) **Conclusion:** These data suggest that inhibiting Drp1-mediated mitochondrial fission attenuates skeletal muscle insulin resistance and improves whole-body glucose homeostasis in mice fed by HFD.

**3335** Board #156 May 29 1:30 PM - 3:00 PM

**Activation Of Specific Estrogen Receptor Isotype Mediates Skeletal Muscle Force Potentiation In Ovariectomized Mice**

GENGYUN C. LE, Dawn A. Lowe, FACSM. University of Minnesota, Minneapolis, MN. (Sponsor: Dawn A Lowe, FACSM) Email: gle@umn.edu  
(No relevant relationships reported)

Estrogens affect force generation of skeletal muscle. Post-tetanic potentiation (PTP) of force is low in ovariectomized mice, and estradiol supplementation rescues potentiation both *in vivo* and *in vitro*. However, it is not known whether this estrogenic influence is through estrogen receptors, and if so, which isotype. **PURPOSE:** We hypothesized activation of estrogen receptor beta (ER $\beta$ ) or G protein-coupled estrogen receptor (GPER), but not estrogen receptor alpha (ER $\alpha$ ) would enhance *in vivo* muscle PTP in ovariectomized mice. **METHODS:** Adult female C57BL/6J mice (n = 4-12 per treatment) had a nerve cuff surgically implanted on the left common peroneal nerve. Six weeks later mice were ovariectomized (OVX). Four weeks later, PTP of the anterior crural muscles was measured immediately before and 1 h after treatment with either vehicle (OVX+Veh), 17 $\beta$ -estradiol (OVX+E<sub>2</sub>), ER $\alpha$  agonist PPT (OVX+PPT; 1  $\mu$ M PPT), ER $\beta$  agonist DPN (OVX+DPN; 50 nM DPN) or GPER agonist G1 (OVX+G1, 2.4 nM G1) *via* tail vein injection. PTP was calculated as the percent increase in twitch torque from baseline to the highest torque of the post-tetanic twitches. One-way ANOVAs with Holm-Sidak post hoc tests were used for data analysis. Results are reported as mean  $\pm$  SE. **RESULTS:** Peak torques of unpotentiated, baseline twitches were not different among the five groups: 0.47  $\pm$  0.03,

0.59  $\pm$  0.04, 0.62  $\pm$  0.12, 0.52  $\pm$  0.11 and 0.54  $\pm$  0.03 mN\*m, respectively (p=0.25). Potentiated twitches generated 7-108% more torque than unpotentiated twitches. PTP of OVX+E<sub>2</sub> and OVX+G1 was significantly greater than that of OVX+Veh mice (59  $\pm$  5% and 61  $\pm$  7% vs 35  $\pm$  5% increase, respectively; p=0.01). PTP of OVX+PPT and OVX+DPN were not significantly different from OVX+Veh mice (41  $\pm$  4% and 49  $\pm$  7% vs 35  $\pm$  5% increase, respectively; p=0.37). **CONCLUSION:** Acute treatment with ER $\alpha$  or ER $\beta$  agonist does not increase *in vivo* PTP of the anterior crural muscles in OVX mice to the extent that E<sub>2</sub> or GPER agonist does. This result partially supports our hypothesis that estrogenic modulation of skeletal muscle force potentiation is not through ER $\alpha$ , and is through GPER. Supported by NIH grants R01-AG031743 and T32-AR050938, and Metropolitan State University Professional Development Grant.

**3336** Board #157 May 29 1:30 PM - 3:00 PM

**Myogenic Regulatory Factor Expression Time Course Following Doxorubicin Injection In Rats Supplemented With Dietary Creatine**

Raquel B. Busekrus, Brandon C. Jones, David S. Hydock. University of Northern Colorado, Greeley, CO. Email: Raquel.Busekrus@unco.edu  
(No relevant relationships reported)

Doxorubicin (Dox) is a powerful chemotherapy agent known to cause muscle dysfunction. In response to skeletal muscle damage and stress, such as DOX treatment, myogenic regulatory factors (MRF) play a role in restoring muscle integrity. Creatine (Cr) supplementation has been shown to increase MRF expression and could attenuate Dox-induced skeletal muscle damage by enhancing repair, but the effects of Cr supplementation on Dox in this context has yet to be explored. **PURPOSE:** To explore the effects of Cr and Dox on the early time course of MRF expression. **METHODS:** Male Sprague-Dawley rats were randomly assigned to one of three feeding groups: rodent chow supplemented with 2% Cr for four weeks (Cr1), rodent chow supplemented with 4% Cr for one week followed rodent chow supplemented with 2% Cr for three weeks (Cr2), or standard rodent chow for four weeks as a control diet (Con). Animals then received 15 mg/kg Dox or saline as a placebo (Sal). Extensor digitorum longus (EDL) muscles were excised at 1, 3, or 5 days after injection, and expression of the primary MRFs Myf5 and MyoD and the secondary MRFs myogenin and Mrf4 were quantified with Western blotting. **RESULTS:** Between group Myf5 (p=0.0203), MyoD (p<0.0001), and myogenin (p=0.0031) expression differences were observed at day 1 with Cr2+Dox expressing higher Myf5 than Con+Sal (p<0.05) and higher MyoD than Con+Sal, Con+Dox, and Cr1+Dox (p<0.05). Furthermore, both Cr1+Dox and Cr2+Dox expressed higher Myf6 than Con+Sal (p<0.05) with only Cr2+Dox expressing higher Myf6 than Con+Dox (p<0.05), and EDLs from Cr1+Dox and Cr2+Dox had higher myogenin levels than Con+Sal (p<0.05) at the 1 day time point. At the 3 and 5 day time points, however, no between-group differences in MRF expression were observed. **CONCLUSIONS:** Cr feeding prior to Dox treatment increased MRF expression 1 day following Dox injection, and including a Cr loading phase (Cr2) led to a heightened response than no Cr loading phase (Cr1). This elevated MRF expression with Cr, however, was not evident at day 3 and 5 following Dox treatment suggesting that Cr feeding may help to enhance early skeletal muscle repair signaling in response to Dox treatment which may be critical to protecting against Dox myotoxicity.

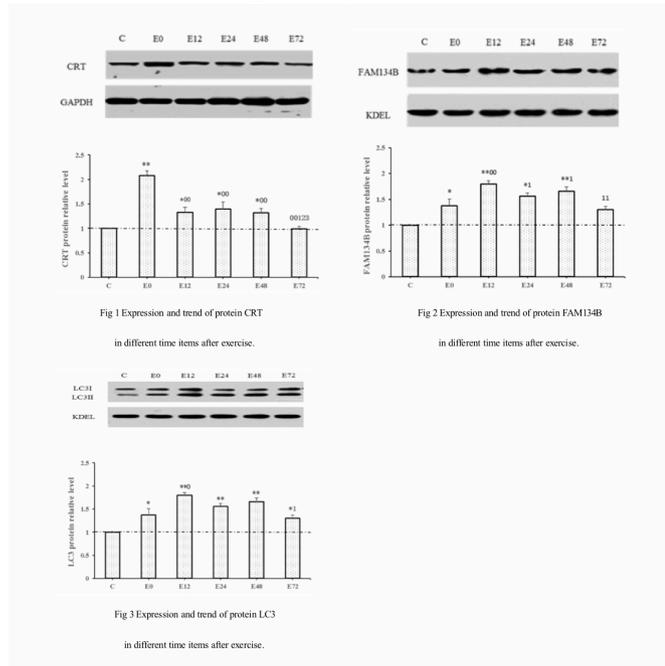
**3337** Board #158 May 29 1:30 PM - 3:00 PM

**The Mechanism Of Fam134b Mediated Endoplasmic Reticulum Autophagy In Skeletal Muscle After Heavy Load Exercise**

Lunyu Li<sup>1</sup>, Haili Ding<sup>2</sup>, Quansheng Su<sup>1</sup>, Zaifang Ren<sup>3</sup>, Zenghao Huang<sup>2</sup>, Songlin Jin<sup>2</sup>. <sup>1</sup>Chengdu Sport University, Chengdu, Sichuan, China. <sup>2</sup>Chengdu Sport University, Chengdu, China. <sup>3</sup>China-Japan Friendship Hospital, Beijing, China. Email: leolly007@163.com  
(No relevant relationships reported)

Endoplasmic reticulum(ER) is a significant organelle involved in the contraction of skeletal muscle. **PURPOSE:** To investigate the role of FAM134B in ER autophagy of skeletal muscle cells after exercise. **METHODS:** (1)Subjects and groups:48 healthy male 8-week-old SD rats were randomly divided into control group (Group C, n=8) and exercise group (Group E, n=40). The time items of group E were divided into 5 subgroups of 0h/12h/24h/48h/72h. (2)Exercise program: the rats were trained by using the electric running platform of small animals with large load exercise and reference to the Armstone's.(3)Sampling and index detection: rats were anesthetized after weighing, soleus was isolated and prepared protein samples and frozen sections;Western blot was used to detect the expression of CRT, FAM134B and LC3 protein in skeletal muscle,and double immunofluorescence staining combined with laser confocal was used to observe the co-location of FAM134B, LC3 and CRT.

**RESULTS:** (1) Compared with group C, the change rate of skeletal muscle protein expression in rats showed that ① CRT ( $2.080 \pm 0.096^{**} 1.325 \pm 0.105^{*00} 1.395 \pm 0.142^{*00} 1.315 \pm 0.096^{*00} 0.990 \pm 0.052^{00123}$ ); in Group E increased by 1.08 times at 0 h after exercise, showing significant difference ② FAM134B ( $1.301 \pm 0.076^{*} 1.967 \pm 0.119^{*00} 1.379 \pm 0.112^{*} 11.500 \pm 0.073^{**} 1.277 \pm 0.09611$ ); in Group E, it was significantly increased at 12 h and 48 h after exercise, 96.7% and 50% respectively. ③ LC3 ( $1.376 \pm 0.132^{*} 1.799 \pm 0.063^{**} 0.562 \pm 0.063^{**} 1.659 \pm 0.084^{**} 1.300 \pm 0.067^{*1}$ ); it was significantly increased in Group E from 0 h to 72 h after exercise. (2) the results of CO location of fam134b and CRT, and co-location of LC3 and CRT showed that compared with group C, group E significantly increased from 0 h to 48 h after exercise. **CONCLUSIONS:** The expression of FAM134B and LC3 in ER increased and co-located with CRT after heavy load exercise, indicating that FAM134B may be involved in the occurrence of ER autophagy after heavy load exercise.



**3338 Board #159 May 29 1:30 PM - 3:00 PM**  
**Autophagy Response To High-intensity Interval Exercise And Moderate-intensity Continuous Exercise Is Dissimilar In Skeletal Muscle And Peripheral Blood Mononuclear Cells**  
Kurt A. Escobar<sup>1</sup>, Anna M. Welch<sup>2</sup>, Andrew Wells<sup>2</sup>, Zac Fennel<sup>2</sup>, Roberto Nava<sup>2</sup>, Zidong Li<sup>2</sup>, Terence A. Moriarty<sup>3</sup>, Carlos H. Nitta<sup>2</sup>, Micah N. Zuhl<sup>4</sup>, Trisha A. VanDusseldorp<sup>5</sup>, Christine M. Mermier<sup>2</sup>, Fabiano T. Amorim<sup>2</sup>. <sup>1</sup>California State University, Long Beach, Long Beach, CA. <sup>2</sup>University of New Mexico, Albuquerque, NM. <sup>3</sup>University of Northern Iowa, Cedar Falls, IA. <sup>4</sup>Central Michigan University, Mount Pleasant, MI. <sup>5</sup>Kennesaw State University, Kennesaw, GA.  
Email: kurt.escobar@csulb.edu  
(No relevant relationships reported)

Few human data exist investigating the autophagic response to exercise in humans including the response to high-intensity interval training (HIIT) compared to moderate-intensity continuous training (MICT). Further, the relationship between post-exercise autophagy in distinct tissues including skeletal muscle and peripheral blood mononuclear cells (PBMCs) is not known. **PURPOSE:** The purpose of this study was to investigate the autophagy response in skeletal muscle and PBMCs following an acute bout of HIIT exercise and MICT exercise. **METHODS:** Using a crossover design, ten recreationally-active males (n=5) and females (n=5) performed a bout of MICT (60 minutes at 55% of max velocity [ $V_{max}$ ]) and HIIT (6 bouts of 1 minute at 100%  $V_{max}$  and 1 minute at 3 MPH, followed by 5 minutes at 3 MPH, followed by another 6 bouts of 1 minute and 100%  $V_{max}$  and 1 minute at 3 MPH). Muscle biopsies from the *vastus lateralis* and PBMCs from venous blood were collected pre- and 3 hours post-exercise. Exercise bouts were separated by  $\geq 72$  hours and performed after abstaining from alcohol for  $\geq 24$  hours and food and caffeine for  $\geq 8$  hours. Muscle tissue and PBMCs were analyzed for protein expression of markers of autophagy LC3I, LC3II, and p62 via western blot analysis. **RESULTS:** No differences were detected in LC3I, LC3II, and p62 protein content 3 hours post-exercise compared to pre-exercise in both HIIT and MICT bouts in skeletal muscle or PBMCs (p>0.05).

However, LC3II:I ratio 3 hours post-exercise was different between HIIT ( $108.1 \pm 54.5\%$ ) and MICT ( $64.3 \pm 47.3\%$ ; p<0.05) in skeletal muscle. There were no differences in LC3II:I in PBMCs between HIIT and MICT. **CONCLUSION:** Our findings show that HIIT and MICT exercise results in distinct changes in autophagy flux as suggested by LC3II:I in human skeletal muscle, but not in PBMCs. Our data suggest that the autophagy response to acute exercise in skeletal muscle and PBMCs are dissimilar which may indicate that distinct exercise thresholds exist.

**3339 Board #160 May 29 1:30 PM - 3:00 PM**  
**Myosin Heavy Chain Isoform Mrna Expression In Low-And High-capacity Running Rats**  
Anaissa Ruiz<sup>1</sup>, Nisreen Wahwah<sup>1</sup>, Nyssa Hoffman<sup>1</sup>, Janet Neisewander<sup>1</sup>, Lauren G. Koch<sup>2</sup>, Christos Katsanos<sup>1</sup>. <sup>1</sup>Arizona State University, Tempe, AZ. <sup>2</sup>The University of Toledo, Toledo, OH.  
(No relevant relationships reported)

Differential expression of Myosin Heavy Chain (MHC) isoforms in skeletal muscle determines its metabolic and functional characteristics. Endurance exercise training is associated with fast-to-slow MHC isoform transition, and which is considered to mediate the beneficial effects of exercise on metabolic health. Rats genetically bred for low-capacity running (LCR) and high-capacity running (HCR) are characterized by the health benefits typically described after endurance exercise training. LCR and HCR rats differed in maximal running capacity 14 fold. **PURPOSE:** To quantify mRNA expression for slow (MHC-I) and fast (MHC-IIa, MHC-IIb) MHC isoforms in soleus, gastrocnemius and vastus skeletal muscle of LCR and HCR male adult rats, and determine if HCR rats have higher mRNA expression for slow, and lower mRNA expression for fast, MHC isoforms. **METHODS:** Muscle tissue from 5 HCR and 5 LCR rats was homogenized and mRNA was isolated. The mRNA content of MHC isoforms in muscle was quantified using reverse transcriptase polymerase chain reaction (RT-PCR), and standardized to the 18S mRNA content in muscle. Differences between groups were calculated using the comparative CT method (2<sup>- $\Delta\Delta$ CT</sup>). LCR were the control group. **RESULTS:** Expression of mRNA of the MHC isoforms differed between groups and the type of skeletal muscle analyzed. MHC-I mRNA expression was lower in the HCR compared to LCR across all muscle groups, but this difference (2<sup>- $\Delta\Delta$ CT</sup>) was more pronounced for the gastrocnemius muscle [LCR:  $1.0 \pm 0.6$  (mean $\pm$ SE); HCR:  $0.3 \pm 0.2$ ; P = 0.08]. Although MHC-IIa mRNA expression appeared lower in soleus and vastus in the HCR, it was higher in the HCR compared to LCR in the gastrocnemius muscle [LCR:  $1.0 \pm 1.0$ ; HCR:  $4.6 \pm 3.6$ ; P = 0.07]. MHC-IIb mRNA expression was lower in the HCR compared to LCR across all muscle groups, but this difference was more pronounced for the soleus muscle [LCR:  $1.0 \pm 1.1$ ; HCR:  $0.2 \pm 0.4$ ; P = 0.08]. **CONCLUSION:** Genetic differences linked to the MHC transcriptome (i.e., decrease in MHC-I mRNA) in muscle do not explain the exercise performance observed in HCR rats. Changes in the muscle MHC transcriptome may not directly be responsible for the health benefits associated with exercise training. It remains to be determined on whether the differences we observed at the MHC mRNA level are translated to the MHC proteome level.

**3340 Board #161 May 29 1:30 PM - 3:00 PM**  
**Effect Of Aerobic Capacity, Ampk-pgc-1 $\alpha$  Pathway In Skeletal Muscle For Detraining Of Different Training**  
YE GAO, GUOHUAN CAO, HAO SU, TIANHAO WEN, JIA SHAO. Beijing Sport University, Beijing, China.  
(No relevant relationships reported)

**PURPOSE:** By observing HIIT group rats and MIT group rats' changes in the timing and content of AMPK and PGC-1 $\alpha$  in skeletal muscle, changes in aerobic capacity given the same load and training time and then stop the training. To provide a reasonable arrangement of retraining programs. **METHODS:** 27 4-month-old male Wistar rats were randomly divided into 3 groups (N=9): control (Group C), MIT (Group M), HIIT (Group H). C do not exercise, H training at 50%-70%-90% VO2max intensity according to the VO2max test results, M training at 70% VO2max intensity. Both H and M were performed for 50min/day, 5 days/week for 6 weeks of training. Rats were randomly selected from 3 groups on the 1<sup>st</sup>, 3<sup>rd</sup>, 7<sup>th</sup>, and 10<sup>th</sup> day after the training was stopped. They were intraperitoneal injected by 5% chloral hydrate to get soleus muscle. Using western blot to analysis AMPK and PGC-1 $\alpha$ . The results are expressed as mean $\pm$ standard deviation. one-way ANOVA and non-parametric test are performed in accordance with the normal distribution. **RESULTS:** 1.The AMPK in the skeletal muscle in H was significantly higher than that in C (P<0.05). The trend of AMPK in M was similar to that in H. 2.The level of PGC-1 $\alpha$  in skeletal muscle compared to C was significantly increased in H (P<0.05). The change trend of PGC-1 $\alpha$  in M was similar to that in H. 3.The VO2max shows a downward trend. **CONCLUSIONS:** 1.After 6 weeks of HIIT or MIT, all indicators showed a downward trend. 2.HIIT is superior to MIT in improving and maintaining AMPK, and PGC-1 $\alpha$  level, but it is less effective in maintaining VO2max.

| The content of AMPK (related) |           |           |           |
|-------------------------------|-----------|-----------|-----------|
| Stop training time            | Group C   | Group H   | Group M   |
| 1 day                         | 1.00±0.00 | 1.50±0.26 | 1.38±0.32 |
| 3 days                        |           | 1.47±0.42 | 1.32±0.18 |
| 7 days                        |           | 1.25±0.26 | 1.26±0.45 |
| 10 days                       |           | 1.03±0.23 | 1.18±0.48 |

| The content of PGC-1 $\alpha$ (related) |           |           |           |
|---|-----------|-----------|-----------|
| Stop training time                      | Group C   | Group H   | Group M   |
| 1 day                                   | 1.00±0.00 | 1.52±0.28 | 1.28±0.15 |
| 3 days                                  |           | 1.43±0.15 | 1.16±0.18 |
| 7 days                                  |           | 1.25±0.22 | 1.19±0.17 |
| 10 days                                 |           | 0.84±0.24 | 1.02±0.26 |

**3341** Board #162 May 29 1:30 PM - 3:00 PM  
**EFFECT OF FORCE ACTIVATION OF NOTCH SIGNALING ON MTOR**

Julia R. Rebellon<sup>1</sup>, Josh R. Huot<sup>2</sup>, Joseph Marino<sup>1</sup>, Cassandra Beach<sup>1</sup>, Jeffrey Gerrard<sup>1</sup>, Kendra Morris<sup>1</sup>, Matthew Bomkamp<sup>3</sup>, Nicole Stott<sup>1</sup>, Susan T. Arthur<sup>1</sup>. <sup>1</sup>UNC Charlotte, Charlotte, NC. <sup>2</sup>Indiana University School of Medicine, Indianapolis, IN. <sup>3</sup>University of Florida, Gainesville, FL.  
 (No relevant relationships reported)

**PURPOSE:** Notch signaling is a prominent pathway necessary for repair of injured muscle. The interactions of Notch with other signaling pathways, specifically mechanistic/ mammalian target of rapamycin (mTOR), in regulating myogenesis is not well known. Studies have been conducted on Notch inhibition, but little research has been performed on activated Notch and the interactions with mTOR. This study was implemented to develop a Notch force activation protocol and to measure the effect of overexpressed Notch on C2C12 proliferation, differentiation and mTOR signaling. **METHODS:** Notch signaling was force activated via suspension or adhesion. For suspension, Notch-1 antibody was introduced to a 12-well plate with C2C12 cells at a concentration of 1:10. For adhesion, Notch ligand, Delta-like Ligand 1 (DLL1), was mixed with Extracellular Matrix (ECM) and coated on a 12-well plate at different concentrations (control, 2.5 $\mu$ g, 5 $\mu$ g, and 10  $\mu$ g) for 12 hours. C2C12 cells were seeded at a concentration of 15,000 cells/well and differentiated for 96 hours. Following designated time period, lysates were collected for Western Blots. Primary antibodies probed for Notch (Hes1), total mTOR signaling (TmTOR), and  $\beta$ -actin. **RESULTS:** Preliminary data for suspension was analyzed via a two-way ANOVA (time x treatment). There is a significant difference in percent change of proliferation at 48 hours ( $p=0.02$ ). Preliminary data of adhesion was analyzed via one-way ANOVA. There is a trend between Hes1 concentration in ligand concentration of 2.5  $\mu$ g ( $p=0.0739$ ). It shows no significant difference in TmTOR concentrations between the various Notch force activation concentrations in proliferating C2C12 cells ( $p=.4298$ ). **CONCLUSIONS:** Preliminary data shows a stronger effect of suspension over adhesion for force activating Notch. A concentration of 2.5 $\mu$ g of ligand is possibly sufficient to force activate Notch, any higher appears too concentrated to activate Notch. Preliminary data also suggests that force activating Notch does not affect mTOR signaling. Experiments are currently testing the ideal DLL1 to activate Notch signaling, as well as examining the effect of force activating Notch on proliferation, differentiation and other markers of mTOR signaling. Different time points for differentiation should be tested in future research.

**3342** Board #163 May 29 1:30 PM - 3:00 PM  
**EXERCISE MODIFIES K<sub>ATP</sub> CHANNEL KIR6.X SUBUNITS EXPRESSION IN SLOW-TWITCH AND FAST-TWITCH MUSCLES OF DIABETIC RATS**

Erick A. Villacaña-Gómez, Sergio Márquez-Gamiño, Karla S. Vera-Delgado, Fernando Sotelo-Barroso, Cipriana Caudillo-Cisneros, Ma. Teresa Melchor-Moreno, Elizabeth Sánchez-Duarte. *Universidad de Guanajuato, León, Mexico.*  
 Email: ea.villicanagomez@ugto.mx  
 (No relevant relationships reported)

Diabetes Mellitus (DM) and the associated hyperglycemic state may adversely affect muscle, which has been called diabetic myopathy. In skeletal muscle, ATP sensitive potassium (K<sub>ATP</sub>) channels link metabolic cell state and electrical excitability. It has been reported that DM is associated with a K<sub>ATP</sub> channel dysfunction, reducing their

protecting role in preventing fiber damage and contractile dysfunction. While regular exercise can improve hyperglycemic status in DM, its impact on the expression of K<sub>ATP</sub> channels subunits is unknown, and could vary in different types of muscle.

**PURPOSE:** To assess the effect of regular exercise on mRNA expression of the K<sub>ATP</sub> channel Kir6.x subunits (Kir6.1 and Kir6.2) in slow-twitch and fast-twitch muscles of streptozotocin-induced diabetic rats.

**METHODS:** Male Wistar rats (25 days old) were randomly divided into four groups: sedentary control, trained control, sedentary diabetic, trained diabetic. Diabetes was induced by a single streptozotocin injection (100 mg/kg body weight), animals with fasting blood glucose levels  $\geq 300$  mg/dL were considered as diabetic. Groups with training program performed exercise on a treadmill (30 minutes daily, 5 days/week) for 8 weeks. At the end of the intervention, gastrocnemius (fast-twitch) and soleus (slow-twitch) muscles were dissected and real-time quantitative PCR experiments were performed to quantify Kir6.1 and Kir6.2 expression.

**RESULTS:** In control conditions, the regular exercise increased Kir6.2 subunit mRNA levels significantly in slow and fast muscle (60  $\pm$  13.49% and 132 $\pm$ 43.81%, respectively), while Kir6.1 mRNA levels did not differ, respect to sedentary control group. In diabetes, relative mRNA expression of the subunit Kir6.1 were significantly higher in both muscles (229.7% and 152%), whereas the mRNA levels of Kir6.2 were downregulated only in slow muscle by 66.8%. These effects were counteracted by the exercise, Kir6.1 expression was decreased in slow and fast muscle (47.28 and 47.57%, respectively), instead the expression of kir6.2 was increased in both muscles.

**CONCLUSION:** Our results indicate that regular exercise modifies the gene expression patterns of Kir6.x subunits during diabetes, by increases the expression of Kir 6.2 subunits and regularizes Kir6.1. These effects are dependent on muscle fiber type.

**3343** Board #164 May 29 1:30 PM - 3:00 PM  
**MiRNAs As Possible Predictors For Training Efficacy**

Manuel Widmann<sup>1</sup>, Felipe Mattioni Maturana<sup>1</sup>, Ansgar Thiel<sup>2</sup>, Andreas M. Nieß<sup>1</sup>, Barbara Munz<sup>1</sup>. <sup>1</sup>University Hospital Tübingen, Tübingen, Germany. <sup>2</sup>Institute of Sports Science, Tübingen, Germany.  
 (No relevant relationships reported)

Recent research suggests that genes encoding micro RNA (miRNA) molecules are differentially expressed in response to training.

**Purpose:** To determine whether specific miRNAs serve as possible predictors for training efficacy.

**Methods.** Six healthy, sedentary female subjects (mean  $\pm$  SD: age 23.2  $\pm$  3.1 years, peak oxygen uptake (VO<sub>2peak</sub>) 31.7  $\pm$  1.6 mL $\cdot$ kg<sup>-1</sup> $\cdot$ min<sup>-1</sup>, body mass index 23.0  $\pm$  1.2 kg/m<sup>2</sup>), aged between 20 and 27 years, performed exercise training on a cycle ergometer, three times a week, for 6 weeks. Participants were randomly assigned to either moderate intensity continuous training (MICT, n=3) or high intensity interval training (HIIT, n=3). The MICT group performed 60 min of continuous cycling at the power output (PO) calculated as corresponding to 90% of the first lactate threshold (LT). The HIIT group performed a warm-up for 10 min at the PO calculated as corresponding to 70% of the maximal heart rate (HRmax), followed by four 4-min intervals at the PO calculated as corresponding to 90% of HRmax, with 4-min recovery periods at 30 W in between. Muscle biopsies were taken pre- and post-training from the *vastus lateralis* muscle, followed by isolation of total RNA. Samples were then analyzed using a commercial miRNA array.

**Results.** Participants increased their VO<sub>2peak</sub> after 6 weeks of training by 4.2 mL $\cdot$ kg<sup>-1</sup> $\cdot$ min<sup>-1</sup> in mean (SD: 0.9). MICT and HIIT induced significant changes in miRNA expression patterns, part of which were specific for one of the two training regimens. For instance, there was a significant ( $p<0.006$ ), 5.5-fold upregulation of the anti-apoptotic miRNA 21-5p in both training groups. Furthermore, we could identify distinct shift in miRNA patterns that correlated with exercise-induced changes in physiological parameters, such as changes in VO<sub>2peak</sub> (delta VO<sub>2peak</sub> vs delta expression of miRNA 503,  $r=-0.9$ ,  $p=0.01$ ) or microvascular properties.

**Conclusions.** Our data suggest that MICT and HIIT exert distinct, but also overlapping effects on miRNA expression patterns. In addition, basal miRNA expression patterns might be associated with the individual response to training. Furthermore, the data are currently reproduced using semi-quantitative RT-PCR (qPCR). Our results might have important implications for the development of personalized exercise recommendations and therapeutic strategies.

**3344** Board #165 May 29 1:30 PM - 3:00 PM  
**The Role Of Collagen Composition And Orientation In Lateral Force Transmission With Aging**

Jed Keenan Lim Obra<sup>1</sup>, Henning T. Langer<sup>1</sup>, Agata A. Mossakowski<sup>1</sup>, Vadim Malis<sup>2</sup>, Edward Smitaman<sup>2</sup>, Usha Sinha<sup>2</sup>, Shantanu Sinha<sup>2</sup>, Keith Baar, FACSM<sup>1</sup>. <sup>1</sup>UC Davis, Davis, CA. <sup>2</sup>UC San Diego, San Diego, CA. (Sponsor: Keith Baar, FACSM)  
 Email: jlobra@ucdavis.edu  
 (No relevant relationships reported)

**PURPOSE:** Collagen is the most abundant protein in the body and functions to provide the mechanical strength of connective tissues. In muscle, collagen fibrils function both to hold muscle fibers together and transmit force laterally between fibers. With aging, force transmission is reduced; however, how changes to specific collagen isoforms or the matrix orientation contribute to force loss is currently unclear. The current study was designed to compare lateral force transmission in the gastrocnemius muscle of young and old people with changes in specific collagen proteins and the orientation of the matrix.

**METHODS:** The calf strength of 12 subjects, 5 between 18 and 30 years old and 7 over the age of 65, was measured within an MRI. Images were taken to determine lateral force transmission. Following strength testing, biopsies were obtained under local anesthetic from the gastrocnemius muscle. Biopsies were pinned to cork at resting length and frozen in isopentane cooled in liquid nitrogen. Cross-sections were taken to determine collagens I, III, IV, and V content, whereas longitudinal sections were stained with picrosirius red to determine matrix orientation. The collagen IV image was also used to determine muscle fiber cross-sectional area (CSA).

**RESULTS:** Collagen I and V were evenly dispersed throughout the cross-sections, whereas Collagen IV and VI were denser around individual muscle fibers. Collagen IV content was similar in young and old. As expected, fiber CSA tended ( $p = 0.1$ ) to decrease in the old subjects. Picrosirius red staining showed that the collagen matrix is oriented at a  $22.3 \pm 3.1\%$  angle to the fibers in young and  $30.2 \pm 8.7\%$  in old subjects. **CONCLUSIONS:** Preliminary data suggests that, in the old, fiber CSA decreases and the extracellular matrix becomes less aligned. By establishing the role of specific collagen proteins during aging, we hope to better understand the relationship between the extracellular matrix and force transmission in muscle and how this relationship is modified by age.

**3345** Board #166 May 29 1:30 PM - 3:00 PM  
**Human Medial Gastrocnemius Conversion To Adipose Tissue, A Histological Analysis**

Kailey M. Omstead, Matthew C. Kostek. Duquesne University, Pittsburgh, PA. (Sponsor: Trent Hargens, FACSM)  
 Email: omsteadk@duq.edu  
 (No relevant relationships reported)

There are very rare reports in the biomedical literature of entire human skeletal muscles being replaced by adipose tissue and thereby affecting lower limb function and ambulation. The causes are unknown. A fully preserved example was discovered in a Medical Anatomy course. **PURPOSE:** To examine the histological characteristics of a bilateral conversion of the medial gastrocnemii, presumably from skeletal muscle to adipose tissue. **METHODS:** Small specimens were collected for preservation, wax embedding, and histological analysis of the affected muscle, unaffected lateral-head of the muscle, nerve, and a control muscle. **RESULTS:** Hematoxylin and Eosin staining revealed an 88% decrease in the number of skeletal muscle fibers with a corresponding increase in the number of adipocytes. Connective tissue was similar between samples; however, the lateral gastrocnemius exhibited signs of inflammation with no necrosis. **CONCLUSIONS:** This is to our knowledge the first full histological analysis of a seeming conversion of the bilateral gastrocnemius medial heads into adipose tissue. The cause is unknown but could be related to the immune cell infiltration.

**3346** Board #167 May 29 1:30 PM - 3:00 PM  
**PGC-1 $\alpha$  mRNA Isoform-specific Response To Exercise And Cold**

Ben Meister, Camille Larson, Dustin Slivka, FACSM. University of Nebraska at Omaha, Omaha, NE. (Sponsor: Dustin Slivka, FACSM)  
 (No relevant relationships reported)

**PGC-1 $\alpha$  mRNA Isoform Specific Response to Exercise and Cold**

Ben Meister, Camille Larson and Dustin Slivka  
 University of Nebraska at Omaha.  
 Cold exposure in conjunction with aerobic exercise has been shown to increase the gene expression of PGC-1 $\alpha$ , the master regulator of mitochondrial biogenesis. PGC-1 $\alpha$  can be expressed as multiple different isoforms due to alternative splicing mechanisms, including the truncated NT-PGC-1 $\alpha$  isoform. These isoforms have differing structures and functions but relatively little about the specificity and response is known.

**PURPOSE:** Determine the difference of PGC-1 $\alpha$  isoform expression following an acute bout of cycling in cold and room temperature conditions. **METHODS:** 8 male participants cycled for 1 hour at 65%  $W_{max}$  at -2°C and 20 °C. A muscle biopsy was taken from the *vastus lateralis* before, 3 h post, and 6 h post exercise. qRT-PCR was used to analyze gene expression of total PGC-1 $\alpha$  and NT-PGC-1 $\alpha$  expression. **RESULTS:** Gene expression of both total PGC-1 $\alpha$  and NT-PGC-1 $\alpha$  increased due to the exercise intervention at both 3 h and 6 h time points ( $p < 0.05$ ), with mRNA expression peaking at 3 h ( $p < 0.05$ ). At 3 h total PGC-1 $\alpha$  was higher in the cold ( $13.2 \pm 6.3$  fold increase) compared to room temperature ( $7.4 \pm 2.0$  fold increase,  $p = 0.03$ ). NT-PGC-1 $\alpha$  was also higher in cold ( $20.8 \pm 12.5$  fold increase) compared to room temperature at 3 h ( $10.7 \pm 3.7$  fold increase,  $p = 0.029$ ). Total PGC-1 $\alpha$  and NT-PGC-1 $\alpha$  were similar in cold and room temperature at 6 h ( $p > 0.05$ ). **CONCLUSION:** Exercise and cold exposure induced alterations in gene expression for total-PGC-1 $\alpha$  and its truncated isoform, NT-PGC-1 $\alpha$ . It appears that NT-PGC-1 $\alpha$  contributes to the reported alterations in the cold-induced PGC-1 $\alpha$  exercise response.

**3347** Board #168 May 29 1:30 PM - 3:00 PM  
**Formoterol Stimulation In Vitro Influences Myogenic Regulatory Factors During Myogenesis In Human Skeletal Muscle Cells**

Chase M. White, Gena D. Guerin, Emily L. Zumbro, Ryan A. Gordon, Dreanna M. McAdams, Matthew L. Sokoloski, David L. Nichols, FACSM, Anthony A. Duplanty. Texas Woman's University, Denton, TX. (Sponsor: David L. Nichols, FACSM)  
 (No relevant relationships reported)

The process of myogenesis within skeletal muscle (SKM) is essential for growth and repair and is coordinated via the expression of myogenic regulatory genes. Previous animal studies have reported that formoterol, a beta-adrenergic receptor agonist, has stimulating effects on genes related to SKM mitochondrial function and biogenesis, similar to effects found for exercise. Lesser known is the potential "exercise mimetic" influence that formoterol stimulation may have during the stages of myogenesis, especially in human SKM cells.

**Purpose:** To investigate the effects of formoterol stimulation on expression of myogenic regulatory genes during myogenesis in human SKM cells. **Methods:** Human SKM myoblasts ( $n = 6$  per group) were cultured and differentiated until mature myotube formation (Day 6). Groups included control cells (CON) and cells stimulated by 30nM formoterol for 3h prior to RNA extraction points (FORM). Total RNA was extracted during mid-myogenesis (Day 4) and at terminal differentiation (Day 6) (a cell culture model of investigating myogenesis). Gene expression for Myogenic factor 5 (Myf5), Myogenic differentiation 1 (MyoD), and Myogenin (MyoG) was determined by qPCR. Data were analyzed using repeated measures ANOVA. **Results:** Significant differences between conditions and time points are detailed in Table 1.

**Conclusions:** For the FORM group, Myf5 expression was elevated at D6 compared to CON while MyoG and MyoD expression was lower than CON for D4 and D6. The interpretation is that FORM stimulation increased stimulus of D4 myoblast proliferation and, thus, delayed initiation of differentiation. These results, coupled with other preliminary data from our lab showing increased mitochondrial biogenesis with this model of investigation, suggests that this exercise mimetic stimulation may cause shift in the cell towards bioenergetic preference rather than fusion of myotubes. Table 1.

| Gene | Comparison        | Fold Change | P Value |
|------|-------------------|-------------|---------|
| Myf5 | D6 CON < D4 CON   | -0.25       | <0.05   |
|      | D6 FORM > D4 FORM | 0.65        | <0.001  |
|      | D6 FORM > D6 CON  | 0.75        | <0.001  |
| MyoD | D4 FORM < D4 CON  | -0.57       | <0.000  |
|      | D6 FORM > D4 FORM | 0.85        | <0.05   |
|      | D6 FORM < D6 CON  | -0.16       | <0.05   |
| MyoG | D6 CON < D4 CON   | -0.33       | <0.001  |
|      | D4 FORM < D4 CON  | -0.72       | <0.001  |
|      | D6 CON < D4 CON   | -0.44       | <0.001  |
|      | D6 FORM < D6 CON  | -0.24       | <0.001  |

**3348 Board #169 May 29 1:30 PM - 3:00 PM**  
**Diurnal Regulation Of Exercise-induced Anabolic And Catabolic Signaling In White Adipose Tissue**

Elias Maurice Malek, Caitlin K. Reynolds, Charli D. Aguilar, Graham R. McGinnis. *University of Nevada, Las Vegas, Las Vegas, NV.* (Sponsor: James Navalta, FACSM)  
 Email: maleke1@unlv.nevada.edu  
 (No relevant relationships reported)

**Purpose:** Autophagy is a degradation system where damaged cellular components can be recycled, resulting in higher cellular efficiency. White adipose tissue has been shown to have a catabolic response to exercise where autophagy will increase immediately after exercise. mTOR is an anabolic signaling pathway that inhibits autophagy, and plays a key role regulating cell size. Autophagy is sensitive to bioenergetic stressors such as exercise and has been shown to be regulated in a circadian fashion. However, it is currently unknown if exercise-induced autophagy is sensitive to the time-of-day at which exercise occurs. The purpose was to assess anabolic and catabolic signaling in white adipose tissue following exercise at two times of day; Zeitgeber time (ZT) 0 (light phase) and ZT12 (dark phase).

**Methods:** 21 week old male C57/BL6 mice (n=38) were habituated to treadmill exercise for 5 days under red light during the active phase, and allowed to recover for 2 days. Following a single 60-minute bout of treadmill exercise at 10 m/min, mice were sacrificed at 3 time points, pre exercise (SED), immediately post exercise (POST), and 1-hour post exercise (1HR). Tissue was analyzed for anabolic (p-mTOR (Ser2448) and p-S6 (Ser204/244)), and catabolic (LC3II/I) signaling pathways via western blotting. Results were analyzed with a 2x3 ANOVA and significance was accepted at p<0.05.

**Results:** Following exercise, there was a significant repression of mTOR (SED=0.990 ± 0.17 vs POST=0.747 ± 0.14, p<0.05) and S6 (SED=0.702 ± 0.39 vs POST=0.186 ± 0.14, p<0.05) activation (Main Effect (ME) Exercise; p<0.05, both), which was significantly stronger following exercise performed at ZT12 (Interaction Effect for p-S6; p<0.05). Autophagy signaling (LC3II/I) was increased at ZT12 (ZT0=1.22 ± 0.33 vs ZT12=2.28 ± 1.09, p<0.05), which appeared to be driven by changes in LC3I expression. LC3II (normalized to total protein) was increased following exercise (SED=0.81 ± 0.26 vs POST=1.28 ± 0.43 and 1HR=1.22 ± 0.28, p<0.05, both) and was higher at ZT0 (ZT0=1.33 ± 0.33 vs ZT12=0.91 ± 0.33, p<0.05), although no interaction was present.

**Conclusion:** Anabolic and catabolic signaling in adipose tissue may be differentially impacted by exercise performed at different times of day.

**3349 Board #170 May 29 1:30 PM - 3:00 PM**  
**The Role Of Mitochondrial Dysfunction And Redox Disturbances After Non-invasive Anterior Cruciate Ligament Injury**

Steven M. Davi<sup>1</sup>, McKenzie S. White<sup>2</sup>, Oh Sung Kwon<sup>1</sup>, Lindsey K. Lopley<sup>2</sup>. <sup>1</sup>University of Connecticut, Storrs, CT. <sup>2</sup>University of Michigan, Ann Arbor, MI.  
 Email: steven.davi@uconn.edu  
 (No relevant relationships reported)

Anterior cruciate ligament (ACL) injury results in protracted quadriceps atrophy, however the mechanisms that drive atrophic pathways remain undefined. Mounting evidence has revealed that mitochondrial dysfunction and redox disturbances are causal events in the initiation of muscle atrophy, yet the extent to which mitochondria damage play a key role in quadriceps muscle atrophy after ACL injury has yet to be explored.

**PURPOSE:** Using a pre-clinical animal model of ACL injury, a time course study was performed to investigate the role of mitochondria and Reactive Oxygen Species (ROS) after injury.

**METHODS:** 48 Long Evans rats (n=8 per group; 4m/4f) underwent non-invasive rupture of the right ACL and were euthanized at 1, 3, 7, 14, 28, 56 days post-injury. 8 rats (4m/4f) served as healthy controls (HC). Respiration was measured by high-resolution respirometry in permeabilized muscle fibers from the right vastus lateralis (VL). ROS production was determined using Amplex Red assays. VL weight was normalized to total body mass for measuring muscle mass loss. One-way ANOVAs with Bonferroni post-hoc were used to determine differences between groups (P < 0.05).

**RESULTS:** Reductions in complex I + II state 3 respiration were observed at 7 and 56 days post-injury (HC: 33.92 ± 4.26 pmol·s<sup>-1</sup>·mg<sup>-1</sup>; 7D: 15.95 ± 1.38 pmol·s<sup>-1</sup>·mg<sup>-1</sup>; 56D: 18.80 ± 2.15 pmol·s<sup>-1</sup>·mg<sup>-1</sup>; F = 5.99, P = 0.002 and P = 0.015 respectively). State 4 respiration did not differ between groups (P > 0.05). Respiratory Control Ratio (RCR), defined as respiration in state 3 divided by respiration in state 4, significantly decreased 7 through 56 days post-injury (HC: 4.00 ± 0.13; 7D: 1.54 ± 0.16; 56D: 1.82 ± 0.20; F = 13.29, P = 0.001 and P = 0.001 respectively) along with increased mitochondrial ROS production 7 through 56 days post-injury (HC: 10.16 ± 0.41 pmol·s<sup>-1</sup>·mg<sup>-1</sup>; 7D: 12.23 ± 0.54 pmol·s<sup>-1</sup>·mg<sup>-1</sup>; 56D: 26.83 ± 0.54 pmol·s<sup>-1</sup>·mg<sup>-1</sup>; F =

178.05, P = 0.001 and P = 0.001 respectively). VL atrophy was observed at 7 and 14 days post-injury (HC: 3.52 ± 0.08 mg·g<sup>-1</sup>; 7D: 3.14 ± 0.07 mg·g<sup>-1</sup>; 14D: 3.18 ± 0.07 mg·g<sup>-1</sup>; F = 5.06, P = 0.013 and P = 0.044 respectively).

**CONCLUSION:** Mitochondria are an important source of muscular ROS production after ACL injury. Mitochondrial dysfunction and redox disturbances contribute to ACL injury-induced quadriceps atrophy.

Funding Source: NIH grant K01AR071503

**3350 Board #171 May 29 1:30 PM - 3:00 PM**  
**Relationship Between Content Of Mitochondria And Z-disk Or Fiber Types**

Guoqiang Geng<sup>1</sup>, Rasmus Jensen<sup>2</sup>, Yiheng Liang<sup>1</sup>, Junqiang Qiu<sup>1</sup>, Ortenblad Niels<sup>2</sup>, Nielsen Joachim<sup>2</sup>. <sup>1</sup>Beijing Sports University, Beijing, China. <sup>2</sup>University of Southern Denmark, Odense, Denmark.  
 Email: garygeng7089@foxmail.com  
 (No relevant relationships reported)

**PURPOSE:** To estimate the relationship between mitochondrial volume contents and z-disks width determined by electron microscopy, analyzed from 13968 images from 582 fibers. **METHODS:** Eleven recreationally active individuals were recruited. Each subject had three endurance tests at 75% VO2max following three different diets and nine biopsies in total. We obtained ten muscle fibers from each of the nine biopsies and used z-disk width as the discriminator of fiber types. From each fib23 24 EM images were obtained in each biopsy (12 intermyofibrillar, IMF, and 12 subsarcolemmal, SS, images, respectively), and point counting method was used to quantify IMF and SS mitochondrial content, and the total content. Relationships between fibers' mitochondrial contents and z-disk width were tested by Pearson's correlation coefficient and linear regression. Interactions and main effects were tested by a mixed effect model with fiber type and diet as fixed factors. **RESULTS:** The total mitochondria volume contents correlated highly significant with fiber z-disk width (Fig 2A. P<.001, R<sup>2</sup> = .20). Also, there were strong correlations between the mitochondrial volume contents in the IMF as well as SS and fiber z-disk (P<.001, R<sup>2</sup> = .18; P<.001, R<sup>2</sup> = .14, respectively, Fig. B, C). The type1 fibers have, on average, a 47% higher total mitochondrial content compared to the type 2 fibers, with 67% higher in SS and 41% in IMF, respectively (P<.001, Mean±SD, IMF:0.065±0.023µm<sup>3</sup>·µm<sup>-2</sup> vs 0.046±0.021µm<sup>3</sup>·µm<sup>-2</sup>; SS: 0.450±0.298µm<sup>3</sup>·µm<sup>-2</sup> vs 0.270±0.253µm<sup>3</sup>·µm<sup>-2</sup>; Total: 0.087±0.033µm<sup>3</sup>·µm<sup>-3</sup> vs 0.059±0.031µm<sup>3</sup>·µm<sup>-3</sup> Fig. D, E, F) **CONCLUSIONS:** The total mitochondrial volume contents, as well as the IMF and SS mitochondrial volume contents are strongly correlated with z-disk width in human muscle fibers (P<.001, R<sup>2</sup> = .20). Thus, fiber typing based on z-disk width is a strong predictor of fibre typing based on mitochondrial volume.

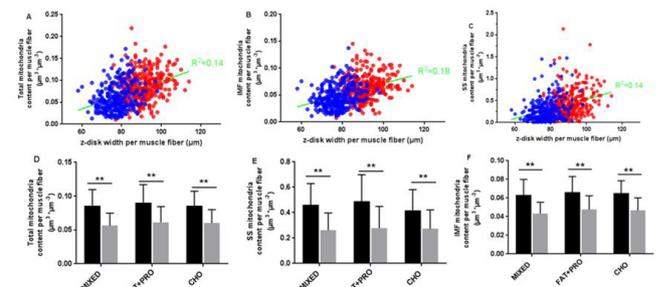


Figure. Association between mitochondrial z-disk width and subcellular specific and total mitochondrial contents. A, B and C, blue spots are type2 and red spots are type1. IMF mitochondrial content is a better predictor for z-disk width than SS (P<.001, R<sup>2</sup> = .42, R<sup>2</sup> = .18, P<.001, R<sup>2</sup> = .37, R<sup>2</sup> = .14, respectively). D, E, F the horizontal line means mean mitochondrial content of all subjects in each diet and fiber type. Black dots are type1 and grey dots are type2. \*\* Different between two fiber types (P<.001).

**3351 Board #172 May 29 1:30 PM - 3:00 PM**  
**Abstract Withdrawn**

**3352 Board #173 May 29 1:30 PM - 3:00 PM**  
**Effects Of Adipose Mesenchymal Stem Cells Injected Intramuscularly On Myostatin Signaling Skeletal Muscle In Rats After Eccentric Exercise**

Xiujuan liu, nianyun zhang, biao sun, bin wang, yan xu. *Nanjing Sports Institute, Nanjing, China.*  
 (No relevant relationships reported)

**PURPOSE:** To observe the effect of adipose mesenchymal stem cells (ASCs) on myostatin signal of skeletal muscle in rats at different time points after eccentric exercise, and to explore the mechanism of ASCs injection on skeletal muscle injury and repair after eccentric exercise. **METHODS:** Phosphate buffer saline (PBS) were injected into the gastrocnemius muscle in the left leg, and ASCs were injected into

the gastrocnemius muscle of the right leg of SD rats after eccentric exercise. The rats were randomly divided into four groups: one day D1, three days D3, seven days W1 and fourteen days W2 after exercise. Skeletal muscle ultrastructure was observed by electron microscopic. The content of serum creatine kinase (CK), skeletal muscle troponin I (sTnI), myostatin (MSTN), follistatin (FST) were measured by ELISA. Real-time PCR was used to detect the expressions of MSTN, ACVR2B, FST mRNA in skeletal muscle. The expression of MSTN, ACVR2B, FST, p-Smad2/3 were detected by Western Blot.

**RESULTS:** Compared with group PBS, adipose mesenchymal stem cell injection significantly promoted the repair of muscle fibers. Compared with group D1, the level of CK in group W2 was significantly decreased, the content of sTnI level in group D3 and group W1 were remarkably increased, the serum MSTN contents in group W1 were significantly decreased, which in group W2 was remarkably increased. Compared with group PBS, the relative expression quantities of MSTN mRNA were significantly decreased at time point D3 and which were extremely significantly down-regulated at time point W2. Compared with group PBS, the expression of MSTN protein were significantly decreased at time point D3, the expression of ACVR2B protein were remarkably increased at time point D1, D3 and W1, however, which was significantly decreased at time point W2. Compared with group PBS, the phosphorylation of Smad2/3 shown significantly decreased at the time point W2 of group ASCs.

**CONCLUSIONS:** After eccentric exercise, allogeneic adipose mesenchymal stem cells injected intramuscularly can decreased the transcription of MSTN in skeletal muscle. Adipose mesenchymal stem cells injected intramuscularly may improve the regeneration and repair of skeletal muscle after eccentric exercise through affecting the downstream signaling pathway of MSTN.

**3353** Board #174 May 29 1:30 PM - 3:00 PM

### Bioinformatics Analysis Of MicroRNA In Skeletal Muscle Of Mice Related To Aerobic Exercise

TAO MEI, YING ZHANG, YANG HU. *Beijing Sport University, Beijing, China.*

Email: meitao@bsu.edu.cn

(No relevant relationships reported)

MicroRNAs (miRNAs) are increasingly being studied as regulators for biological processes in skeletal muscle. However, little information relating to biological process regulated by aerobic exercise-affected miRNA is available. Bioinformatics analysis provides a perspective on the direction of future research.

**PURPOSE:** To analyze the functions of miRNAs which were affected by 8-week aerobic exercise in skeletal muscle of mice. **METHODS:** Twenty C57BL/6J mice were randomly divided into exercise (E) and control (C) groups. The E group were trained on a treadmill with a program of slope 0°, 12m/min, 60min/day, and 5 days/week. The C group lived normally without training. After 8-week of training, skeletal muscles were harvested for RNA extraction. Subsequently, miScript miRNA PCR Arrays was conducted to identify the differentially expressed miRNAs between two groups. Target gene prediction was performed by using TargetScan and microT-CDS tools. Gene Ontology analysis (GO) on the target gene was performed with Cytoscape Bingo. MirPath v.3 from the DIANA tools was used to execute the Kyoto Encyclopedia of Genes and Genomes (KEGG) analyses. **RESULTS:** 44 miRNAs were upregulated (Fold Change $\geq$ 2.0, P<0.05) and 14 miRNAs were downregulated (Fold Change $\leq$ -2.0, P<0.05) after the aerobic exercise. Prediction of target genes showed that there were a total of 9122 target genes (Ptpn9, Gria3, Zfp219, etc.) for the up-regulated miRNAs, while 3636 target genes (Nrf1, Lmbr11, Zbp1, etc.) for the down-regulated miRNAs. GO analysis revealed that the differentially expressed miRNAs participated in a variety of molecular functions and biological processes including nucleic acid binding, protein binding, regulation of gene expression, macromolecule metabolic process and others. KEGG analysis showed that the up-regulated miRNAs were significantly enriched in MAPK, Wnt and mTOR signaling pathway. The down-regulated miRNAs were mainly enriched in MAPK, Wnt signaling pathway. **CONCLUSION:** MiRNAs induced by aerobic exercise potentially regulate the biological processes of skeletal muscle mainly through MAPK and Wnt signaling pathways.

Supported by Key R&D Projects of the Ministry of Science and Technology (grant no 2018YFC2000600), and Fundamental Research Funds for the Central Universities (grant no. 2016SYS002).

**3354** Board #175 May 29 1:30 PM - 3:00 PM

### Aerobic Training Activates Nrf<sub>2</sub>-mediated Anti-oxidative Effect Of Ampk On Mouse Skeletal Muscle

luo lin<sup>1</sup>, Zhang Ying<sup>2</sup>. <sup>1</sup>Guizhou Normal University, Guiyang, China. <sup>2</sup>Beijing Sport University, Beijing, China.

Email: 5925860@qq.com

(No relevant relationships reported)

**PURPOSE:** To study the antioxidative effect of AMPK activated by aerobic training on Nrf<sub>2</sub> mediated skeletal muscle in mice. **METHODS:** 8-week-old AMPK  $\alpha_2$  transgenic mice (TG mice), AMPK  $\alpha_2$  knockout mice (KO mice) and wild-type mice

(WT mice) were randomly divided into two groups: the quiet group and the training group, with 10 mice in each group. In the training group, 6 days a week, aerobic training was conducted on the running platform with a gradient of 0 and a speed of 12 m / min for 1 hour every day for 4 weeks. The level of ROS in skeletal muscle was detected by fluorescence colorimetry. Rc-per was used to detect the level of antioxidant enzyme mRNA in skeletal muscle of mice in each group. Western blot method was used to detect the expression of AMPK  $\alpha_2$ , AMPK  $\alpha$ , Nrf<sub>2</sub>, pnr<sub>f</sub>, and antioxidant enzyme protein. **RESULTS:** after 4 weeks of aerobic training (3) the expression of pnr<sub>f</sub> protein in skeletal muscle of wild mice and AMPK  $\alpha_2$  transgenic mice increased significantly. (4) compared with the wild mice, the expression of AMPK  $\alpha_2$  gene knockout mice skeletal muscle catm<sub>r</sub>na, nqo-1m<sub>r</sub>na, ho-1m<sub>r</sub>na, gp<sub>x</sub>-1m<sub>r</sub>na and sod1m<sub>r</sub>na decreased significantly. (5) the expression of cat, GSR, HO-1 and SOD1 protein in the skeletal muscle of wild mice increased significantly. The expression of AMPK  $\alpha_2$  in transgenic mice was high, and the expression of protein (cat, GPx-1, nqo-1) and protein (GCLC, GSR, HO-1, SOD1, SOD2) in the skeletal muscle of wild mice increased significantly. Compared with the wild mice in the training group, the expression of AMPK  $\alpha_2$  in transgenic mice was high (GPx-1, GSR, HO-1, nqo-1, SOD1), SOD2) and GCLC protein expression increased significantly. Compared with the wild mice in the training group, AMPK  $\alpha_2$  knockout mice showed a significant decrease in the expression of protein (HO-1 and SOD2) in skeletal muscle tissue. (6) there was no significant difference in ROS level in skeletal muscle of wild mice, AMPK  $\alpha_2$  transgenic mice and AMPK  $\alpha_2$  knockout mice before and after training. **CONCLUSIONS:** the activation of AMPK by aerobic training can promote the expression of pnr<sub>f</sub> in skeletal muscle, then increase the expression of antioxidant enzymes and improve the antioxidant capacity of the body.

**3355** Board #176 May 29 1:30 PM - 3:00 PM

### Effects Of Mild Hypoxic Conditions On Mrna Expression Of Spinal Cord In The Young And Old Mouse

Hirofumi Miyata<sup>1</sup>, Hiroshi Nagahisa<sup>2</sup>, Nami Matsuura<sup>1</sup>.

<sup>1</sup>Yamaguchi Univ., Yamaguchi, Japan. <sup>2</sup>Kumamoto Univ., Kumamoto, Japan.

Email: hiro@yamaguchi-u.ac.jp

(No relevant relationships reported)

We have developed a method to evaluate motoneuron plasticity by real-time RT-PCR analysis for whole spinal cord. **PURPOSE:** In this study, we examined effects of mild hypoxic conditions on mRNA expression of spinal cord as well as skeletal muscle in young and old mouse. **METHODS:** Young (12-week old, n=16) and old (20-month old, n=17) mice were divided into three groups of control, continuous hypoxia, and intermittent hypoxia. Both hypoxic groups were subjected to exposure for 5 days under oxygen concentration of 16%. The intermittent hypoxic group was exposed six times to an oxygen concentration of 16% intermittently every hour for 12 hours of the light day of the day. Immediately after completion of the exposure, the spinal cord (Cervical 3 - 6 and Lumber 2 - 5) as well as muscles (diaphragm and gastrocnemius muscles) were removed and mRNA expression levels were investigated using real time RT-PCR system. **RESULTS:** Although the mRNA expression levels of PGC1 $\alpha$  and VEGF-A were significantly (P < 0.05) higher in diaphragm than gastrocnemius muscles, these mRNA expressions levels were not affected by hypoxic stimulation. While, the mRNA expression levels of muscle remodeling factors (Pax7, MyoD, BDNF, and MHCe) were significantly (P < 0.05) higher in hypoxic condition than control group. Compared with young mice, the expression levels of inflammatory cytokine receptor (IL-6R $\alpha$ ) and neurotrophic factors (BDNF, VEGF-A) of muscles increased in old mice. The increased expressions may be considered to be an indispensable adaptive change for age-related changes in skeletal muscle including neuromuscular junction. In the both hypoxia groups, the mRNA expression level of neurotrophic factors (VEGF-A, FGF2) significantly (P < 0.05) increased in the cervical, but not in the lumbar spinal cord. **CONCLUSIONS:** We concluded that the mRNA expressions of trophic factor were changed by hypoxic stimulation not only in the muscle but also in the cervical spinal cord.

**3356** Board #177 May 29 1:30 PM - 3:00 PM

### Effect Of Phb1 On F<sub>0</sub>F<sub>1</sub>-atpase And Mitochondrial Function In Energy Metabolism

Wen Fang<sup>1</sup>, Ze Li<sup>2</sup>, Xingdong Ma<sup>1</sup>, Hong Feng<sup>2</sup>. <sup>1</sup>Tsinghua University, Beijing, China. <sup>2</sup>Tianjin University of Sport, Tianjin, China.

Email: fangwen5702175@163.com

(No relevant relationships reported)

**PURPOSE:** To investigate the mechanism of PHB1 on F<sub>0</sub>F<sub>1</sub>-ATPase and its effect on exercise capacity, and whether PHB1 can be used as a scientific basis for regulating energy metabolism. **METHODS:** An animal model of moderate-intensity exercise and exhaustive exercise and a complete C2C12 cell line culture system, PHB1 overexpression and RNA interference in adenovirus vectors were established. 32 8-week-old healthy male SD rats were randomly divided into three groups: normal

control(NC),moderate intensity exercise(MIE)and acute exhaustive exercise(AEE) groups.NC and AEE:routinely raised. MIE:Rats were run at 15m/min per day for 60min until the end of the 8th week.Slope:10%.AEE:The rats were subjected to acute exhaustive exercise after 8 weeks.They were sacrificed 48h after the last experiment. PHB1 expression,ATP content, $F_oF_1$ -ATPase,oxidative stress (ROS),cellular oxygen consumption rate (OCR),and mitochondrial respiratory function(RCR)in skeletal muscle were measured by animal and cell experiments.**RESULTS:**Compared with NC,MIE group RCR(+73%, $p<0.001$ ),ATP content (+48%, $p<0.05$ ), $F_oF_1$ -ATPase activity(+79%, $p<0.05$ ),PHB1 expression(+42%, $p<0.01$ ),ROS level(-75%, $p<0.001$ ) decreased;AEE group RCR(-58%, $p<0.05$ ),ATP content (-55%, $p<0.05$ ), $F_oF_1$ -ATPase activity(-56%, $p<0.001$ ),PHB1 expression(-31%, $p<0.01$ )decreased,and ROS(+79%, $p<0.05$ )increased.In C2C12 cells,PHB1 overexpression group,ATP content(+86%, $p<0.01$ ), $F_oF_1$ -ATPase mRNA level(+59%, $p<0.05$ ), $F_oF_1$ -ATPase protein expression level(+69%, $p<0.05$ ), $F_oF_1$ -ATPase activity(+226%, $p<0.01$ ),and OCR(+256%, $p<0.01$ ),ROS level(-74%, $p<0.01$ ),significant enhancement of cellular respiratory function.In the low expression group of PHB1,ATP content(-21%, $p<0.01$ ), $F_oF_1$ -ATPase mRNA level(-64%,  $p<0.05$ ), $F_oF_1$ -ATPase protein expression level(-89%, $p<0.05$ ), $F_oF_1$ -ATPase activity(-93%, $p<0.01$ ),and OCR(-190%, $p<0.01$ ),ROS production was significantly increased(+104%, $p<0.01$ ),and cellular respiratory function was significantly reduced.**CONCLUSION:**In energy metabolism,PHB1 may play a role in stabilizing the mitochondrial structure and positively regulating  $F_oF_1$ -ATPase activity,thereby enhance mitochondrial function and promoting energy metabolism.Supported by NSFC(No.31470061)

**3357** Board #178 May 29 1:30 PM - 3:00 PM

**Combined Effects Of Unloading And Radiation On Skeletal Muscle In Mice**

Rodrigo Fernandez-Gonzalo<sup>1</sup>, Björn Hansson<sup>1</sup>, Eric Emanuelsson<sup>1</sup>, Bjorn Baselet<sup>2</sup>, Marjan Moreels<sup>2</sup>, Mieke Neefs<sup>2</sup>, Sarah Baatout<sup>2</sup>, Helene Rundqvist<sup>1</sup>. <sup>1</sup>Karolinska Institutet, Stockholm, Sweden. <sup>2</sup>Belgian Nuclear Research Centre SCK•CEN, Mol, Belgium.  
Email: rodrigo.gonzalo@ki.se  
(No relevant relationships reported)

In preparation for upcoming space missions to the Moon and Mars, there is a need to understand how space stressors (e.g. microgravity, radiation) affect different physiological systems. As skeletal muscle is a critical organ, not only for locomotion but also for overall body homeostasis, defining the molecular impact of microgravity and radiation on this tissue will help developing new, or fine-tuning current countermeasures to maintain health and physiological function of space travellers. **PURPOSE:** To investigate the effects of combined radiation and unloading on anabolic/catabolic and immune/inflammatory processes on skeletal muscle in mice. **METHODS:** Ten C57/BL6J mice were subjected to 14-d hind-limb unloading by tail suspension with an acute radiation session (dose=25 mGy, X-ray) on day 7 of unloading (HLUR). Ten mice were used as control (CTRL; similar cages, sham radiation). Mice were sacrificed and soleus muscle was immediately dissected, weighed and frozen. Then, RNA was extracted and converted to cDNA. Gene expression of anabolic/catabolic (i.e. myostatin, MuRF-1, Atrogin-1, PGC-1 $\alpha$ ) and immune/inflammatory markers (i.e. CD4, CD8, IFN $\gamma$ , CD11b, MHCII, TNF, IL-6) was assessed by RT-PCR. Independent t-tests were used to compare HLUR vs. CTRL. **RESULTS:** Soleus muscle weight was ~30% lower in HLUR vs. CTRL ( $P<0.001$ ). Myostatin expression was greater in HLUR vs. CTRL (1.8-fold,  $P=0.014$ ). MHCII expression was higher in HLUR vs. CTRL (2.4-fold,  $P<0.001$ ). There was a trend for group differences ( $P<0.08$ ) in CD11b and TNF mRNA content with HLUR showing greater values than CTRL. Gene expression of CD4, CD8 and IFN $\gamma$  was barely detected in either group. **CONCLUSIONS:** The combination of unloading and radiation has a major impact on skeletal muscle. Apart from inducing muscle atrophy, as indicated by the decreased muscle weight and increased myostatin levels, these two space stressors altered the immune profile within the muscle. The increased gene expression of MHCII and CD11b indicates that the myeloid component of the immune system is activated upon unloading and radiation in skeletal muscle. In contrast, the almost undetected mRNA levels of CD4, CD8 and IFN $\gamma$  may imply that unloading and acute radiation have little impact on the lymphoid component. These findings should be followed up with immunohistochemical analysis.

**3358** Board #179 May 29 1:30 PM - 3:00 PM

**Role Of The Mct-1 T1470a Polymorphism (rs1049434) In The Uptake Of Lactate In Females Following 30 Second Wingate Test**

Will C. Hawkins. *University of Southern Indiana, Evansville, IN.*  
(No relevant relationships reported)

**PURPOSE:** The purpose of this investigation was to examine the role of the MCT-1 T1470A single nucleotide polymorphism on blood lactate clearance rates in females following a 30 second Wingate test. **METHODS:** Lactate was measured before the test, immediately following the test and -10, -20, -30 and -40 minutes post. Lactate

decreases were calculated for each 10-minute period. Participants were divided into three groups based on their T1470A genotype (TT, TA, AA). **RESULTS:** There was no significant interaction between genotype and lactate clearance ( $p=0.123$ ), however the TT genotype group had significantly higher clearance rates when collapsed across time points ( $p=0.003$ ). Lactate clearance was higher in the TT genotype when compared to both the TA genotype ( $p=0.002$ ) and the AA genotype ( $p=0.009$ ). This effect was caused by significantly higher lactate accumulation in TT genotype subjects immediately following the Wingate test when compared to TA ( $p=0.001$ ) and AA ( $p=0.003$ ) subjects. **CONCLUSION:** To our knowledge, our investigation is the first that demonstrates that the MCT-1 genotype effects lactate clearance in women. Our findings differ from the body of literature carried out using male participants, which suggests that the T allele adversely effects lactate clearance. Further, our findings indicate that peak lactate clearance occurs earlier in the TT group compared to the TA and AA group in resistance trained females. Future research should continue to examine the MCT-1 polymorphism in woman and how this genetic information can be integrated into exercise prescription protocols.

**F-58 Free Communication/Poster - Blood Flow Restriction**

Friday, May 29, 2020, 1:30 PM - 4:00 PM  
Room: CC-Exhibit Hall

**3359** Board #180 May 29 1:30 PM - 3:00 PM

**Effects Of Blood Flow Restriction With Eccentric Exercise On Muscle Adaptation**

Malcolm Jones, E. Todd Schroeder. *University of Southern California, LOS ANGELES, CA.*  
(No relevant relationships reported)

**Purpose:** BFR during RT has been reported clinically to rehabilitate/prevent injury in healthy people and people with orthopedic conditions. Further, subjective accounts of minimal muscle soreness post-training suggest a reduction in exercise induced muscle damage compared to traditional RT. We sought to compare the effects of BFR eccentric RT at low loads on muscle performance to traditional eccentric resistance training at high loads, and to explore the feasibility of multifrequency bioelectric impedance analysis (BIA) to assess muscle damage and hypertrophy. **Methods:** 25 healthy young adults  $25 \pm 5$ yo (11 female, 14alen) were randomized into two groups (BFR L, BFR R and trained 2x/wk for 6 wks. The contralateral leg was trained traditionally to serve as the control (TC) after baseline testing (single-leg vertical jump, Nordbord bilateral eccentric hamstring strength, legcurl bilateral 1RM, legcurl hamstring endurance)At the conclusion, participants re-tested. BIA data was collected pre (0, 24, 48hrs) and post (0, 24, 48hrs). Pre-post paired t-tests and coefficient of determination were used for analysis. **Results:** There was 96% compliance. There were no significant changes in single leg vertical jump (left: $p=0.14$ , right: $p=0.26$ ), hamstring strength (left: $p=0.17$ , right:  $p=0.38$ ), or hamstring endurance in either leg (left: $p=0.95$ , right:  $p=0.12$ ) or condition. There were significant increases (7.5-9.5%) in hamstring 1RM in both legs (left: $p<0.01$ , right: $p<0.01$ ) and both training conditions (BFR: $p<0.01$ , TC: $p<0.01$ ). There was low correlation between phase angle and participant perceived soreness ( $r^2=0.15$ ), but scores were significantly lower in BFR leg immediately ( $p=0.04$ ) and 24hr ( $p=0.04$ ) post training. **Conclusions:** Eccentric BFR resistance training exhibited similar outcomes to traditional training with less reported soreness. However, interpretation of these data are limited by methodologic approach.

**3360** Board #181 May 29 1:30 PM - 3:00 PM

**Acute Cardiovascular And Muscular Response To No-load Exercise With And Without Blood Flow Restriction**

Wenyuan G. Zhu, Tayla E. Kuehne, Noam Yitzchaki, Ryo Kataoka, Samuel L. Buckner. *University of South Florida, Tampa, FL.*  
(No relevant relationships reported)

**PURPOSE:** To examine acute changes in muscle thickness, isometric strength, and arterial occlusion pressure (AOP) following NO LOAD exercise with and without the application of blood flow restriction (BFR) in the upper body. **METHODS:** Changes in muscle thickness, isometric strength and AOP were examined following four sets of twenty repetitions of unilateral elbow flexion exercise. Participants performed maximal muscle contractions with no external load throughout a full range of motion with and without the application of a moderate BFR (40% of AOP). Results are displayed as mean (SD). **RESULTS:** 39 resistance-trained males and females completed the study. For isometric torque there was a condition x time interaction ( $p=0.012$ ). The BFR condition had lower isometric torque immediately following exercise [56.07 (17.78) Nm] compared to the control group [58.67 (19.06) Nm]. In addition, both

the BFR and control conditions demonstrated a decrease in torque immediately following exercise [mean change = 4.5 (4.5) and 1.82 (4.5) Nm for BFR and control conditions respectively], which remained decreased below baseline 15 minutes post exercise [mean change 2.39 (5.5) and 2.28 (3.19) Nm for BFR and control conditions respectively]. For muscle thickness, there was a main effect for time ( $p < 0.001$ ). Muscle thickness increased from pre [3.52 (.78) cm] to post [3.68 (.81) cm] exercise and remained increased above baseline 15 min post exercise [3.6 (.80) cm]. For AOP, there was a group x time interaction ( $p = 0.027$ ). The change in AOP was greater in the BFR group [16.6 (13.42) mmHg] compared to the control group [11.1 (11.84) mmHg]. **CONCLUSIONS:** NO LOAD exercise with the application of BFR led to greater reductions in isometric torque compared to NO LOAD exercise without the application of BFR. In addition, the application of BFR led to an exaggerated cardiovascular response compared to NO LOAD exercise alone. There were no differences in acute muscle swelling between NO LOAD exercise with and without BFR. These results suggest that the application of BFR to NO LOAD exercise may lead to a greater level of muscle fatigue when performing four sets of twenty maximal repetitions. This is accompanied with an exaggerated cardiovascular response.

**3361** Board #182 May 29 1:30 PM - 3:00 PM  
**The Acute Muscular Response To Passive Movement And Blood Flow Restriction**

Joonsun Park<sup>1</sup>, Daphney M. Stanford<sup>2</sup>, Samuel L. Buckner<sup>3</sup>, Matthew B. Jesse<sup>2</sup>. <sup>1</sup>The University of Southern Mississippi, Hattiesburg, MS. <sup>2</sup>The University of Mississippi, University, MS. <sup>3</sup>University of South Florida, Tampa, FL.  
 (No relevant relationships reported)

In immobilized patients, passive movement (PM) with blood flow restriction (BFR) reduces atrophy over PM alone; whether these effects are greater than BFR alone is uncertain. **PURPOSE:** To determine if acute muscular responses are unique when combining BFR and PM compared to PM alone or BFR alone. **METHODS:** 20 participants performed four conditions (randomized order): time control (TC), PM, BFR, and PM combined with BFR (PM+BFR) over two visits (one condition each leg, per visit). For PM, a dynamometer moved (45°/second) the leg through 3 sets of 15 knee extensions/flexions (90°). For BFR, a cuff was inflated to 80% arterial occlusion pressure on the proximal portion of the leg. Muscle thickness (MT) was measured at 60% and 70% of the anterior upper leg before, immediately after, five minutes after, and ten minutes after each condition. Oxygenated, deoxygenated (HHb), and total (tHb) hemoglobin of the vastus lateralis were monitored throughout conditions via near-infrared spectroscopy. Ratings of perceived effort (RPE-E) and discomfort (RPE-D) were reported before conditions and after each set. Data [presented as mean (SD)] were analyzed using Bayesian RMANOVA. **RESULTS:** 60% MT [ $\Delta$  before to immediately after: TC = 0.04 (0.09), PM = -0.01 (0.15), BFR = -0.00 (0.11), PM+BFR = 0.01 (0.22) cm] and 70% MT [ $\Delta$  before to immediately after: TC = 0.01 (0.09), PM = -0.01 (0.15), BFR = 0.02 (0.11), PM+BFR = -0.03 (0.22) cm] did not change ( $BF_{10} = 0.014$  and  $0.015$ , respectively). HHb and tHb changes were generally greater with BFR and PM+BFR [i.e. channel 2 HHb:  $\Delta$  start set 1 to end set 3: TC = 1.07 (1.21), PM = -1.23 (1.86), BFR = 9.58 (2.81), PM+BFR = 10.11 (3.16)  $\mu$ m]. RPE-E increased with time and condition ( $BF_{10} = 2.882e+8$ ), [ $\Delta$  before to end set 3: TC = 0.0 (0.2), PM = 0.7 (1.0), BFR = 0.9 (2.1), PM+BFR = 1.3 (1.7)]. RPE-D changes were greater for BFR and PM+BFR ( $BF_{10} = 1.877e+13$ ), [ $\Delta$  before to end set 3: TC = 0.0 (0.2), PM = 0.4 (1.1), BFR = 3.2 (1.8), PM+BFR = 2.6 (1.5)]. **CONCLUSION:** PM and/or BFR alone are not sufficient to acutely increase MT (generally associated with a hypertrophic stimulus) in healthy people. Changes in tissue oxygenation seem to be driven by BFR rather than a unique effect of combining PM with BFR. The extent of this effect and what it would mean for adaptation in either healthy or bed-ridden patients warrants further investigation.

**3362** Board #183 May 29 1:30 PM - 3:00 PM  
**Muscle Swelling Following Low Load Blood Flow Restriction Exercise Does Not Differ Between Cuff Widths In The Lower Body**

Zachary W. Bell<sup>1</sup>, Takashi Abe<sup>1</sup>, Vickie Wong<sup>1</sup>, Robert W. Spitz<sup>1</sup>, Ricardo B. Viana<sup>1</sup>, Raksha N. Chatakondi<sup>1</sup>, Scott J. Dankel<sup>2</sup>, Yujiro Yamada<sup>1</sup>, Jeremy P. Loenneke, FACSM<sup>1</sup>. <sup>1</sup>The University of Mississippi, University, MS. <sup>2</sup>Rowan University, Glassboro, NJ. (Sponsor: Jeremy P. Loenneke, FACSM)  
 Email: zwbell@go.olemiss.edu  
 (No relevant relationships reported)

Acute muscle swelling is a purported mechanism for muscle hypertrophy following blood flow restriction (BFR) training. Currently there are numerous cuff widths used within the lower body BFR literature. However, studies suggest that growth may be attenuated with a wider cuff. Whether this is related to a differential acute swelling response has not been previously shown. **PURPOSE:** To examine the acute changes in muscle swelling following low load BFR exercise in the lower body, in response to different cuff widths inflated to the same relative pressure. **METHODS:** Ninety-six (43

men, 53 women) participants completed two conditions (one each leg). Participants completed four sets of unilateral knee extension exercise to failure using 30% of their one repetition maximum (1RM) with BFR applied with either a narrow (5 cm) or a wide (12 cm) cuff inflated to 40% of their arterial occlusion pressure. Muscle thickness and echo intensity were measured at two sites (proximal and distal) before and after each exercise bout as surrogate markers of swelling. A repeated measures analysis with a between subject factor of sex was used to assess changes. Bayes Factors ( $BF_{10}$ ) were used to quantify evidence. **RESULTS:** The difference in acute changes in muscle thickness ( $BF_{10}$ : 0.43) and echo intensity ( $BF_{10}$ : 0.87) between cuff widths was not different between the proximal (i.e. wide cuff covered this site) and distal (no cuff was over this site) location. Further, changes in muscle thickness at the proximal [5cm: 0.58 cm vs. 12 cm: 0.57 cm; median difference (95% credible interval) of 0.009 (-0.04, 0.06) cm] and distal [5 cm: 0.63 cm vs. 12 cm: 0.63 cm; median difference (95% credible interval) of 0.00002 (-0.03, 0.04) cm] site did not differ based on cuff width or sex (Men: 0.58 cm vs. Women: 0.58 cm and Men: 0.64 cm vs. Women: 0.63 cm for proximal and distal sites, respectively). Echo intensity appeared to decrease at the proximal and distal sites with no differences between cuff widths. However, there was some evidence that this change at the distal site may be different between sexes [ $BF_{10}$ : 49.8; Men: -1.9 vs. Women: -4.2 AU]. **CONCLUSIONS:** Acute muscle swelling occurs in men and women, even when using a wider cuff. Thus, if there is to be attenuation in growth with a wider cuff, it is unlikely to be due to differences in acute swelling.

**3363** Board #184 May 29 1:30 PM - 3:00 PM  
**Examination Of High-velocity Blood Flow Restricted Resistance Exercise Versus High-load Resistance Exercise**

Summer B. Cook, FACSM, Christopher J. Cleary, Brittany T. Duncan. University of New Hampshire, Durham, NH.  
 Email: summer.cook@unh.edu  
 (No relevant relationships reported)

Muscle strength gains following blood flow restricted (BFR) resistance training are consistently lower than those observed after HL training and this may be due to differences in neuromuscular activation. Integrating high-velocity muscle contractions and BFR resistance exercise may increase neuromuscular activation. **PURPOSE:** To compare torque and neuromuscular activation before and after sessions of HL knee extension exercise and high-velocity BFR knee extension exercise in young and older adults. **METHODS:** Ten young males and females (20.3 $\pm$ 1.5 years, 1.73 $\pm$ 0.6 m, 69.2 $\pm$ 10.4 kg) and 10 older males and females (72.6 $\pm$ 4.7 years, 1.70 $\pm$ 12 m, 74.3 $\pm$ 14.6 kg) performed randomized sessions of HL (80% 1-RM for 3 sets of 10 isotonic knee extension repetitions) and low-load, high-velocity BFR (30% 1-RM coupled with a vascular restriction for one set of 30 knee extension repetitions and 3 sets of 15 repetitions completed as quickly as possible). Knee extension isometric torque was assessed before and after each session of exercise and neuromuscular activation of the vastus lateralis (VL) was quantified with surface electromyography (EMG). **RESULTS:** The young participants had higher isometric torque than the older participants (213.4 $\pm$ 54.8 vs 160.1 $\pm$ 56.3 Nm;  $P=0.01$ ). There was an average decrement in torque of 31.4 $\pm$ 9.2% among all participants from baseline to post exercise ( $P<0.01$ ). The magnitude of this decrement was similar between conditions ( $P=0.19$ ), age ( $P=0.12$ ), and the interaction of time, condition and age ( $P=0.16$ ). EMG amplitude normalized to pre isometric torque in the first 5 knee extension repetitions of the HL condition averaged 106 $\pm$ 57% and 90 $\pm$ 33% in the BFR high-velocity condition. In the last 5 repetitions, EMG amplitude averaged 117 $\pm$ 56% and 113 $\pm$ 46 in the HL and BFR conditions respectively. This was a significant increase in EMG amplitude ( $P<0.01$ ) but there were no interactions or main effects of condition or age ( $P>0.05$ ). **CONCLUSION:** Combining high-velocity contractions with BFR resistance exercise results in decrements in torque and heightened neuromuscular activation similar to HL exercise in both young and older adults. Future studies should evaluate the training adaptations from high-velocity BFR resistance training. Supported by University of New Hampshire Grimes Family Fund.

**F-59 Free Communication/Poster - Cellular and Molecular**

Friday, May 29, 2020, 1:30 PM - 4:00 PM  
 Room: CC-Exhibit Hall

**3364** Board #185 May 29 1:30 PM - 3:00 PM

**Proposal Of A New In Vitro Exercise Model For Cartilage Regeneration**

Pedro G. Morouco. *Polytechnic Institute of Leiria, Leiria, Portugal.*

Email: pedro.morouco@ipleiria.pt  
 (No relevant relationships reported)

Tissue Engineering and Regenerative Medicine are promising interdisciplinary fields regarding tissue and/or organ repair and regeneration. Due to the extremely high incidence of osteoarthritis in such an aging population, it is critical to put all efforts in developing a successful implant for osteochondral tissue regeneration; although there has been a huge amount of work aiming to regenerate it, a tailored construct has not been achieved yet. **PURPOSE:** to develop a 3D in vitro model and bioreactor system to evaluate osteochondral regeneration, as well as cell-material interaction and material induced cell migration and differentiation, under physiological conditions in a bioreactor system with the ability of providing mechanical and electrical stimuli. **METHODS:** Multiphysics computer simulations were performed to explore which combination of stimuli facilitate cells adhesion, proliferation, viability and differentiation. A suite of new mathematical models were developed and validated, together with robust and efficient computational tools that allow simulation of chondral regeneration in vitro and in vivo. **RESULTS:** An automated integrated smart system for the assembly and in vitro culture process of the osteochondral constructs was designed. The platform integrate two distinct zones: the multi-material bioprinter and the custom-designed bioreactor. Due to different environmental conditions (temperature, humidity and PCO<sub>2</sub>) that must be ensured in the fabrication and culture areas, a custom-made incubator with two separate areas and differential environmental control were developed. **CONCLUSION:** The integrated assembly system was validated by comparing the biological and mechanical properties of the produced constructs. Preliminary results have demonstrated both adequate mechanical and biological properties of the 3D constructs, using Poly(glycerol-sebacate) and graphene.

**3365** Board #186 May 29 1:30 PM - 3:00 PM

**Therapeutic Potential Of Different Pericyte Populations In The Recovery Of Skeletal Muscle Mass Following Disuse**

Samuel Lapp, Yu Fu Wu, Svyatoslav Dvoretzkiy, Amanda Tannehill, Gabriela Garcia, Marni Boppart, FACS. *University of Illinois at Urbana-Champaign, Urbana, IL.* (Sponsor: Marni Boppart Sc.D., FACS)

Email: sclapp2@illinois.edu  
 (No relevant relationships reported)

Significant loss in skeletal muscle mass and function can occur following periods of extended bed rest or immobilization. Physical therapy is recommended, but recovery may be incomplete in special populations due to injury and functional limitations. Our lab recently demonstrated the capacity for pericytes, or vascular stromal cells, to accelerate recovery of skeletal muscle following disuse in a mouse model. Different pericyte populations exist in skeletal muscle based on localization and unique cell surface markers, yet the most therapeutic population has not been identified. **PURPOSE:** To identify the pericyte population with the greatest therapeutic benefit when transplanted into muscle following a period of disuse. **METHODS:** Twenty-four 4-month old C57BL/6 mice were randomly divided into four groups (n=6/group). Mice hindlimbs were immobilized in full dorsiflexion via a surgical staple inserted through the center of the foot and body of the gastrocnemius for 2 weeks. At 2 weeks post immobilization, staples were removed and either pericytes (CD146<sup>+</sup>Lin<sup>-</sup>, CD146<sup>+</sup>NG2<sup>+</sup>Lin<sup>-</sup>, NG2<sup>+</sup>Lin<sup>-</sup>) or saline (control) were injected into the tibialis anterior (TA) muscle. TA muscles were excised for analysis after 2 weeks of remobilization and the extent of recovery was assessed. One-way ANOVA was used to compare the extent of improvement between treatment groups. **RESULTS:** There was no significant improvement in TA muscle weight or myofiber CSA with pericyte transplantation in the current study (p>0.05). However, a trend toward significant improvement in myofiber CSA was noted for fibers ranging 2000-3000 μm<sup>2</sup> in mice receiving CD146<sup>+</sup>NG2<sup>+</sup>Lin<sup>-</sup> pericytes (p=0.072). Significant improvements in capillarization and collagen remodeling were detected in mice receiving CD146<sup>+</sup>NG2<sup>+</sup>Lin<sup>-</sup> (p<0.05) and CD146<sup>+</sup>Lin<sup>-</sup> (p<0.05) pericytes compared to controls. **CONCLUSION:** CD146<sup>+</sup>Lin<sup>-</sup> pericyte transplantation effectively recovered capillary quantity and collagen remodeling following a period disuse compared to controls, whereas NG2<sup>+</sup>Lin<sup>-</sup> pericytes did not demonstrate similar capacity for recovery. Supported by NIH Grant NIAMS R01 AR072735 to MDB.

**3366** Board #187 May 29 1:30 PM - 3:00 PM

**A Novel Umbilical Cord Derived Wharton's Jelly Formulation For Regenerative Medicine Applications**

Ashim Gupta<sup>1</sup>, Sobrasua E. Ibim<sup>2</sup>, Howard Levy<sup>1</sup>, Rebecca Sze Tu<sup>3</sup>, Saadiq F. El-Amin III<sup>1</sup>. <sup>1</sup>*BioIntegrate LLC, New York, NY.* <sup>2</sup>*Morris Brown College, Atlanta, GA.* <sup>3</sup>*Columbia University, New York, NY.*

Email: ashim6786@gmail.com

Reported Relationships: **A. Gupta:** Salary; BioIntegrate LLC. Ownership/interest/stock; Right Mechanics Inc..

**PURPOSE:** Musculoskeletal injuries have traditionally been treated with activity-modification, physical therapy, pharmacological agents and surgical procedures. These modalities have limitations, as well as potential side-effects. Over the last decade, there has been an increased interest in the use of biologics for regenerative medicine applications (RMA), including umbilical cord (UC) derived Wharton's Jelly (WJ). Despite this increase, there is insufficient literature assessing the amount of growth factors, cytokines, hyaluronic acid (HA) and extracellular vesicles (EV) including exosomes in these products. The purpose of this study was to develop a novel WJ formulation and evaluate the presence of growth factors, cytokines, HA and EV including exosomes.

**METHODS:** WJ was isolated from human-UC obtained from consenting C-section donors and formulated into an injectable form. Randomly selected samples from different batches were analyzed for sterility testing and quantified for presence of growth factors, cytokines, HA and particles in EV size range.

**RESULTS:** The results showed all samples passed the sterility test. Growth factors including IGF1, 2, 3, 4 and 6, TGF-α, PDGF-AA were detected. Expression of several immunomodulatory cytokines, RANTES, IL-6R, IL-16, were also detected. Expression of pro-inflammatory cytokines MCSFR, MIP-1α; anti-inflammatory cytokines TNF-RI, TNF-RII, IL-1RA; and homeostatic cytokines TIMP-1 and TIMP-2 were observed. Cytokines associated with wound-healing, ICAM-1, G-CSF, GDF-15, and regenerative properties, GH were also expressed. High concentrations of HA were observed. Particles in the EV size range (30-150nm) were detected and were enclosed by the membrane, indicative of true EV.

**CONCLUSIONS:** Our results confirmed the presence of numerous growth factors, cytokines, HA and EV in the WJ formulation. More studies are underway to confirm the presence of exosomes in detected EV using exosome-specific markers. We believe the presence of multiple factors within one WJ formulation may play a role in reducing inflammation, pain and augment healing of musculoskeletal injuries. This offers a potential expanded use for RMA.

**3367** Board #188 May 29 1:30 PM - 3:00 PM

**Overexpression Of PGC-1α In Human Primary Myotubes Increases Regulators Of Exosome Biogenesis And Secretion**

Derek Middleton<sup>1</sup>, Christopher Kargl<sup>1</sup>, Jeffery Brault<sup>2</sup>, Timothy Gavin, FACS. <sup>1</sup>*Purdue University, West Lafayette, IN.*

<sup>2</sup>*Indiana University, Indianapolis, IN.* (Sponsor: Timothy P. Gavin, FACS)

(No relevant relationships reported)

Skeletal muscle functions as an endocrine organ. Exosomes, small vesicles containing mRNAs, miRNAs, and proteins, are secreted from muscle cells and facilitate cell-to-cell communication. Our recent work found greater exosome release from oxidative compared to glycolytic muscle. Peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC-1α) is a key driver of mitochondrial biogenesis, a characteristic of oxidative muscle. It was hypothesized that PGC-1α regulates exosome biogenesis and secretion in skeletal muscle. **PURPOSE:** To determine if PGC-1α regulates skeletal muscle exosome biogenesis and secretion. **METHODS:** On day 4 of differentiation, primary myotubes from vastus lateralis biopsies from lean donors (BMI < 25.0 kg/m<sup>2</sup>) were exposed to adenovirus encoding human PGC-1α or GFP control. On day 6 of differentiation, culture media was replaced with exosome-free media. On day 8, cells were collected for mRNA and protein analysis. **RESULTS:** Overexpression of PGC-1α increases regulators of exosome biogenesis in the endosomal sorting complexes required for transport (ESCRT) pathway: Alix (GFP: 2.9 ± 1.0 vs. PGC-1α: 7.6 ± 1.4), TSG-101 (GFP: 1.8 ± 0.1 vs. PGC-1α: 7.3 ± 2.1), CD63 (GFP: 2.6 ± 0.3 vs. PGC-1α: 3.7 ± 0.4), Clathrin (GFP: 3.5 ± 0.1 vs. PGC-1α: 11.6 ± 2.5), and the secretion pathway: Rab27b (GFP: 2.6 ± 0.7; PGC-1α: 3.2 ± 0.3). **CONCLUSION:** Overexpression of PGC-1α increases gene expression of regulators of exosome biogenesis and secretion in human primary myotubes.

**3368** Board #189 May 29 1:30 PM - 3:00 PM  
**Effects Of Obesity On Cardiotoxin Induced Damage And Regeneration Of Lean And Obese Human Myotubes**

Brian P. Sullivan<sup>1</sup>, Chris Kargl<sup>1</sup>, Lis Quevedo<sup>2</sup>, Joci Mena<sup>2</sup>, Timothy P. Gavin, FACSM<sup>1</sup>. <sup>1</sup>Purdue University, West Lafayette, IN. <sup>2</sup>Universidad Nacional de Colombia, Bogota, Colombia. (Sponsor: Tim Gavin, FACSM)  
 Email: sulli170@purdue.edu  
 (No relevant relationships reported)

Obesity increases the susceptibility of skeletal muscle to damage and impairs the regenerative response following muscle damage. Obesity is associated with an increase in ectopic lipid accumulation and inflammatory cell infiltration in skeletal muscle. It is unclear if the impairments in skeletal muscle regeneration and increased susceptibility to damage is due to these factors or if defects in integrity and repair are inherent to muscle of obese subjects. **PURPOSE:** To investigate if myotubes isolated from obese donors are (1) more susceptible to damage and (2) have a blunted regeneration response. **METHODS:** Differentiated myotubes from lean (LN) and obese (OB) donors were treated with 0.5  $\mu$ M of cardiotoxin (CTX) for 1 hr. Cells were allowed to recover in skeletal muscle growth media for 3 days and then differentiation media for 2 days. Cells were isolated immediately (ImPost), 3 and 5 days following CTX treatment. **RESULTS:** CTX significantly reduced the fusion index of differentiated cells, but there were no differences between LN and OB at ImPost (no-CTX: LN 28% vs. OB 28%; CTX: LN 15% vs. OB 12%), 3 Days (no-CTX: LN 38% vs. OB 38.0%; CTX: LN 30% vs. OB 29%), or 5 Days (no-CTX: LN 41% vs. OB 39%; CTX: LN 37% vs. OB 34%). CTX significantly reduced cell viability assessed via MTT but no differences were observed between LN and OB at ImPost (no-CTX: LN 0.20 au vs. OB 0.21 au; CTX LN 0.11 au vs. OB 0.14 au), 3 days (no-CTX: LN 0.37 au vs. OB 0.37 au; CTX LN 0.08 au vs. OB 0.12 au), or 5 days (no-CTX: LN 0.34 au vs. OB 0.34 au; CTX LN 0.19 au vs. OB 0.22 au). No differences were observed in the expression of key metabolic proteins PFK-1, Citrate Synthase, or  $\beta$ -Had following CTX administration in LN or OB. **CONCLUSION:** When cultured under identical conditions, myotubes isolated from young, healthy obese donors demonstrate similar damage following CTX treatment and similar regenerative responses compared to myotubes from lean donors.

**3369** Board #190 May 29 1:30 PM - 3:00 PM  
**Single-cell RNA Sequencing Of Human Skeletal Muscle Reveals Novel Progenitor Populations**

Alasdair W.R. Cameron<sup>1</sup>, Scott Wotherspoon<sup>2</sup>, Stevan A. Springer<sup>1</sup>, Nick Gaulton<sup>1</sup>, Laura V. Young<sup>1</sup>, Adam P.W. Johnston<sup>1</sup>. <sup>1</sup>University of Prince Edward Island, Charlottetown, PE, Canada. <sup>2</sup>Queen Elizabeth Hospital, Charlottetown, PE, Canada.  
 (No relevant relationships reported)

**INTRODUCTION:** Skeletal muscle contains numerous stem and progenitor cell populations that reside within the interstitium between myofibres. These cells directly and indirectly support muscle repair; however, the identities and functions of these cells remain poorly characterized in human muscle. **PURPOSE:** To apply a novel genetic tool, single cell RNA sequencing (scRNAseq), to identify progenitor cell populations within uninjured human skeletal muscle. **METHODS:** Total mononuclear cells were isolated from the hamstrings of n=5 orthopedic surgery patients (2 males, 3 females, mean age ~23.4) and combined for droplet based scRNAseq using the 10x Chromium Controller. Bioinformatic analysis was conducted using R package Seurat V3.0, which computed principal components for projecting cells in two dimensions and employed unsupervised graph-based clustering using uniform manifold approximation and projection (UMAP). **RESULTS:** Following quality control, a total of 2736 cells were analyzed at a read depth of ~41,000 reads per cell with an average of 1255 genes detected per cell. Analysis of differentially expressed genes identified 8 distinct cell clusters which corresponded to the expected cell populations of satellite cells, endothelial/vascular related cells, mesenchymal/fibroblastic cells, T-cells, macrophages, as well as type I and type II muscle cells. Interestingly, the analysis also revealed two poorly characterized populations. The first expressed both mesenchymal and smooth muscle-related genes and displayed a similar transcriptional profile to "smooth muscle mesenchymal cells" (SMMCs) recently described in rodents. The second was typified by the expression of the transcription factor *Twist-2* suggesting they may be analogous to a newly defined muscle stem cell population responsible for the growth of type-II fibres. In addition to the primary clusters, analysis also identified numerous "sub-clusters" of cells providing insight into previously undescribed cellular heterogeneity, the function of which remains unknown. **CONCLUSION:** scRNAseq is an effective tool to define and transcriptionally characterize cell populations within human skeletal muscle. Ongoing analysis is examining the function of SMMCs and *Twist-2*-positive cells in response to exercise.

**3370** Board #191 May 29 1:30 PM - 3:00 PM  
**Regulation Of Myokine Expression In Exosome-like Vesicles By Electric Pulse Stimulation Of C2C12 Myotubes**

Ju-Hee Kang<sup>1</sup>, Sujin Kim<sup>1</sup>, Sohee Moon<sup>1</sup>, Hyo-Bum Kwak<sup>2</sup>, Dong-Ho Park<sup>2</sup>. <sup>1</sup>College of Medicine, HDRC, Inha University, Incheon, Korea, Republic of. <sup>2</sup>Inha University, Incheon, Korea, Republic of.  
 Email: johygang@inha.ac.kr  
 (No relevant relationships reported)

Physical exercise (PE) is a well-known non-pharmacological intervention to overcome chronic low-graded inflammation-induced sarcopenia through humoral factors. However, it is not fully elucidated whether PE-induced maintenance of muscle homeostasis against inflammation is associated with muscle cell-derived myokines and extracellular vesicles. **PURPOSE:** To determine the effects of inflammation of muscle cell on the myokine expression in exosome-like vesicles (ELVs), and the effects of electric pulse stimulation (EPS), as an exercise mimetic on the myokine expression using C2C12 myotubes.

**METHODS:** Inflammation of C2C12 was induced by treatment of a cytokine mixture (CM, TNF- $\alpha$ +INF- $\gamma$ ), and insulin resistance was induced by palmitate (0.75 mM) for 24 hrs. ELVs were enriched from conditioned media by differential ultracentrifugation. EPS was set as 11.5V, 2m/s, 2Hz for 24 hrs. We considered  $P < 0.05$  as significant, using GraphPad Prism ver 2.0 program.

**RESULTS:** Treatment of C2C12 by CM significantly inhibited the expression of myogenic regulators (myogenic transcription factors, myogenic myokine, and signaling proteins), while induced the expression of atrophic factors (atrogin-1, myostatin and signaling proteins). In addition, the inflamed C2C12 myotubes released anti-myogenic ELVs which contain abundant myostatin and scanty level of decorin, comparing with control ELVs. When we stimulated C2C12 myotubes by EPS system, levels of myogenic regulators (MyoD and myogenin), myogenic myokines (FDNCS, decorin, FGF21 and cathepsin B), and metabolic function of myotubes were significantly increased, however the levels of myostatin and atrogin-1 were down-regulated. Furthermore, EPS increased the mitochondrial activity and activated mitochondrial biogenesis pathways.

**CONCLUSIONS:** Inflammation, expression of anti-myogenic regulators and mitochondrial dysfunction are major contributors in metabolic diseases- or aging-induced sarcopenia. Therefore, our results suggested that activation of anti-myogenic activity in muscle cells by contraction (i.e., EPS in vitro and skeletal muscle contraction during PE in vivo) through myokine-containing ELVs may be a mechanism of beneficial effects of PE against sarcopenic factors.

**3371** Board #192 May 29 1:30 PM - 3:00 PM  
**Effects Of Electrical Pulse Stimulation On Mitochondrial Dynamics In Myotubes From Lean And Severely Obese Humans**

Wenqian Deng<sup>1</sup>, Benjamin A. Kugler<sup>2</sup>, Bergomi Francois<sup>2</sup>, Meaghan Nasta<sup>2</sup>, Joseph Houmar<sup>3</sup>, Kai Zou<sup>2</sup>. <sup>1</sup>Chengdu Sports University, Chengdu, China. <sup>2</sup>University of Massachusetts Boston, Boston, MA. <sup>3</sup>East Carolina University, Greenville, NC.  
 Email: deng\_wen\_qian@163.com  
 (No relevant relationships reported)

Exercise/contractile activity improves skeletal muscle mitochondrial dynamics and insulin sensitivity. However, the adaptations in mitochondrial dynamics in response to exercise/contractile activity between lean and severely obese humans have not been directly compared. Electrical pulse stimulation (EPS) has been used in human skeletal muscle cells (HSkMCs) as an *in vitro* exercise model and can produce physiological adaptations similar to exercise/exercise training.

**PURPOSE:** The purpose of the study was to compare the effects of EPS on mitochondrial network structure and expression of regulatory proteins in mitochondrial dynamics processes in cultured myotubes derived from lean and severely obese humans.

**METHODS:** HSkMCs isolated from muscle biopsies from lean (n=8, BMI = 23.8  $\pm$  1.1 kg/m<sup>2</sup>) and severely obese humans (n=8, BMI = 45.5  $\pm$  1.5 kg/m<sup>2</sup>) were differentiated to mature myotubes and electrically stimulated for 24 hours by applying an electrical pulse at 11.5V, 1Hz and 2ms. Four-hours after EPS, mitochondrial network structure was determined in live cells via confocal microscopy and protein markers of mitochondrial dynamics were measured by immunoblotting.

**RESULTS:** Mitochondrial content was significantly lower in myotubes from severely obese humans when compared to the leans (Total MitoTracker Intensity: 376.0  $\pm$  36.1 vs. 224.8  $\pm$  15.1,  $P < 0.05$ ) and EPS had no effect on mitochondrial content. Myotubes from severely obese humans also exhibited more fragmented mitochondrial networks when compared to the leans (Number of Non-Networked Individual Mitochondria: 2.6  $\pm$  0.4 vs. 1.9  $\pm$  0.2,  $P < 0.05$ ). Interestingly, EPS improves mitochondrial network structure by enhancing mitochondrial network size in both groups (Mitochondrial Network Size: 7.2  $\pm$  0.3 vs. 8.7  $\pm$  0.6,  $P < 0.05$ ). Consistently, mitochondrial fission

protein Drp1 ser<sup>616</sup> phosphorylation was significantly reduced following EPS in both groups ( $1.09 \pm 0.07$  vs.  $0.95 \pm 0.06$ ,  $P < 0.05$ ). No differences of mitochondrial fusion proteins were found between any groups.

**CONCLUSIONS:** Our data reveal that EPS induces similar intrinsic adaptations in mitochondrial dynamics in cultured myotubes derived from lean and severely obese humans.

**3372** Board #193 May 29 1:30 PM - 3:00 PM  
**Gene Expression Responses Of Skeletal Myotubes To Mechanical Loading In Vitro**

Athanasios Moustogiannis, Evangelos Zevolis, Michael Koutsilieris, Anastassios Philippou. *National and Kapodistrian University of Athens, Athens, Attiki, Greece.*  
 Email: moustogi@gmail.com  
 (No relevant relationships reported)

Skeletal muscle can adapt to mechanical loading by changing its mass and overall contractile phenotype via the activation of mechanotransduction and intracellular signaling mechanisms. In vitro mechanical loading of differentiated myoblasts (myotubes) has been utilized for mimicking the mechanical loading conditions of skeletal muscle in vivo. **PURPOSE:** This study investigated the effects of mechanical loading of myotubes on their gene expression responses associated with various aspects of cellular function, such as differentiation, hypertrophy and apoptosis. **METHODS:** C2C12 myoblasts were cultured on elastic membranes up to day 9 of their differentiation and then underwent a passive, cyclic stretching (15% elongation, at a frequency of 0.25 Hz, for 12 hours). Myotubes were harvested and lysed 12 hours after the completion of the stretching protocol. Real Time-PCR was utilized to measure changes in mRNA expression levels of myogenic regulatory factors (MRFs: MyoD, Myogenin, MRF4), as well as growth (IGF-1 isoforms: IGF-1Ea, IGF-1Eb), atrophy (Murfl, Atrogin, Myostatin), apoptotic (Foxo, Fuca, p53) and inflammatory factors (IL-6, IL-1b) in response to mechanical loading of the differentiated myoblasts. **RESULTS:** Mechanical loading of the myotubes resulted in increased expression of MyoD (1.5-fold;  $p < 0.05$ ) and MRF4 (2.0-fold;  $p < 0.05$ ) while Myogenin expression decreased by 0.4-fold ( $p < 0.05$ ). Expression of muscle atrophy factors Atrogin (0.5-fold), Myostatin (0.4-fold), and Murfl (0.4-fold), and of the inflammatory factor IL-1b (0.5-fold) was significantly decreased ( $p < 0.05$ ). No significant changes were revealed in the expression levels of IGF-1 isoforms (IGF-1Ea: 0.9-fold, IGF-1Eb: 1.1-fold) and apoptotic factors (Foxo: 0.8-fold, Fuca: 1.1-fold, p53: 1.0-fold), as well as of IL-6 (0.8-fold) in response to the selected stretching protocol of the differentiated myoblasts. **CONCLUSIONS:** These findings suggest that the specific mechanical loading protocol can further affect the myogenic differentiation program and protein synthesis of skeletal myotubes by influencing the expression of myogenic factors and downregulating muscle atrophy genes.

**3373** Board #194 May 29 1:30 PM - 3:00 PM  
**Novel Method To Visualize AMPK Protein Localization In Single Human Muscle Fibers Via Confocal Microscopy**

Carlos S. Zepeda<sup>1</sup>, Christopher E. Pardini<sup>1</sup>, Kara K. Lazauskas<sup>2</sup>, Irene S. Tobias<sup>2</sup>, Andrew J. Galpin<sup>2</sup>, James R. Bagley<sup>1</sup>. <sup>1</sup>San Francisco State University, San Francisco, CA. <sup>2</sup>California State University Fullerton, Fullerton, CA.  
 Email: czepeda3@mail.sfsu.edu  
 (No relevant relationships reported)

**Purpose:** AMP-activated protein kinase (AMPK) is the energy regulator of skeletal muscle cells. Current methods can identify the magnitude of AMPK expression in skeletal muscle cells via Western blotting and Capillary Nano-Immunoassay (CNIA); however, these methods lack the ability to visually identify AMPK localization within single muscle fibers. Identifying AMPK in human muscle is important because it is involved in various exercise training adaptations such as mitochondrial biogenesis and glucose transport. Therefore, we aimed to develop a novel confocal microscopy method to identify AMPK protein expression (relative intensity) and localization within human single muscle fibers. **Methods:** A vastus lateralis muscle biopsy was obtained from a healthy male and immediately fixed (4% PFA). Twenty fibers were isolated, placed on microscope slides, incubated in 0.1% Triton (15min), then incubated in 5% normal goat serum (blocking solution; 4h). This was followed by exposure to a 1 antibody (Ab) (anti-AMPK $\alpha$ 2) in 5% bovine serum albumin (14h at 4°C). Fibers were then exposed to a 2 Ab (anti-rabbit IgG conjugated w/ AlexaFluor 488) and phalloidin (AlexaFluor 568) to label actin (2h). Finally, fibers were mounted under coverslips with AntiFade Gold w/DAPI for myonuclei detection. Confocal microscopy imaging was conducted using a Zeiss LSM 710 with 63x plan apochromatic objective (oil emersion). Images were processed via ImageJ. **Results:** Muscle fiber contractile proteins (actin; red), myonuclei (blue), and AMPK proteins (green) were successfully visually identified at rest (AMPK fluorescence intensity =  $1199.64 \pm 630$  AU). To ensure that no auto-fluorescence or non-specific binding was observed, images were compared to control slides: 1) DAPI only, 2) 1 Ab only, 3)

2 Ab only, and 4) no staining. **Conclusion:** These methods allow for the successful visualization (relative intensity) and localization of AMPK proteins within single human muscle fibers. This method could be used in future research to investigate the response and myonuclear co-localization of AMPK following exercise in human skeletal muscle to elucidate how they may play a role in these physiological processes.

**F-60** Free Communication/Poster - Exercise  
**Training Responses and Muscle Damage**

Friday, May 29, 2020, 1:30 PM - 4:00 PM  
 Room: CC-Exhibit Hall

**3374** Board #195 May 29 1:30 PM - 3:00 PM  
**An Examination Of The Nonlocal Repeated Bout Effect Of The Elbow Flexor Muscles**

Jun Seob Song, Sunggun Jeon, William Miller, Minsoo Kang, FACSM, Xin Ye. *The University of Mississippi, Oxford, MS.*  
 (Sponsor: Minsoo Kang, FACSM)  
 Email: jsong6@go.olemiss.edu  
 (No relevant relationships reported)

Unaccustomed eccentric exercises usually result in muscle damage. It has been well documented that the magnitude of muscle damage can be attenuated in the subsequent bouts of the similar exercise, which is known as the repeated bout effect (RBE). The potential nonlocal RBE (e.g., from the upper limb to lower limb or vice versa), however, has not been examined yet. **PURPOSE:** To examine whether performing an initial bout of eccentric damaging exercise (EDE) on the elbow flexor muscles could induce any RBE against the muscle damage from the subsequent identical EDE performed on the knee flexors. **METHODS:** Six healthy men (Age:  $24 \pm 4$  yrs; Weight:  $84.3 \pm 15.2$  kg; Height:  $174.3 \pm 9.2$  cm) and nine women (Age:  $21.1 \pm 1$  yrs; Weight:  $65.5 \pm 13.4$  kg; Height:  $162.8 \pm 3.5$  cm) participated in this study. The participants performed the baseline bout of knee flexion (KF) EDE on one randomly chosen thigh. After a washout period, the participants performed the elbow flexion (EF) EDE on a randomly chosen arm. Lastly, the second bout of EDE was performed on the contralateral leg one week after the EF EDE. All EDE protocols consisted of six sets of 10 eccentric contractions with the load equivalent to 150% of the concentric 1-repetition maximum of the leg curl or arm curl exercise. Range of motion (ROM) at the knee joint, muscle soreness, and the relative KF isometric strength were taken before, after, one day (1D), two days (2D), and seven days (7D) after the EDE protocols. Separate three-way (bout [baseline, second]  $\times$  group [dominant, non-dominant]  $\times$  time [Pre, Post, 1D, 2D, 7D]) repeated measures ANOVAs were used to examine the changes in dependent variables. **RESULTS:** The ROM did not show any 3-way or 2-way interactions, but a main effect for time ( $p < 0.001$ ). There was a significant bout  $\times$  time interaction ( $p = 0.042$ ) for the relative isometric strength, and the follow-up paired t-tests indicated a significant difference at the Post-testing time point (baseline bout vs. second bout:  $80.5 \pm 10.4\%$  vs.  $87.5 \pm 13.0\%$ ,  $p = 0.046$ ). The muscle soreness only showed significant main effects for bout ( $p = 0.034$ ) and time ( $p < 0.001$ ), with the pairwise comparison showing significantly smaller value for the second bout when compared to that for the baseline bout. **CONCLUSIONS:** This preliminary study showed potential nonlocal RBE between the upper and lower body muscles.

**3375** Board #196 May 29 1:30 PM - 3:00 PM  
**Hyperbaric Oxygen Therapy Promotes Muscle Recovery After Contusion Injury Via Angiogenesis By Reactive Nitrogen Species**

Naoki Yamamoto, Takuya Oyaizu, Kazuyoshi Yagishita, Mitsuhiro Enomoto, Masaki Horie, Toshiyuki Ohara, Mikio Shioda, Ryohei Takada, Atsushi Okawa. *Tokyo Medical and Dental University, Tokyo, Japan.*  
 Email: yamamoto.orth@tmd.ac.jp  
 (No relevant relationships reported)

**Background:** Muscle contusion is a common sports injury, but delayed return to competition may negatively influence athlete's careers. Recently, hyperbaric oxygen (HBO) treatment promoted early recovery from muscle injury with reduction of soft tissue swelling. Increased reactive oxygen species (ROS) and reactive nitrogen oxide species (RNS) is a key mechanism of HBO, which supplies abundant oxygen due to increased dissolved oxygen at high pressure, and a high O<sub>2</sub> content in tissues. RNS generally stimulate vascular endothelial growth factor (VEGF) secretion from endothelial cells, which then induces angiogenesis. **Purpose:** To investigate whether HBO could promote angiogenesis with induction of ROS /RNS and induce muscle regeneration after contusion injury in rats. **Methods:** Muscle contusion was induced

by the mass-drop method on the right calf muscle of rats. After the injury, the rats were divided into non-treated (NT) and HBO-treated groups. The HBO protocol consisted of 100% oxygen inhalation at 2.5ATA for 120 minutes once a day for 5 consecutive days. We measured VEGF levels and histologically evaluated blood vessel formation and muscle regeneration in the contused muscles. In a functional analysis, we measured the tensile strength of the calf muscles at the final observation point. We also evaluated the effects of a ROS/RNS inhibitor (NAC) or RNS specific inhibitor (L-NAME) in the HBO group. **Results:** HBO significantly increased VEGF levels at 3 hours (NT group:  $311.2 \pm 58.2$  pg/ml, HBO group:  $827.5 \pm 83.8$  pg/ml) and promoted blood vessel formation at 3-7 days after contusion (3 days: NT group:  $0.04 \pm 0.02$  /HPF, HBO group:  $0.4 \pm 0.1$  /HPF, 5 days: NT group:  $0.82 \pm 0.2$  /HPF, HBO group:  $2.14 \pm 0.7$  /HPF, 7 days: NT group:  $2.8 \pm 0.8$  /HPF, HBO group:  $5.9 \pm 0.9$  /HPF). Administration of both NAC and L-NAME before HBO suppressed angiogenesis (7 days: NAC + HBO group:  $3.4 \pm 0.8$  /HPF, L-NAME + HBO group:  $2.9 \pm 0.6$  /HPF) and muscle regeneration (NT group:  $20.22 \pm 2.2$  /HPF, HBO group:  $34.6 \pm 3.2$  /HPF, NAC + HBO group:  $20.0 \pm 2.4$  /HPF, LNAME + HBO group:  $19.4 \pm 1.5$  /HPF) even after HBO. RNS inhibition is more important for the effects of HBO. **Conclusions:** HBO increased angiogenesis mainly through generation of RNS in the early phase and promoted muscle regeneration after muscle contusion injury.

**3376** Board #197 May 29 1:30 PM - 3:00 PM  
**Changes In Paraspinal Muscle T2 Times And Creatine Kinase After A Bout Of Eccentric Exercise**

Anne Schomöller, Lucie Risch, Hannes Kaplick, Anne Schraplau, Monique Wochatz, Tilman Engel, Dominik Sonnenburg, Frank Mayer. *University of Potsdam, Potsdam, Germany.*

(No relevant relationships reported)

Eccentric (ECC) exercises might cause muscle damage, characterized by delayed-onset muscle soreness, elevated creatine kinase (CK) levels and local muscle oedema, shown by elevated T2 times in magnet resonance imaging (MRI) scans. Previous research suggests a high inter-individual difference regarding these systemic and local responses to eccentric workload. **PURPOSE:** To analyze ECC exercise-induced muscle damage in lumbar paraspinal muscles assessed via MRI.

**METHODS:** Ten participants (3f/7m; 33±6y; 174±8cm; 71±12kg) were included in the study. Quantitative paraspinal muscle constitution of M. erector spinae and M. multifidus were assessed in supine position before and 72h after an intense eccentric trunk exercise bout in a mobile 1.5 tesla MRI device. MRI scans were recorded on spinal level L3 (T2-weighted TSE echo sequences, 11 slices, 2mm slice thickness, 3mm gap, echo times: 20, 40, 60, 80, 100ms, TR time: 2500ms). Muscle T2 times were calculated for manually traced regions of interest of the respective muscles with an imaging software. The exercise protocol was performed in an isokinetic device and consisted of 120sec alternating ECC trunk flexion-extension with maximal effort. Venous blood samples were taken before and 72h after the ECC exercise. Descriptive statistics (mean±SD) and t-testing for pre-post ECC exercises were performed.

**RESULTS:** T2 times increased from pre- to post-ECC MRI measurements from 55±3ms to 79±28ms in M. erector spinae and from 62±5ms to 78±24ms in M. multifidus ( $p < 0.001$ ). CK increased from 126±97 U/L to 1447±20579 U/L. High SDs of T2 time and CK in post-ECC measures could be due to inter-individual reactions to ECC exercises. 3 participants showed high local and systemic reactions (HR) with T2 time increases of 120±24% (M. erector spinae) and 73±50% (M. multifidus). In comparison, the remaining 7 participants showed increases of 11±12% (M. erector spinae) and 7±9% (M. multifidus) in T2 time. Mean CK increased 9.5-fold in the 3 HR subjects compared with the remaining 7 subjects.

**CONCLUSIONS:** The 120sec maximal ECC trunk flexion-extension protocol induced high amounts of muscle damage in 3 participants. Moderate to low responses were found in the remaining 7 subjects, assuming that inter-individual predictors play a role regarding physiological responses to ECC workload.

**3377** Board #198 May 29 1:30 PM - 3:00 PM  
**Relationship Of Baseball Pitching Volume To Performance, Biometrics, And Reactive Hyperemia: A Pilot Study**

Robert D. Chetlin<sup>1</sup>, Brent A. Baker<sup>2</sup>, Douglas J. Altavilla<sup>1</sup>, Sarah F. McDonnell<sup>1</sup>, Duane S. Davis<sup>3</sup>, Bradley R. Jacobson<sup>1</sup>.  
<sup>1</sup>Mercyhurst University, Erie, PA. <sup>2</sup>CDC-NIOSH, Morgantown, WV. <sup>3</sup>Marshall University, Huntington, WV. (Sponsor: Paul M. Gordon, FACSM)

Email: rchetlin@mercyhurst.edu

(No relevant relationships reported)

We recently demonstrated body fat %, fast ball velocity, and RPE were significant predictors of valgus torque in NCAA baseball pitchers. Even though changes in hyperemic-induced limb volume are associated with acute, repetitive pitching

performance, possibly indicating approaching dominant elbow soft-tissue risk, no investigation, to our knowledge, has examined relationships between performance, biometric, and throwing-limb volume in collegiate pitchers.

**PURPOSE:** To quantify the relationship between pitching performance, subject biometrics, and hyperemic-induced changes in collegiate baseball pitchers during game-simulated pitching sessions of 40, 80, or 120 pitches.

**METHODS:** Following informed consent, 5 male subjects ( $\bar{x}$  age =  $18.8 \pm 0.8$  years;  $\bar{x}$  BMI =  $27.6 \pm 1.8$ ;  $\bar{x}$  body fat % =  $22.9 \pm 6.2$ ;  $\bar{x}$  throwing velocity =  $80.4 \pm 1.8$  mph) were block-assigned to groups of 40, 80, or 120 pitches. Bouts consisted of 10 pitches (~20s between pitches) delivered from an artificial mound with 1-2 mins rest between bouts. HR and RPE were recorded immediately following each 10-pitch bout. A MOTUS sensor and compression sleeve measured elbow valgus torque. A Stalker Sport II Radar Gun measured fastball velocity. Pre-test and post-test upper- and lower-extremity limb girths were measured, signifying reactive hyperemia. Wilcoxon non-parametric testing determined pre- to post-test differences. Pearson correlation identified relationships between variables. Alpha was set at  $p \leq 0.05$ .

**RESULTS:** No group differences were found on any performance, biometric, demographic, or hemodynamic variable. HR ( $72.6 \pm 8.3$  bpm vs.  $97.6 \pm 10.0$  bpm,  $p = 0.02$ ) and dominant forearm limb girth ( $29.4 \pm 1.5$  cm vs.  $30.9 \pm 1.5$  cm,  $p = 0.04$ ) increased from pre-test to post-test for subjects combined. Significant correlations were found for: pitching volume & post-test HR ( $r = 0.90$ ,  $p = 0.039$ ); post-test dominant upper arm circumference & RPE ( $r = 0.89$ ,  $p = 0.042$ ), and; valgus torque % change & pitching volume ( $r = 0.91$ ,  $p = 0.031$ ).

**CONCLUSIONS:** Forearm limb girth increased for subjects combined, and; given this metric's indication of reactive hyperemia, future research focused on elucidating and quantifying the biological components of the tissue (compartments), as well as their contribution to performance- and/or injury-specific outcomes, is warranted.

**3378** Board #199 May 29 1:30 PM - 3:00 PM  
**Comparison Of Flat, Uphill And Downhill High Intensity Interval Training On Performance And Skeletal Muscle**

Kathryn H. Myburgh, FACSM, Cameron Sugden, Evan E. Knight, Tracey Ollewagen. *Stellenbosch University, Stellenbosch, South Africa.*

Email: khm@sun.ac.za

(No relevant relationships reported)

Skeletal muscle and exercise performance adapt to high intensity interval training (HIIT). Downhill running is an eccentric-biased exercise modality whereas uphill running is concentric-biased and flat running has aspects of both. Therefore, variation in adaptation may differ with HIIT done on flat (F) or uphill (UH) or downhill (DH) gradients. **PURPOSE:** To compare the training effect of three modes of HIIT on laboratory and outdoor performance and muscle cross-sectional area (CSA) and satellite cell number per fiber (SC). **METHODS:** 17 fit, but not elite, young adult male runners volunteered for HIIT: 6 sets of 3 minutes and 1-minute rest between, for 10 sessions over 4 weeks. Gradients were flat, +5% or -10% and running speeds 85%, 80% or 90% of peak treadmill speed (PTS) respectively. Performance tests included PTS (0% gradient), maximum isometric quadriceps force (Iso) and 5 km road time trial (TT). Muscle biopsies were taken at baseline and 6 hours after the 10<sup>th</sup> session. Data analyzed using mixed models ANOVA, presented as mean ± SD. **RESULTS:** HIIT improved PTS (km/h) in F (pre:  $17.7 \pm 1.3$ , post  $18.9 \pm 1.5$ ;  $P < 0.05$ ) and UH (pre:  $17.6 \pm 0.8$ , post:  $18.7 \pm 0.8$   $P < 0.01$ ), but not DH (pre:  $17.8 \pm 1.3$ , post  $18.0 \pm 1.3$ ), whereas only DH significantly increased Iso strength (25%  $P < 0.05$  compared to F: -1% and UH: -4.4%). Similarly, only DH increased muscle fiber cross-sectional area (CSA) (31%  $P < 0.05$  compared to F: -5% and UH: 10%). DH increased muscle SC number/fiber highly significantly (pre:  $0.097 \pm 0.01$  post:  $0.297 \pm 0.04$   $P < 0.0001$ ). Interestingly, UH HIIT group did not change SC content (pre:  $0.102 \pm 0.018$ , post:  $0.106 \pm 0.02$ ), but flat HIIT increased significantly (pre:  $0.115 \pm 0.01$ , post:  $0.148 \pm 0.01$   $P < 0.01$ ), although not nearly as much as DH HIIT (F: 30%, DH: 208%). 5 km TT improved in all groups (F: 3%; UH: 3.5% and DH: 3.5%; all  $P < 0.05$ ). **CONCLUSION:** Muscle adapted differently in response to the different gradients of HIIT. Neither SC number/fiber nor CSA changed with UH HIIT. CSA also did not change with F HIIT, although SC number/fiber increased. DH HIIT increased both CSA and SC number/fiber to a greater extent. Although laboratory performance test changes differed between groups, all 3 groups improved outdoor TT performance. Therefore, different training specific adaptations in skeletal muscle conferred similar race performance improvements.

**3379** Board #200 May 29 1:30 PM - 3:00 PM  
**Effects Of Repeated Bout Of Eccentric Exercise On Muscle Stiffness In Elbow Flexors**

Min-Ghyu Sun, Choun-Sub Kim, Maeng-Kyu Kim. *Kyungpook National University, Daegu, Korea, Republic of.*

Email: sunminghyu@naver.com

(No relevant relationships reported)

Up to now, maximal voluntary isometric contraction (MVIC), range of motion (ROM), and serum creatine kinase (CK) have been used for studying exercise-induced muscle

damage (EIMD) with single- and repeated bout effect following eccentric contraction (EC). However, it is unknown whether muscle stiffness reflecting the mechanical properties would be a competent parameter for detecting EIMD following EC in elbow flexors. **PURPOSE:** This study was conducted to examine changes of EIMD indices through repeated bout EC and to investigate the correlation between EIMD markers and mechanical properties in elbow flexors. **METHODS:** Thirteen healthy males performed 6 x 5 sets of maximal EC at 90°/sec angular velocity on non-dominant elbow flexors using isokinetic dynamometer. Three weeks washout period were given between the first- (ECC1) and second eccentric exercise session (ECC2). To evaluate EIMD symptoms, MVIC, ROM, muscle swelling, soreness, and serum CK activity were measured. Echo intensity (EI) on *brachialis* and *biceps brachii* m. was obtained using ImageJ software. Moreover, muscle fatigue as measured by electromyography and mechanical properties as measured by myotonometer were assessed for each session. All parameters were obtained at post-exercise 24, 48, 72, and 96 hours, including before and immediately after EC. **RESULTS:** There were significant differences from those of baseline in MVIC, ROM, muscle swelling, soreness, fatigue, and stiffness at each session. Moreover, muscle swelling and stiffness in *biceps brachii* m. had statistical differences between sessions. Although CK and EI had no significant differences in ECC2, there were significant differences from those of baseline in ECC1. Also, there were statistical differences between sessions in CK and EI. Additionally, stiffness in *biceps brachii* m., but not *brachialis* and ROM had significantly negative correlations in each session at 48 and 72 hours, respectively. **CONCLUSIONS:** Taken together, these data revealed that muscle stiffness, except for CK and EI, in elbow flexors were not shown adaptation after repeated bout EC. As shown by the relationship between the stiffness and ROM, the stiffness as a mechanical property can be used as an indicator of muscle damage. Supported by the National Research Foundation of Korea Grant (NRF-2017R1C1B1006196).

**3380** Board #201 May 29 1:30 PM - 3:00 PM  
**Abstract Withdrawn**

**3381** Board #202 May 29 1:30 PM - 3:00 PM  
**Effect Of Low Intensity Eccentric Exercise Training On Maximal Eccentric Exercise induced Muscle Damage**  
Nilsel Okudan, Aysel Yildirim, Muaz Belviranli. *Faculty of Medicine Selcuk University, Konya, Turkey.*  
Email: nilselokudan@gmail.com  
(No relevant relationships reported)

**PURPOSE:** The aim of this study was to investigate the effects of low-intensity eccentric exercise performed before maximal eccentric exercise which causes muscle damage and oxidative stress on muscle injury markers and oxidative stress. **METHODS:** The study was carried out with 22 male Wistar albino rats obtained from Experimental Animal Research and Application Center of Selcuk University. Rats were randomly divided into 3 groups. Rats in the control group (K, n: 6) were not given any exercise protocol. The maximal eccentric exercise protocol was applied to the rats in the maximal eccentric exercise group (M, n: 8) only one at rate of 20 m / min, at -15° inclination for 90 min. Low intensity eccentric exercise protocol, which does not cause muscle damage was applied to the rats in the low intensity eccentric exercise + maximal eccentric exercise group (DY+M, n: 8) at 10 m / min, at -15° inclination, 30 min / day for one week and maximal eccentric exercise protocol was applied 24 hours after this exercise. Blood and muscle tissue samples were taken 24 hours after the last exercise session and creatine kinase (CK), lactate dehydrogenase (LDH) and superoxide dismutase (SOD1) activities and myoglobin (Mg), malondialdehyde (MDA) and glutathione (GSH) levels were measured. **RESULTS:** Serum Mg level was higher in the M group compared to the DY+M and the K groups. Serum CK and LDH activities were higher in the DY+M and the M groups compared to the K group. MDA level was higher in M group compared to K and DY+M groups in vastus intermedius muscle, in M group compared to the K group in gastrocnemius muscle and in the DY+M and the M groups compared to the K group in plasma. GSH level in the vastus intermedius muscle and plasma was higher in the DY+M group compared to the M group. GSH level in gastrocnemius muscle was not different between groups. SOD1 activity was higher in the DY+M group compared to the K group in the vastus intermedius muscle, in the DY+M group compared to the K and the M groups in the gastrocnemius muscle. SOD1 activity in plasma was not different between groups. **CONCLUSIONS:** Low intensity eccentric exercise training applied before the maximal eccentric exercise has a partial protective effect against muscle damage, especially in the vastus intermedius muscle prevents the formation of oxidative stress and strengthens the antioxidant defense.

**3382** Board #203 May 29 1:30 PM - 3:00 PM  
**The Effects Of A 50k Ultramarathon On Plasma IL-6 And Rectus Femoris Muscle Thickness**

Dakota T. Siok<sup>1</sup>, Kathleen Dondro<sup>1</sup>, Christa M. Nelson<sup>2</sup>, Steven J. Prior<sup>3</sup>, Odessa Addison<sup>4</sup>, Rian Q. Landers-Ramos<sup>1</sup>. <sup>1</sup>Towson University, Towson, MD. <sup>2</sup>University of Maryland School of Medicine, Baltimore, MD. <sup>3</sup>University of Maryland, College Park, MD. <sup>4</sup>University of Maryland School of Medicine and Veterans Affairs Medical Center, Baltimore, MD.  
Email: dsiok1@students.towson.edu  
(No relevant relationships reported)

**PURPOSE:** to assess plasma IL-6 concentrations and muscle thickness (MT) using ultrasound imaging throughout and after a 50-kilometer race and to determine the relationship between changes in IL-6 and changes in MT. **METHODS:** Men and women (n=11) age 39 ± 7 years participated in a 50k trail race consisting of five 10k laps. Ultrasound imaging was performed on the rectus femoris at rest (passive) and during isometric contraction before the race, within 60 minutes of completing the race, and 24-hrs post-race. To maintain consistent ultrasound probe placement, the probe was outlined at baseline testing. Images were analyzed using ImageJ, and the % change in MT from passive to isometric contraction was calculated. Blood was drawn 30 minutes following consumption of a pre-race meal, 10k into the race, within 60 minutes of completion of the race and 24 hrs post-race. Plasma IL-6 was assessed using an enzyme-linked immunosorbent assay (ELISA). **RESULTS:** Change in MT from passive to isometric contraction increased from a pre-race value of 9.1 ± 2.7% to 14.1 ± 2.6% post-race although this did not reach statistical significance (P=0.256). Compared to pre-race values, change in MT increased significantly 24 hrs post-race (9.1 ± 2.7% vs. 17.8 ± 1.7%; P=0.021). IL-6 concentrations increased from pre-race levels of 0.37 ± 0.25 pg/mL to 3.1 ± 0.86 pg/ml at 10k (P=0.008) and to 29 ± 3.3 pg/mL post-race (P<0.001). Twenty-four-hour follow-up testing revealed a return of IL-6 levels to pre-race values (0.59 ± 0.3 pg/mL; P=0.488). The mean change (post-pre) in IL-6 inversely correlated with the mean change in MT (r= -0.685, P=0.02). **CONCLUSIONS:** Ultramarathon running leads to an acute but substantial increase in plasma IL-6 which precedes changes in MT. The relationship between changes in IL-6 and MT pre- and post-race indicates a potential role for IL-6 in the delayed exercise-induced inflammatory response with prolonged running. Supported by Towson University Summer Undergraduate Research Institute, University of Maryland College Park, and the Baltimore Veterans Affairs Medical Center

**3383** Board #204 May 29 1:30 PM - 3:00 PM  
**The Efficacy Of Protein Supplementation On Attenuating Muscle Atrophy Following Disuse**

Lee A. Weidauer, Leah Kroeger, Matt Vukovich, FACSM. *South Dakota State University, Brookings, SD.* (Sponsor: Matthew Vukovich, FACSM)  
Email: lee.weidauer@sdsstate.edu  
(No relevant relationships reported)

**PURPOSE**  
The purpose of this study was to determine the effects of protein supplementation during muscular disuse in maintaining muscle cross-sectional area, lean mass, strength, and jump force in the collegiate population.

**METHODS**  
Two groups of healthy collegiate participants (n=14) underwent two weeks of unilateral lower limb suspension (ULLS), during which the control group consumed a normal diet (CON) and the treatment group (PRO) received an additional 75g/day of supplemental protein. Outcome measures included lean mass (LM) measured using DXA, muscle area (MA) of the lower leg using pQCT, isokinetic torque measurements using a Biodex ergometer, and force production during jumping using a portable force platform. Differences in the change of these outcome measurements from baseline to follow-up were compared between the treatment and control groups (group \* time interaction, controlling for baseline measurement).

**RESULTS**  
Daily protein intake for the treatment group (2.6±1.0 g/kg/d) was greater than the control group (1.5±1.1 g/kg/d). Daily caloric intake was not different between groups (3015±1098 kcal/day; Treatment 2772±432 kcal/day). MA decreased in both groups following ULLS with no differences between groups measured. However, there was a moderate difference in change between groups with the PRO maintaining their total LM (group\*time interaction, p=0.08) and leg LM (group\*time interaction, p=0.1) when compared to the CON.

**CONCLUSION**  
This study demonstrates a universal loss in lower leg muscle area muscle during a relatively short period of disuse. Additionally, there was evidence of a trend toward a positive effect of protein supplementation on lean mass maintenance during disuse. The results of this study serve as an important first step of identifying nutritional interventions to augment rehabilitation.

3384 Board #205 May 29 1:30 PM - 3:00 PM

**ACUTE ANDROGEN AND GLUCOCORTICOID RECEPTOR RESPONSE FOLLOWING A MODERATE INTENSITY RESISTANCE EXERCISE BOUT**STEPHANIE A. SONTAG<sup>1</sup>, Justin X. Nicoll<sup>2</sup>, Andrew C. Fry<sup>1</sup>, Eric M. Mosier<sup>3</sup>. <sup>1</sup>University of Kansas, Lawrence, KS. <sup>2</sup>California State University, Northridge, CA. <sup>3</sup>Northwest Missouri State University, Maryville, MO.

Email: stephanie\_sontag@yahoo.com

(No relevant relationships reported)

**PURPOSE:** The purpose of this study was to examine the acute androgen receptor (AR) and glucocorticoid receptor (GR) response to a moderate intensity resistance exercise bout in resistance trained (RT) and untrained men (UT).**METHODS:** RT men (n = 10; X ± SD, age = 21.3 ± 1.7 yrs, height = 175.8 ± 6.8 cm, body mass = 84.5 ± 13.5 kg, back squat 1RM = 154.3 ± 19.3 kg, training history = 5.4 ± 2.0 yrs) and UT men (n = 9; X ± SD, age = 20.8 ± 3.1 yrs, height = 178.7 ± 8.9 cm, body mass = 81.0 ± 14.0 kg, squat 1RM = 108.1 ± 13.7 kg, training history = 0.7 ± 1.7 yrs) volunteered for this study. Prior to the RE bout, subjects were strength tested for back squat (BS) and leg extension (LE). Subjects returned 4-7 days later between 10am-2pm, and completed a RE bout consisting of 6 sets of 10 repetitions of BS at 75% 1RM, immediately followed by 4 sets of 10 repetitions of LE at 75% 1RM with 1.5 min rest between all sets. Muscle samples were collected from the *vastus lateralis* prior to exercise (PRE) and 10 min (10P), 30 min (30P), 60 min (60P), and 180 min (180P) post exercise. Total AR and GR expression was determined via western blotting. Receptor data were not normally distributed, thus all receptor data were analyzed using Mann-Whitney U test, Friedman test, and Wilcoxon signed-rank test.**RESULTS:** For total AR expression, there were no differences between time points within the RT group (p > .05); however, there were differences between time points within the UT group (p = .016). In the UT group, total AR expression significantly decreased at 30P (-19%Δ, z = -2.192, p = .027) and 60P (-11%Δ, z = -2.192, p = .027) post exercise, but returned to baseline values by 180P (z = -.178, p > .05). For Total GR content, there were no differences between time points within the RT or UT groups (p > .05). Total GR content was significantly greater in the RT group compared to the UT group at 10P (Mann-Whitney U = 19, z = -2.123, p = .035).**CONCLUSIONS:** While no changes were observed for AR expression in the RT group, the UT subjects experienced a significant decrease in AR expression at 30P and 60P suggesting acute AR responses vary depending on training status. No differences were seen across time for the GR in either group; however, RT and UT subjects were different from each other at 10P. It is unclear if these responses are related to the acute hormonal response; therefore, future research will address this.

3385 Board #206 May 29 1:30 PM - 3:00 PM

**Abstract Withdrawn**

3386 Board #207 May 29 1:30 PM - 3:00 PM

**Fiber Type Profile and Its Relation To Wilks Coefficient In Both Male And Female Powerlifters**Steven B. Machek<sup>1</sup>, Paul S. Hwang<sup>1</sup>, Thomas D. Cardaci<sup>1</sup>, Emiliya S. Suezaki<sup>1</sup>, Caelin S. Kim<sup>1</sup>, Dylan T. Wilburn<sup>1</sup>, Daniel Blake<sup>2</sup>, Andrew J. Galpin<sup>2</sup>, James R. Bagley<sup>3</sup>, Darryn S. Willoughby, FACSM<sup>1</sup>. <sup>1</sup>Baylor University, Waco, TX. <sup>2</sup>California State University, Fullerton, Fullerton, CA. <sup>3</sup>San Francisco State University, San Francisco, CA. (Sponsor: Darryn Willoughby, FACSM)

Email: steven\_machek2@baylor.edu

(No relevant relationships reported)

**PURPOSE:** Strikingly little data exist on powerlifter fiber type distributions, and none elucidate differences between genders in powerlifting. Past research established powerlifters have relatively higher fast-twitch fiber proportions versus sedentary and aerobic demographics, but it is unknown if fast-twitch content is predictive of performance. Furthermore, the Wilks Coefficient is a common means to normalize powerlifting performance relative to bodyweight in competition. Therefore, the purpose of this study was to 1) compare the myosin heavy chain fiber (MHC) fiber type profiles between powerlifters and sedentary controls of men and women, and 2) determine if fast-twitch fiber content predicts powerlifter Wilks coefficient.**METHODS:** Twelve actively competing powerlifters (PL; n = 6M/6F) and ten sedentary controls (CON; n = 5M/5F) were recruited for this cross-sectional analysis. Subjects underwent a percutaneous muscle biopsy from the *vastus lateralis* using fine needle aspiration. Samples were analyzed MHC isoform content via mixed homogenate SDS-PAGE. MHC isoforms (MHC I, IIa, and IIx) were analyzed via multiple 2x2 (group x gender) analysis of variance (ANOVA) at a significance level of p < 0.05. MHC IIa content was compared to Wilks coefficient using a Pearson correlation coefficient at p < 0.05.**RESULTS:** There were significant group differences for all MHC isoforms, where PL had a higher proportion of MHC I (p < .001) and IIa (p = .010) content relative to CON. Conversely, PL a significantly lower proportion of MHC IIx content versus CON (p < .001). There was a significant gender effect for MHC IIa fibers, where females had a higher proportion versus males (p = .021). Lastly, Pearson correlation analysis revealed a non-significant, low correlation between MHC IIa content and Wilks coefficient (r = -.288; p = .364).**CONCLUSIONS:** These results illustrate that powerlifting-style training may result in higher proportions of MHC I and IIa fibers, as well as losses in MHC IIx content. Contrary to previous literature, our data also show a higher proportion of fast-twitch MHC IIa fibers in females versus males. Overall, MHC IIa content is not a significant predictor of powerlifting performance as per Wilks coefficient, suggesting other biochemical markers and/or neural efficiency underline variations in skill.**F-61 Free Communication/Poster - Skeletal Muscle Fatigue**

Friday, May 29, 2020, 1:30 PM - 4:00 PM

Room: CC-Exhibit Hall

3387 Board #208 May 29 1:30 PM - 3:00 PM

**Do Decreases In Voluntary Activation Account For Fatigability Differently In Males And Females?**Rob J. MacLennan<sup>1</sup>, Alina P. Swafford<sup>2</sup>, Dennis P. Kwon<sup>2</sup>, Jason M. DeFreitas<sup>1</sup>, Matt S. Stock<sup>2</sup>. <sup>1</sup>Oklahoma State University, Stillwater, OK. <sup>2</sup>University of Central Florida, Orlando, FL.

Email: robjmaclellan@gmail.com

(No relevant relationships reported)

Muscular fatigue has been reported to have varying effects depending on sex. Both males and females incur deficits in strength resulting from strenuous activity but males suffer greater relative deficits. Similarly, in a fatigued state, males may be relatively less able to activate muscles. **PURPOSE:** We sought to determine whether the decrease in strength that males and females suffer is related to changes in their voluntary activation (%VA). **METHODS:** Twenty-two untrained, college-aged, males (11) and females (11) participated. Subject's dominant lower leg was strapped to an attachment set at an angle of 110° (180° = full extension) for isometric knee extensions. At pretesting, subjects performed maximal voluntary contractions (MVC) and the interpolated twitch technique was applied to assess %VA. Following initial testing, a fatiguing protocol was performed which consisted of 20 six-second MVCs with 3 seconds in between. In the fatigued state, subjects again performed an MVC and %VA was assessed. Linear regression was performed to determine if the variance in fatigability, as measured by change in MVC, can be accounted for by changes in %VA for each sex. **RESULTS:** Regression showed that 15.3% and 1.1% of the variance in force loss could be explained by changes in %VA in males and females, respectively. However, neither of these models were significant (p = 0.233 and p = 0.760). The results are shown in the figure below for both males (circles) and females (triangles). A 2-way mixed-factorial ANOVA showed neither a group × time interaction (p = 0.296), nor a main effect for time (p = 0.288) for %VA. **CONCLUSIONS:** The findings suggest that voluntary activation was not responsible for the force loss with fatigue in either males or females. For the females, this could be partially due to the fact that many of them had minimal changes in MVC from the fatiguing protocol, whereas all of the males showed at least a 10% deficit. However, there were no differences in %VA between males and females.

3388 Board #209 May 29 1:30 PM - 3:00 PM

**The Characters And Mechanisms Of Bioelectricity And NIRS In Low Intensity Sustained Muscle Fatigue Contraction**

Xiaodong Liu, Shanghai University of Sport, Shanghai, China. Email: 15501019518@163.com

(No relevant relationships reported)

The central and peripheral fatigues induced by sustained muscle contraction remain debatable. The neuromuscular and muscle oxygenation (SmO<sub>2</sub>) and perfusion ([tHb]) have obvious changes in active and antagonistic muscles when enduring low intensity sustained muscle fatigue contraction.**PURPOSE:** Characteristics and mechanisms of surface electromyography (sEMG), SmO<sub>2</sub> and [tHb] in active and antagonistic muscles induced by elbow flexor fatigue. **METHODS:** Twelve healthy male participants (25.3 ± 4.8 years old) performed isometric elbow flexion at 20% of their maximum voluntary contraction (MVC) force for fatigue. The EMG signals were recorded from the biceps brachii (BB) and triceps brachii (TB) muscles using linear electrode arrays composed of sixteen electrodes (10mm inter-electrode distance). The monopolar EMG signals were amplified

(Sessantaquattro, OT Bioelettronica) and sampled at 2000Hz. Muscle fiber conduction velocity (MFCV), mean power frequency (MPF) and median frequency (MF) were calculated by OT BioLab software. SmO<sub>2</sub> and [tHb] of BB and TB muscles were recorded with a MOXY near-infrared spectroscopy (NIRS) device (MOXY-5, Fortiori Design LLC).

**RESULTS:** Compared to the initial stage, the fatigue stage of BB muscle had a significantly decrease in MFCV (4.50±0.28 m/s VS 3.96±0.21 m/s, p<0.05), MPF (68.90±7.44 Hz VS 55.80±8.97 Hz p<0.05) and MF (64.60±5.88 Hz VS 48.93±5.27 Hz, p<0.05). SmO<sub>2</sub> of BB muscle reduced to the minimum at nearly half stage (ΔSmO<sub>2</sub>: 65±9%), but the [tHb] increased (Δ[tHb]: 0.48±0.13 g/dl). Fatigue stage of TB muscle had a decline in MPF (68.90±7.44 Hz VS 63.32±3.81 Hz p<0.05), MF (62.71±6.12 Hz VS 53.03±5.69 Hz, p<0.05). And SmO<sub>2</sub> and [tHb] of TB muscle had a slightly increase (ΔSmO<sub>2</sub>: 10±2%, Δ[tHb]: 0.29±0.08 g/dl).

**CONCLUSIONS:** In low intensity sustained muscle fatigue contraction, myoelectric central and peripheral fatigues induced active muscle fatigue. Meanwhile, antagonistic muscle has much oxygen and perfusion and central nerve may lead to fatigue.

**3389** Board #210 May 29 1:30 PM - 3:00 PM  
**Neuromuscular Electrical Stimulation At Long Pulse Duration Is Associated With Higher Muscle Oxygen Utilization**

Federica Gonnelli<sup>1</sup>, Enrico Rejc<sup>2</sup>, Mirco Floreani<sup>1</sup>, Nicola Giovanelli<sup>1</sup>, Stefano Lazzari<sup>1</sup>. <sup>1</sup>University of Udine, Udine, Italy. <sup>2</sup>University of Louisville, Louisville, KY.  
 Email: gonnelli.federica@spes.uniud.it  
 (No relevant relationships reported)

Conventionally Neuromuscular Electrical Stimulation (NMES), delivered on the muscle belly at low frequency and short pulse duration, is used in rehabilitation protocols to prevent muscle atrophy. However, conventional NMES causes rapid on-set of fatigue and possibly activates muscle fibers in a synchronous, spatially fixed order (i.e. reverse of the size principle). To overcome these limitations, in the past years, a novel approach that utilizes both high frequency (100Hz) and long pulse duration (1000μs) (Wide Pulse High Frequency Stimulation, WPHF) was proposed. During WPHF NMES muscle contraction is achieved via afferent nerve fibers, allowing the reflexive discharge of motor units, with the contribution of spinal circuitries, and mimic the recruitment order of a voluntary effort (i.e. first type I fibers).

**PURPOSE:** Evaluating muscle oxygen consumption via Near-Infrared Spectroscopy (NIRS) technique during two NMES bouts at fixed frequency (100Hz), applying Short (200μs) and Long (1000μs) Pulse duration, while concurrently matching the external force output. **METHODS:** Two 5 minutes intermittent (1 sec on - 3 sec off) NMES bouts at Short and Long pulse duration were delivered on the right quadricep muscle of 14 healthy subjects while sitting on an isometric chair. NIRS recorded oxygen extraction (i.e. Deoxygenated Hemoglobin - Myoglobin) from the vastus lateralis of the stimulated limb. Equal muscle force between protocols was achieved by carefully selecting the individual stimulation intensity. **RESULTS:** We selected 10 consecutive contractions for Short and Long Pulse NMES in order to have equal muscle output and evaluate the corresponding oxygen consumption. In the selected contractions, Peak Force was 15.3 ± 5.7 and 15.4 ± 5.6 % (p: ns) of the Maximal Voluntary Contraction while Force Time Integral was 1522.6 ± 593.4 and 1539.4 ± 597.3 Nm\*s (p: ns) for Short and Long Pulse respectively. At the same force output, Long Pulse NMES exhibited higher oxygen consumption, in percentage of the physiological calibration, than Short Pulse NMES (36.71 ± 11.82 % vs 28.79 ± 17.07 %, p:0.041). **CONCLUSION:** Applying Long Pulse NMES can elicit higher muscle oxygen utilization compared to Short Pulse duration, suggesting preferential recruitment of oxidative, type I muscle fibers, likewise to a voluntary contraction.

**3390** Board #211 May 29 1:30 PM - 3:00 PM  
**Electrical Stimulation-induced Fatigue In The Contralateral Leg Impairs Endurance Exercise Performance**

Fabio Giuseppe Laginestra<sup>1</sup>, Markus Amann<sup>2</sup>, Emine Kirmizi<sup>3</sup>, Gaia Giuriato<sup>1</sup>, Federico Ruzzante<sup>1</sup>, Anna Pedrinolla<sup>1</sup>, Camilla Martignon<sup>1</sup>, Cantor Tarperi<sup>1</sup>, Federico Schena<sup>1</sup>, Massimo Venturelli<sup>1</sup>. <sup>1</sup>University of Verona, Verona, Italy. <sup>2</sup>University of Utah, Salt Lake City, UT. <sup>3</sup>Uludag University, Eskisehir, Turkey.  
 Email: fabiogiusseppe.laginestra@univr.it  
 (No relevant relationships reported)

During fatiguing exercise, the development of peripheral fatigue and the associated increased firing of group III/IV afferent fibres, promote central fatigue. **PURPOSE:** The aim of this study was to assess whether peripheral fatigue in the contralateral leg induced by electrical quadriceps stimulation to bypass central command, would impair endurance performance of the subsequently exercising ipsilateral leg. **METHODS:** Eight young healthy males were recruited for this study. After completing an incremental test to exhaustion on a single-leg knee extensor ergometer, the subjects performed two tests on separate days. On the first day, they performed a time-to-

exhaustion test at 85% of their maximal power output (No-PreF trial). Exercise-induced quadriceps muscle fatigue was assessed by supramaximal electrical femoral nerve stimulation evaluating changes in the potentiated resting twitch force (Q<sub>tw,pot</sub>), maximal voluntary contraction (MVC) and voluntary activation (VA) from pre to post exercise. On the second day, the same exercise bout was preceded by the induction of fatigue in the contralateral quadriceps through electrical stimulation (PreF trial). The pre-fatiguing protocol was terminated once the subjects reached the maximum tolerance score on a 1-10 visual analogue scale (duration: 6.6 ± 0.9 min). Integrated electromyography (iEMG) was recorded and used to estimate spinal motoneuronal output. **RESULTS:** Time to exhaustion in the PreF trial was reduced by 41% (9.1 ± 1.5 to 5.4 ± 1.2 min, p < 0.05). The reduction in MVC (-36 ± 8 vs -23 ± 10%, p < 0.05) and Q<sub>tw,pot</sub> (-53 ± 3 to -39 ± 9% p < 0.05) was more accentuated in the No-PreF trial compared to PreF. Conversely, VA was more affected in PreF than in No-PreF (-20 ± 7 vs -14 ± 5%, p < 0.05). At every submaximal time point, iEMG was significantly higher in PreF compared to No-PreF, while at exhaustion it was higher in the latter (p<0.05). **CONCLUSIONS:** Pre-induced muscle fatigue in the contralateral limb impairs endurance performance of the exercising ipsilateral limb. This cross-over effect of fatigue is likely mediated by the inhibitory influence associated with group III/IV muscle afferent feedback and not related to changes associated with central command. Funding: No funding was received for this study

**3391** Board #212 May 29 1:30 PM - 3:00 PM  
**The Effects Of 50k Ultramarathon Running On Quadriceps Torque And Circulating Inflammatory Calprotectin.**

Kathleen R. Dondero<sup>1</sup>, Inez Hankerson<sup>1</sup>, Christa M. Nelson<sup>2</sup>, Steven J. Prior<sup>3</sup>, Odessa Addison<sup>2</sup>, Rian Q. Landers-Ramos<sup>1</sup>. <sup>1</sup>Towson University, Towson, MD. <sup>2</sup>University of Maryland School of Medicine, Baltimore, MD. <sup>3</sup>University of Maryland, College Park, College Park, MD.  
 Email: kdondero@towson.edu  
 (No relevant relationships reported)

Ultramarathon running has increased in popularity over the past decade. However, the effects of prolonged running on novel circulating inflammatory factors, such as calprotectin, and their relationship to muscle strength are not completely understood.

**Purpose:** Determine the effects of prolonged running on quadriceps strength and plasma calprotectin levels and examine the relationship between these two factors. **Methods:** Trained men and women (n=11) age 39 ± 7 years participated in a 50-kilometer(k) trail run consisting of five 10k laps. Seated knee extensor force was measured before the race, after each lap, immediately post-race and 24h post-race using a hand-held dynamometer. Quadriceps torque (N.m.) was calculated by multiplying tibial length by force. Blood was drawn 30 minutes after participants finished eating their pre-race meal, after the first lap (10k), within 60 minutes of finishing the race and 24h post-race. Plasma calprotectin was measured using an enzyme-linked immunosorbent assay (ELISA). **Results:** Quadriceps torque did not significantly change from pre-race to lap 1 (P=0.64), but significantly declined post-race (-10%; P=0.047) and returned to pre-race values by 24h post-race (P=0.1). Compared with lap 1, quadriceps torque declined significantly by lap 2 (-9%; P=0.024) but remained unchanged from lap 2 through post-race (between -10 and -8% from lap 2 through post-race; P>0.05 for each timepoint). Plasma calprotectin increased 63% at lap 1 (P=0.003), 83% post-race (P=0.001), and returned to pre-race values 24h post-race (P=0.66). Pre-race calprotectin levels directly correlated with quadriceps torque at lap 1 (r=0.627, P=0.023), post-race (r=0.771, P=0.005) and 24h post-race (r=0.767, P=0.006). Plasma calprotectin levels 24h post-race directly correlated with 24h post-race quadriceps torque (r=0.604; P=0.04). **Conclusion:** Athletes participating in a 50k ultramarathon experienced an acute decline in quadriceps torque that coincided with an acute increase in plasma calprotectin concentrations. Both torque and plasma calprotectin returned to pre-race values after 24h. The relationships between calprotectin levels and muscle torque before, during, and after the race suggest a potential novel role for calprotectin in muscle recovery from an ultramarathon.

**3392** Board #213 May 29 1:30 PM - 3:00 PM  
**Fatigue Etiology At Exhaustion When Cycling Above Vs At Or Below Maximal Lactate Steady-state Threshold.**

Rafael de Almeida Azevedo<sup>1</sup>, Jonas Forot<sup>2</sup>, Guillaume Y. Millet<sup>3</sup>, Juan M. Murias<sup>1</sup>. <sup>1</sup>University of Calgary, Calgary, AB, Canada. <sup>2</sup>Université Grenoble Alpes, Grenoble, France. <sup>3</sup>Université Jean Monnet, Saint-Etienne, France.  
 Email: rafael.azevedo@ucalgary.ca  
 (No relevant relationships reported)

Exercising above maximal lactate steady state (MLSS) has detrimental effects compared to exercising at MLSS. However, neuromuscular fatigue (NMF) to exercise above MLSS is unknown. **PURPOSE:** To evaluate NMF during exercise slightly below, at and above MLSS. **METHODS:** Nine men (24±3 yrs.; 76±7 kg; VO<sub>2max</sub>, 3.55±0.19 L·min<sup>-1</sup>) exercised to exhaustion at MLSS, 10 W below (-10W) and above

(+10W) MLSS. NMF was evaluated before (B), at min 10 (10'), 30 (30') and at exhaustion, by maximal voluntary contractions (MVC). Voluntary activation (VA) and contractile function of knee extensors [peak twitch torque (TwPt)] were tested using electrically-evoked contractions. Oxygen uptake ( $\dot{V}O_2$ ) and blood lactate concentration ([Lac]) were measured. **RESULTS:** Time to exhaustion (TTE) for -10W (66±14 min) and +10W (44±8 min) were longer and shorter than MLSS (53±9 min) ( $p<0.05$ ).  $\dot{V}O_2$  was stable for -10W (10', 2.9±0.19; 30', 2.9±0.28; TTE, 2.9±0.25 L·min<sup>-1</sup>) and MLSS (10', 3.0±0.21; 30', 3.0±0.29; TTE, 3.1±0.23 L·min<sup>-1</sup>) ( $p>0.05$ ), but increased at +10W (10', 3.0±0.21; 30', 3.2±0.32; TTE, 3.3±0.39 L·min<sup>-1</sup>;  $p<0.05$ ). [Lac] was stable for -10W (10', 4.1±1.1; 30', 4.4±1.2; TTE, 4.0±1.0 mM;  $p>0.05$ ). MLSS showed an increase at TTE (10', 5.3±1.4; 30', 5.8±1.4; TTE, 6.1±1.8 mM;  $p<0.05$ ). +10W showed a constant increase (10', 5.3±1.2; 30', 8.0±1.6; TTE, 8.6±1.6 mM;  $p<0.05$ ). MVC dropped from baseline for -10W (B, 561±178; 10', 436±128; 30', 420±131; TTE, 395±120 N;  $p<0.05$ ), MLSS (B, 518±130; 10', 405±96; 30', 361±75; TTE, 344±73 N;  $p<0.05$ ) and +10W (B, 517±172; 10', 392±124; 30', 384±146; TTE, 349±88 N;  $p<0.05$ ), and was not different amongst conditions. VA dropped from baseline for -10W (B, 98±2; 10', 90±6; 30', 89±6; TTE, 89±6 %;  $p<0.05$ ), MLSS (B, 97±2; 10', 91±5; 30', 91±5; TTE, 88±5 N;  $p<0.05$ ) and +10W (B, 98±2; 10', 94±5; 30', 90±7; TTE, 87±7 %;  $p<0.05$ ), and was not different amongst conditions. TwPt dropped from baseline for -10W (B, 173±30; 10', 129±22; 30', 119±17; TTE, 112±17 N;  $p<0.05$ ), MLSS (B, 172±31; 10', 129±28; 30', 119±24; TTE, 111±22 N;  $p<0.05$ ) and +10W (B, 167±33; 10', 113±25; 30', 103±27; TTE, 97±26 N;  $p<0.05$ ). +10W showed greater decline throughout the bout compared to the other conditions. **CONCLUSION:** Despite different TTE amongst conditions, peripheral NMF was only different exercising slightly above MLSS compared to the other conditions.

**3393** Board #214 May 29 1:30 PM - 3:00 PM

### Fatigue-induced Changes In Neuromuscular Responses During Maximal Bilateral Leg Extensions

Tyler J. Neltner<sup>1</sup>, John Paul V. Anders<sup>1</sup>, Cory M. Smith<sup>2</sup>, Joshua L. Keller<sup>1</sup>, Ethan C. Hill<sup>3</sup>, Terry J. Housh, FACSM<sup>1</sup>, Richard J. Schmidt<sup>1</sup>, Glen O. Johnson, FACSM<sup>1</sup>. <sup>1</sup>University of Nebraska-Lincoln, Lincoln, NE. <sup>2</sup>University of Texas- El Paso, El Paso, TX. <sup>3</sup>University of Central Florida, Orlando, FL. (Sponsor: Dr. Terry J. Housh, FACSM)

(No relevant relationships reported)

**Purpose:** The purpose of the present study was to compare the fatigue-induced changes in neuromuscular responses from both vastus lateralis (VL) muscles during maximal, bilateral isokinetic leg extensions. **Methods:** Fourteen men (22.6 ± 4 yr) performed consecutive, maximal, bilateral, concentric isokinetic leg extensions at 180 °·s<sup>-1</sup> until their peak torque was reduced by 70% (67 ± 19 repetitions). The amplitude (root mean square = RMS) and frequency (mean power frequency = MPF) contents of the electromyographic (EMG) and mechanomyographic (MMG) signals from the VL muscles of both legs were recorded simultaneously during each repetition of the fatiguing bout. The EMG RMS, EMG MPF, MMG RMS, MMG MPF and torque values were normalized to the values corresponding to 10% of the total number of repetitions completed and statistically compared at 5% intervals. Four, 2 (right and left VL) x 19 (10-100% of the total repetitions) repeated measures ANOVAs were used to determine mean differences for each neuromuscular parameter. A 1 x 19 repeated measures ANOVA was used to analyze torque changes across repetitions. Pairwise comparisons were used to identify when the neuromuscular and torque values changed from the values at 10% of the total repetitions. **Results:** The results indicated no significant interactions involving the right and left VL of any of the neuromuscular parameters. There were, however, significant main effects for repetitions collapsed across the muscles for both MMG RMS ( $p = 0.03$ ;  $\eta^2 = 0.147$ ) and EMG MPF ( $p < 0.01$ ;  $\eta^2 = 0.376$ ). Bilateral peak torque (271.1 ± 44.6 N·m) decreased significantly ( $p < 0.01$ ;  $\eta^2 = 0.695$ ) from 40-100% of the total repetitions. **Conclusion:** The results of this study revealed no differences between the right and left VL muscles for the patterns of neuromuscular responses during the fatiguing bilateral leg extensions. Peak torque decreased by 40.3% across all repetitions and was dissociated from the patterns of responses for EMG RMS and MMG MPF. The decreases across repetitions for EMG MPF and MMG RMS suggested that the fatigue-induced decrease in torque was due to excitation-contraction coupling failure secondary to an increase in metabolic byproducts.

**3394** Board #215 May 29 1:30 PM - 3:00 PM

### The Comparison Of Contralateral Repeated Bout Effects On Arm Muscle And Hand Muscle

Sunggun Jeon, William Miller, Junseob Song, Minsoo Kang, FACSM, Xin Ye. University of Mississippi, University, MS.

(Sponsor: Minsoo Kang, FACSM)

Email: sjeon3@go.olemiss.edu

(No relevant relationships reported)

**Purpose:** To compare the potential contralateral repeated bout effect (conRBE) in both biceps brachii and first dorsal interosseous (FDI) muscles.

**Method:** Fifteen adults (Age: 25.2 ± 4.4 years; Weight: 76.0 ± 11.4 kg; Height: 177.1 ± 7.3 cm) participated in this study. Participants were randomly assigned into either arm (n = 8) or hand group (n = 7). After the first visit as the familiarization, Visit 2 was the eccentric exercise visit, during which the participants performed 6 sets of 10 repetitions eccentric exercise at 50% maximal voluntary isometric contraction (MVIC) in the designated muscle group (randomly chosen between dominant and non-dominant sides). Before (pre) and after (post) exercise, MVIC, submaximal isometric trapezoid contraction task, range of motion (ROM), and delayed-onset muscle soreness (DOMS) were measured. Specifically, the trapezoid contraction task required the participants to gradually increase the force from 0 to 30% MVIC in 3 seconds, held it for 10 seconds, and then gradually decreased the force to 0% in 3 seconds. During the Visits 3 and 4 (24-hour post- and 48-hour post-exercise), all measurements were collected. One week after Visit 2, the exact same exercise was performed and the measurements were obtained for the contralateral muscle. Surface EMG signals from the biceps brachii or FDI muscles were collected, and separate three-way [group (arm vs. hand) × bout (bout 1 vs. 2) × time (pre vs. post vs. 24 post vs. 48 post)] repeated measures analysis of variances (ANOVAs) were used to examine the mean differences in dependent variables.

**Results:** For the biceps brachii muscle, the pre to 24 post change (delta) in ROM showed a significant difference between first bout and second bout (first vs. second bout: 27.01 ± 11.84 vs. 16.81 ± 9.88,  $p = 0.042$ ). There were significant differences between first bout and second bout at 24 post (55.06 ± 11.44 vs. 37.38 ± 12.67,  $p = 0.006$ ) and 48 post (65.38 ± 10.00 vs. 47.44 ± 14.99,  $p = 0.007$ ) for DOMS. In addition, normalized EMG amplitude showed a significant difference between first bout and second bout at post (69.87 ± 25.41% vs. 41.37 ± 17.13%,  $p = 0.009$ ). However, there was no conRBE in all dependent variables on FDI muscle.

**Conclusion:** The elbow flexor muscles showed conRBE, but hand muscle did not have any protective effect. Therefore, conRBE seems to be muscle specific.

**3395** Board #216 May 29 1:30 PM - 3:00 PM

### Abstract Withdrawn

## F-62 Free Communication/Poster - Biomechanical Measurement Equipment

Friday, May 29, 2020, 1:30 PM - 4:00 PM

Room: CC-Exhibit Hall

**3396** Board #217 May 29 2:30 PM - 4:00 PM

### Quantitative Measure Of Force Output Across Various Biomechanical Support Devices At The Knee

Thomas J. Cahill<sup>1</sup>, Dillon J. Canter<sup>1</sup>, Daniel J. Canter<sup>1</sup>, Cardyl P. Trionfante<sup>2</sup>. <sup>1</sup>Miami University, OXFORD, OH. <sup>2</sup>Thomas More University, Crestview Hills, KY.

Email: cahilltj@miamioh.edu

(No relevant relationships reported)

**Introduction:** The capacity to transfer high amounts of motor force against extreme resistances is desirable for recreational and competitive athletes alike. Due to this, the popularity of polymer-based wraps and sleeves has been increasing due to their known ability to aid in the increase of force output. However, the discrete force quantity (carryover value) has been largely overlooked in research. In the present study, passive force is measured in order to eliminate voluntary motor activation and to collect values representing ergogenic aid alone. **Purpose:** To quantify the force produced by the resistance-induced stretching of various ergogenic aids. **Methods:** 9 adult males (22.1±4.3yrs) underwent a series of passive force measurements, taken in duplicate, on a HUMAC NORM Isokinetic Dynamometer. Duplicate measures for each treatment were taken in three separate sessions. In each session, subjects were treated with no wrap (RAW), a knee sleeve (KS), or a manually wrapped "X" pattern knee wrap (KW) treatment. Peak torque was measured at 9 angles (70°, 75°, 80°, 85°, 90°, 95°, 100°, 105°, and 110°) for each treatment. Average force through full ROM was calculated for each subject. One-tail paired *t*-tests were ran ( $\alpha=0.05$ ) at all angles between all treatments and also between mean torque values. One-way ANOVA test was also ran for mean torque of all treatments ( $\alpha=0.05$ ). **Results:** Average force output for RAW tests was (3.72±4.64 N·m), (7.38±8.04 N·m) for KS and (12.64±11.55 N·m) for KW. One-tailed paired *t*-test for RAW vs KW yielded a ( $t=5.86$ ) and ( $p<0.05$ ). One-tail paired *t*-test for RAW vs KS yielded ( $t=3.31$ ) and a ( $p<0.05$ ). KS vs. KW yielded ( $t=3.01$ ) and a ( $p<0.05$ ). Paired one-tail *t*-tests yielded significant differences ( $p<0.05$ ) between every condition at every angle except for 70° ( $p=0.0813$ ) and 75° ( $p=0.360$ ) between RAW and KS. One-way ANOVA between average of torque production showed significant results,  $p$ -value: ( $\leq 0.05$ ), ( $f=18.35$ ). **Conclusion:** Data indicates the use of ergogenic aid in passive force tests significantly increased passive torque production. KW condition resulted in the greatest torque production. KS showed less passive torque production than KW, but more than RAW.

**3397** Board #218 May 29 2:30 PM - 4:00 PM  
**Quantification Of On-ice Figure Skating Jumps Using Data From A Wearable Device**

Sarah T. Ridge, Riley E. Reynolds, Kaden Weber, Dustin Bruening, *Brigham Young University, Provo, UT.*  
 Email: sarah\_ridge@byu.edu  
 (No relevant relationships reported)

The number of jumps figure skaters perform daily has never been formally quantified, though it has been suggested that skaters perform 50-100 jumps per training day. The magnitude of force, high loading rates, and frequent repetitions likely contribute to the high injury rate of competitive skaters. Monitoring the number of jumps performed may help decrease risk of injury, similar to the institution of pitch counts in youth baseball.

Activity monitors that are commonly used for activities such as walking and running record many false positives during figure skating jump quantification due to the variety of skating movements that generate similar acceleration profiles. Previously, we developed an algorithm that successfully counted 39 of 40 jumps performed during the competitive routines of 7 local skaters whose isolated jumps were used to create the algorithm.

**Purpose:** To test the performance of the algorithm on an independent sample of skaters of varying skill levels.

**Methods:** 18 healthy competitive figure skaters participated in this study (ages 8-26y, 12 female). Each skater wore an IMU affixed to the lower back while they performed a variety of jumps, spins, and footwork. A high speed video camera recorded all trials for validation purposes. Custom software was used to analyze the IMU data to quantify the number of jumps performed with >1 rotation.

**Results:** Analysis of the videos showed that we recorded a total of 200 jumps with >1 rotation. The algorithm correctly quantified 94.5% of the jumps in this dataset (189 successful jumps). It also identified 11 jumps with ≤1 rotation.

**Conclusions:** These results show that this algorithm can be successfully applied to a unique dataset. Many of the jumps with ≤1 rotation that were counted were “popped” jumps, where a skater intends to perform a multi-revolution jump prior to take-off, but perform a single instead. Multi-revolution jumps that were not counted included falls and those with too much rotation that occurs on the ice prior to take-off. Finally, this dataset showed that the algorithm may need to be customized for smaller and/or low-level skaters as it failed to identify 7 of 12 jumps performed by a small, beginning level skater (8y, 122cm, 23.6 kg). Further improvements may be made by using machine learning algorithms to differentiate types of jumps as well as jump count.

**3398** Board #219 May 29 2:30 PM - 4:00 PM  
**Reliability Of Quantitative Kinematics From A Portable Hand-held Device**

Brooke A. Smith<sup>1</sup>, Brett Pexa<sup>1</sup>, Audrey Westbrook<sup>1</sup>, Kevin J. Mullen<sup>1</sup>, Thomas Maly<sup>2</sup>, Frantisek Zahalka<sup>2</sup>, Justin Waxman<sup>1</sup>, Kevin Ford, FACSM<sup>1</sup>. <sup>1</sup>High Point University, High Point, NC. <sup>2</sup>Charles University, Prague, Czech Republic. (Sponsor: Kevin Ford, FACSM)  
 Email: bsmith2@highpoint.edu  
 (No relevant relationships reported)

The current gold standard for assessing kinematics is three-dimensional (3D) motion analysis. However, the equipment required to accomplish this is not generally available in sport or clinical settings. Portable handheld devices (PD) are available that synchronize multiple two-dimensional video views to qualitatively evaluate complex sport skills. However, the use of quantitative kinematic analysis on PD compared to standard computer software (CS) has not been investigated. **PURPOSE:** To investigate the intra- and inter-rater reliability of PD compared to an open source CS. **METHODS:** Twenty-seven collegiate male soccer players (height: 179.8±5.6cm, mass: 75.9±6.9kg) were analyzed (120 Hz) during a drop vertical jump from a 30-cm box. PD and CS were separately used to 1) select a single frame from the frontal plane view when both knees were visually the most medial during landing and 2) digitize and record the frontal plane knee angle from hip, knee and ankle joint centers to estimate lower extremity valgus. Reliability between systems and reliability between testers were established with intra-class correlations (ICC<sub>2,k</sub>, ICC<sub>3,k</sub>, respectively). Precision was calculated with standard error of measurement (SEM). **RESULTS:** Intra-rater reliability was 0.993 [95% CI 0.985, 0.997] with SEM of 1.09 on the right, and 0.971 [95% CI 0.938, 0.987] SEM of 2.69 on the left limb. Inter-rater reliability on the right side was 0.979 [95% CI 0.954, 0.990] with SEM of 1.97 for the right limb and 0.978 [95% CI 0.943, 0.990] with SEM of 2.37 on the left, respectively. **CONCLUSION:** In collegiate male soccer players, PD exhibited excellent intra- and inter-rater reliability. The data indicates that it might be a useful tool to integrate into a screening protocol to quickly estimate lower extremity valgus. However, future analyses should compare traditional 3D motion analysis to determine validity.

**3399** Board #220 May 29 2:30 PM - 4:00 PM  
**Reliability Of IMU Derived Kinematic Measures During The Forward Lunge**

James Davenport<sup>1</sup>, Sarah Ward<sup>2</sup>, William Johnston<sup>1</sup>, Cathy Goulding<sup>1</sup>. <sup>1</sup>The Insight Centre for Data Analytics - University College Dublin, Dublin, Ireland. <sup>2</sup>University of Otago, Dundin, New Zealand.  
 Email: james.davenport@ucdconnect.ie  
 (No relevant relationships reported)

The integration of inertial sensor data into the clinical environment and beyond, demonstrates the potential of improved clinical interpretation of an individual's functional movement capacity. Previously this has only been possible through the use of expensive laboratory-based motion capture systems. The forward lunge, a lower limb functional movement which exaggerates the gait cycle is commonly used by clinicians to assess lower limb strength, flexibility and balance. Combining Inertial measurement units with the forward lunge exercise could provide a quantified measure which was previously not possible in the clinical setting. **Purpose:** To determine the intrasession-reliability of kinetic measures derived from shank based inertial sensors during a forward lunge. **Methods:** Twenty-three healthy participants took part in the study (12 Male, 11 Female, 30.8 ± 8.6yrs, 1.7 ± 0.9m, 65.3 ± 10.8kg). Each participant performed 3 sets of 5 lunges bilaterally, each with a 10 min rest period adequate to establish intra-session reliability. Lunge distance and stance was set as 100% of leg length and hip width respectively (± 5%). IMUs were worn on the lateral aspect of each shank. The lunge was segmented into initiation, initial contact, mid-point, and termination. Peak & root mean squared (RMS) of total acceleration signals of the shank based IMU were taken for all lunges. Intraclass correlation coefficients (ICCs) were calculated based on a mean rating (k=3), absolute agreement two-way mixed effects model. Intra-session reliability was defined as poor (ICC<0.5), moderate (0.5-0.75), good (0.75-0.9) or excellent (>0.9). **Results:** ICC values ranged from 0.916 to 0.981 for left limb peak acceleration and 0.903 to 0.978 for right limb peak acceleration. ICCs for RMS of left and right limb ranged from 0.908 to 0.979 and 0.899 to 0.977 respectively. **Conclusions:** The IMUs showed good to excellent reliability for both peak and RMS total acceleration across both limbs during the forward lunge. This demonstrated the potential for their integration as a clinical tool to provide quantified measures of an individual's forward lunge performance.

**3400** Board #221 May 29 2:30 PM - 4:00 PM  
**Test-retest Reliability And Concurrent Validity Of An In-shoe Pressure System During Two Landing Maneuvers**

Ahmad D. Alanazi<sup>1</sup>, Katy Mitchell<sup>2</sup>, Toni Roddey<sup>2</sup>, Aqeel Alenazi<sup>3</sup>, Alexis Ortiz, FACSM<sup>4</sup>. <sup>1</sup>Majmaah University, Majmaah, Saudi Arabia. <sup>2</sup>Texas Woman's University, Houston, TX. <sup>3</sup>Prince Sattam Bin Abdulaziz University, Alkharj, Saudi Arabia. <sup>4</sup>University of the Incarnate Word, San Antonio, TX.  
 Email: aalanazi@mu.edu.sa  
 (No relevant relationships reported)

In-shoe pressure sensor systems have been used to measure vertical ground reaction forces (GRFs) during functional tasks in clinical settings. However, no study has evaluated their reliability and validity during functional tasks in healthy soccer players. **PURPOSE:** To determine the test-retest reliability of the peak plantar pressure measured by an in-shoe pressure system during landing from long-jump (LLJ) and landing from heading-jump (LHJ) performed by healthy soccer players. A second purpose was to evaluate the concurrent validity of the peak plantar pressure in relation to the peak vertical GRFs obtained using a force plates system as a criterion reference during both landing maneuvers.

**METHODS:** Ten healthy soccer players (age: 25.6 ± 2.67; BMI: 22.74 ± 2.33) participated in this study. LLJ included jumping forward and landing on the force plates, whereas LHJ included jumping forward to head a soccer ball and landing on the force plates. Each participant performed five trials of each landing maneuver. Within three days from initial testing, participants were asked to perform the same five trials of each landing task. Peak plantar pressure and peak vertical GRFs were measured during the landing phase (from initial contact to maximum bilateral knee flexion). Intra-class correlation coefficients [ICC (3,2)] were used to determine test-retest reliability. Pearson product-moment coefficient of correlations (r) were calculated to compare the peak plantar pressure with the peak vertical GRFs.

**RESULTS:** Test-retest reliability exhibited good reliability for peak pressure during LLJ (ICC = 0.96) and LHJ (ICC = 0.89). Peak plantar pressure and peak vertical GRFs showed a significant good-to-excellent positive correlation (r = 0.80, p < 0.001) during the LLJ, whereas a significant moderate-to-good positive correlation (r = 0.67, p = 0.03) was observed during the LHJ.

**CONCLUSION:** The present findings indicate that the in-shoe pressure system is reliable and valid during both landing maneuvers in healthy soccer players. Therefore, this system could be a useful tool to evaluate vertical GRFs in field and laboratory settings since it does not restrict participants to step or land on the force plates, thus allowing them to perform a more natural functional task.

3401 Board #222 May 29 2:30 PM - 4:00 PM

**Reliability Of Inertial Sensor Derived Knee Joint Angular Velocity During A Forward Lunge**Sarah Ward<sup>1</sup>, James Davenport<sup>2</sup>, Cathy Goulding<sup>2</sup>, Brian Caulfield<sup>2</sup>. <sup>1</sup>University of Otago, Dunedin, New Zealand. <sup>2</sup>University College Dublin, Dublin, Ireland.  
Email: sarah.ward@otago.ac.nz*(No relevant relationships reported)*

Incorporating inertial measurement units (IMU) into screening tools affords the ability to 'quantify' commonly used functional tasks using angular velocity and acceleration as an outcome variable. These 'quantified' tasks have may have greater depth, accuracy and sensitivity than that achieved with standard clinical evaluation tools. Angular velocity can quantify how fast a segment or joint rotates, and provide a preliminary understanding of neuromuscular control during dynamic tasks including a forward lunge. **PURPOSE:** To determine the reliability of IMU-derived knee joint angular velocity during a forward lunge. **METHODS:** Twenty-three healthy individuals participated in this study (12M/11F, 30.8 ± 8.6 years, 1.7 ± 0.9 cm, 65.3 ± 10.8 kg). Participants performed a set of 5 lunges on the right limb and 5 on the left limb, repeated 3 times separated by 10 minute rest periods. Lunge distance was normalized to 100% (±5%) of leg length. IMUs were worn on the lateral thigh and shank of each limb. The following anchor points were defined for segmentation: initiation, initial contact 1 (IC<sub>1</sub>), midpoint and initial contact 2 (IC<sub>2</sub>)/termination. Peak and average thigh and shank angular velocity were extracted from the z-axis gyroscope signal for each lunge segment and for a 50ms window either side of IC<sub>1</sub>. Peak and average knee joint angular velocity in each segment was calculated from thigh and shank data. Intraclass correlation coefficients (ICCs) were calculated based on a mean rating (*k*=3), absolute agreement, 2-way mixed-effects model. Intra-session reliability was defined as poor (ICC<0.5), moderate (0.5-0.75), good (0.75-0.9) or excellent (>0.9). **RESULTS:** ICC values ranged from 0.841 to 0.911 for peak left knee joint angular velocity and 0.760 to 0.939 for peak right knee joint angular velocity. Average left knee joint velocity had ICCs ranging from 0.912 to 0.972, and 0.922 to 0.965 for average right knee joint angular velocity. **CONCLUSIONS:** IMU-derived knee joint angular velocity had good to excellent intra-session reliability during a forward lunge and demonstrate good potential for providing objective quantified data on forward lunge performance. IMUs may provide a more accessible alternative to 3D motion analysis or screening tools for lower limb function and neuromuscular control in a clinical setting.

3402 Board #223 May 29 2:30 PM - 4:00 PM

**Validity And Reliability Of A Mobile App For Measuring Bar Velocity In The Bench Press Exercise**Daniel Boulosa<sup>1</sup>, Alejandro Pérez-Castilla<sup>2</sup>, Amador García-Ramos<sup>3</sup>. <sup>1</sup>Federal University of Mato Grosso do Sul, Campo Grande, Brazil. <sup>2</sup>University of Granada, Granada, Spain. <sup>3</sup>Universidad Católica de la Santísima Concepción, Concepción, Chile. (Sponsor: Carl Foster, FACSM)  
Email: daniel.boulosa@gmail.com*Reported Relationships: D. Boulosa: Ownership/interest/stock; CEO and Founder of iLOAD Solutions.*

Velocity based-training (VBT) has been demonstrated to be a valid and useful approach to promote greater neuromuscular adaptations in resistance training (RT). This approach typically requires velocity monitoring during RT sessions for appropriate adaptations. The validity and reliability of a chronometer-based mobile App for RT monitoring in the half-squat exercise have been previously shown with a 10 repetition maximum (RM) load, when compared to a linear encoder. However, no data exist with other exercises and different loads. **PURPOSE:** To determine the validity and reliability of a chronometer-based mobile App for velocity monitoring in the bench press exercise with different loads. **METHODS:** Twenty handball players (23.0 ± 2.6 yrs, 1.76 ± 0.06 m, 79.6 ± 13.0 kg) completed, after 1RM determination, 5 repetitions with the 25, 40, 55 and 70% of 1RM in the bench press exercise, with the maximal intended velocity, in 2 days separated by 48-72 hrs. Bar velocity (m·s<sup>-1</sup>) was monitored simultaneously by means of a linear encoder with a sampling rate of 1,000 Hz (reference method), and a chronometer-based mobile App. Validity was examined through paired samples *t*-test, the Hedge's effect size (ES), the Pearson's correlation coefficient (*r*), and the standard error of estimate (SEE). Reliability was assessed by the coefficient of variation (CV) and the standard error of measurement (SEM). **RESULTS:** Regarding validity, all relative loads evaluated demonstrated significant differences (*P* < 0.05) and small to moderate ES (range: 0.31-1.19) between devices, with the mobile App exhibiting greater bar velocities than the linear encoder. However, bar velocities measured with both devices were highly correlated (*r* ≥ 0.74) with a very low SEE (≤ 0.09 m·s<sup>-1</sup>). The App exhibited for all loads a low SEM (≤ 0.11 m·s<sup>-1</sup>), and acceptable CV (< 10%) with the exception of the highest load (70%1RM) (CV = 12.1%). **CONCLUSIONS:** A chronometer-based mobile App may be considered a valid and reliable method for VBT monitoring in the bench press exercise.

3403 Board #224 May 29 2:30 PM - 4:00 PM

**The Validity Of A Smartphone-based Seated Postural Control Assessment In Non-ambulatory Adults**Mikaela L. Frechette, Libak Abou, Laura A. Rice, Jacob J. Sosnoff. University of Illinois at Urbana-Champaign, Champaign, IL.  
Email: mikaela5@illinois.edu*(No relevant relationships reported)*

Individuals who rely on wheeled mobility have unique fall risk factors (e.g. seated postural control) but recommended fall risk screening tools are predominately designed for ambulatory individuals. Consequently, most non-ambulatory adults do not undergo comprehensive fall risk screening or receive targeted fall prevention strategies.

**PURPOSE:** To examine the validity of smartphone-based postural control assessments in non-ambulatory adults. **METHODS:** Eleven participants (age: 35.4 ± 17.9) completed three clinical tests: The Trunk Control Test, Function in Sitting Test (FIST), and Tee-Shirt Test, as well as, four instrumented balance tasks in a standardized order: eyes open, eyes closed, functional reach, and functional stability boundary. During the balance tasks, participants held a smartphone and research-grade accelerometer to their chest. These devices measured root mean square (RMS) acceleration in the medial-lateral (ML), anterior-posterior, and vertical axes during all tasks. A median split of FIST scores differentiated participants with better and worse postural control. Spearman rank-order correlations between the two devices' measurements were conducted, and receiver operating characteristic (ROC) and the area under the curves (AUC) were constructed to distinguish participants with better and worse postural control. **RESULTS:** Participant scores from the FIST differed between those with better and worse postural control (*p* = 0.020). There were significant moderate to strong correlations between measures derived from the smartphone and measures derived from the research-grade accelerometer during the balance tasks (*p* = 0.636-1.000; *p* < 0.01-0.035). The AUC for ROC plots were significant for RMS ML sway during the eyes open task and functional stability boundary (*p* = 0.045 and 0.018, respectively). **CONCLUSION:** This pilot study illustrated that smartphone technology may be able to provide a valid assessment of seated postural control and have the ability to distinguish between those with better and worse postural control in the ML direction. Leveraging this form of technology could provide easily accessible and objective fall risk assessments for non-ambulatory adults.

**Funded by:** The National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR)

3404 Board #225 May 29 2:30 PM - 4:00 PM

**Validation Of A Wearable Inertial Sensor Unit To Measure Balance And Sway During Postural Tasks**Jason M. Avedesian, Mathew Sunil Varre, Ryan Tingle, Janet S. Dufek, FACSM. University of Nevada, Las Vegas, Las Vegas, NV. (Sponsor: Janet S. Dufek, FACSM)  
Email: jason.avedesian@unlv.edu*(No relevant relationships reported)*

Current postural control tests for baseline concussion analysis and return to play decision making are of moderate reliability, attributed to subjective scoring. A recently developed inertial measurement unit (IMU) may offer clinicians a feasible, objective tool for postural control analysis surrounding a concussive event. **PURPOSE:** To assess the validity of a wearable IMU against a force platform (FP) during postural control tasks in adults. **METHODS:** Twenty-four participants completed three trials of four stance conditions (double-leg, tandem, left leg, and right leg) with eyes open (EO) and eyes closed (EC). Concurrent measures of postural control (anterior-posterior and medial-lateral sway, path length, and sway area) during each stance were collected as participants stood on a single FP while wearing the IMU on the sternum. Statistical analyses were conducted on mean percentage change (MPC) from EO to EC for sway parameters from the FP and IMU during the four stance conditions. Multiple multivariate analyses of variances were conducted to determine whether statistical differences existed between instruments (*α* = 0.05). **RESULTS:** The differences in MPC when comparing the IMU to the FP were 5-33% for double-leg stance, 8-130% for tandem stance, 0-82% for left leg stance, and 12-178% for right leg stance across postural control measures. Significant multivariate differences were found for double-leg [*F* = 12.233, *p* < .001], tandem [*F* = 15.927, *p* < .001], left leg [*F* = 3.725, *p* = .011], and right leg [*F* = 4.031, *p* = .007] stance. Pairwise comparisons indicated significant differences for anterior-posterior sway (*p* = .010) and path length (*p* < .001) during double-leg stance and path length (*p* = .005) during tandem stance. **CONCLUSIONS:** Preliminary results indicate large differences in postural control when utilizing this IMU versus a FP for assessing sway in direct comparisons. It must be noted that sway from this IMU is projected from its center of mass. Thus, direct comparison may be misleading. Further study is suggested to incorporate the IMU projection algorithm, in order to make more appropriate direct comparisons between instruments. It is important for researchers to understand algorithms that are implemented in IMU software to determine reliability of measurement, prior to stating experimental outcomes.

3405 Board #226 May 29 2:30 PM - 4:00 PM

**Validation Of Step Length Between An Anti-Gravity Treadmill And A 2-Dimensional Camera System**

Karina Moreno-Flores<sup>1</sup>, Matthew Lusk<sup>1</sup>, Pedro Migliano<sup>2</sup>, Rebecca Greenwood<sup>3</sup>, Alexis Ortiz, FACSM<sup>3</sup>. <sup>1</sup>UT Health San Antonio, San Antonio, TX. <sup>2</sup>Texas Woman's University, Houston, TX. <sup>3</sup>University of the Incarnate Word, San Antonio, TX.

(No relevant relationships reported)

Lower body positive pressure treadmills (LBPTT) allow patients to walk in a gravity reduced environment of their total body weight with new embedded gait analysis module capable of documenting gait outcomes. **PURPOSE:** To validate step length (SL) measurement calculated by the LBPTT against a two-dimensional camera system. **METHODS:** Nine participants (5 male and 4 females; mean age 30.8 years) walked and ran for five minutes at 3mph, 4mph, 5mph, and 6mph on a lower body positive pressure treadmill (LBPTT). At each speed the subjects were unweighted at 80%, 60%, 40% and 20% of their total body weight (BW). A side camera view was employed to record step length. Five SL measurements from the middle minute were taken from each video from heel to heel and averaged to represent SL for each BW and speed. The right and left SL measurements from the treadmill were averaged as a composite SL measurement for analysis. Intraclass correlation coefficients were estimated for the average of five trials of the video data. Pearson correlations were calculated between step length from the treadmill and video. Correlations were considered significant at alpha .05.

**RESULTS:** All speeds and body weight conditions exhibited excellent reliability (ICC > 0.90) for the average of five trials for the video analysis. The correlations between the treadmill and video analysis for the speeds of 3 and 4 mph showed varied correlations fluctuating from poor to good ( $r=-.21-.98$ ) with correlations greater than  $r=.85$  showing statistical significance. The correlations between treadmill and cameras for the 5 and 6 mph speeds showed no statistically significant correlations ranging from  $r=-.02-.69$ .

**CONCLUSIONS:** The gait analysis module of the LBPTT does not measure direct step length from the instrumented belt after the transition from walking to running. The LBPTT might be using an algorithm to extrapolate the anticipated step length if the subject were not on the treadmill.

3406 Board #227 May 29 2:30 PM - 4:00 PM

**Testing The Performance Of An Innovative Video-based Technique For Gait Analysis**

Laura Simoni<sup>1</sup>, Alessandra Scarton<sup>2</sup>, Guido Pasquini<sup>3</sup>, Federico Gori<sup>2</sup>, Silvia Pogliaghi, FACSM<sup>1</sup>. <sup>1</sup>Università di Verona, Verona, Italy. <sup>2</sup>Microgate srl, Bolzano, Italy. <sup>3</sup>Fondazione Don Gnocchi, Firenze, Italy.

Email: laura.simoni@univr.it

(No relevant relationships reported)

Gait abnormalities such as high stride frequency (SF) and stride variability (SV) may increase the risk of overuse injuries and/or be a sentinel of medical conditions. Low-cost and time-efficient alternatives to traditional stereophotogrammetry would allow the applicability of gait analysis on a large scale for early diagnosis/longitudinal monitoring.

**Purpose:** test the performance of an innovative video-based gait analysis technique in healthy individuals.

**Methods:** 37 healthy individuals (29±16 yrs) performed a 90°, test on treadmill at self-selected walking speed. We measured SF by an optical sensor platform; then we calculated average ± SD and within-subject coefficient of variation as an index of SV. We also recorded a 60 fps video of the subject (posterior view). With a custom designed web-based video analysis software we performed a spectral analysis of the brightness over time for each pixel of the image, that reinstated the frequency contents of the videos. The main frequency content (F1) from this analysis should reflect the forcing/dominant variable, i.e. SF. Then, an harmonic index (HI) was calculated, that reflects the proportion of the pixels of the image that move consistently with F1 or its supraharmonics. The higher the HI value, the less variable is gait. The correspondence between SF and F1 was evaluated by paired t-Test and correlation and between SV and HI by correlation.

**Results:** Subjects walked at a self-selected speed of  $1.1±0.2$  m·s<sup>-1</sup>. SF was not significantly different from and highly correlated with F1 ( $0.88±0.07$  vs  $0.89±0.08$  Hz,  $p=0.06$ ,  $r^2=0.98$ ). The SV was  $1.93±0.81\%$  and it was significantly and moderately correlated with HI ( $0.084±0.033$ ,  $p=0.006$ ,  $r=-0.45$ ).

**Conclusions:** The innovative video-based technique of global gait analysis proposed in our study accurately identifies the main frequency content and the variability of gait in healthy individuals thus providing a time-efficient, low-cost means to study human locomotion.

3407 Board #228 May 29 2:30 PM - 4:00 PM

**Best Practice Use Of Wearable Accelerometers In Gait Biomechanics**

Jennifer S. Addleman, David Hawkins. *University of California, Davis, Davis, CA.*

Email: jsaddleman@ucdavis.edu

(No relevant relationships reported)

Advances in wearable technology provide opportunities to collect biomechanical data in real time and non-lab settings. However, there are currently no standards for best practice use of wearable sensors for gait applications. **PURPOSE:** Provide best practice recommendations for use of wearable accelerometers (WA) in gait biomechanics. **METHODS:** Literature was reviewed to determine appropriate WA range for gait biomechanics and establish procedures for calibrating and processing WA data for gait applications. Drop tests of three, simultaneously initialized, commercially available WAs were performed to determine signal time synchronization and 1 g acceleration accuracy. WAs were secured to different lower limb locations (pelvis, knee, ankle) and walking and running trials performed. Peak acceleration magnitude and timing were compared within and among WAs by location and gait type. Vertical ground reaction force (GRFvert) was estimated using a regression model, developed based on pelvis acceleration data, to determine the sensitivity of the GRFvert estimates to WA placement. **RESULTS:** Peak lower limb accelerations can exceed 25 g during running. WAs initialized at the same time had significant temporal differences (up to 1.06 s). Accelerations during freefall were within 17 % of 1 g. After synchronizing WA signals based on the drop test results, there were no significant differences in WA magnitude and timing among three WAs located around the right iliac crest, but there were significant acceleration differences among WAs located at the right iliac crest, knee, and ankle. Walking and running peak GRFvert estimates based on accelerations of the iliac crest differed from estimates based on accelerations of the knee ( $-5 ± 28$  N and  $-142 ± 80$  N, respectively) and ankle ( $261 ± 28$  N and  $-274 ± 66$  N, respectively). **CONCLUSIONS:** WAs should be: (1) selected to measure a range greater than 25 g, (2) calibrated to ensure accuracy, (3) manually time synched if using multiple sensors, (4) placed carefully though exact placement is not critical to anatomical site acceleration estimates near the hip, and (5) located at the same anatomical site that was used to develop an acceleration-dependent model if the goal is to use that model to estimate a particular quantity (i.e. GRFvert).

3408 Board #229 May 29 2:30 PM - 4:00 PM

**Comparison Of Ground Reaction Forces Derived From Force Plate And Motion Capture Systems During Vertical Jumps**

Eric M. Mosier<sup>1</sup>, Andrew C. Fry<sup>2</sup>, Justin X. Nicoll<sup>3</sup>, Dimitrije Cabarkapa<sup>2</sup>, Stephanie A. Sontag<sup>2</sup>, Rhonda Cross Beemer<sup>1</sup>.

<sup>1</sup>Northwest Missouri State University, Maryville, MO. <sup>2</sup>The University of Kansas, Lawrence, KS. <sup>3</sup>California State University Northridge, Northridge, CA.

Email: emosier@nwmissouri.edu

(No relevant relationships reported)

**PURPOSES:** This investigation compared the ground reaction forces (GRFs) between a force plate and GRF derived from a markerless motion capture system (MCS) during a counter-movement vertical jump (CMVJ). **METHODS:** Healthy, recreationally active men ( $n=10$ ;  $±SD$ ; age= $22.5±2.1$  yrs, height= $180.8±4.6$  cm, weight= $80.8±7.5$  kg) and women ( $n=8$ ; age= $20.5±0.8$  yrs, height= $171.7±5.7$  cm, weight= $68.1±7.2$  kg) volunteered to perform 3 CMVJs separated by 30 seconds of rest. A 3-D markerless motion capture system (MCS; DARI Motion, Scientific Analytics, Lincoln, NE) was sampled at 50 Hz, while a uni-axial force plate (Rice Lake Weighing Systems, Rice Lake, WI) and a data acquisition system (Biopac, Goleta, CA) sampling at 1000 Hz was used and resampled to 50 Hz for analysis. Participants begin the CMVJ standing on the force plate while in the MCS capture area. Ground reaction peak force (PF) was determined as the max force before takeoff, and ground reaction mean force (MF) was determined across the entire CMVJ from start of the motion to takeoff. Linear regressions were performed to compare MF and PF between the two devices (i.e. MCS vs. force plate) with the Pearson correlation ( $r$ ), coefficient of determination ( $r^2$ ), and standard error of the measurement (SEM) calculated. Paired samples  $t$ -tests (MCS vs. force plate;  $p≤0.05$ ) were performed on the MF and PF. **RESULTS:** Mean ± SD and results are shown in table 1. Paired samples  $t$ -tests indicated significant differences ( $<0.01$ ) for MF and PF. Linear regression analysis indicated excellent agreement between MCS and force plate for MF ( $r=0.97$ ,  $r^2=0.93$ , SEM= $13.99$  N) and PF ( $r=0.92$ ,  $r^2=0.84$ , SEM= $35.72$  N), respectively. **CONCLUSION:** Although significant differences were indicated, the linear regression analysis indicated that GRF can be accurately derived from a MCS without the use of a force plate. Furthermore, the intricate kinetic characteristics of human motion can be validly determined without being restricted to performing on a force plate.

Table 1. Comparison of ground reaction forces from force plate and motion capture system (MCS) during counter-movement vertical jumps

|            | Force Plate (N) | MCS (N)       | r    | r <sup>2</sup> | SEM   |
|------------|-----------------|---------------|------|----------------|-------|
| Mean Force | 887.9±131.0     | 972.9±147.8*  | 0.97 | 0.93           | 13.99 |
| Peak Force | 1662.0±368.6    | 1823.9±355.5* | 0.92 | 0.84           | 35.72 |

(n=54); ( $\bar{X} \pm SD$ ); \* indicates significant difference (p<0.01)

**3409** Board #230 May 29 2:30 PM - 4:00 PM  
**Measuring A Rider's Centre Of Mass Displacement During Non-seated Cycling Using A Single Inertial Measurement Unit**

Ross D. Wilkinson, Glen A. Lichtwark. *The University of Queensland, St Lucia, Queensland, Australia.*

Email: ross.wilkinson@uqconnect.edu.au

(No relevant relationships reported)

Instantaneous power output measured at the cranks when cycling in a non-seated posture is not equivalent to the instantaneous joint power produced by the rider. This discrepancy is due to additional power that is generated on, and by, the rider's centre of mass (CoM). Capturing CoM motion in a laboratory setting is relatively straight forward; however, an accurate and reliable method for measuring this in the field remains elusive.

**PURPOSE:** To test whether a single Inertial Measurement Unit (IMU) placed on the torso of the rider at L4-5 can provide an accurate and precise measure of vertical CoM displacement during non-seated cycling.

**METHODS:** We first assessed whether the IMU could track its own vertical displacement by comparing it to an attached marker cluster tracked using three-dimensional motion capture. We then compared vertical displacement of the IMU to a kinematic estimate of vertical CoM displacement using a full body musculoskeletal model. IMU (100 Hz) and motion capture (200 Hz) data was collected synchronously for 10-s on seven participants while they cycled on an ergometer in a non-seated posture at three different power outputs and at two different cadences (70 rpm and 120 rpm). Sensor performance was quantified as the dynamic root mean square (RMS) error of yaw, pitch, and roll components of angular velocity. An agreement analysis corrected for repeated measures was also performed, which encompassed the limits of agreement, accuracy, precision, average error, and maximum error between each method.

**RESULTS:** In all trials, the IMU performed well with a dynamic RMS error of  $0.17 \pm 0.04$  radians/s across all orientation components. The IMU measured vertical displacement of the marker cluster with high accuracy ( $0.002 \pm 0.002$  m) and precision ( $0.009 \pm 0.005$  m) with an average error of 1.7% and 5% at 70 rpm and 120 rpm, respectively. Agreement between the IMU and the kinematic prediction of CoM displacement was lower with an accuracy of  $0.016 \pm 0.003$  m and precision of  $0.010 \pm 0.004$  m.

**CONCLUSIONS:** These results suggest that a single IMU can provide a highly accurate and precise measure of its own orientation and amplitude of vertical displacement. Further research is required to test whether agreement between the IMU and the model's CoM can be improved by placing the IMU in different positions on the torso.

**F-63** Free Communication/Poster - Motor Control

Friday, May 29, 2020, 1:30 PM - 4:00 PM

Room: CC-Exhibit Hall

**3410** Board #231 May 29 2:30 PM - 4:00 PM  
**The Role Of Dopaminergic Synapse And D2DR In Movement Control**

Jiali Cheng<sup>1</sup>, Xinwei Wang<sup>2</sup>, Lijuan Hou<sup>3</sup>, Decai Qiao<sup>3</sup>, Hongjun Yu<sup>1</sup>, Andriara Schwingel<sup>4</sup>. <sup>1</sup>Tsinghua University, Beijing, China. <sup>2</sup>Hebei GEO University, Shijiazhuang, China. <sup>3</sup>Beijing Normal University, Beijing, China. <sup>4</sup>University of Illinois at Urbana-Champaign, Urbana, IL.

Email: cj118@mails.tsinghua.edu.cn

(No relevant relationships reported)

Exercise fatigue is a common physiological phenomenon in sports. The central nervous system (CNS) has important regulating effect on exercise fatigue. The basal ganglia are involved in motor function regulation through direct and indirect pathways. Striatum is the main input nucleus of basal ganglia and plays an important role in movement

control. **PURPOSE:** Explore the role of dopaminergic synapse and D2 dopamine receptors (D2DR) in movement control by investigating synaptic ultrastructural change of the dorsolateral striatum (DLS) and D2DR antagonist/agonist effect on autonomic activity in exercise-induced fatigue rats. **METHODS:** Male Wistar rats were randomly divided into either the sham control group (SCG), 1-day fatigue group (1FG), 3-day fatigue group (3FG), 7-day fatigue group (7FG), 24-hour recovery group (24RG) or 48-hour recovery group (48RG). The synaptic ultrastructure was observed by transmission electron microscopy. Further a D2DR antagonist and agonist were used to interfere with the autonomic exercise of rats with Open Field Test. **RESULTS:** We found that: (1) The proportion of asymmetrical synapse of DLS (SCG:  $41 \pm 2\%$ ), 7FG:  $28 \pm 4\%$ ), number of presynaptic vesicles (SCG:  $13.35 \pm 4.58$  (number/ $\mu\text{m}^2$ ), 7FG:  $5.92 \pm 2.7$  (number/ $\mu\text{m}^2$ ), p<0.05), number of synaptic terminal mitochondria (SCG:  $0.19 \pm 0.18$  (number/ $\mu\text{m}^2$ ), 7FG:  $0.15 \pm 0.1$  (number/ $\mu\text{m}^2$ ), p<0.05), and the area of synaptic terminals (SCG:  $123925.64 \pm 54773.42$  ( $\mu\text{m}^2$ ), 7FG:  $84447.16 \pm 29495.42$  ( $\mu\text{m}^2$ ), p<0.05), decreased with the increase of exercise days. (2) The total exercise distance of each group decreased gradually with the increase of exercise intensity (p<0.05). Additional rat's exhaustion time was also significantly shortened after injection of the D2DR antagonist (before:  $147.33 \pm 5.63$ , after:  $103 \pm 4.14$ , p<0.01). **CONCLUSIONS:** The activity of synapses in the dorsolateral striatum of rats decreased with the increase of exercise fatigue. Exercise fatigue reduced the autonomic activity of rats, which was further enhanced by D2DR antagonist intervention. This indicates that the regulatory role of D2DR in motion may be related to synaptic plasticity of dopaminergic in substantia nigra and striatum, suggesting that D2DR can be used as an important target to address exercise fatigue.

**3411** Board #232 May 29 2:30 PM - 4:00 PM  
**ARE MOTOR UNIT FIRING PROPERTIES CONTROLLED WITHIN DISTINCT REGIONS OF A MUSCLE**

Micheal J. Luera<sup>1</sup>, Jesus A. Hernandez-Sarabia<sup>1</sup>, Carlos A. Estrada<sup>2</sup>, Jason M. DeFreitas<sup>1</sup>. <sup>1</sup>Oklahoma State University, Stillwater, OK. <sup>2</sup>Aurora University, Aurora, IL.

Email: mike.luera@okstate.edu

(No relevant relationships reported)

Previous findings have suggested that the distribution of motor units within a muscle may display region-specific muscle activation. Consequently, if regionalization of motor units indeed exists, then force generating capacities would be highly task and joint dependent. **PURPOSE:** To examine for regional motor unit control from proximal and distal locations of biarticular [rectus femoris (RF)] and monoarticular [vastus lateralis (VL)] muscles during low-force knee extensions. **METHODS:** Following 2 maximal voluntary contractions (MVC), eighteen resistance-trained men (n = 9, age =  $23 \pm 3$  yrs) and women (n = 9,  $22 \pm 2$  yrs) performed a 10 sec isometric ramp contraction up to 30% MVC. On two separate occasions, surface electromyographic (EMG) signals were collected from proximal and distal locations of either the VL or RF. These were used to record EMG amplitude and were also decomposed into the constituent motor unit action potentials. The slope and intercept values were calculated across the motor units for relationships between mean firing rate, recruitment threshold, and action potential size for each subject. Paired samples t-tests were used to compare regression coefficients and EMG amplitude between proximal and distal locations of the RF and the VL separately. **RESULTS:** There were no differences in EMG amplitude between locations in the RF (p = 0.31, d = 0.39), however, amplitude in the distal location of the VL was greater than the proximal (p < 0.05; d = 0.64). There were no significant differences in slope or intercept coefficients for any of the motor unit relationships (see Table 1) (p = 0.08 - 0.91, d = 0.01 - 0.64). **CONCLUSION:** Although there was a regional difference in the activation across the VL, there were no region-specific differences in the motor unit firing properties. The differences in amplitude were likely due to other factors that affect EMG signals, such as the underlying morphology (muscle size, subcutaneous fat thickness, etc.).

Table 1. Mean slope and intercept coefficients for relationships between motor unit firing properties

| Mean Firing Rate vs. Recruitment Threshold      |          |                        |         |           |
|---|----------|------------------------|---------|-----------|
|   |          |                        | p-value |           |
| Regression Equation                             |          |                        | Slope   | Intercept |
| VL  | Proximal | $y = -0.667x + 23.49$  | 0.46    | 0.77      |
|   | Distal   | $y = -0.753x + 22.90$  |         |           |
| RF  | Proximal | $y = -0.384x + 22.34$  | 0.59    | 0.51      |
|   | Distal   | $y = -0.343x + 32.85$  |         |           |
| Mean Firing Rate vs. Action Potential Size      |          |                        |         |           |
| VL  | Proximal | $y = -95.79x + 25.54$  | 0.08    | 0.25      |
|   | Distal   | $y = -72.28x + 23.51$  |         |           |
| RF  | Proximal | $y = -74.623x + 22.92$ | 0.77    | 0.20      |
|   | Distal   | $y = -78.683x + 24.57$ |         |           |
| Action Potential Size vs. Recruitment Threshold |          |                        |         |           |
| VL  | Proximal | $y = 0.011x + 0.013$   | 0.59    | 0.75      |
|   | Distal   | $y = 0.009x + 0.019$   |         |           |
| RF  | Proximal | $y = 0.013x + 0.056$   | 0.17    | 0.55      |
|   | Distal   | $y = 0.019x + 0.055$   |         |           |

**3412** Board #233 May 29 2:30 PM - 4:00 PM  
**EFFECTS OF CONTINUOUS CYCLING TRAINING ON MOTOR UNIT BEHAVIOR AND MUSCLE ACTIVATION DURING REPETITIVE CONTRACTIONS**

Michael A. Trevino<sup>1</sup>, Adam J. Sterczala<sup>2</sup>, Jonathan D. Miller<sup>3</sup>, Mandy E. Parra<sup>3</sup>, Hannah L. Dimmick<sup>4</sup>, Trent J. Herda<sup>3</sup>.  
<sup>1</sup>Oklahoma State University, Stillwater, OK. <sup>2</sup>University of Pittsburg, Pittsburg, PA. <sup>3</sup>University of Kansas, Lawrence, KS. <sup>4</sup>University of Calgary, Calgary, AB, Canada.  
 Email: michael.a.trevino@okstate.edu  
 (No relevant relationships reported)

**PURPOSE:** To examine the effects of 10 weeks of continuous cycling training on maximal aerobic capacity ( $VO_{2MAX}$ ), maximal strength (MVC) of the knee extensors, and motor unit (MU) behavior of the vastus lateralis (VL) in sedentary males.

**METHODS:** Nine males completed 40 supervised training sessions. Pre- and post-intervention, participants performed a cycling  $VO_{2MAX}$  test and MVCs on an isokinetic dynamometer followed by two consecutive submaximal (40% relative to pre-training MVC) contractions of the right knee extensors. Surface electromyographic (EMG) decomposition assessed recruitment thresholds (RT), action potential amplitudes ( $MUAP_{AMP}$ ) and mean firing rates (MFR) for each observed MU from the VL for the 40% MVCs and linear regressions determined the y-intercepts (y-ints) and slopes for the MFR and  $MUAP_{AMP}$  vs. RT relationships. EMG amplitude for the 40% MVCs was normalized (N-EMG) to the MVC for the current visit. Separate paired samples *t*-tests examined  $VO_{2MAX}$  and MVC. Separate two-way ANOVAs (time x repetition [rep]) examined N-EMG and the y-ints and slopes for the MFR and  $MUAP_{AMP}$  vs. RT relationships. Alpha was 0.05.

**RESULTS:** Ten weeks of training resulted in significant increases in  $VO_{2MAX}$  ( $3.4 \pm 0.6$  vs.  $3.8 \pm 0.5$  L/min;  $P = 0.005$ ) while MVC was unchanged ( $212.7 \pm 34.3$  vs.  $201.4 \pm 32.1$  Nm;  $P = 0.056$ ). For the slopes and y-ints from the MFR and  $MUAP_{AMP}$  vs. RT relationships, there were no significant two-way interactions ( $P = 0.152 - 0.669$ ) or main effects for time ( $P = 0.213 - 0.753$ ) or repetition ( $P = 0.313 - 0.639$ ). For N-EMG, there was no significant two-way interaction ( $P = 0.485$ ). There were main effects for time ( $37.3 \pm 7.0$  vs.  $47.6 \pm 14.2\%$ ;  $P = 0.035$ ) and rep ( $41.2 \pm 11.9$  vs.  $43.7 \pm 12.7\%$ ;  $P = 0.044$ ). N-EMG was greater for post-training and repetition 2 when collapsed across time and repetition.

**CONCLUSIONS:** Continuous cycling increased maximal aerobic capacity, whereas maximal strength of the knee extensors and motor unit firing rates and action potential amplitudes in relation to recruitment thresholds for the VL were unchanged. Although aerobic training is believed to improve endurance, participants exhibited greater muscle activation when completing a contraction at pre-training torque levels and similar increases in muscle activation when completing the ensuing contraction.

**3413** Board #234 May 29 2:30 PM - 4:00 PM

**Physiological Determinants Of The Rate Of Torque Development In Older Men: A Pilot Study**

Mitchel Magrini<sup>1</sup>, Ryan J. Colquhoun<sup>2</sup>, Sydnie Fleming<sup>2</sup>, Matthew C. Ferrell<sup>3</sup>, Nathaniel D.M. Jenkins<sup>3</sup>, Jason M. DeFreitas<sup>3</sup>. <sup>1</sup>Creighton University, Omaha, NE. <sup>2</sup>University of South Alabama, Mobile, AL. <sup>3</sup>Oklahoma State University, Stillwater, OK. (Sponsor: Joan Eckerson, FACSM)  
 (No relevant relationships reported)

In young, healthy adults, early phase (i.e., 0-50 ms) rate of torque development (RTD) is primarily determined by neural characteristics. However, it is unclear if this remains the case in older adults. **PURPOSE:** To examine the physiological characteristics of early phase RTD in older men. **METHODS:** Seventeen older males (age =  $73 \pm 6$  y) completed 2 maximal (MVIC) and 2 rapid (rMVIC) isometric knee extensions. Early phase RTD values were calculated from the first 50 ms ( $aRTD_{50}$ ) of the rapid contractions and normalized ( $nRTD_{50}$ ) to maximal torque (%MVIC/s). Muscle activation amplitude (EMG) was calculated during the first 50 ms ( $nEMG_{50}$ ) of EMG onset and was normalized to the peak-to-peak M-wave amplitude (% $M_{pp}$ ) of the vastus lateralis (VL), vastus medialis (VM), and rectus femoris (RF). Evoked peak twitch torque ( $\tau_{TT}$ ) was determined as the maximal torque (Nm) produced from a single electrical stimulus. Motor unit number estimation (MUNE) was calculated as a ratio of the ensemble average of the single MU potential amplitude to the compound muscle action potential amplitude and was corrected for alteration. Muscle quality (MQ) was determined by examining the average muscle cross-sectional area relative to the average muscle echo intensity for each muscle using an ultrasound. Relationships between the predictor variables ( $nEMG_{50}$ , MUNE,  $\tau_{TT}$ , MQ) and RTD ( $aRTD_{50}$  and  $nRTD_{50}$ ) were analyzed via Pearson's correlation coefficients. Stepwise multiple regression was used to examine the amount of variance in  $aRTD_{50}$  and  $nRTD_{50}$  accounted for by each of the predictor variables. **RESULTS:**  $aRTD_{50}$  ( $577.8 \pm 241.0$  Nm/s<sup>1</sup>) was related to MUNE ( $144.1 \pm 47.1$ ,  $r = .549$ ,  $p = .023$ ),  $nEMG_{50}$  ( $137.5 \pm 97.7$  % $M_{pp}$ ,  $r = .673$ ,  $p = .003$ ), and  $\tau_{TT}$  ( $20.34 \pm 12.5$  Nm,  $r = .504$ ,  $p = .039$ ).  $nRTD_{50}$  ( $433.2 \pm 175.4$  %MVIC/s) was related to MUNE ( $r = .531$ ,  $p = .028$ ) and  $nEMG_{50}$  ( $r = .604$ ,  $p = .010$ ).  $nEMG_{50}$  and  $\tau_{TT}$  were significant determinants ( $p = .001$ ) that accounted for 45.3% and 15.5% of the variance in  $aRTD_{50}$ , respectively.  $nEMG_{50}$  was the only significant predictor ( $p = .01$ ), explaining 36.4% of the variance in  $nRTD_{50}$ . **CONCLUSIONS:** These pilot data support the notion that early phase RTD is primarily determined by neural factors, even in older adults. These data also suggest that possessing a higher number of viable MUs may influence early phase absolute RTD in older men.

**3414** Board #235 May 29 2:30 PM - 4:00 PM

**Lower Extremity Neuromuscular Alteration During Dual Cognitive Standing Balance Tasks In Adults Diagnosed With HIV**

Leah R. Jamison<sup>1</sup>, Jonathan Marshall<sup>1</sup>, Ashley Richmond<sup>1</sup>, Melanie Stephens<sup>2</sup>, Martin Rosario<sup>1</sup>. <sup>1</sup>Texas Woman's University, Dallas, TX. <sup>2</sup>Texas Woman's University, Denton, TX.  
 Email: lhammer@twu.edu  
 (No relevant relationships reported)

Individuals diagnosed with human immunodeficiency virus (HIV) often present with impaired postural control as a consequence of proprioceptive alteration, due to secondary effects of prescription medication. **PURPOSE:** This study seeks to evaluate lower extremity neuromuscular activation during dual postural control tasks in individuals living with HIV.

**METHODS:** Twenty-three participants of Hispanic-latino origin diagnosed with HIV (18 male and 5 female, average age  $55 \pm 1.7$  years) with an average CD4 count of 698.8 (22 years of HIV diagnosis) enrolled in this study. Surface electromyography (EMG) on the tibialis anterior (TA) and gastrocnemius (GA) muscles was used on the participant's dominant leg. Each task took approximately 15 seconds to finish. Each participant was instructed to quietly stand in a bi-pedal posture on a balance foam. Four single balance and dual cognitive-balance tasks (count backwards from 100 in increments of 3) were performed on the balance foam.

**RESULTS:** The variables of interest in this study were 1) time to peak, 2) decay and 3) duration of muscle activation for TA and GA. A repeated measure ANOVA analysis was used to compare all variables of interest. No significant difference is indicated between duration and decay of muscle activation for TA and GA across the various tasks assessed. Throughout the cognitive balance task, GA time to peak activation was slower ( $P < 0.001$ ) during eyes closed (EC) head movements (HUD) ( $7.7 \pm 0.7$  seconds) when compared to HUD with eyes open (EO) ( $0.3 \pm 0.2$  secs) and, eyes open (EO) ( $0.5 \pm 0.2$  secs).

**CONCLUSIONS:** As the GA plays a major role in static balance, an increased fall risk could be resultant of this delay in time to peak onset. As such, our research recommends lower extremity electromyography and strength assessment in this population to forestall or decrease fall hazards.

3415 Board #236 May 29 2:30 PM - 4:00 PM

**Baseline Performance May Alter Feedback Effectiveness Of Single And Dual Task Landings**

Thomas W. Kernozek, FACSM<sup>1</sup>, Emily Anderson<sup>1</sup>, Stephanie Dietrich<sup>1</sup>, Renee Dade<sup>1</sup>, Becky Heinert<sup>2</sup>, Drew Rutherford<sup>1</sup>.  
<sup>1</sup>University of Wisconsin-La Crosse, La Crosse, WI. <sup>2</sup>Gundersen Health System, La Crosse, WI.  
 Email: kernozek.thom@uwlax.edu  
 (No relevant relationships reported)

Anterior cruciate ligament (ACL) injuries are common in female athletes. Performance-based feedback (FB) may alter landing mechanics. **PURPOSE:** To provide peak vertical ground reaction force (PvGRF), loading asymmetry (LA), and frontal-plane (FP) video as post-trial landing FB to evaluate and train female collegiate athletes during single- and dual-task (ST and DT) drop landing. **METHODS:** 88 athletes performed both ST and DT (with/without jumping for a suspended ball) landings onto custom, portable force plates sampled at 2000 Hz. FP video showing knee-to-ankle (K:A) ratio, a surrogate for knee valgus, was recorded at 100 Hz. Performance trials were conducted in blocks of 3 ST and 6 DT pre-tests, 6 ST and 6 DT with post-trial visual FB (PvGRF in body weight (BW), LA, and FP video), and 3 ST and 6 DT post-tests. **RESULTS:** Quartiles were determined from PreST PvGRF to determine groups (Grp 1 < 3.45 BW; Grp 2: between 3.45-4.01 BW; Grp 3: between 4.01-4.72 BW; Grp 4 > 4.72 BW). PvGRF and K:A ratio between task (ST or DT) and over time (pre-test, post-test) were compared using a two-way repeated measures ANOVA where a group\*time interaction was observed ( $p < 0.05$ ). Follow-up tests revealed that Grp 3 and 4 improved PvGRF and K:A ratio from PreST to PostST that were maintained in PostDT (PvGRF: PreST to PostST Grp 3 = -20.6%, Grp 4 = -32.2%, PostST to PostDT Grp 3 = 5.0%, Grp 4 = 5.2%; K:A ratio: PreST to PostST Grp 3 = 4.1%, Grp 4 = 11.0%, PostST to PostDT Grp 3 = 0%, Grp 4 = 1.0%). Grp 1 and 2 demonstrated no change in K:A ratio despite the reduced PvGRF from PreST to PostST. These changes were not maintained during PostDT (PreST to PostST Grp 1 = -11.2%, Grp 2 = -18.3%, PostST to PostDT Grp 1 = 7.8%, Grp 2 = 2.3%). **CONCLUSIONS:** Collegiate athletes with PreST PvGRF > 4.01 BW may benefit more from performance-based landing FB that are maintained during DT scenarios.

3416 Board #237 May 29 2:30 PM - 4:00 PM

**The Effect Of Responsive Equine Simulator Therapy Device On Biomechanics Of Sitting**

Henry Wang, Brian Fox, Rachel McCormick, Crystal Hajek, D. Clark Dickin. Ball State University, Muncie, IN.  
 Email: hwang2@bsu.edu  
 (No relevant relationships reported)

A responsive equine simulator therapy (REST) system is a sitting device replicating motions experienced during horse riding. The mild motion introduced by the REST could promote a more active sitting experience to users. Although the REST system could potentially provide the benefits associated with active sitting, the effect of a REST system on trunk motion, trunk and leg muscle activations over that of sitting on a normal chair has yet to be examined. **Purpose:** To quantify trunk motion patterns and trunk and leg muscle activity during sitting on a REST system compared to an office chair. **Methods:** 20 healthy participants (22±2 yr, 75±10 kg, 1.71±7.9 m) sat on the REST device and an office chair for 20 minutes in randomized order. Electromyography (EMG) sensors were placed bilaterally on the external oblique, rectus abdominis, erector spinae, adductor longus, soleus, and tibialis anterior. 3D Motion capture was conducted while participants performed the two sitting conditions. One way repeated measures ANOVA was used to determine differences in trunk motion and root mean square (RMS) EMG between the two sitting conditions. **Results:** For any given 10-sec sitting interval, the trunk center of mass traveled a greater distance during the REST condition (25.4±7.9 cm) over that of the Chair condition (3.6±1.5 cm) ( $p < 0.001$ ). Also, mean angular speeds of the trunk during sitting on the REST was greater in the sagittal plane (0.20±0.12 deg/s vs. 0.07±0.06 deg/s) ( $p < 0.001$ ) and in the transverse plane (0.11±0.04 deg/s vs. 0.05±0.09 deg/s) ( $p = 0.011$ ) than those of the Chair condition. Furthermore, average RMS EMGs of the external oblique (6.13±0.34 mv vs. 5.95±0.30 mv) ( $p = 0.037$ ), tibialis anterior (18.96±0.37 mv vs. 18.73±0.30 mv) ( $p = 0.007$ ), and soleus (9.58±0.65 mv vs. 8.70±1.10 mv) ( $p = 0.018$ ) were significantly higher in the REST condition than those in the Chair condition during a 10-sec interval. **Conclusion:** Using a REST device resulted in a significant increase in trunk motion. The elevated activities in trunk and leg muscles serve to maintain and control upper body posture. These biomechanical responses imply that people could assist in helping to establish an active lifestyle by using the REST device on a regular basis.

3417 Board #238 May 29 2:30 PM - 4:00 PM

**The Influence Of Apoe Genotype On Motor Cortex Function Following Mtbi**

Alia L. Yasen<sup>1</sup>, Geeta N. Eick<sup>1</sup>, Kirstin N. Sterner<sup>1</sup>, Anita D. Christie<sup>2</sup>. <sup>1</sup>University of Oregon, Eugene, OR. <sup>2</sup>Western University, London, ON, Canada. (Sponsor: Charles Rice, FACSM)  
 Email: ayasen@uoregon.edu  
 (No relevant relationships reported)

Approximately 10-15% of individuals diagnosed with mild traumatic brain injury (mTBI) continue to experience symptoms beyond 3 months post-injury. Although the underlying physiology of these prolonged symptoms remains unknown, numerous factors have been suggested to contribute to recovery from mild traumatic brain injury (mTBI). Among the most extensively studied is the influence of the Apoe4 allele. **PURPOSE:** The purpose of this study was to examine the potential influence of APOE genotype on neurophysiological recovery from mTBI in individuals with chronic symptoms. **METHODS:** Twenty seven participants provided a saliva sample for APOE genotyping and were categorized into one of two groups: (i) with history of mTBI and no remaining symptoms ( $n = 21$ , Control), and (ii) with chronic symptoms from mTBI, lasting at least 3 months post-injury ( $n = 6$ , Chronic). Measures of glutamate and GABA concentrations in the primary motor cortex were obtained using proton magnetic resonance spectroscopy (<sup>1</sup>H-MRS). Transcranial magnetic stimulation (TMS) was used to assess corticomotor excitability with the amplitude of the motor evoked potential (MEP<sub>amp</sub>), and intracortical inhibition through the duration of the cortical silent period (CSP). **RESULTS:** Glutamate ( $p = 0.55$ ) and GABA ( $p = 0.73$ ) concentrations in M1, as well as MEP<sub>amp</sub> ( $p = 0.20$ ) and CSP duration ( $p = 0.47$ ), did not differ between mTBI groups. There were no differences in these measures between ε4 carriers and non-carriers ( $p \geq 0.50$ ) and no significant interactions between mTBI group and ε4 carrier status for any of the four measures ( $p \geq 0.07$ ). **CONCLUSION:** The lack of differences in glutamate, GABA, and corticomotor excitability and inhibition across groups suggests that motor cortex function may not explain the physiology underlying differences in symptom recovery post-mTBI. While the apoe4 allele has been associated with differences in outcome following mTBI, it did not seem to affect the function of the human motor cortex in this group of participants.

3418 Board #239 May 29 2:30 PM - 4:00 PM

**Does Ipsilateral Motor Cortex Activity During Unilateral Fatigue Explain The Deficits In The Non-fatigued Limb?**

Jesus A. Hernandez-Sarabia, Alejandra Barrera-Curiel, Micheal J. Luera, Jason M. DeFreitas. Oklahoma State University, STILLWATER, OK.  
 Email: jesusah@okstate.edu  
 (No relevant relationships reported)

Performing unilateral contractions to exhaustion has been shown to lead to force deficits of both the exercised and unexercised limbs. Although limb muscles are controlled by the contralateral hemisphere of the brain, neuroimaging studies have also shown slight activation of the ipsilateral motor cortex during unilateral tasks. However, whether cortical activity of the ipsilateral hemisphere might, in part, be responsible for the force decrements in the non-fatigued limb remains unknown. **PURPOSE:** To quantify the relationship between changes in maximal voluntary contraction (MVC) of the non-fatigued limb, and oxyhemoglobin (HbO) changes in the ipsilateral motor cortex during a fatiguing task. **METHODS:** Eleven subjects ( $M \pm SD$  20.8±1.14 yrs.) performed two maximal voluntary isometric knee extensions of the left leg before (MVC<sub>pre</sub>) and after fatiguing protocol (MVC<sub>post</sub>). The fatiguing protocol consisted of repeated, 50-second long isometric knee extensions with the right leg at 30% MVC until failure. During the fatigue protocol, hemodynamic responses of the motor cortex were recorded at a sampling rate of 5.81 HZ using a continuous-wave functional near infrared spectroscopy system (fNIRS). Raw fNIRS signals were processed and converted to hemoglobin concentrations using an open-source software (HomER2), and the peak HbO (HbO<sub>peak</sub>) was obtained from the final contraction before failure. MVC<sub>pre</sub> and MVC<sub>post</sub> were used to calculate the percentage of change in maximal force from the fatiguing task (MVC<sub>diff</sub>). A Pearson's correlation between HbO<sub>peak</sub> and MVC<sub>diff</sub> was calculated using a commercial software. **RESULTS:** Paired samples t-test showed a significant difference ( $p < 0.05$ ) between MVC<sub>pre</sub> (828.34±238.8 N) and MVC<sub>post</sub> (743.99±227.56 N). Pearson's correlation between HbO<sub>peak</sub> (2.93±1.86E-8) of the ipsilateral motor cortex and MVC<sub>diff</sub> (-9.86±12.11 %) of the unexercised leg was not statistically significant ( $R = -0.368$ ,  $p = .265$ ). **CONCLUSIONS:** We hypothesized that peaks in oxyhemoglobin on the ipsilateral motor cortex during a fatiguing task would explain, to some extent, the force deficits in the unexercised leg. It is worth noting that this study was underpowered for a correlation. However, it is also possible that if the contralateral force deficit is indeed due to neural factors, that it is not cortical in origin.

**3419** Board #240 May 29 2:30 PM - 4:00 PM  
**External Resistance Is Imperative For Training-induced Efferent Neural Drive Enhancement In Older Individuals**

Tiril Tøien<sup>1</sup>, Runar Unhjem<sup>2</sup>, Ann Charlotte Gjertsen Kvellestad<sup>3</sup>, Thomas Storehaug Øren<sup>3</sup>, Eivind Wang<sup>3</sup>. <sup>1</sup>Molde University College, Molde, Norway. <sup>2</sup>Nord University, Bodø, Norway. <sup>3</sup>Norwegian University of Science and Technology, Trondheim, Norway.  
 Email: tiril.toien@himolde.no  
 (No relevant relationships reported)

Strength training performed with heavy loads and maximal intended velocity is documented to enhance efferent neural drive in older individuals. However, it remains unclear whether the neural plasticity following training result from motor skill learning or if external resistance is a prerequisite.

**PURPOSE:** To investigate the importance of external resistance on neural plasticity in older individuals.

**METHODS:** Electrically evoked potentials (H-reflex and V-waves normalized to maximal M-wave) and voluntary activation (VA) were assessed in 36 older individuals (73±4 years). Participants were randomized to 3 weeks of plantar flexion strength training, with (maximal strength training; MST) or without (unloaded ballistic training; UBT) heavy external loading (90% of one repetition maximum), or a control group. Both training groups aimed to execute the concentric phase of movement as fast and forcefully as possible.

**RESULTS:** The MST group improved maximal voluntary contraction (MVC) and rate of force development (RFD) by 18±13% (p<0.01) and 35±17% (p<0.01), respectively, and this was different (p<0.01) from the UBT group which exhibited a 7±8% (p<0.05) increase in MVC (p<0.05) and a tendency of an increase in RFD (p=0.12). Concomitant improvements in efferent neural drive, evident as a 79±80% increase in V/M-ratio (p<0.01) and a tendency towards increased VA (p=0.11), were only apparent after MST. No changes were observed in H/M-ratio for any of the groups. **CONCLUSION:** External loading following exercise training appears to be a prerequisite for efferent neural drive enhancement in older individuals, and advocates that heavy resistance training should be recommended to counteract the typically observed age-related decline in motoneuron firing frequency and recruitment.

**3420** Board #241 May 29 2:30 PM - 4:00 PM  
**Performance Fatigability And Neuromuscular Patterns Of Responses For Bilateral Versus Unilateral Leg Extensions In Men.**

John Paul Anders<sup>1</sup>, Joshua Keller<sup>1</sup>, Corey Smith<sup>2</sup>, Ethan Hill<sup>3</sup>, Tyler Neltner<sup>1</sup>, Terry Housh, FACSM<sup>1</sup>, Richard Schmidt<sup>1</sup>, Glen Johnson, FACSM<sup>1</sup>. <sup>1</sup>University of Nebraska- Lincoln, Lincoln, NE. <sup>2</sup>University of Texas at El Paso, El Paso, TX. <sup>3</sup>University of Central Florida, Orlando, FL. (Sponsor: Terry Housh, FACSM)  
 (No relevant relationships reported)

**Purpose:** The purpose of the present study was to examine performance fatigability and patterns of neuromuscular responses for electromyographic (EMG) and mechanomyographic (MMG) amplitude (AMP) and mean power frequency (MPF) of the vastus lateralis (VL) during bilateral (BL) and unilateral (UL) maximal, concentric, isokinetic leg extensions. **Methods:** Eleven men (Mean ± SD; age = 22.9 ± 3.7 years; height = 177.8 ± 6.7 cm; weight = 80.4 ± 7.9 kg) performed 50 BL and UL maximal, concentric, isokinetic leg extensions at 60°·s<sup>-1</sup> on separate days. The EMG and MMG from the non-dominant VL were recorded. The EMG AMP, EMG MPF, MMG AMP, MMG MPF and isokinetic peak torque were normalized to their corresponding maximal voluntary isometric contraction values. Every five of the 50 repetitions were averaged together to produce a total of 10 repetitions throughout the fatiguing task. Five separate 2 (Condition [BL and UL]) × 10 (Repetitions [5-50]) repeated measures ANOVAs were performed to examine the normalized EMG AMP, EMG MPF, MMG AMP, MMG MPF, and isokinetic torque. **Results:** The 2 × 10 repeated measures ANOVA for normalized isokinetic torque demonstrated a significant Condition by Repetition Interaction (p < 0.001, η<sup>2</sup><sub>p</sub> = 0.594). Follow up 1-way ANOVAs demonstrated that for the BL and UL conditions, repetition 5 was significantly greater than repetitions 15-50. There were no interactions, but significant main effects for Repetition with an increase in EMG AMP (p < 0.001; η<sup>2</sup><sub>p</sub> = 0.255) and decreases in EMG MPF (p < 0.001; η<sup>2</sup><sub>p</sub> = 0.650), MMG AMP (p < 0.001; η<sup>2</sup><sub>p</sub> = 0.402), and MMG MPF (p < 0.001; η<sup>2</sup><sub>p</sub> = 0.796). Additionally, EMG MPF and MMG AMP demonstrated significant main effects for Condition (p = 0.031; η<sup>2</sup><sub>p</sub> = 0.387 and p = 0.002; η<sup>2</sup><sub>p</sub> = 0.64, respectively), with BL exhibiting greater values in both parameters. **Conclusion:** The findings of the present study suggested there was greater performance fatigability during UL versus BL leg extensions. Both modalities demonstrated similar patterns of neuromuscular responses, however, the BL condition exhibited a lower decline in action potential conduction velocity (EMG MPF) and lower increases in muscle

stiffness (MMG AMP) than the UL condition. These findings suggested the greater performance fatigability during UL muscle actions may be attributable to peripheral mechanisms of fatigue.

**3421** Board #242 May 29 2:30 PM - 4:00 PM  
**Impact Of Mental Fatigue On Force Control And Muscle Activation**

Katie Kowalski, Laura Graham, Anita Christie. University of Western Ontario, London, ON, Canada. (Sponsor: Charles Rice, FACSM)  
 (No relevant relationships reported)

Mental fatigue (MF) leads to performance declines in tasks requiring force control. However, the neuromuscular mechanisms leading to these declines are not well understood. **PURPOSE:** To determine the effect of MF on the ability to match a target force and identify associated changes in muscle activation in males and females. **METHODS:** Nineteen participants (10 female) performed one 10-s isometric dorsiflexion contraction at 20 and 50% maximum voluntary contraction (MVC) before and after completing 20 min of the psychomotor vigilance task (PVT). The PVT is a sustained attention reaction time (RT) task known to induce MF. Force, indwelling and surface electromyography (sEMG) of the tibialis anterior were measured prior to and immediately following the PVT. **RESULTS:** Mean values for all variables can be found in Table 1. PVT RT and subjective fatigue increased similarly in males and females over time, indicating successful induction of MF. Mean absolute force produced at 20% and 50% MVC increased in males and females from pre- to post-PVT. However, there were no significant changes in the root mean square error of force at either contraction intensity. sEMG amplitude declined after the PVT in the 20% MVC condition with a trend towards declining at 50% MVC in both males and females. This was accompanied by a slowing of motor unit discharge rate after the PVT at 20% MVC in both sexes, but only in males at 50% MVC. **CONCLUSION:** Inducing MF led to changes in mean force of submaximal isometric contractions. This was accompanied by a decline in agonist muscle activity, suggesting alterations to motor control in the presence of MF.

**Table 1. Impact of PVT**

|                            | Pre-PVT        |                | Post-PVT       |                |
|----------------------------|----------------|----------------|----------------|----------------|
|                            | Female         | Male           | Female         | Male           |
| <b>Reaction time (ms)*</b> | 281.31 ± 32.07 | 270.40 ± 31.79 | 312.62 ± 37.33 | 315.85 ± 40.38 |
| <b>Subjective fatigue*</b> | 3.50 ± 1.18    | 2.44 ± 1.01    | 5.40 ± 1.65    | 4.44 ± 2.01    |
| <b>Mean force (N)</b>      |                |                |                |                |
| 20% MVC*                   | 41.37 ± 7.62   | 45.76 ± 13.19  | 41.52 ± 8.08   | 47.09 ± 13.36  |
| 50% MVC*                   | 94.36 ± 19.41  | 105.60 ± 31.01 | 95.39 ± 19.72  | 107.59 ± 31.70 |
| <b>RMSE force (%)</b>      |                |                |                |                |
| 20% MVC                    | 2.32 ± 1.48    | 2.61 ± 1.46    | 3.25 ± 2.92    | 3.27 ± 1.34    |
| 50% MVC                    | 6.25 ± 2.61    | 7.76 ± 4.98    | 5.78 ± 4.18    | 5.58 ± 3.27    |
| <b>sEMG (mV)</b>           |                |                |                |                |
| 20% MVC*                   | 0.41 ± 0.10    | 0.46 ± 0.09    | 0.39 ± 0.08    | 0.43 ± 0.09    |
| 50% MVC                    | 0.74 ± 0.36    | 0.84 ± 0.37    | 0.66 ± 0.23    | 0.75 ± 0.31    |
| <b>MUDR (Hz)</b>           |                |                |                |                |
| 20% MVC*†                  | 15.84 ± 3.20   | 13.62 ± 2.92   | 14.60 ± 1.94   | 11.06 ± 1.66   |
| 50% MVC#                   | 18.46 ± 3.03   | 18.65 ± 5.21   | 19.56 ± 4.05   | 15.03 ± 2.60   |

\*main effect of time (p<0.03); †main effect of sex (p=0.01); #interaction (p=0.02). RMSE = root mean square error; sEMG = surface electromyography; MUDR = motor unit discharge rate

**3422** Board #243 May 29 2:30 PM - 4:00 PM  
**Sex Differences In Neuromuscular Fatigue Effects On Intermuscular Control Patterns In Leg Extensors**

Zhong Wang, Amelia Chen, Anthony Johnson, Lisa Griffin. The University of Texas at Austin, Austin, TX.  
 Email: zhongwang2015@outlook.com  
 (No relevant relationships reported)

Muscles in females tend to be less fatigable than in males. This may be because females have a higher proportion of Type I muscle fibers. It is also possible that females could employ different synergistic activation patterns during sustained

fatiguing contractions. Sex differences in intermuscular control pattern changes following fatigue have not yet been investigated. **Purpose:** To investigate differences in VMO-VL activation level changes *pre-, during and post-fatigue* between females and males. **Method:** Five healthy females and 5 healthy males performed 5 trials of step-up before and after a sustained fatiguing isometric leg extension task of 20% maximal voluntary contraction (MVC). VMO and VL EMG signals were recorded and normalized to percent maximum. **Results:** Males took longer to perform the step-up than females ( $P < 0.05$ ), but the speeds did not change with fatigue. With sexes pooled, the activation levels of both the VMO and the VL during step-up were lowered following fatigue (*pre- vs. post-fatigue*, VMO: 21.2% vs. 16.7% EMG<sub>max</sub>, VL: 28.3% vs. 21.7% EMG<sub>max</sub>; both  $P < 0.05$ ). Normalized *pre-fatigue* VL activation levels were lower in males than in females (11.6% vs. 45.0% respectively,  $P < 0.05$ ), whereas *pre-fatigue* VMO levels were similar between the sexes (males: 13.1% vs. females: 29.4% EMG<sub>max</sub>). After fatigue, there was no difference in VMO and VL activation levels between the sexes, indicating greater fatigue in the VL relative to the VMO in females (activation %<sub>post</sub> - %<sub>pre</sub>, female VL vs. VMO: -11% vs. -5%,  $P < 0.05$ ). In males, the VMO and VL fatigued to a similar degree (VL vs. VMO: -2.5% vs. -3.3%). During the sustained isometric fatiguing contraction, the female VL tended to be activated to a greater degree than the VMO, whereas males activated both muscles more equally (VL/VMO activation ratio, 1.55 vs. 0.86, females vs. males,  $p = 0.084$ ). **Conclusion:** Our results show that males and females exhibit different relative VMO-VL neuromuscular fatigue patterns. Females tend to rely more on the VL than the VMO during fatigue while males tend to use both muscles equally.

**3423** Board #244 May 29 2:30 PM - 4:00 PM  
**Quadriceps Function In Chronic Anterior Knee Pain With Or Without A History Of Knee Surgery**  
 Sungwan Kim<sup>1</sup>, Jihong Park<sup>2</sup>. <sup>1</sup>Bridgewater State University, Bridgewater, MA. <sup>2</sup>Kyung Hee University, Yongin, Korea, Republic of.  
 Email: jihong.park@khu.ac.kr  
 (No relevant relationships reported)

It is unclear if a history of knee surgery additively affects quadriceps dysfunction in patients with chronic anterior knee pain (AKP). **PURPOSE:** To compare quadriceps function (strength, activation, and power) in chronic AKP patients with or without a history of knee surgery, to matched healthy controls. **METHODS:** Twenty-eight chronic AKP patients with (n=14; ACL reconstruction=5, meniscectomy=4, and both combined=5) or without (n=14) a history of knee surgery, and 20 matched (age, height, mass, BMI, thigh circumference, and physical activity) healthy controls participated in this cross-sectional study (average values of all three groups in the order of demographics listed above: 22 years, 173 cm, 76 kg, 25 kg/m<sup>2</sup>, 57 cm, 235 min/week). Perception and duration of pain, and functional outcomes were also matched between AKP patient groups (4.1/10 cm in visual analogue scale; 41 months; 54/80 score in Lower Extremity Functional Scale). For quadriceps strength, maximal voluntary isometric contraction (MVIC) was obtained. For quadriceps activation and power, central activation ratio (CAR) and rate of torque development during MVIC assessments were calculated. Parametric or non-parametric tests (depends on normal distribution) with calculations of effect sizes [ES] determined the group differences ( $p < 0.05$ ). **RESULTS:** As compared with the matched healthy controls, AKP patients with and without a history knee surgery showed a less quadriceps strength (3.1 vs. 2.2 [1.2] and 1.8 [2.3] N·m/kg,  $p < 0.001$ ) and power (10.1 vs. 7.8 [1.0] and 7.2 [1.1] N·m/kg/s,  $p < 0.03$ ). There were no differences between AKP patient groups in quadriceps strength ( $p = 0.15$ ) and power ( $p = 0.79$ ). A less quadriceps activation was observed in AKP patients without a surgery (0.75 in CAR), as compared with the knee surgery group (0.90 [1.7],  $p = 0.002$ ) and healthy controls (0.96 [3.0],  $p < 0.0001$ ). **CONCLUSION:** Both chronic AKP patient groups showed a similar amount of strength deficit that an experience of knee surgery does not appear to result in a summative effect. Central activation closed to normal (0.90 in CAR) in chronic AKP patients with a past surgical history may suggest that peripherally mediated inhibition plays a bigger role in their quadriceps weakness. Supported by the National Research Foundation of Korea (NRF-2017S1A8022854).

**3424** Board #245 May 29 2:30 PM - 4:00 PM  
**Abstract Withdrawn**

**3425** Board #246 May 29 2:30 PM - 4:00 PM  
**Muscle Activation Signal Decay**  
 Clint R. Frandsen, Grayson Tarbox, Logan A. Thorneloe, A Wayne Johnson, Sarah T. Ridge. Brigham Young University, Provo, UT.  
 Email: clintfrf@byu.edu  
 (No relevant relationships reported)

Muscle activation can be measured through a technique called muscle functional magnetic resonance imaging (mfMRI), which uses T2 signal decay in muscle tissue to

measure activation. This method allows for activation of deep muscles to be measured in a noninvasive way. However, this method requires users to account for the intensity of subjects' previous activity and allow for sufficient rest time to assure the accuracy of measurements.

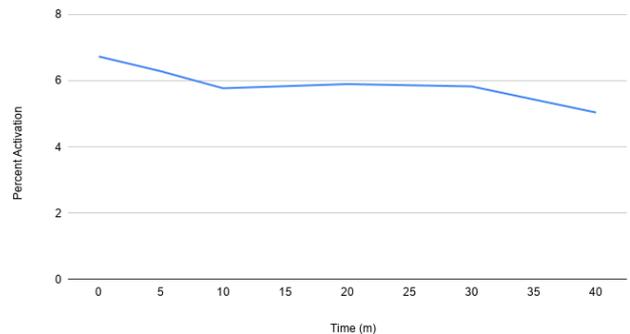
**Purpose:** To determine a method to assess calf muscle activation from a single bout of walking.

**Methods:** Four participants (female=2; 20-25 y) having had minimal activity prior in the day rested their legs for over an hour to assure the calf muscle activation had completely returned to baseline prior to scanning. A pre-exercise scan of the participants right calf muscle was performed to measure baseline activation. Participants then walked barefoot on a treadmill at a brisk pace (~3.5mph) for 15 mins. Immediately after, they were scanned in the same location of the calf every 2 mins for the next 45 mins.

**Results:** There was an average 6.7% increase in activation ( $p = 0.02$ ), of the four calf muscle groups being tracked, after 15 min of barefoot walking. Muscle activation signal slowly decreased for 10 mins before plateauing at around 5.7% activation above the pre-exercise levels ( $p < 0.07$ ). This post exercise activation level remained relatively constant for over 30 mins.

**Conclusion:** Muscle activation from walking can be accurately measured immediately after exercise but continued measurements taken after 10 mins of scanning, post-low intensity exercise, may be affected by factors related to the MRI scanning procedure and not changes in actual muscle activation. This post exercise activation level plateau may be due to tissue heating or other factors related to prolonged scanning.

Signal Decay of Muscle Activation



**3426** Board #247 May 29 2:30 PM - 4:00 PM  
**Corticomotor Network Activity Does Not Contribute To The Bilateral Deficit Phenomenon**  
 Anne Beethe<sup>1</sup>, Christopher Connaboy<sup>2</sup>, Lee Fisher<sup>2</sup>, Lovalekar Mita<sup>2</sup>, Bradley Nindl, FACSM<sup>2</sup>, Shawn Flanagan<sup>2</sup>. <sup>1</sup>Utah State University, Logan, UT. <sup>2</sup>University of Pittsburgh, Pittsburgh, PA. (Sponsor: Bradley Nindl, FACSM)  
 (No relevant relationships reported)

The bilateral deficit (BLD) phenomenon is an inability to maximally contract bilaterally as compared to the sum of the corresponding unilateral contractions, and is expressed as an index (BI). The underlying mechanism is unknown, but altered transcallosal inhibition (TCI) and diminished voluntary activation (VA) during bilateral homologous (BH), as compared to bilateral non-homologous (BNH) and unilateral tasks, is considered the most likely mechanism. **PURPOSE:** To examine corticospinal activity during BH, BNH, and unilateral maximal contractions, and resultant changes from task practice. **METHODS:** Eleven healthy adults (6 women/5 men, 25.6±3.7years; 171.81±11.44cm; 74.4±21.2kg) participated in the counterbalanced repeated measures study. TCI and VA were assessed with transcranial magnetic stimulation for BH, BNH, and unilateral dominant flexion (DF) sessions 1 and 7. For sessions 2-6, five of each BH elbow flexion, BNH flexion/extension, and DF maximal voluntary isometric contraction (MVIC) tasks were practiced. Paired t-tests or Wilcoxon signed-rank tests, as appropriate, were used to test TCI and VA between sessions 1 and 7. Pearson or Spearman correlation coefficients, as appropriate, between VA and TCI measures and BLD and peak force measures were used to assess any association between neurological and performance variables on test days 1 and 7. **RESULTS:** There were no differences in VA or TCI between BH, BNH, and DF. BH VA decreased from day 1 (95.14±4.3%) to day 7 (92.2±4.4%,  $p = 0.014$ ), but did not exceed the minimal detectable change (6.47). VA for BH ( $r = -0.655$ ;  $p = 0.039$ ) and DF ( $r = -0.636$ ;  $p = 0.035$ ) was associated with BH BI on day 1. When associated with peak force, day 7 BH ( $r = -0.627$ ,  $p = 0.039$ ) and BNH ( $r = -0.682$ ,  $p = 0.021$ ) TCI was correlated. **CONCLUSION:** BI was similar to prior research, but neurophysiological measures did not explain these differences. This is similar to previous equivocal research between BH and unilateral maximal force and TCI and/or VA, suggesting differences in BH and BNH BI are not solely influenced by neural drive modifications.

Of interest, TCI was highly correlated with force, revealing neurophysiological influence between tasks, but differences in bilateral and unilateral force may be influenced by outside mechanisms.

3427 Board #248 May 29 2:30 PM - 4:00 PM

### Electromyographic Activity Of Rolling Mat Pilates Exercises For Intensity Analysis

Paula Finatto<sup>1</sup>, Rafael F. Escamilla, FACSM<sup>2</sup>, Cláudia Silveira Lima<sup>1</sup>. <sup>1</sup>Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil. <sup>2</sup>California State University, Sacramento, CA. (Sponsor: Rafael Fassina Escamilla, FACSM)  
Email: paula.finatto@hotmail.com  
(No relevant relationships reported)

There are a discrepancy in relation to the pre-classification intensity of Pilates exercises (PE) and their real impact on muscular activation compromising training prescription. **PURPOSE:** To compare five muscles EMG activation during seven PE. **METHODS:** Surface EMG were recorded for lower (LRA) and upper rectus abdominis (URA), internal (IO) and external obliques (EO) and multifidus (MS) muscles, while seventeen women performed the Rolling Like a Ball basic (RLBbas), Rolling Like a Ball intermediate (RLBint), Rolling Like a Ball advanced (RLBadv), The Seal, Open Leg Rocker (OLR), The Hundred basic, and The Hundred advanced (HDadv) exercises. **RESULTS:** For the URA, LRA, IO and EO muscles, the exercises RLBbas (21.94% ± 7.3; 26.31% ± 9.79; 31.59% ± 11.65; 39.50% ± 13.5, respectively), RLBint (20.72% ± 11.52; 29.27% ± 9.8; 36.76% ± 16.44; 44.91% ± 15.95, respectively), RLBadv (25.20% ± 7.33; 30.89% ± 9.66; 35.35% ± 8.87; 43.88% ± 13.09), SL (24.11% ± 13.53; 33.28% ± 13.87; 35.15% ± 16.37; 37.6% ± 17.24, respectively), OLR (21.91% ± 10.78; 30.94% ± 11.39; 33.65% ± 13.87; 34.26% ± 10.26, respectively) and HDbas (53.92% ± 16.3; 47.92% ± 20.59; 36.54% ± 16.83; 46.64% ± 26.05, respectively) exercises presented significant less EMG percentage when compared to HDadv (71.69% ± 18.03; 75.69% ± 17.44; 57.86% ± 16.49; 88.71% ± 30.40, respectively). Besides, for the URA muscle significant ( $p < 0.001$ ) more EMG percentage was found comparing the HDbas to the RLBbas, RLBint, RLBadv, SL and OLR exercises. Furthermore, for the MS muscle, significant greater EMG was found when compared the RLBbas (27.59% ± 10.95), RLBint (27.68% ± 12.9), RLBadv (32.26% ± 13.29) and SL (32.1% ± 13.81) exercises to the HDbas (7.89% ± 3.20;  $p < 0.001$ ) and HDadv (9.89 ± 3.08;  $p = 0.001$ ;  $p < 0.001$ ;  $p = 0.002$ , respectively) exercises. **CONCLUSIONS:** The HDadv was the most effective exercise in producing muscle activity of the spinal flexors, while the other exercises could be grouped at the same moderate level of intensity for the LRA, URA, IO and EO muscles. Contrary to the current PE prescription, the RLBbas, RLBint, RLBadv and SL exercises, although indicated as spinal flexors exercises (less than 30% of maximum for spinal flexor muscles), seem to play a more significant role in the activation of MS, resulting in a moderate EMG activation. Supported by Capes and CNPq.

3428 Board #249 May 29 2:30 PM - 4:00 PM

### Comparison Of Fascicle Behaviors Between Superficial And Deeper Muscles Of Triceps Brachii During Isometric Contractions

Hiroshi Akima<sup>1</sup>, Hisashi Maeda<sup>1</sup>, Teruhiko Koike<sup>1</sup>, Koji Ishida<sup>1</sup>, Ryosuke Ando<sup>2</sup>. <sup>1</sup>Nagoya University, Nagoya, Aichi, Japan. <sup>2</sup>Japan Institute of Sports Sciences, Tokyo, Japan. (Sponsor: Katsumi ASANO, FACSM)  
(No relevant relationships reported)

Fascicle length and pennation angles during muscle contraction are often used in biomechanical models of the muscle-tendon complex to understand the functional roles of muscles and tendinous tissues. However, previous studies have focused on the lower limb muscles, information on fascicle behavior of the upper limb muscles is missing. **PURPOSE:** Ando et al. (2016) showed different between superficial and deeper muscles of the lower extremities in humans; however, the muscles of the upper limbs have not been examined in previous studies. The purpose of this study was to assess whether the fascicle behaviors of the upper extremities are similar to those of the lower extremities during isometric contractions. **METHODS:** Thirteen healthy men and women performed isometric elbow extension tasks at 50% and 75% of maximal voluntary contraction (MVC) at 60°, 90°, and 120° of elbow extension (full extension = 180°). Extended field-of-view (EFOV) B-mode ultrasonography was used to obtain sagittal plane panoramic images of the long head (TB-Long) and medial head (TB-Med) of the triceps brachii at rest and during contraction; fascicle length and pennation angle were measured. **RESULTS:** In the TB-Long, significant fascicle shortening from rest was found during 50% ( $8.7 \pm 0.3$  to  $7.6 \pm 0.3$  cm,  $P < 0.05$ ) and 75%MVC ( $8.7 \pm 0.3$  to  $7.5 \pm 0.3$  cm,  $P < 0.05$ ) at 60° and during 75%MVC ( $8.2 \pm 0.3$  to  $7.2 \pm 0.2$  cm,  $P < 0.05$ ) at 90° of extension. There was no significant fascicle shortening in the TB-Med muscle under any conditions. There was no significant pennation angle change from rest in either muscle. The pennation angle of the TB-Long (e.g. rest,  $12.9 \pm 0.8^\circ$  at 90°) was significantly greater than that of the TB-Med (e.g. rest,  $9.3 \pm 0.5^\circ$  at 90°) under all conditions. **CONCLUSION:** These results suggest that fascicle shortening

in the TB-Long muscle occurs in flexion; however, no change was found in the TB-Med. Different MTC features between superficial and deep muscles will be developed in the upper limbs, as shown in lower limb muscles. Supported by a Grant-in-Aid for Scientific Research (B) from the Ministry of Education, Culture, Sports, Science and Technology Grants (17H02142)

3429 Board #250 May 29 2:30 PM - 4:00 PM

### Kinetics And Kinematics Of Isoinertial Ballistic Contractions In Older Adults

Emmet J. Mc Dermott<sup>1</sup>, Thomas G. Balshaw<sup>1</sup>, Katherine Brooke-Wavell<sup>1</sup>, Thomas M. Maden-Wilkinson<sup>2</sup>, Jonathan P. Folland, FACSM<sup>1</sup>. <sup>1</sup>Loughborough University, Loughborough, United Kingdom. <sup>2</sup>Sheffield Hallam University, Sheffield, United Kingdom. (Sponsor: Professor Jonathan Folland, FACSM)  
Email: e.mcdermott2@lboro.ac.uk  
(No relevant relationships reported)

Regular resistance training (RT) is recommended for older adults to help offset age-induced declines in neuromuscular performance (e.g. power, force and velocity). However, there is limited research comparing the kinetics (force) and kinematics (velocity and power) of different types of RT contractions, and specifically concentric only (CON-ONLY) and eccentric-concentric (ECC-CON) contractions aiming to throw the load as far as possible. **PURPOSE:** To compare the kinetics and kinematics of ballistic contractions performed as CON-ONLY (explosive concentric contraction performed from rest) vs ECC-CON (a prior controlled eccentric lowering of the load followed by an explosive concentric contraction) in an older adult population. **METHODS:** Twelve healthy active older adult males (age:  $66 \pm 5$  yrs; height:  $1.81 \pm 0.1$  m; body mass:  $78.5 \pm 11.0$  kg; activity:  $2175 \pm 1450$  MET-min-week) completed 3 sessions (1 familiarisation and 2 measurement) using an instrumented isoinertial (30°) leg press dynamometer that facilitated recording of force and displacement that were used to derive velocity and power. Participants performed a series of attempts using both types of contraction (CON-ONLY and ECC-CON: counterbalanced) with a range of loads in ascending order during each measurement session (day 1: 20, 35 and 50; day 2: 50, 65 and 80%1RM). **RESULTS:** No main effect for contraction ( $p > 0.05$ ) was found for peak power or peak velocity across loads. A main contraction effect was found for peak force ( $p = 0.012$ ), with post hoc analysis revealing no difference ( $p > 0.05$ ) between contractions at any load. A main effect for contraction type was found for mean power ( $p = 0.016$ ) and mean velocity ( $p < 0.01$ ), with post hoc analysis revealing that mean power was higher for ECC-CON at 65% ( $310$  vs.  $430$ W,  $+23.0\%$ ,  $p < 0.01$ ) and 80%1RM ( $229$  vs.  $337$ W,  $47.3\%$ ,  $p < 0.01$ ). Mean velocity was higher in ECC-CON across all loads ( $+13.7 - 49.5\%$ ; all  $p < 0.01$ ). **CONCLUSIONS:** CON-ONLY and ECC-CON ballistic contractions produced similar peak neuromuscular performance in an older adult population. However, ECC-CON contractions involved greater mean power and mean velocity. In conclusion, it may be beneficial for older adults to perform ECC-CON contractions as they provide equivocal peak neuromuscular performance as CON-ONLY, but superior mean neuromuscular performance.

### F-64 Free Communication/Poster - Posture and Balance

Friday, May 29, 2020, 1:30 PM - 4:00 PM  
Room: CC-Exhibit Hall

3430 Board #251 May 29 2:30 PM - 4:00 PM

### Reliability Of The Repeated Unilateral Partial Squat As A Neuromuscular Control Screening Activity

Hannah S. Stein, Shannon E. Linderman, Alexandra K. Lesiw, Eric M. Berkson, Donna Moxley Scarborough. Massachusetts General Hospital, Boston, MA.  
Email: hstein@mgh.harvard.edu  
(No relevant relationships reported)

**PURPOSE:** A single leg squat task is often used to assess dynamic strength, flexibility, coordination and balance of an athlete. The composite of these physical components provides insight to the clinician about an athlete's overall neuromuscular control. However, the variation in the non-weight bearing limb's position influences body alignment causing variability in movement patterns. The repeated unilateral partial squat (RUPS) activity is designed in hopes to limit this variability. The purpose of this study is to assess the within-subject kinematic repeatability of the RUPS activity. **METHODS:** A 20 Vicon MX™ T-series motion capture system (240 Hz) was used to construct a 15-segment model of 33 study consenting female adolescent athletes (mean age =  $17.4 \pm 3.1$  y). Each stood on one leg at the edge of a 20-cm box, with opposite

limb dangling straight. The subject lowered the contralateral limb without ground contact for 5 repetitions in a row. Peak pelvis drop and lower limb joint angles at the time of peak knee flexion were calculated using Visual 3D™ biomechanics software. After a practice trial, 1 trial was performed on each limb with 3 of the 5 repetitions included in an ICC two-way mixed effects evaluation of kinematics repeatability reliability. **RESULTS:** Joint kinematics across the ankle, knee, hip, trunk and pelvis demonstrated good to excellent repeatability reliability with consistent levels of within item variability (Table 1). Peak knee, hip and trunk flexion and the position of the non-weight bearing limb demonstrated good to excellent consistency. The frontal plane measures, such as pelvis and trunk lateral flexion and hip adduction demonstrated good consistency (Table 1). **CONCLUSIONS:** Results demonstrate good to excellent repeatable kinematics during the RUPS activity especially in the sagittal plane. Findings of this repeatability study suggest that the RUPS may be a possible neuromuscular control screening tool for similar healthy athletes.

Table 1. Joint angle calculations at time of peak knee flexion across 3 repetitions of the repeated unilateral partial squat task

| Measure                                      | Mean (variance) | Cronbach's a | ICC                                  |
|--|-----------------|--------------|--------------------------------------|
| Ankle dorsiflexion(+)plantar (-)             | 35.339 (0.002)  | 0.959        | ICC3,1=0.889 (0.837-0.928), p<0.0001 |
| Ankle eversion (+)inversion (-)              | 3.032 (0.009)   | 0.983        | ICC3,1=0.951 (0.927-0.969), p<0.0001 |
| Ankle pronation (+)supination(-)             | 8.107 (0.005)   | 0.954        | ICC3,1=0.874 (0.816-0.918), p<0.0001 |
| Knee flexion (+)extension (-)                | 57.876 (0.004)  | 0.972        | ICC3,1=0.921 (0.883-0.949), p<0.0001 |
| Knee valgus (+)varus(-)                      | 3.159 (0.001)   | 0.995        | ICC3,1=0.986 (0.978-0.991), p<0.0001 |
| Knee internal (+)external rotation (-)       | 2.715 (0.031)   | 0.967        | ICC3,1=0.909 (0.865-0.941), p<0.0001 |
| Hip flexion (+)extension (-)                 | 36.519 (0.154)  | 0.987        | ICC3,1=0.962 (0.943-0.976), p<0.0001 |
| Hip abduction (+)adduction (-)               | -15.36 (0.026)  | 0.958        | ICC3,1=0.885 (0.831-0.925), p<0.0001 |
| Hip external (+)internal rotation (-)        | 1.477 (0.002)   | 0.972        | ICC3,1=0.921 (0.882-0.949), p<0.0001 |
| Pelvis flexion (+)extension (-)              | -7.686 (0.101)  | 0.987        | ICC3,1=0.959 (0.938-0.974), p<0.0001 |
| Pelvis lateral flexion                       | 0.422 (0.018)   | 0.951        | ICC3,1=0.867 (0.806-0.913), p<0.0001 |
| Trunk flexion (+)extension (-)               | -0.122 (0.037)  | 0.990        | ICC3,1=0.989 (0.954-0.981), p<0.0001 |
| Trunk lateral flexion                        | 0.12 (0.003)    | 0.951        | ICC3,1=0.868 (0.808-0.914), p<0.0001 |
| Contralateral hip flexion (+)extension (-)   | 17.906 (0.120)  | 0.985        | ICC3,1=0.954 (0.931-0.971), p<0.0001 |
| Contralateral hip abduction (+)adduction (-) | 1.93 (0.045)    | 0.959        | ICC3,1=0.885 (0.832-0.925), p<0.0001 |

**3431 Board #252 May 29 2:30 PM - 4:00 PM**  
**Relationship Of Mets And Muscle Engagement To Learning Of Yoga Postures**

Paula R. Pullen (aka Seffens)<sup>1</sup>, Shane Robinson<sup>1</sup>, William S. Seffens<sup>2</sup>. <sup>1</sup>University of North Georgia, Oakwood, GA. <sup>2</sup>SejTec, Atlanta, GA. (Sponsor: Walter Thompson, FACSM)  
 Email: prseffens@ung.edu  
 (No relevant relationships reported)

**PURPOSE:** We are developing an exergame that provides real-time assessment of performance for yoga postures by measuring basic physiologic parameters analyzed to assess yoga skill acquisition as a means to promote healthy physical activity and wellness.  
**METHODS:** A convenience sample of 20 adult students in a college yoga course were recorded by a Microsoft Kinect 3D digital camera attached to a PC while following instructions from a yoga instructor. Three yoga sessions scheduled as pre-test, mid-way and a post-test were captured during the regularly scheduled yoga class which met twice weekly for 75 minutes, over a 10-week period. In addition for a positive control, we recorded six yoga instructors performing the same series of five yoga postures as the “gold standard” for training using a machine learning classifier. Scoring of frames were performed by at least two yoga instructors. We examined various statistical functions derived from raw frame scores of false and true positives and negatives. The statistical measure of sensitivity showed consistent increasing trends for *Mountain*, *Forward Bend*, and *Upward Salute* postures. For *Mountain*, sensitivity went from 0.78 to 0.87, while the expert’s test clips scored 0.94. Which suggests greater training has occurred as the student postures were closer to the yoga instructor’s poses as the “gold standard”. VO<sub>2</sub> was measured as METS.  
**RESULTS:** We found more difficult or strenuous yoga postures measured higher METS. Repeated Measures analysis of posture learning found significance for majority of yoga postures. We sought to determine if different yoga poses that scored easier to learn based on the linear fit slope of sensitivity correlate with muscle-skeleton complexity of that pose as estimated with total engaged muscle mass. Using literature values of estimated standard muscle masses and identity of muscle engagements in a yoga pose, we ranked yoga poses by total muscle mass engaged. From linear fit slopes, the hardest to learn are *Upward Salute* and *Side Bend* poses, while *Forward Bend* was easiest with greatest slope of learning.  
**CONCLUSIONS:** We developed a score based on the muscle-skeleton complexity of that pose from engaged muscle masses. We find that engaged muscle mass relates to the magnitude of VO<sub>2</sub> and that the greater the engaged muscle mass the easier the posture is to learn.

**3432 Board #253 May 29 2:30 PM - 4:00 PM**  
**Visual Biofeedback Improves Balance Control... Until It Doesn'T**

Adam Goodworth<sup>1</sup>, Sara Fitzhugh<sup>2</sup>, Amy Kratzer<sup>2</sup>, Makenna Lommori<sup>2</sup>, Mark Rowley<sup>2</sup>, Jernique Robertson<sup>2</sup>, Sandra Saavedra<sup>2</sup>. <sup>1</sup>Westmont College, Santa Barbara, CA. <sup>2</sup>University of Hartford, West Hartford, CT.  
 Email: agoodworth@westmont.edu  
 (No relevant relationships reported)

**PURPOSE:** Visual feedback of one’s balance has potential to augment balance training. However, natural visual cues of the environment already provide robust stabilization, and therefore additional visual biofeedback may have little effect on body sway. We quantified the extent to which different types of visual feedback influence sway in a novel trunk balancing task. **METHODS:** Twelve healthy young adults sat on a motorized bench that tilted up and down in direct proportion to trunk sway. This paradigm greatly increases the difficulty of the balance task and requires subjects to rely on visual and vestibular systems. In each trial, participants were provided different types visual feedback through a rotating needle-gage display on a 15 by 20 cm computer monitor located 0.85 m in front of the participant. Trials lasted 100 s, were randomly ordered, and included direct feedback (needle rotated in proportion to body sway), inverted feedback (needle rotated in the opposite direction of sway), time delayed feedback (0.5 s), random feedback RF, eyes closed, and control (eyes open with screen off). Participants were informed “visual feedback might be helpful”. **RESULTS:** Direct feedback trials had a large and significant (p<.05) impact on sway resulting in lower positional variability (root-mean-square, RMS): 62% of control trials. Despite moving in the opposite direction, inverted feedback also reduced sway to appreciable amounts of 80% RMS compared to control, but was not statistically significant. Time delayed feedback only reduced sway to 90% of control RMS. In contrast, random feedback actually significantly (p<.05) increased participants’ sway by 44%, similar to the anticipated significant (p<.05) increases in sway in the eyes closed trial (90% increase). RMS velocity was less impacted by visual feedback with only eyes closed trials associated with significant changes. **CONCLUSION:** Real-time position-based visual feedback had a powerful effect on balance, reducing body sway, while random feedback increased sway. Interestingly, even when participants were trying to ignore the random feedback, it still increased body sway. Results suggest that carefully selected real-time visual feedback could be useful in augmenting balance training during challenging balance tasks. Funding: NSF DARE 1803714

**3433 Board #254 May 29 2:30 PM - 4:00 PM**  
**NOT JUST A FOOTWEDGE - GOLF SPECIFIC FOOTWEAR AND ITS EFFECTS ON HUMAN BALANCE**

Samuel J. Wilson<sup>1</sup>, Paul T. Donahue<sup>2</sup>, Charles C. Williams<sup>3</sup>, Jacob R. Gdovin<sup>4</sup>, James G. Mouser<sup>5</sup>, Jeffrey D. Simpson<sup>6</sup>, Andrew Crawford<sup>1</sup>, Savannah McLain<sup>1</sup>, Abigail Johnson<sup>1</sup>, Jessica Mutchler<sup>1</sup>, Barry Munkasy<sup>1</sup>, John C. Garner<sup>5</sup>. <sup>1</sup>Georgia Southern University, Statesboro, GA. <sup>2</sup>Southern Mississippi University, Hattiesburg, MS. <sup>3</sup>LaGrange College, LaGrange, GA. <sup>4</sup>Missouri State University, Springfield, MO. <sup>5</sup>Troy University, Troy, AL. <sup>6</sup>University of West Florida, Pensacola, FL. (Sponsor: Tamera Hunt, FACSM)  
 Email: sjwilson@georgiasouthern.edu  
 (No relevant relationships reported)

Golfers represent a unique situation in terms of postural control, in that during a normal round of golf, players are on their feet for close to four hours. Several golf specific footwear are available. However, little is known about how these types of golf footwear affect neuromuscular control of the lower extremities over prolonged periods of standing and walking. **PURPOSE:** To examine the effects of duration of walking/standing while barefoot (BF) and wearing a dress shoe (DS), tennis shoe (TS), and minimalist (MIN) style golf shoe, on muscle activity of the lower extremity during standing postural control. **METHODS:** Six male adults completed this study. Standing balance was recorded under six different conditions: eyes open (EO), eyes closed (EC), eyes open sway referenced vision (EOSRV), eyes open sway referenced platform (EOSRP), eyes closed sway referenced platform (ECSR), and eyes open sway referenced vision and platform (EOSRVP). Surface electromyography (EMG) was recorded during balance testing from the left leg vastus medialis (Q), and semitendinosus (H). Raw EMG data were collected at 1,500 Hz, Band-pass filtered (20-250Hz) and rectified prior to analysis. Variables of interest were the mean muscle activity (mV) of each muscle. The testing sessions consisted of a counterbalanced allocation of footwear over 4 separate testing days, separated by at least 48 hours. Each session included muscle activity measures during standing balance every 60 minutes, for 4 hours (pre, 60, 120, 180, 240 minutes). A 4x5 repeated measures ANOVA was used, with an alpha level of 0.05. **RESULTS:** A significant interaction was observed in the EOSRV condition for Q (F(12,60) = 1.945, p = 0.05), suggesting that at 60 minutes, the MIN condition was significantly higher than BF and TS (5.60 > 2.45 & 3.515). Further, a significant interaction was observed in the EOSRP condition for

H ( $F(12,60) = 2.057, p = 0.03$ ). This interaction suggests that at 180 minutes, the DS was significantly higher than the MIN ( $3.980 > 1.812$ ). **CONCLUSION:** The current results suggest that standing postural control measures are altered by footwear differences. Over time it appears that some footwear may cause balance strategy changes possibly due to increased workload on the lower extremity.

**3434** Board #255 May 29 2:30 PM - 4:00 PM  
**Correlation Between Pelvic Tilt Angle, Hip Range Of Motion And Hip Muscles Torque Ratios**  
 Maria C. Herrera, Tal Amasay, Claire Egret, Kathryn Ludwig,  
*Barry University, Miami, FL.*  
 Email: mcrisher89@gmail.com  
 (No relevant relationships reported)

Anterior pelvic tilt is associated with excessive foot pronation, excessive hip internal rotation (HIR), and knee valgus, which may lead to hip muscles strains, sciatic nerve compressions, and sacroiliac and lumbosacral joint instability. Posterior pelvic tilt is associated with feet supination and increased hip external rotation (HER), which may lead to tibial stress fractures, medial tibial stress syndrome, knee pain, anterior cruciate ligament injury, and low back pain. Hip adductors/abductors (add/abd) torque ratio (TR) below 80%, was associated with adductor strains. The average hip flexors/extensors (flex/ext) TR in sport performance was found to be 70%. There is a lack of evidence that correlates pelvic tilt angle with limited HIR, HER, add/abd TR, and flex/ext TR. **PURPOSE:** to examine the correlation between natural pelvic tilt angle and HIR, HER, add/abd TR, and flex/ext TR. **METHODS:** Twenty-six subjects participated in this study, fifteen females ( $22.0 \pm 2.8$  years old,  $163.5 \pm 7.5$  cm,  $65.9 \pm 10.4$  kg) and eleven males ( $22.0 \pm 2.2$  years old,  $178.5 \pm 4.5$  cm,  $78.4 \pm 8.7$  kg). Using a 3D motion analysis system, the measurement of both natural pelvic tilt (NPT) in standing natural position and HIR and HER in lunge position, for the right and left limbs, were recorded. Hip torques were collected with an isokinetic dynamometer, five trials at 30 deg/s and at 60 deg/s. **RESULTS:** The mean value for NPT was  $5.7 \pm 5.4$  deg. There were no significant correlations between NPT and the dependent variables for the right limb: HIR ( $r = -0.16, p = 0.43$ ), HER ( $r = -0.11, p = 0.58$ ), add/abd TR at 30 deg/s ( $r = -0.19, p = 0.34$ ), add/abd TR at 60 deg/s ( $r = -0.13, p = 0.51$ ), flex/ext TR at 30 deg/s ( $r = 0.32, p = 0.10$ ) and flex/ext TR at 60 deg/s ( $r = -0.70, p = 0.70$ ). Similar results were observed for the left limb: HIR ( $r = -0.20, p = 0.89$ ), HER ( $r = -0.25, p = 0.21$ ), add/abd TR at 30 deg/s ( $r = -0.17, p = 0.38$ ), add/abd TR at 60 deg/s ( $r = -0.12, p = 0.55$ ), flex/ext TR at 30 deg/s ( $r = 0.60, p = 0.75$ ) and flex/ext TR at 60 deg/s ( $r = -0.19, p = 0.33$ ). **CONCLUSION:** the measurement of NPT angle in standing natural position is not a good predictor of HIR, HER, add/abd TR, and flex/ext TR. Future research should look at these relations during functional dynamic movements and during pelvic tilt end range of motion.

**3435** Board #256 May 29 2:30 PM - 4:00 PM  
**Effects Of Hip Range Of Motion On Balance With Presence Or Absence Of A Warm-up**  
 Benton McCann, Stephanie Reed, Brett George, Chris Todden.  
*Baker University, Baldwin City, KS.* (Sponsor: Justin Kraft, FACSMM)  
 Email: bentongmccann@stu.bakeru.edu  
 (No relevant relationships reported)

Baseline balance assessments are commonplace in the athletic training field. They are used in comparison with re-evaluations to determine if an injury has occurred. **PURPOSE:** The specific aim of this study was to evaluate in what manner a warm-up effected hip range of motion (ROM) and balance testing in a collegiate population. The significance of this study is to reduce the inconsistencies surrounding baseline balance assessments. Currently there is limited research looking into how hip ROM directly impacts balance. **METHODS:** Data was collected from a total of 16 participants. Participants completed two testing periods under the condition of a biking protocol or a waiting protocol. The biking protocol required participants to cycle on an ergometric bike for 20 minutes at 3-5 METs, while the waiting protocol required no movement for 20 minutes. Immediately following each protocol, a manual goniometer was used to collect ROM values for hip flexion, extension, abduction, and internal and external rotation. The two balance assessments were then completed. Test one consisted of the Balance Error Scoring System (BESS) with the second test utilizing a baseline balance test with the use of force plate technology. Hip ROM values and balance scores were compared between the two conditions. **RESULTS:** A Shapiro test was used to ensure the sample points were approximately normally distributed for the differences between the matched pairs. The flexion values for the left ( $p$ -value  $< .008$ ) and right ( $p$ -value  $< .01$ ) hip joints were found to be significant. All other hip ROM values demonstrated no significance. Significance was found for total errors of the BESS ( $p$ -value  $< .01$ ). No significance was recorded for the force plate balance test. **CONCLUSION:** These results demonstrate the presence of a warm-up increased hip flexion range of motion in both hip joints and also impacted BESS balance scores. In conclusion, this suggests the addition of a warm-up to baseline balance assessment. A larger sample size is needed to further validate these findings.

Supported by American College of Sports Medicine - Central States Region Chapter Undergraduate Research Grant

**3436** Board #257 May 29 2:30 PM - 4:00 PM  
**Stroboscopic Vision-induced Sensory Re-weighting During Dynamic Postural Control**  
 Sean B. Cooley, Seunguk Han, J. Ty Hopkins, FACSMM,  
 Hyunwook Lee. *BYU, Provo, UT.* (Sponsor: Dr. Ty Hopkins, FACSMM)  
 Email: seancooley.hhm@gmail.com  
 (No relevant relationships reported)

Three main sensory systems (somatosensory, visual, and vestibular) contribute to human postural control. These three sensory systems can compensate for each other if one of them lose their orientation information. Adjusting sensory input is referred to as sensory re-weighting. However, due to experimental limits, little is known how disrupted vision affects sensory re-weighting during dynamic postural control. **PURPOSE:** Therefore, this study examined the effect of impaired visual sensory input on dynamic postural control through the use of stroboscopic glasses. **METHODS:** Subjects were 24 physically active adults (male: 12, female: 12, height:  $172.1 \pm 7.8$  cm, weight:  $67.5 \pm 10.4$  kg) recruited from a university population, aged 18-35 years. Each subject performed the star excursion balance test (SEBT), which includes 3 trials comprised of 3 directions (anterior, posteromedial: PM, and posterolateral: PL) on each visual condition (eyes open: EO, Low Strobe frequency Vision: LSV, High Strobe frequency Vision: HSV) Each trial and visual condition was run on both firm and foam surface. Reach distance was analyzed by 2 (surface conditions)  $\times$  3 (vision conditions) ANOVAs. **RESULTS:** In surface condition main effects, subjects performed significantly ( $p < .05$ ) shorter reach distances (anterior, PM, and PL). In vision condition main effects, subjects with EO performed significantly lower reach distances in the PM direction than HSV and LSV ( $p < .05$ , both), and subjects demonstrated shorter reach distance with EO than with LSV in PL direction ( $p < .05$ ). Only with HSV, subjects performed shorter reach distance on the foam surface than the firm surface ( $p < .05$ ). **CONCLUSIONS:** People with impaired visual sensory (strobe vision) input and/or unstable surface tend to have decreased dynamic postural control when tasked to move in a medial and lateral direction. People also demonstrated higher reliance on visual information when the somatosensory function is disturbed. The stroboscopic glasses may be used to identify the reliance of visual information in people who have an altered or reduced somatosensory system.

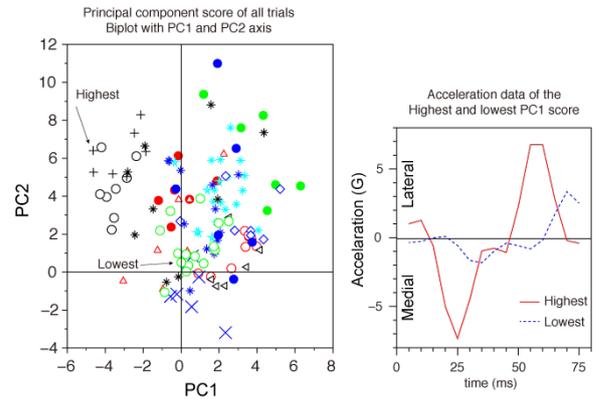
**3437** Board #258 May 29 2:30 PM - 4:00 PM  
**Effect Of Postural Control And Exertion On Dynamic Visual Acuity In Collegiate Athletes.**  
 Katelyn M. Mitchell<sup>1</sup>, Michael E. Cinelli<sup>1</sup>, Kristine Dalton<sup>2</sup>.  
<sup>1</sup>*Wilfrid Laurier University, Waterloo, ON, Canada.* <sup>2</sup>*University of Waterloo, Waterloo, ON, Canada.*  
 (No relevant relationships reported)

Dynamic visual acuity (DVA) requires visuo-perceptual processing to resolve the critical details of a target in motion. Athletes demonstrate superior DVA performance compared to non-athletes in a seated position. **PURPOSE:** To investigate the effects of different postures and exertion levels on DVA in athletes. **METHODS:** Varsity rugby players ( $n = 10$ ; female = 6; age =  $20.4$  yrs  $\pm 1.4$ ) without recent concussion ( $> 2$  years) and/or vestibular-ocular abnormalities were included. DVA was assessed using a custom program (moV&V&MP, University of Waterloo, Ontario) displayed on a 55" LCD monitor at a viewing distance of 4m. The program presented a randomly (RW) or horizontally (H) moving letter 'E' target facing left/right/up/down. Participants had to correctly identify the orientation of the target with a keypad as it progressively reduced in size. DVA was scored as the log of the minimum angle of resolution (LogMAR), of the smallest target correctly identified (i.e., low score = better DVA). Participants completed one RW and H trial at a speed of 2.31m/s ( $30^\circ/s$ ) during four conditions: seated; standing; and treadmill walking at low (85-100 beats per minute [bpm]) and moderate (115-130bpm) intensities. **RESULTS:** The difference in LogMAR scores from the seated condition were calculated for each of the other conditions. There were no interaction effects of target motion and posture ( $F = 1.02, p = .382$ ), and no main effect of target motion ( $F = 0.30, p = .598$ ). However, there was a trending main effect of posture (Stand: 0.00 vs. Walk Low: -0.14 vs. Walk Mod: 0.04  $p = .056, f = 0.25$ ). These findings indicate that athletes' DVA improved from seated during moderate intensity treadmill walking more so than both standing and low-intensity treadmill walking. **CONCLUSION:** Athletes appear to have improved DVA in sport-specific conditions of greater postural and exertional demands. Therefore, sport training experience may enhance visuo-perceptual skills. These findings may inform clinicians to consider the assessment of DVA with progressive, dynamic contexts for rehabilitation, such as for return to sport from concussion.

**3438** Board #259 May 29 2:30 PM - 4:00 PM  
**Comparison Of Balance Between Middle-aged Adult Olympic Weightlifters And Runners**

Bryan L. Riemann, Mara A. Mercardo, Kayleigh R. Erickson, Gregory J. Grosicki. *Georgia Southern University-Armstrong Campus, Savannah, GA.*  
 Email: briemann@georgiasouthern.edu  
 (No relevant relationships reported)

Beginning at about middle-age (e.g., 40 to 50yrs), notable declines in strength, balance and functional performance begin to occur; however, participation in physical activity has been demonstrated to slow down the progression of these age-related declines. Middle-age runners (RUN) are demonstrated to exhibit superior balance compared to healthy age-matched counterparts. Whether similar balance benefits occur in middle-age Olympic weightlifters (OWL) has not been studied. **PURPOSE:** To compare balance performance between middle-age adults regularly participating in either OWL or RUN. **METHODS:** A total of 48 National Masters Olympic Weightlifting competitors (22 females, 47.3±8.5yrs) and 42 (17 females, 47.7±8.5yrs) distance RUN who were training at least 30km/week participated in two 30s balance testing trials on firm (FI) and foam (FO) surfaces with eyes open (EO) and eyes closed (EC). Medial-lateral center of pressure velocities (MLCPV) were averaged across trials for each condition and natural logarithm transformed to reduce positive skewness. Bivariate coefficients (separate by group) between age, height, mass, years of experience, and body mass index (BMI) with MLCPV were performed followed by a three factor (exercise group x gender x condition) repeated measures analysis of variance. **RESULTS:** No significant ( $P>0.08$ ) relationships for the OWL between MLCPV and age, height, mass, BMI and experience ( $r = -.230$  to  $.211$ ) were revealed. For the RUN, age was significantly related ( $P=0.043$ ) to MLCPV across all four conditions ( $r = .313$  to  $.360$ ). While there were no significant differences between the groups for either EO-FI ( $P=0.143$ ,  $d = .34$ ) or EO-FO ( $P=0.209$ ,  $d = .26$ ), the OWL demonstrated significantly better balance (lower MLCPV) than the RUN for both EC-FI ( $P=0.009$ ,  $d = .59$ ) and EC-FO ( $P=0.001$ ,  $d = .70$ ). There were no significant differences related to gender ( $P>0.05$ ). **CONCLUSIONS:** The most salient result was the identification of better balance performance by the OWL, particularly when visual inputs were unavailable, compared to the RUN. As Olympic weightlifting involves high-velocity whole-body movements, the OWL may develop an enhanced ability to utilize vestibular and somatosensory inputs to compensate for the absence of visual information.



**3439** Board #260 May 29 2:30 PM - 4:00 PM  
**Classification Of Lower Limb Frontal Plane Excursion During Single-legged Landing Using Principal Component Analysis Of Inertia Sensor Data**

Issei Ogasawara<sup>1</sup>, Yohei Shimokochi<sup>2</sup>, Susumu Iwasaki<sup>3</sup>, Ken Nakata<sup>1</sup>. <sup>1</sup>*Osaka University, Toyonaka, Japan.* <sup>2</sup>*Osaka University of Health and Sport Sciences, Sennan, Japan.* <sup>3</sup>*Fort Lewis College, Durango, CO.*  
 Email: ogasawaraissei@hss.osaka-u.ac.jp  
 (No relevant relationships reported)

**PURPOSE:** This study aimed to evaluate the temporal pattern of the frontal-plane lower limb translation during single-legged landing using the principal component analysis (PCA) of the inertial sensor data. **METHODS:** Eighteen legs from nine healthy women were tested. Participants performed a total of six single-legged landings for each leg. The wearable inertial sensor was fixed at the participant's tibial tuberosity. The x-axis of the inertia sensor was aligned to the transverse axis of the shank segment, and the mediolateral acceleration of the proximal end of the shank segment was measured at 200Hz. The time window of interest was 0 to 75 ms after foot contact (15 data points). The acceleration data matrix (108 trials \* 15 data point) from all trials of all participants was constructed for PCA. Eigenvalues and eigenvectors of the covariance matrix of the acceleration data matrix were calculated to identify the principal components (PC). **RESULTS:** The first two PCs explained more than 90% of total data variation (1st PC 69.7%, and 2nd PC 21.7%). The 1st PC represented the medially directed abrupt acceleration of the proximal shank, and the 2nd PC showed the slow but oscillated knee motion. The athlete of the highest PC score of the 1st PC showed a rapid medial knee motion just after foot impact, whereas the lowest one showed a stable knee motion after landing. **CONCLUSIONS:** PCA using acceleration signals successfully classified the degree of the medial knee translation after single-legged landing and screened the athletes who had a rapid medial knee translation. The abrupt increase of the medial knee translation has reported being a risk of non-contact anterior cruciate ligament (ACL) injury; therefore, the PCA based evaluation would be a useful technology for risk prediction of the non-contact ACL injury.

**3440** Board #261 May 29 2:30 PM - 4:00 PM  
**Gathering Your 'Sea Legs': Changes In Postural Control Following Extended Duration In An Offshore Environment**

Nicole K. Rendos<sup>1</sup>, Clark F. Bailey<sup>1</sup>, Samuel J. Wilson<sup>2</sup>, Harish Chander<sup>3</sup>, Jeffrey D. Simpson<sup>1</sup>. <sup>1</sup>*University of West Florida, Pensacola, FL.* <sup>2</sup>*Georgia Southern University, Statesboro, GA.* <sup>3</sup>*Mississippi State University, Mississippi State, MS.*  
 (No relevant relationships reported)

Mal de débarquement (MdD) is the subjective perception of self-motion experienced after prolonged episodes of passive motion (PM) such as a boat ride (e.g. sea legs). Transient MdD (< 48 hours) occurs frequently and is described as a rocking, bobbing, or swaying sensation accompanied by unsteadiness and disequilibrium after cessation of the PM stimulus, and is suggested to impact postural control. **PURPOSE:** To examine changes in postural control after prolonged exposure to boat movement at sea. **METHODS:** Postural control of 24 adults (13 M, 11 F; age = 35 ± 12 y; height = 170.3 ± 8.8 cm; mass = 84.2 ± 17.0 kg) was assessed in bilateral stance on a force platform with eyes open (EO), eyes closed (EC), foam surface eyes open (FEO), and foam surface eyes closed (FEC) before (PRE) and after (POST) a 7-hour deep sea fishing excursion. Postural control measurements including average sway (cm), sway range (cm), sway velocity (cm/s), and maximum sway velocity (cm/s) were analyzed in the medial/lateral (ML) and anterior/posterior (AP) directions. Time-to-boundary (TTB) measures of postural control (minimum, average, SD of minima) were computed. All variables were compared PRE/POST using a paired *t*-test and Cohen's *d* effect sizes were calculated. **RESULTS:** Greater ML sway excursion was observed POST in EC ( $t = 2.37$ ,  $p = .013$ ,  $d = 0.66$ , PRE = 0.13 ± 0.04, POST = 0.18 ± 0.10), FEO ( $t = 2.95$ ,  $p = .004$ ,  $d = 0.46$ , PRE = 0.40 ± 0.14, POST = 0.47 ± 0.17), and FEC ( $t = 2.03$ ,  $p = .027$ ,  $d = 0.42$ , PRE = 0.50 ± 0.12, POST = 0.55 ± 0.15). Greater AP sway excursion was observed POST in FEO ( $t = 1.77$ ,  $p = 0.045$ ,  $d = 0.38$ , PRE = 0.63 ± 0.17, POST = 0.72 ± 0.30) and FEC ( $t = 2.18$ ,  $p = 0.02$ ,  $d = 0.48$ , PRE = 0.87 ± 0.21, POST = 0.98 ± 0.24). ML sway range ( $t = 3.34$ ,  $p = .001$ ,  $d = 0.54$ , PRE = 2.42 ± 0.66, POST = 2.87 ± 0.99) and AP sway range ( $t = 2.18$ ,  $p = 0.020$ ,  $d = 0.53$ , PRE = 4.01 ± 0.80, POST = 4.64 ± 1.56) increased POST in FEO. Maximum AP sway velocity increased POST in EO ( $t = 1.73$ ,  $p = 0.049$ ,  $d = 0.45$ , PRE = 4.20 ± 1.26 cm/s, POST = 5.14 ± 2.93 cm/s). Analysis of TTB measures did not reveal PRE/POST differences among any condition. **CONCLUSION:** Extended durations on a boat at sea increase postural sway upon returning to land. These findings suggest that 'sea legs' impairs the ability to re-weight appropriate sensory information in conditions dependent on somatosensory and vestibular feedback.

**3441** Board #262 May 29 2:30 PM - 4:00 PM  
**Reactive Balance Differences Between Collegiate Sports**

Benjamin Cassidy, Amanda Morris, Ryan Pelo, Nora F. Fino, Craig Chelette, Jonathan Burke, Vitor G. Carioca, Angela P. Presson, Leland E. Dibble, Peter C. Fino. *University of Utah, Salt Lake City, UT.*  
 Email: b.cassidy@utah.edu  
 (No relevant relationships reported)

Static and dynamic postural stability have been characterized in athletes and shown to differ across sports. However, these tests of stability may not specifically capture the

balance required for reactive athletic movements. The Push-and-Release (P&R) test is a standardized clinical tool used to assess reactive postural control in balance-impaired populations.

**PURPOSE:** To examine differences between sport team and task (single [ST] and dual task [DT]) in reactive postural response measures.

**METHODS:** 40 healthy, male athletes (age  $18.50 \pm 0.75$ ; body mass index [BMI]  $24.11 \pm 2.38$ ) were recruited from 3 collegiate teams: baseball ( $n=12$ ), lacrosse ( $n=17$ ), and swimming ( $n=11$ ). Reactive postural responses were assessed using the P&R in backward and forward directions under ST and DT (concurrent verbal cognitive task) conditions. All conditions were performed with eyes closed. Inertial sensors on the sternum, lumbar, feet, and right tibia were used to assess step latency (L), time of first heel contact (HC), and time to stabilization (TTS). A sensor on the tester's hand was used to determine release time. To assess if postural response measures differ by sport and task, linear mixed effects models with random intercepts and stratified by direction (forward or backward), were used and adjusted for age and BMI.

**RESULTS:** Lacrosse players had faster L compared to baseball players in the forward direction ( $p=0.018$ ). No other differences by sport were observed. In the forward direction, DT outcomes were slower than ST outcomes (L:  $p<0.0001$ ; HC:  $p=0.0004$ ; TTS:  $p=0.0064$ ). In the backward direction, L was slower in the DT condition ( $p=0.0034$ ), but no task differences were found for HC or TTS ( $p=0.0628$  and  $p=0.8733$ , respectively).

**CONCLUSION:** In the forward direction only, DT slowed all postural responses. While L differed between lacrosse and baseball in the forward direction, no other differences were found across sports. As most outcomes were unaffected by sport, the P&R may be a clinically relevant assessment in athletics. However, due to the limited sample size, caution should be applied when interpreting these findings and future studies are needed.

Supported by PAC 12 Student Athlete Health & Wellbeing (PI: Fino, Dibble) and University of Utah Study Design and Biostatistics Center through NCATS Grant 8UL1TR000105.

**3442 Board #263 May 29 2:30 PM - 4:00 PM**  
**Reactive Postural Responses In Collegiate Athletes**

Amanda Morris, Benjamin Cassidy, Ryan Pelo, Nora F. Fino, Nick E. Monson, Daniel M. Cushman, Angela P. Presson, Leland E. Dibble, Peter C. Fino. *University of Utah, Salt Lake City, UT.*  
 (No relevant relationships reported)

Athletes frequently need to recover balance after an external disturbance during tasks with high cognitive demand. Mobility impaired populations demonstrate deficits in reactive postural responses to backward and lateral perturbations but, little is known about postural responses in college athletes.

**PURPOSE:** To examine differences in direction and task (single [ST] and dual task [DT]) in reactive postural response measures during the push-and-release (P&R) test.

**METHODS:** Reactive postural responses in 98 healthy ( $F=42$ , age  $19.3 \pm 1.60$  years, BMI  $23.56 \pm 3.29$  kg/m<sup>2</sup>) college athletes were assessed using the P&R in four directions (forward, backward, right, left), with eyes closed, under ST and DT (concurrent verbal cognitive task) conditions. Inertial sensors on the sternum, lumbar, right tibia, and feet were used to assess step initiation latency, time of first heel contact (HC), and time to stabilization (TTS). A sensor on the tester's hand determined release time. Linear mixed models with random intercepts were used to determine if postural response measures differed by direction and task.

**RESULTS:** There was a significant interaction between direction and task for HC ( $p=0.04$ ), with the largest difference in DT and ST in the forward direction ( $95\%CI = [0.05, 0.08]$ ), and the smallest difference in the backward direction ( $95\%CI = [0.02, 0.05]$ ). There were also significant main effects for direction ( $p<0.0001$ ) and task ( $p<0.0001$ ) for each postural response (latency, HC, TTS). Means adjusted for age, sex, and BMI are presented below.

|                         | Latency (s)        | Time to Stabilization (s) | Heel Contact (s)   |
|-------------------------|--------------------|---------------------------|--------------------|
| <b>Direction</b>        |                    |                           |                    |
| Backward                | 0.13 (0.12 - 0.14) | 1.19 (1.14 - 1.24)        | -                  |
| Left                    | 0.18 (0.17 - 0.19) | 1.02 (0.97 - 1.08)        | -                  |
| Right                   | 0.17 (0.17 - 0.18) | 1.03 (0.98 - 1.09)        | -                  |
| Forward                 | 0.20 (0.19 - 0.21) | 1.06 (1.01 - 1.11)        | -                  |
| <b>Task</b>             |                    |                           |                    |
| Dual                    | 0.20 (0.19 - 0.20) | 1.15 (1.11 - 1.20)        | -                  |
| Single                  | 0.15 (0.14 - 0.15) | 1.00 (0.96 - 1.04)        | -                  |
| <b>Direction x Task</b> |                    |                           |                    |
| Backward, Dual          | -                  | -                         | 0.47 (0.45 - 0.48) |
| Backward, Single        | -                  | -                         | 0.43 (0.42 - 0.45) |
| Left, Dual              | -                  | -                         | 0.52 (0.51 - 0.53) |
| Left, Single            | -                  | -                         | 0.47 (0.45 - 0.48) |
| Right, Dual             | -                  | -                         | 0.53 (0.51 - 0.54) |
| Right, Single           | -                  | -                         | 0.46 (0.45 - 0.48) |
| Forward, Dual           | -                  | -                         | 0.57 (0.55 - 0.58) |
| Forward, Single         | -                  | -                         | 0.50 (0.49 - 0.51) |

**CONCLUSION:** Postural responses differ by direction during the P&R in college athletes. The largest differences were between the forward and backward directions. These directions may be most sensitive to detecting changes in reactive postural control; future work will examine the utility of the P&R for return-to-play decisions. Supported by PAC 12 (PI: Fino, Dibble); University of Utah Study Design and Biostatistics Center (UL1TR002538)

**3443 Board #264 May 29 2:30 PM - 4:00 PM**  
**THE EFFECTS OF GOLF SPECIFIC FOOTWEAR ON MUSCLE ACTIVATION DURING STANDING POSTURAL CONTROL**

Andrew Crawford<sup>1</sup>, Paul T. Donahue<sup>2</sup>, Charles C. Williams<sup>3</sup>, Jacob R. Gdovin<sup>4</sup>, James G. Mouser<sup>5</sup>, Jessica Mutchler<sup>1</sup>, Barry A. Munkasy<sup>1</sup>, John C. Garner<sup>5</sup>, Samuel J. Wilson<sup>1</sup>. <sup>1</sup>Georgia Southern University, Statesboro, GA. <sup>2</sup>Southern Mississippi University, Hattiesburg, MS. <sup>3</sup>LaGrange College, LaGrange, GA. <sup>4</sup>Missouri State University, Springfield, MO. <sup>5</sup>Troy University, Troy, AL. (Sponsor: Tamerah Hunt, FACSM)  
 Email: ac08610@georgiasouthern.edu  
 (No relevant relationships reported)

Postural control in golf represents an unusual challenge as players are on their feet four hours or more. Several golf specific footwear are available, though, little is known about how these footwear affect human balance. **PURPOSE:** To examine the effects of durations of walking/standing while barefoot (BF) and wearing a dress shoe (DS), tennis shoe (TS), and minimalist (MIN) style golf shoe, on muscle activity of the lower extremity during balance. **METHODS:** Six male adults completed this study. Balance was recorded under six conditions: eyes open (EO), eyes closed (EC), eyes open sway referenced vision (EOSRV), eyes open sway referenced platform (EOSRP), eyes closed sway referenced platform (ECSR), and eyes open sway referenced vision and platform (EOSRVP). Surface electromyography (EMG) was recorded during balance testing from the left leg tibialis anterior (DF), and medial gastrocnemius (PF). Raw EMG data were collected at 1,500 Hz, Band-pass filtered (20-250Hz) and rectified. Variables of interest were the mean muscle activity (mV) of each muscle. Testing sessions consisted of a counterbalanced allocation of footwear over 4 separate days, separated by at least 48 hours. Each session included muscle activity measures during balance every 60 minutes, for 4 hours (pre, 60, 120, 180, 240 minutes). A 4x5 repeated measures ANOVA was used, with an alpha level of 0.05. **RESULTS:** A significant interaction was observed in the EO condition for PF muscle activity ( $F(12,60) = 1.94$ ,  $p = 0.04$ ). With the MIN muscle activity significantly lower than TS, and DS at 2 hours ( $4.16 < 6.86 & 6.58$ ). An interaction was also observed in the EOSRV condition for the PF ( $F(12,60) = 1.97$ ,  $p = 0.048$ ), suggesting that at 4 hours, the DS was significantly higher than the MIN ( $9.96 > 5.83$ ). A footwear effect was observed for the EC condition

(F(3,12) = 3.96,  $p = 0.035$ ). With the MIN condition significantly higher than the DS (3.06 > 1.77). A time effect was observed in the EOSRV condition for the DF (F(4,16) = 3.86,  $p = 0.022$ ), with muscle activity at 60 minutes, significantly lower than 120 and 180 (1.86 < 2.56 & 2.30) **CONCLUSION:** These results indicate a possible shift in balance strategy, particularly when visual information is removed. Certain golf specific footwear may increase the workload on the ankle musculature and cause a shift to a more hip/knee balance strategy.

**3444** Board #265 May 29 2:30 PM - 4:00 PM  
**The Relationship Between Functional Movement And Balance**  
 Layci J. Harrison<sup>1</sup>, Lindsey K. Lepley<sup>2</sup>, Sandra L. Stevens<sup>3</sup>, Dana K. Fuller<sup>3</sup>, John M. Coons<sup>3</sup>, Jennifer L. Caputo<sup>3</sup>. <sup>1</sup>University of Houston, Houston, TX. <sup>2</sup>University of Michigan, Ann Arbor, MI. <sup>3</sup>Middle Tennessee State University, Murfreesboro, TN. (Sponsor: Don Morgan, FACSM)  
 Email: lharris5@central.uh.edu  
 (No relevant relationships reported)

Layci J. Harrison, Lindsey K. Lepley, Sandra L. Stevens, Dana K. Fuller, John M. Coons, Jennifer L. Caputo.  
 University of Houston, Houston, TX; University of Michigan, Ann Arbor, MI; Middle Tennessee State University, Murfreesboro, TN.  
 Functional movement assessments are used to predict injury in multiple populations, but the components that most contribute to functional movement are unknown. Identifying the influence of static balance via the Balance Error Scoring System (BESS) and dynamic balance via the Y-Balance Test (YBT), can provide valuable information to clinicians. This knowledge can be used to help individuals improve functional movement screening (FMS) scores which, in turn, can reduce injury risk. **PURPOSE:** To examine the contributions of static and dynamic balance on functional movement. **METHODS:** Participants from the general population ( $N = 77$ ; men = 31; women = 46; average age =  $42 \pm 16$  years) completed the FMS, YBT, and BESS during one laboratory visit. **RESULTS:** Together, YBT and BESS were significant predictors of FMS scores ( $p < .001$ ,  $R^2 = .54$ ). Individually, both YBT ( $p < .001$ ,  $R^2 = .498$ ) and BESS ( $p < .001$ ,  $R^2 = .321$ ) were significant predictors of FMS scores. When controlling for age ( $p < .001$ ,  $R^2$  Change = .364) and history of lower body surgery ( $p < .001$ ,  $R^2$  Change = .532), the YBT and BESS were still significant predictors of the FMS. Risk of injury according to YBT risk and FMS risk were not associated,  $\chi^2(1, N = 77) = 1.20, p = .273$ ,  $Cramer's V = .125$ . There was a significant association between BESS risk and FMS risk,  $\chi^2(1, N = 77) = 9.29, p = .01$ ,  $Cramer's V = .347$ . **CONCLUSION:** Static and dynamic balance both contribute to functional movement. This information can be used when developing training and rehabilitation protocols to reduce injury risk as measured by FMS.

**3445** Board #266 May 29 2:30 PM - 4:00 PM  
**The Impact Of Balance With Visual Feedback On Tibialis Anterior/gastrocnemius Neuromuscular Activity In Healthy Young Adults.**  
 Daniel heistand, Abigail Versemann, Martin G. Rosario. *Texas Woman's University, Dallas, TX.*  
 Email: mrosario1@twu.edu  
 (No relevant relationships reported)

Balance is a functional activity that must be worked on in rehabilitation of every type of back and lower extremity pathology or trauma. With these types of issues, balance generally will become impaired, requiring activities to increase the patient's stability. **PURPOSE:** To identify the impact of balance activities with visual cues on lower extremity muscle activation timing. **METHODS:** This study assessed muscle activation and postural strategies during different visual feedback activities on a balance board with a fix middle fulcrum. Fifteen young, healthy adults were recruited and performed seven tasks on two different levels of difficulty. The various visual activities were projected to a wall, 10 feet away from the balance board. Participants had to follow a target by moving the balance board in 7 pre-set different tasks. Participants had surface electromyography on tibialis and gastrocnemius muscles. Gastrocnemius and tibialis anterior muscle activation were recorded with EMGworks software for each trial. In the analysis of the electromyography data, the following variables were measured: time to peak muscle activation, time to decay of muscle contraction, and time of muscle contraction duration. A repeated measure ANOVA was used for all the variables of interest. **RESULTS:** High and lower fulcrum balance boards appear to provoke similar muscle activation among all variables ( $P > 0.05$ ). TA muscle compensates differently on the rear twist (RT), front twist (FT), and counter clock (CC) balance maneuvers compared to the other four tasks. TA showed a faster Timed to peak [seconds] (RT 0.007+/-0.001, FT 0.007+/-, CC 0.009.005 +/- .004;  $P < 0.001$ ), rapid decay [seconds] (TT .008+/-0.005, FT 0.10+/-0.1, CC 0.009+/-0.005;  $P < 0.001$ ), and shorter time of duration [seconds] (RT 0.2+/-0.001, FT 0.2+/-0.1, CC 0.02+/- 0.005;  $P < 0.001$ ) of muscle activation.

**CONCLUSIONS:** Balance with visual feedback can provoke a different muscle activation pattern in lower extremities muscles, such as tibialis anterior. For patients with balance alteration related to nerve conduction or muscle weakness on the lower extremity, we recommend activities were muscle activation is a challenge due to the surface but also due to visual feedback/cortex interplay.

**3446** Board #267 May 29 2:30 PM - 4:00 PM  
**The Effect Of Renewal Massage And Modified Squat Exercise On Body Alignment In Genu Varum Patients**  
 Hee-Bok Song, Han-Joon Lee, Sung-Jin Hong, Kyun-Sang Yoon, Myung-Il Seo. *University of Ulsan, Ulsan, Korea, Republic of.* (Sponsor: Minsoo Kang, FACSM)  
 (No relevant relationships reported)

**PURPOSE:** This study evaluates the effect on body alignment three weeks after massage and squat exercise in patients with genu varum. **METHODS:** Twenty-one participants with genu varum have participated in the study and randomly assigned into 3 groups: renewal massage group ( $n=7$ ), modified squat exercising group ( $n=8$ ), and controlled group ( $n=6$ ). A renewal massage is a full body massage that begins with the central part of the body and proceeds with the whole body. Renewal massage and modified squats exercising were carried out for three weeks, five times a week, and 40 minutes per week. Dependent variables were C-spine angle, T-spine angle, L-spine angle, sacral inclination angle, femoral-tibial angle of both right and left. Descriptive analyses including mean and standard deviation were computed for all variables using SPSS/PC ver 18.0, and the group mean difference was analyzed as ANCOVA with the pre-test values as covariates. The post-hoc test was performed with the least significant difference (LSD). The significance level set at .05. **RESULTS:** The ANCOVA result indicated that after controlling for differences in pre-test values, there was a significant difference in the sacral inclination angle (F[2,17] = 3.590,  $p < .05$ ). The post-hoc test result showed that the renewal massage group ( $19.86 \pm 3.18$ ) has lower mean than control group ( $34.63 \pm 4.07$ ). No statistical significance difference was found on C-spine angle, T-spine angle, L-spine angle, femoral-tibial angle of both right and left. **CONCLUSIONS:** The three-weeks renewal massage seems to have differed only in the sacral inclination angle. Further studies are warranted to examine the effect of dose-response relationship (i.e., changing the duration and frequency) for the renewal massage.

**F-65** Free Communication/Poster - Concussion and Behavior  
 Friday, May 29, 2020, 1:30 PM - 4:00 PM  
 Room: CC-Exhibit Hall

**3447** Board #268 May 29 1:30 PM - 3:00 PM  
**Fronto-parietal Network Hyperconnectivity As A Result Of Head Impacts In College Ice Hockey**  
 Melissa S. DiFabio<sup>1</sup>, Daniel R. Smith<sup>1</sup>, Katherine M. Breedlove<sup>2</sup>, Thomas A. Buckley<sup>1</sup>, Curtis L. Johnson<sup>1</sup>. <sup>1</sup>University of Delaware, Newark, DE. <sup>2</sup>Center for Clinical Spectroscopy, Brigham and Women's Hospital, Boston, MA.  
 Email: mdifabio@udel.edu  
 (No relevant relationships reported)

Impairment in executive functioning has been reported as a result of sustaining repetitive, sports-related head impacts (RHI) after just one season of play. Brain networks associated with executive functioning may be damaged by RHI, which can be assessed through resting-state functional connectivity (rs-FC) with fMRI, which has previously shown connectivity to be affected by RHI. **PURPOSE:** To examine rs-FC related to the fronto-parietal network (FPN) over the course of an ice hockey season. **METHODS:** Twenty-three collegiate club ice hockey players (19M/4F) were divided into two groups: Impact (men's forwards/defensemen,  $n=17$ ) and No Impact (goalenders and women,  $n=6$ ). Players were scanned on a Siemens Prisma 3T scanner prior to the first game of their season (PRE) and within two weeks of their final game (POST). Six seed regions-of-interest (ROIs) within the FPN were selected for rs-FC analysis: R/L middle frontal gyrus, R/L posterior parietal cortex, and R/L lateral prefrontal cortex; all data analysis was completed using SPM12/Conn Toolbox. A 2x2 repeated measures ANOVA was performed to test for significant ( $p < 0.01$ ) group-by-time interactions. A secondary regression analysis was performed in a subset of Impact players ( $n=13$ ) to identify if accelerometer (Triax, Norwalk, CT) and video confirmed total number of head impacts sustained over a season were predictive of PRE/POST changes in rs-FC. **RESULTS:** A significant group-by-time interaction was found in connectivity between the R middle frontal gyrus and R posterior parietal cortex ( $T = 3.49, p < .01$ ); post-hoc analysis revealed significant POST hyperconnectivity in the Impact group only ( $T = 2.96, p < .01$ ) and no PRE/POST changes were noted in the No

Impact group. Total number of impacts (54.8±33.5) significantly predicted POST hyperconnectivity between the L lateral prefrontal cortex and L pallidum ( $r^2=0.79$ ,  $p=0.001$ ).

**CONCLUSIONS:** Post-season hyperconnectivity between ROIs involved in executive functioning was found in athletes who regularly sustain impacts compared to those who do not, which is consistent with previous rs-FC RHI findings in different networks. Hyperconnectivity has been suggested to represent brain injury and players who sustain more impacts may be more likely to have neurological damage that results in deficits in executive function.

**3448** Board #269 May 29 1:30 PM - 3:00 PM  
**Identifying The Educational Needs Of 9<sup>th</sup> And 10<sup>th</sup> Grade High School Students Regarding Concussion**  
 Brent A. Harper, *Chapman University, Irvine, CA*. (Sponsor: A. Lynn Millar, FACSM)  
 Email: ptmi@aol.com  
*(No relevant relationships reported)*

**PURPOSE:** To evaluate adolescent concussion knowledge and behaviors regarding concussion using a modified Rosenbaum Concussion Knowledge and Attitudes Survey (RoCKAS) questionnaire.

**METHODS:** RoCKAS questionnaire was taken by female and male 9<sup>th</sup> and 10<sup>th</sup>-grade high school students ( $n=190$ ) with a mean age of  $15.1 \pm 0.8$  years (64.7% female; 35.3% male). 59.4% reported belonging to a competitive sports team. A sampling of questions from the RoCKAS questionnaire was used to assess groups for (1) general concussion knowledge and (2) the demonstration of safe attitudes and behaviors in situational decision making ("safe" or "unsafe").

**RESULTS:** Validity scale scores were appropriate, meaning participants were actually reading and answering the questions thoughtfully. General concussion knowledge was correctly answered by 83.8% ( $p=0.007$ ). Those not participating in athletics were less knowledgeable than those participating in sports (20.1%). Males not participating in sports answered incorrectly 23.4% of the time. There was no statistical significance comparing females in relation to sports participation. Responses to the four situational questions analyzed identified answers to be unsafe on the behavior questions 87.1 % of the time ( $p=0.0001$ ). In fact, the actual age of the participants negatively correlated with the behavior answers ( $r=-0.4$ ,  $p=0.0001$ ).

**CONCLUSIONS:** High school 9<sup>th</sup> and 10<sup>th</sup>-graders are knowledgeable about concussion. Those participating in sporting teams are more knowledgeable, especially males. There is no knowledge differences between females who participate or do not participate in sports. Situation based questions indicate an unacceptable level of safety, suggesting poor behaviors in return-to-play (RTP) and concussion reporting decisions, which was worse in older individuals. The RoCKAS information may be helpful to identify behavior deficits that can inform cohort-specific concussion educational programs designed to enhance the safety of youth athletics.

**3449** Board #270 May 29 1:30 PM - 3:00 PM  
**Fear Of Re-injury Correlates With Concussion Symptoms And Reaction Time Among Adolescents With Concussion**  
 Sarah Elizabeth Reinking<sup>1</sup>, Julie C. Wilson<sup>2</sup>, Gregory C. Walker<sup>2</sup>, Corrine Seehusen<sup>1</sup>, David R. Howell<sup>1</sup>. <sup>1</sup>*Children's Hospital Colorado, Aurora, CO*. <sup>2</sup>*University of Colorado School of Medicine, Aurora, CO*.  
 Email: sarah.reinking@childrenscolorado.org  
*(No relevant relationships reported)*

**Background:** Athletes appear to be at an increased risk of musculoskeletal injury following return to play after concussion. Underlying causes are likely multi-factorial but not well established. Fear of re-injury has been widely studied in musculoskeletal injuries, but its effect on concussion recovery is unknown.

**Purpose:** To examine the association of fear of re-injury with physical and self-reported measures after concussion. We hypothesized that greater fear of re-injury would be correlated with a higher symptom severity, worse sleep quality, and worse physical test performance.

**Methods:** Athletes ( $n=19$ ;  $15.0 \pm 1.8$  years of age; 42% female;  $7.4 \pm 3.3$  days post-injury) were tested within 14 days of concussion, and underwent assessments of self-reported and physical examination measures. Self-reported measures included the Tampa Scale of Kinesiophobia (TSK)- assessing fear of re-injury, Post-Concussion Symptom Inventory (PCSI), and Pittsburgh Sleep Quality Index (PSQI). Physical examination measures included clinical reaction time, near point of convergence, single and dual-task tandem gait, and Balance Error Scoring System (BESS). We examined correlations between TSK scores and each outcome measure using Pearson correlation coefficients, adjusting for age, sex, and time from injury using linear regression models.

**Results:** Higher TSK scores were significantly correlated with higher symptom severity (PSCI) scores ( $r=0.69$ ;  $p=0.001$ ) and slower reaction times ( $r=0.53$ ;  $p=0.02$ ). TSK scores were not significantly correlated with single-task tandem gait ( $r=0.23$ ;

$p=0.34$ ), dual-task tandem gait ( $r=0.29$ ;  $p=0.23$ ), PSQI ( $r=0.43$ ;  $p=0.08$ ), NPC ( $r=0.03$ ;  $p=0.91$ ), or BESS ( $r=0.23$ ;  $p=0.35$ ) scores. After adjusting for the effect of age, sex, and time from injury to examination, higher TSK scores were significantly associated with slower clinical reaction time performance ( $\beta=2.8$ ; 95% CI= 0.94, 4.62;  $p=0.006$ ), greater symptom severity ( $\beta=3.64$ ; 95% CI=2.07, 5.21;  $p<0.001$ ), and worse sleep quality ( $\beta=0.37$ ; 95% CI= 0.05, 0.68;  $p=0.03$ ).

**Conclusions:** In accordance with our hypothesis, higher TSK scores were correlated with higher symptom severity and slower reaction times. This suggests that assessing an athlete's fear of re-injury may be useful following concussion and throughout recovery.

**3450** Board #271 May 29 1:30 PM - 3:00 PM  
**Neurofilament Light Not Associated With Concussion History Or Recency In Special Operations Forces Combat Soldiers**  
 Jacob R. Powell<sup>1</sup>, Adrian J. Boltz<sup>1</sup>, Jamie P. DeCicco<sup>1</sup>, Avinash Chandran<sup>1</sup>, Stephen M. DeLellis<sup>2</sup>, Marshall L. Healy<sup>3</sup>, Shawn F. Kane, FACSM<sup>3</sup>, James H. Lynch, FACSM<sup>3</sup>, Gary E. Means<sup>3</sup>, Jason P. Mihalik, FACSM<sup>1</sup>. <sup>1</sup>*The University of North Carolina at Chapel Hill, Chapel Hill, NC*. <sup>2</sup>*Defense Medical Strategies LLC, Fayetteville, NC*. <sup>3</sup>*United States Army Special Operations Command, Fort Bragg, NC*. (Sponsor: Jason Mihalik, FACSM)  
 Email: jrpowell@unc.edu  
*(No relevant relationships reported)*

Special Operations Forces (SOF) combat soldiers sustain high rates of blast and blunt neurotrauma. Most are mild traumatic brain injuries (i.e., concussion). Repetitive concussions may develop long-term neurological sequelae. Detecting the effects of cumulative exposure to concussion may be helpful to recognize and intervene therapeutically before chronic symptoms begin emerging. Neurofilament light chain (NfL) is an abundantly expressed cytoskeletal component of large caliber myelinated subcortical axons. Peripheral increases may indicate ongoing axonal disruption or chronic repetitive white matter injury within the brain.

**PURPOSE:** To determine the effects of concussion history, lifetime incidence, and recency on NfL concentrations in SOF combat soldiers. **METHODS:** 185 SOF combat soldiers (age=33.0±3.5 yrs) participated in our cross-sectional study and self-reported concussion history (90 no, 95 yes), lifetime incidence (0, 1, 2, 3+) and recency (<1 month, <1 year, >1 year). Fasted blood samples were obtained from an antecubital vein at a standardized time for all subjects. Serum was separated and stored until analysis. Serum NfL levels were quantified using sandwich enzyme immunoassay kits according to manufacturer instruction. Medians and interquartile ranges (IQRs) were reported because NfL concentrations were not normally distributed. A Wilcoxon rank-sum analysis compared NfL concentrations between those with and without concussion history. Kruskal-Wallis tests compared NfL concentrations across lifetime incidence and recency. **RESULTS:** We did not observe differences in NfL concentrations ( $z=1.80$ ,  $p=0.07$ ) between those with (median=449.7 pg/mL, IQR=192.1) and without (median=484.4 pg/mL, IQR=221.2) concussion history. There was no effect of concussion lifetime incidence ( $X^2(3)=3.87$ ,  $p=0.28$ ) or recency ( $X^2(2)=0.86$ ,  $p=0.65$ ) on serum NfL concentrations. **CONCLUSION:** We did not observe differences in serum NfL concentration in SOF combat soldiers based on concussion history, lifetime incidence, and recency. Our SOF combat soldiers were otherwise healthy and asymptomatic. Despite this, our findings suggest SOF combat soldiers demonstrated higher NfL concentrations than those reported for civilian severe brain injury and neurodegenerative disease patients.  
 Funded by USASOC

**3451** Board #272 May 29 1:30 PM - 3:00 PM  
**Parent Beliefs Regarding Chronic Traumatic Encephalopathy Associated With Sport-related Concussion**  
 Katherine Ford Daniels, Abigail C. Bretzin, Morgan Anderson, Marco Alcala, Ara Schmitt, Erica Beidler. *Allegheny Health Network, Pittsburgh, PA*.  
 Email: klfdid10@gmail.com  
*(No relevant relationships reported)*

**PURPOSE:** To determine CTE beliefs of youth athletes' parents, and examine the association of sex and prior concussion history with those views.

**METHODS:** This was a cross-sectional survey study of parents ( $n=467$ ; males = 185, females = 282; history of concussion = 52) of youth contact sport athletes (i.e., football, soccer, ice hockey, lacrosse). The survey included items on demographics, diagnosed concussion history, and a standardized concussion knowledge assessment with two exploratory items about CTE beliefs. Parents were asked if CTE was a complication of multiple concussions and premature return-to-play. The 15-minute

survey was administered on-site after practices/events. The association between CTE beliefs, sex (male/female), and concussion history (yes/no) were assessed using chi-square analyses with significance set at  $p \leq .05$ .

**RESULTS:** A majority 70.7% (n=319/451) of parents indicated CTE was a complication of multiple concussions; 67.1% (n=294/438) identified CTE was a complication of returning to play prematurely. A greater proportion of male parents (77.4%, n=137/177) indicated CTE was a complication of multiple concussions compared to female parents (66.3%, n=181/273;  $\chi = 6.38, p = .01, V = .12$ ). A greater proportion of male parents (74.6%, n=129/173) identified CTE was a complication of premature return to play compared to female parents (62.1%, n=164/264;  $\chi = 7.32, p = .007, V = .13$ ). There were no significant associations between diagnosed concussion history and CTE beliefs ( $\chi^2$ 's = .51-1.52,  $p$ 's = .22-.47,  $V$ 's = .03-.06).

**CONCLUSIONS:** Parents commonly recognized CTE as a complication of multiple concussions and premature return to play, which shows they are aware of this neurodegenerative condition. Additionally, a greater proportion of male parents endorsed CTE beliefs compared to females. This finding could be a byproduct of the media's attention towards CTE cases in male athletes specifically. Future research should consider how beliefs about CTE may influence sport participation within a family unit.

**3452 Board #273 May 29 1:30 PM - 3:00 PM**  
**Associations Of Concussion And Playing History With Clinical Outcomes In Young College Football Alumni**  
 Samuel R. Walton<sup>1</sup>, Benjamin L. Brett<sup>2</sup>, Avinash Chandran<sup>1</sup>, J. D. DeFreese<sup>1</sup>, Kelly S. Giovanello<sup>1</sup>, Amy Nader<sup>2</sup>, Zachary Y. Kerr<sup>1</sup>, Michael McCrea<sup>2</sup>, Kevin M. Guskiewicz, FACSM<sup>1</sup>. <sup>1</sup>University of North Carolina at Chapel Hill, Chapel Hill, NC. <sup>2</sup>Medical College of Wisconsin, Milwaukee, WI. (Sponsor: Dr. Kevin Guskiewicz, FACSM)  
 Email: srwalton@email.unc.edu  
 (No relevant relationships reported)

The effects of concussion history (CH) and years of playing football on cognitive function and mood-related symptoms in former football players is unclear. Most former player studies include mid-to-late life individuals, and little is known about younger cohorts.  
**PURPOSE:** Assess the influence of CH and years played on cognitive function, mood-related symptoms, and life satisfaction in former football players.  
**METHODS:** Former collegiate football players (n = 58; age 37.9 ± 1.5 years; BMI 31.3 ± 5.0 kg/m<sup>2</sup>) from 16 schools completed a health survey and subsequent in-person evaluation 15 yrs post-college football. Outcomes included cognitive tests: Symbol Digit Modalities Test (SDMT), Controlled Oral Word Association Test (COWAT), revised Hopkins Verbal Learning Test (HVLTr), and Trails A (TMTA) and B (TMTB); and self-reported outcomes: NeuroQOL Cognition Short Form (NQC), Beck Depression Inventory (BDI-II) and Anxiety (BAI-II) inventories, and Satisfaction with Life Scale (SWLS). Current symptom severity (SS) was reported on the Graded Symptom Checklist alongside typical hours slept per night. CH was split into tertiles: 0-1, 3-6, or 7+ prior concussions. Multivariable linear regression models were used to assess the influence of CH and years played on each outcome with BMI, sleep, and SS as covariates.  
**RESULTS:** Model predictors and adjusted R<sup>2</sup> values are in Table 1. Higher SS was associated with worse outcomes on most measures. Worse SDMT scores were partially explained by greater CH and years played. In addition to SS, greater CH related to better COWAT performance; those with more sleep had longer TMTA times; and those with lower BMI and more sleep had higher SWLS.  
**CONCLUSIONS:** Our data show no clear influence of CH or years played on cognitive function, mood-related symptoms, or life satisfaction. In our relatively young sample, SS at the time of testing was associated with worse outcomes. Continued longitudinal analyses may explain age related changes on these outcomes.

Table 1. Backwards Removal Regression Coefficients.

| Outcomes                | Adj. R <sup>2</sup> | Predictors         |     |                          |      |                 |     |                        |      |                        |      |
|-------------------------|---------------------|--------------------|-----|--------------------------|------|-----------------|-----|------------------------|------|------------------------|------|
|                         |                     | Concussion History |     | Years of Football Played |      | Body Mass Index |     | Average Sleep Duration |      | Total Symptom Severity |      |
|                         |                     | Beta               | p   | Beta                     | p    | Beta            | p   | Beta                   | p    | Beta                   | p    |
| SDMT                    | .159                | -.22               | .08 | -.43                     | <.01 | ...             | ... | ...                    | ...  | ...                    | ...  |
| COWAT                   | .068                | .23                | .09 | ...                      | ...  | ...             | ... | ...                    | ...  | -.30                   | .03  |
| HVLTr Total Score       | .057                | ...                | ... | ...                      | ...  | ...             | ... | ...                    | ...  | -.27                   | .04  |
| HVLTr Percent Retention | N/A                 | ...                | ... | ...                      | ...  | ...             | ... | ...                    | ...  | ...                    | ...  |
| HVLTr Recognition       | N/A                 | ...                | ... | ...                      | ...  | ...             | ... | ...                    | ...  | ...                    | ...  |
| TMTA                    | .155                | ...                | ... | ...                      | ...  | ...             | ... | .45                    | .001 | .27                    | .05  |
| TMTB                    | .115                | ...                | ... | ...                      | ...  | ...             | ... | ...                    | ...  | .36                    | <.01 |
| NQC                     | .440                | ...                | ... | ...                      | ...  | ...             | ... | ...                    | ...  | -.67                   | <.01 |
| BDI-II                  | .522                | ...                | ... | ...                      | ...  | ...             | ... | ...                    | ...  | .73                    | <.01 |
| BAI-II                  | .591                | ...                | ... | ...                      | ...  | ...             | ... | ...                    | ...  | .77                    | <.01 |
| SWLS                    | .176                | ...                | ... | ...                      | ...  | -.23            | .06 | .26                    | .05  | -.22                   | .09  |

Standardized Betas and p-values are presented only for the final model of predictors remaining after the backwards elimination process for each outcome. Removal criterion p-value was  $\geq .1$ . SDMT = Symbol Digit Modalities Test, COWAT = Controlled Oral Word Association Test, HVLTr = Hopkins Verbal Learning Test - Revised, TMTA = Trail Making Test A, TMT B = Trail Making Test B, NQC = NeuroQOL Cognitive Function Short Form, BDI = Beck Depression Inventory, BAI = Beck Anxiety Inventory, SWLS = Satisfaction With Life Scale, Adj. R<sup>2</sup> = Adjusted R<sup>2</sup> value for the regression model of each outcome.

**3453 Board #274 May 29 1:30 PM - 3:00 PM**  
**Sport-related Concussion Reporting Behaviors And Non-disclosure Patterns Of Youth Contact Sport Athletes**  
 Abigail Cecelia Bretzin<sup>1</sup>, Morgan Anderson<sup>2</sup>, Ara Schmitt<sup>3</sup>, Erica Beidler<sup>3</sup>. <sup>1</sup>University of Pennsylvania, Philadelphia, PA. <sup>2</sup>Michigan State University, East Lansing, MI. <sup>3</sup>Duquesne University, Pittsburg, PA.  
 Email: Abigail.Bretzin@Pennmedicine.upenn.edu  
 (No relevant relationships reported)

Current literature on sport-related concussion (SRC) reporting behaviors and reasons for non-disclosure is dominated by older athletic populations. Youth athletes participating in contact sports are at risk for SRC; however, little is known about SRC disclosure patterns and reasons for non-disclosure in this group. **PURPOSE:** To examine SRC reporting behaviors and reasons for non-disclosure in youth contact sport athletes.  
**METHODS:** Youth athletes (n = 442; 66.5% male, 33.5% female) aged 8-14 years participating in football (22.4%), ice hockey (26.5%), lacrosse (24.9%), and soccer (26.2%) completed a 15-minute survey composed of demographics, diagnosed and non-disclosed SRC history, and reasons why they did not report a suspected SRC. The survey was adapted for elementary school readability and researchers were present to clarify any athlete questions. Descriptive statistics expressed frequencies of self-reported diagnosed SRC, suspected SRC non-disclosure, and reasons for non-disclosure.  
**RESULTS:** A total of 44 (10%) youth contact sport athletes recalled a diagnosed SRC; 68.1% (n = 30) of those recalled 1, 20.5% (n = 9) recalled 2, and 13.6% (n = 6) recalled  $\geq 3$  diagnosed SRC. Youth athletes also indicated they thought they had a SRC but still played in a practice (n = 55, 13.0%) or game (n = 51, 12.0%), respectively. While, 50 (11.8%) athletes reported they thought they sustained a SRC and did not report it to anyone. The most common reasons for non-disclosure selected by youth athletes included: I did not want to lose playing time (n = 33, 66.0%), I did not want to miss a game (n = 10, 56.0%), at the time I did not think it was a concussion (n = 26, 52%), I did not want to let my team down (n = 23, 46%).  
**CONCLUSIONS:** Epidemiological evidence of SRC in this setting is lacking; however, these novel results identified 10% of youth athletes self-reported a previous SRC. Significantly, 13% of athletes indicated they remained in play with a suspected SRC and 12% of athletes did not report their suspected SRC to anyone. Youth athletes' reasons for non-disclosure were similar to those reported in high school and college athletes. Recent research suggests negative consequences of continued play with SRC, especially in acute stages. Future educational initiatives should emphasize these risks, and focus on reasons why athletes withhold reporting.

3454 Board #275 May 29 1:30 PM - 3:00 PM

**Assessing The Relationship Between Depression-related Symptoms And Post-concussion Clinical Outcomes**Christine E. Callahan<sup>1</sup>, Robert D. Moore<sup>2</sup>, Alison A. Crew<sup>3</sup>, Michael Vesia<sup>4</sup>, Johna K. Register-Mihalik<sup>1</sup>, Steven P. Broglio<sup>4</sup>.  
<sup>1</sup>University of North Carolina at Chapel Hill, Chapel Hill, NC.  
<sup>2</sup>University of South Carolina, Columbia, SC. <sup>3</sup>Michigan State University, East Lansing, MI. <sup>4</sup>University of Michigan, Ann Arbor, MI.

Email: chriscal@live.unc.edu

(No relevant relationships reported)

Concussive injury and depression affect millions of individuals each year and are connected through common overlapping symptoms. **PURPOSE:** Aim 1 was to establish an association between post-concussion depression-related symptoms and post-concussion symptoms, balance performance, vestibular function, and executive function. Aim 2 was to further establish the relationship between concussion history and post-concussion depression-related symptoms, concussion symptoms, and mood disturbance. **METHODS:** 164 concussed individuals (mean age=14.52±3.51 years, 50.61% male, mean time from injury=18.24±13.60) were included in this analysis. Depression-related symptoms were quantified using the Beck Depression Inventory (BDI-II) and post-concussion symptoms using the Rivermead Post-Concussion Symptoms Questionnaire (RPQ). Clinical post-concussion assessments utilized were the modified Balance Error Scoring System (mBESS), Vestibular/Ocular-Motor Screening (VOMS), and, for adolescent patients, the Behavior Rating Inventory of Executive Function (BRIEF). Mood disturbance was quantified using the Profile of Mood States (POMS). mBESS, VOMS, RPQ, and BRIEF were measured against BDI-II scores using Pearson Correlation and Linear Regression analyses. BDI-II, POMS, and RPQ scores were analyzed based on concussion history using Wilcoxon Rank-Sum Tests. **RESULTS:** As depression-related symptoms increased, post-concussion symptoms ( $p<0.001$ ,  $r=0.68$ ) and VOMS scores measuring changes in headache and dizziness ( $p<0.001$ ,  $r=0.34$ ;  $p=0.01$ ,  $r=0.20$  respectively) significantly increased. There was no significant correlation between depression-related symptoms and balance performance ( $p=0.093$ ,  $r=0.13$ ). In adolescents, as depression-related symptoms increased parent reported executive function decreased ( $p<0.001$ ,  $r=0.46$ ). Those who reported a concussion history reported significantly more depressive-related symptoms ( $p=0.004$ ), concussion symptoms ( $p=0.004$ ), and mood disturbance ( $p=0.002$ ). **CONCLUSION:** This study adds to the current literature surrounding the relationship between concussion and depression by identifying a relationship between depression related symptoms, post-concussion symptoms, and post-concussion clinical assessments.

3455 Board #276 May 29 1:30 PM - 3:00 PM

**Nonverbal Hand Movements Indicate Symptoms After Sport Related Concussions**Ingo Helmich. *Department of Neurology, Psychosomatic Medicine, and Psychiatry, Cologne, Germany.*

Email: i.helmich@dshs-koeln.de

(No relevant relationships reported)

Because post-concussion symptoms are often not clearly visible, speech-accompanying gestures may help clinicians to gain additional information about the patient's history and symptoms during medical consultation. **PURPOSE:** We hypothesized that athletes with SRC and who suffered from persisting symptoms would display more gestures during concussion assessment protocols when compared to non-concussed athletes because of the athletes' previous motor-sensory experiences made during the concussive event. **METHODS:** Three matched groups of 40 (active) athletes were investigated in the context of concussion assessment (and baseline) protocols: 14 symptomatic and 14 asymptomatic athletes with a SRC, and 12 non-concussed athletes. Certified raters using a standard analysis system for nonverbal behavior analyzed videotaped hand movements and gestures during a standardized concussion assessment protocol. **RESULTS:** Symptomatic athletes spent significantly more time with *in space* hand movements, i.e., movements that act in the body-external free space without touching anything and specifically, *motion quality presentation* gestures than non-concussed athletes. **CONCLUSIONS:** Increased *in space* movements, which are functionally gestures, and specifically, *motion quality presentation* gestures in symptomatic athletes indicate that the more vivid sensory motor experience of the head trauma is reflected in more gestural expressions. Thus, hand movements and gestures differentiate athletes who suffer from post-concussion symptoms from non-concussed athletes indicating the athletes' motor-sensory experiences of the event and its aftereffects. The present study highlights the fact that gestures can be employed as behavioral markers of symptoms after sport-related concussions.

3456 Board #277 May 29 1:30 PM - 3:00 PM

**Baseline Concussion Symptom Reporting As A Possible Screening Method For Generalized Anxiety Disorder**Eric E. Hall, FACSM, Anna Keane, Emma McCabe, Emily Klevan, Ethan Williams, Caroline J. Ketcham. *Elon University, Elon, NC.*

Email: ehall@elon.edu

(No relevant relationships reported)

Athletes with previous diagnosis of a psychiatric condition, such as depression or anxiety, have been shown to experience a larger overall concussion symptom score compared to those without a previous psychiatric treatment. Anxiety rates in college students is high (42%) with student-athletes only slightly lower (37%) compared to the general population (18%). **PURPOSE:** The purpose of this study was to compare concussion-related anxiety symptoms and validated anxiety disorder screeners to see if baseline concussion symptoms could be used as a screening tool for follow-up mental health assessments. **METHODS:** 254 club level collegiate student-athletes (18.2±1.4yrs, 150 female, 104 male) completed the Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) including the 22-item Post-Concussion Symptom Scale (PCSS), the Patient Reported Outcome Measurement Information System (PROMIS-29), and the Depression Anxiety Stress Scales (DASS-21). DSM-5 Anxiety symptoms were compared to the PCSS symptoms and an anxiety-related concussion symptom score was calculated. These along with the anxiety sub-scores for both the DASS-21 and PROMIS-29 were used for analysis. **RESULTS:** Participants were divided into 4 anxiety level groups based on norms from the DASS-21 (normal=36; mild=76; moderate=87; severe=28). There was a significant correlation ( $p<0.001$ ) between Anxiety Cluster PCSS symptom score and DASS-21 anxiety subscale ( $r=.41$ ) and PROMIS-29 Anxiety Sub-score ( $r=.44$ ). The DASS-21 and PROMIS-29 were also significantly correlated ( $r=.64$ ,  $p<0.001$ ). There were significant group differences across the 4 DASS-21 anxiety levels for Anxiety Symptom Cluster ( $F(4, 226)=9.27$ ,  $p<0.001$ ) and the PROMIS-29 Anxiety subscale ( $F(4, 223)=31.01$ ,  $p<0.001$ ). **CONCLUSIONS:** The significance from this data shows that the proposed symptom clusters that potentially pertain to anxiety symptoms are meaningfully related to higher scores on the DASS-21 and the PROMIS-29 anxiety related questions. Participants that demonstrated a higher overall concussion-related anxiety symptom score were more likely to exhibit more severe levels of anxiety suggesting that this cluster score could potentially screen individuals at risk for anxiety disorders thus providing a pathway to refer and provide resources and support.

**F-66 Free Communication/Poster - Metabolism and Behavior**

Friday, May 29, 2020, 1:30 PM - 4:00 PM

Room: CC-Exhibit Hall

3457 Board #278 May 29 1:30 PM - 3:00 PM

**SELF-PERCEIVED HEALTH AND PHYSICAL FUNCTION ARE ASSOCIATED WITH BODY COMPOSITION AND BLOOD LIPIDS**Madison Filippini, Emilija Peleckas, Alexandra I. Hopun, Gabrielle A. Volk, Melanie Ziazaris, Kyle L. Timmerman, FACSM. *Miami University, Oxford, OH.* (Sponsor: Kyle Timmerman, FACSM)

(No relevant relationships reported)

Clinical indicators of health status such as body composition, blood lipids, and cardiorespiratory fitness are objective; however, self-perceived health may be influenced by multiple factors. Thus, the **PURPOSE** of the present study was to explore associations among objective measures of health, self-perceived health, and habitual physical activity in overweight, older adults. **METHODS:** In 35 (27 F/8 M) overweight (body mass index, BMI $\geq 27$  kg/m<sup>2</sup>), older adults (>58 years) we assessed blood lipids (point-of-care analyzer); body composition (bioelectrical impedance); habitual physical activity (7-day accelerometry); cardiorespiratory fitness (VO<sub>2</sub>max); and self-perceived health (36-item short form survey, SF-36). The SF-36 includes questions that assess eight health concepts including perceptions of physical function and general health. Scores for each concept can range from 0% (poor) to 100% (excellent). Associations were assessed utilizing partial correlations (controlling for age and sex). Significance was set to  $p<0.05$ . **RESULTS:** Average values for these subjects included: age: 64±5y; SF-36 (general health): 63±14%; SF-36 (physical function): 77±16%; BMI: 35±5 kg/m<sup>2</sup>; body fat percentage: 44.7±0.1%; VO<sub>2</sub>max: 16±3 ml/kg/min; moderate-to-vigorous physical activity (MVPA): 47±23 min/day; LDL cholesterol: 105±27 mg/dL, HDL cholesterol: 49±11 mg/dL, triglycerides: 113±40 mg/dL, and glucose: 100±15 mg/dL. Self-perceived physical function was

significantly ( $p < 0.05$ ) correlated with indices of body composition and blood lipids [body fat percentage ( $r = -0.39$ ), visceral fat area ( $r = -0.42$ ), and LDL cholesterol ( $r = -0.51$ )], but not habitual MVPA. Self-perceived general health was significantly correlated with LDL/HDL ( $r = -0.60$ ), but not indices of body composition or physical activity level. **CONCLUSIONS:** These preliminary data suggest that perception of general health and physical function are more closely related to indices of body composition and blood lipids than habitual physical activity level.

**3458 Board #279 May 29 1:30 PM - 3:00 PM**  
**Contributors To Percent Body Fat In Career Firefighters**

Gena R. Gerstner<sup>1</sup>, Megan R. Laffan<sup>2</sup>, Abigail J. Trivisonno<sup>2</sup>, Hayden K. Giuliani<sup>2</sup>, Jacob A. Mota<sup>2</sup>, Johna Register-Mihalik<sup>2</sup>, Abbie Smith-Ryan, FACSM<sup>2</sup>, Brian G. Pietrosimone, FACSM<sup>2</sup>, Joseph P. Weir, FACSM<sup>3</sup>, Eric D. Ryan<sup>2</sup>. <sup>1</sup>Old Dominion University, Norfolk, VA. <sup>2</sup>University of North Carolina at Chapel Hill, Chapel Hill, NC. <sup>3</sup>University of Kansas, Lawrence, KS. (Sponsor: Joseph Weir, FACSM)  
 (No relevant relationships reported)

Firefighters have substandard levels of fitness and a high prevalence of overweight and obesity. Understanding exercise status and barriers to exercise may be important factors regarding body composition. **PURPOSE:** The purpose of this study was to examine the influence of exercise status and barriers to exercise on percent body fat (%BF) in career firefighters. **METHODS:** Fifty-eight male career firefighters [age: 31.3±7.0 yrs; stature: 178.9±7.6 cm; body mass: 90.0±17.6 kg; %BF: 23.5±7.5%] volunteered for this investigation. Participants self-reported exercise status and rated sixteen barriers to exercise (e.g., too busy) on a Likert-type scale (1-7). Dual-energy X-ray absorptiometry was used to assess %BF. Aerobic exercise time [AER = moderate intensity minutes + (vigorous intensity minutes × 2)] and resistance training workload [RT = days × minutes × intensity] were calculated. Pearson's correlation coefficients were used to determine the relationships between %BF and potential predictor variables including AER, RT, and the sixteen barriers. The significant exercise barriers were averaged into one construct (BAR). The internal consistency of BAR was measured using Cronbach's alpha. Multicollinearity was monitored using the variance inflation factor (VIF). Stepwise regression analysis was conducted. An alpha level was set *a priori* at 0.05 for all analyses. **RESULTS:** %BF was related to AER ( $r = -0.364; P = 0.005$ ) and RT ( $r = -0.400; P = 0.002$ ). Seven of the sixteen barriers (i.e., too busy, not enough time, irregular work hours, family obligations, interferes with work, too tired, lack of support from officers) were significantly related with greater %BF ( $r = 0.270-0.354; P = 0.006-0.042$ ) and were included in the final construct BAR. The Cronbach's alpha for BAR was 0.80. The stepwise analysis suggests that AER and BAR were significant predictors of %BF ( $R^2 = 0.306, P < 0.001$ ; maximum VIF = 1.98). **CONCLUSIONS:** These findings suggest that firefighters with poorer body composition likely partake in less aerobic exercise and experience greater perceived barriers to exercise. Interventions aiming to mitigate barriers to exercise, specifically aerobic exercise, may be helpful in improving body composition.

**3459 Board #280 May 29 1:30 PM - 3:00 PM**  
**Examining The Perceived Barriers To Physical Activity Among Older Adults: Moderating Effects Of Body Mass Index**

Stephan Anlauf<sup>1</sup>, Eric Faßl<sup>1</sup>, Marc Lochbaum<sup>2</sup>, Youngdeok Kim<sup>3</sup>. <sup>1</sup>Ruhr-Universität Bochum, Bochum, Germany. <sup>2</sup>Texas Tech University, Lubbock, TX. <sup>3</sup>Virginia Commonwealth University, Richmond, VA. Email: stephan.anlauf@rub.de  
 (No relevant relationships reported)

Lack of physical activity (PA) is a major public health concern, especially for older people. However, data on possible factors limiting older adults' engagement in PA are still under-investigated. **PURPOSE:** The purpose of this study is twofold: 1) to examine the association of perceived PA barriers with leisure-time PA (LTPA) in a sample of older adults; and 2) to explore the possible moderating effect of body mass index (BMI). **METHODS:** 296 older adults aged ≥60 years old took part in a cross-sectional survey. LTPA was measured by the International Physical Activity Questionnaire and participants were categorized into the three groups, no-LTPA group for individual who did not report LTPA; and below/upper 50<sup>th</sup> percentile of total LTPA MET values for low- and high-LTPA groups, respectively. Barriers to being active questionnaire (BBAQ) was used to assess perceived PA barriers in a binary manner (i.e., no barrier/at least 1 barrier) for each of the seven domains (i.e., time, social, energy, will, injury, skill, and resources). BMI (kg/m<sup>2</sup>) was calculated by self-reported height and weight and used to create the three BMI groups (BMI <25, 25-29.99, and ≥30). Using a no-LTPA group as a referent, a multinomial logistic regression model predicting the likelihoods of being low- and high LTPA groups was established after adjusting for study covariates, followed by stratified analyses by BMI groups. **RESULTS:** In general, "lack of will" (49.66%) was the most frequently cited PA barrier followed by "social influence" (38.51%) and "fear of

injury" (36.49%). In the fully adjusted multinomial logistic regression model, greater perceived barrier in "social influence" was associated with lower odds of reporting high-LTPA (odds ratio (OR) = 0.41). In the follow-up stratified analyses demonstrated that PA barriers differently affect LTPA levels by BMI groups. Among individuals with BMI between 25 and 29.99, "lack of time" (OR = 0.11) was the significant predictor of LTPA level. Whereas, "fear of injury" (OR = 0.11) and "lack of energy" (OR = 0.18) were the significant factors associated with LTPA among those with BMI ≥30. **CONCLUSIONS:** The present study provides relevant data on barriers to LTPA for older adults. Promotion and intervention strategies should consider the exposed barriers of older adults in order to reduce their obstacles to PA.

**3460 Board #281 May 29 1:30 PM - 3:00 PM**  
**Sex-specific Correlates Of Metabolic Syndrome Risk In College Students**

Alexandra N. Smith<sup>1</sup>, Ewan R. Williams<sup>2</sup>, Bhibha M. Das<sup>3</sup>, Michael V. Fedewa<sup>4</sup>, Ellen M. Evans, FACSM<sup>2</sup>, Simon Higgins<sup>1</sup>. <sup>1</sup>Elon University, Elon, NC. <sup>2</sup>University of Georgia, Athens, GA. <sup>3</sup>East Carolina University, Greenville, NC. <sup>4</sup>University of Alabama, Tuscaloosa, AL. (Sponsor: Ellen Evans, FACSM)  
 (No relevant relationships reported)

Over half of college students possess ≥1 metabolic syndrome (MetS) risk factors, with each subsequent risk factor increasing lifetime cardiovascular disease risk. As opposed to taking a reactionary response to established disease, early behavioral intervention may be effective in preventing MetS risk advancement. While correlates of MetS in the general adult population have been described, ideal targets for sex-specific primary prevention strategies in college students are unknown. **PURPOSE:** To identify the sex-specific prevalence of MetS risk factors and their correlates in a college-aged population. **METHODS:** First-year students aged 18-20 y/o ( $n=390$ ; 67.4% female; 70% white) were screened for traditional MetS risk factors using IDF/AHA/NHLBI harmonized criteria. Potential correlates of MetS risk included inflammatory markers, relative adiposity, anxiety, depression, stress, diet, physical activity, alcohol consumption, smoking, and sleep. Principal component analysis was used to construct sex-specific continuous MetS risk scores, with waist circumference, systolic blood pressure, HDL-C, and fasting glucose, insulin, and triglycerides as factors in the final model. Two principal components with an eigenvalue ≥1 created the continuous MetS risk score, explaining 51.2% and 54.2% of the variance in risk in females and males, respectively. Multivariate linear regression assessed the relationships between potential correlates and MetS risk score. **RESULTS:** One or more MetS risk factors were present in 66.9% of males and 59.3% of females, with 3.1% and 2.3% having defined MetS, respectively. In females, % kcal from sugar ( $\beta = .25, p = .001$ ), stress ( $\beta = .19, p = .003$ ), and relative adiposity ( $\beta = .45, p < .001$ ) were positively associated with MetS risk, whereas moderate to vigorous physical activity ( $\beta = -.12, p = .028$ ) and anxiety ( $\beta = -.15, p = .017$ ) were negatively associated with MetS risk. In contrast, correlates in males included race ( $\beta = .24, p = .002$ ; coded as non-white=0, white=1), C-reactive protein ( $\beta = .20, p = .006$ ), and relative adiposity ( $\beta = .53, p < .001$ ), with % kcal from saturated fat approaching significance ( $\beta = .23, p = .064$ ). **CONCLUSION:** The sex-specific prevalence of MetS risk factors and correlates suggest that a one-size-fits-all approach to prevention may not be effective in this population.

**3461 Board #282 May 29 1:30 PM - 3:00 PM**  
**How Motivation Affects Our Training And Nutrition Goals: A Comparison Between Bodybuilders And Overweight Women**

Henry Chan, Roberta C. Muzy, Paula H. D. Kanas, Luciana O. P. Lancha, Ivan S. Rabelo, Katia Rubio, Paulo C. Muzy, Antonio H. Lancha JR. University of São Paulo (USP), São Paulo, Brazil. Email: henry.chan@usp.br  
 (No relevant relationships reported)

Bodybuilders are well known by their addiction to the perfect physique, requiring not only a strong body, but also a strong mind. This potential psychological, motivational, emotional and dedication in bodybuilding has significant impact in athletes' lives, supporting self-control, confidence, individual's social realization and mood. Moreover, their motivation and self-control are important skills for a competition. On the other hand, most part of the population doesn't have this strong motivation, struggling a bit more with nutrition and training programs. In nutritional studies, the "triangle" defined by trigger, behavior and reward really influence how people stick to a diet plan and their actions facing a goal related to losing or gaining weight. **PURPOSE:** The aim of this research is to study how the strong mind, dedication of bodybuilders, associated with intrinsic and extrinsic motivation, affect their success through a nutritional program, in comparison to non-athletes. Furthermore, we also want to understand the relevance of behavior and locus of control differences between these two groups. **METHODS:** The current study was designed to compare two groups ( $n=18$ ): bodybuilders women ( $n=10$ ) and overweight women ( $n=8$ ). The data were collected by

survey monkey link, composed by 12 sentences about nutrition and training lifestyle with 3 column each: depend on myself, depend on a reward and depend on others. Participants were requested to answer by classifying how the sources of control affect each item with scales from 1 to 5 (1- very low influence, 5- very high influence). The average of each question and column were calculated for comparison. **RESULTS:** According to the protocol, the column "depend on myself" had the same average 4.9/5 for bodybuilders and overweight women. For "depend on others" the athletes average was 1.2/5 and for non-athletes 1.4/5. The major difference was regarding "depend on a reward" with an average of 2.7/5 for the bodybuilders group and 1.9/5 for non-athletes. **CONCLUSIONS:** When discussing about motivation in fitness and nutrition goals, we concluded that a source of reward is much more significant to athletes.

**3462** Board #283 May 29 1:30 PM - 3:00 PM  
**Diabetes Prevention Program: An Investigation Of Lifestyle Coaches' Habits And Motivations**

Melanie K. Sookiasian<sup>1</sup>, Selen Razon<sup>1</sup>, Patricia G. Davidson<sup>1</sup>, Umit Tokac<sup>2</sup>, Melissa A. Reed<sup>1</sup>. <sup>1</sup>West Chester University, West Chester, PA. <sup>2</sup>University of Missouri, St Louis, MO.  
 Email: MS803524@WCUPA.EDU

(No relevant relationships reported)

The Diabetes Prevention Program (DPP) was created after a 27-center randomized clinical trial was conducted to determine if lifestyle intervention alone, or combined with pharmacological therapy could prevent or delay the onset of Type 2 Diabetes (T2DM). Lifestyle intervention decreased the incidence of T2DM by 58% compared with a 31% reduced incidence in the pharmacological group. A key component of the DPP are lifestyle coaches (LC). LC deliver curriculum intended to initiate and promote lifestyle change to individuals at risk for T2DM. Little is known about the behaviors of the LC. **PURPOSE:** The purpose of this study was to investigate the habits and motivations of LC to elucidate their motivations for coaching. **METHODS:** A sixteen item electronic survey was emailed to LC. Data was analyzed using descriptive and qualitative analyses, as well as chi-square tests. **RESULTS:** Sixty-three participants (60 female, 3 male) (Age range = 18-75+) responded to the survey. Descriptive analyses indicated that the majority of responding coaches worked in healthcare fields (59.65%) and achieved  $\geq 150$  minutes of physical activity (PA) per week (68.42%). Qualitative analyses indicated two types of motivation for coaching: internal (N=19) and external motivation (N=36). External motivation further included two sub-themes external-others (N=11) and external-self (N=25). Additional chi-square analyses revealed that those with bachelor and master's degrees, and working full time in healthcare occupations reported significantly less incidence of diabetes ( $p < .05$ ) and higher instances of achieving 150 minutes or more PA per week ( $p < .05$ ). **CONCLUSION:** These results suggest that lifestyle coaches are employed mainly in healthcare fields and are motivated to coach by external factors. The results indicate coaches may serve as appropriate role models in the adoption of PA behaviors and could help with training, delivery, and recruitment efforts for future coaches. Supported by Health Promotion Council (HPC) Grant.

**3463** Board #284 May 29 1:30 PM - 3:00 PM  
**Obesity In Adolescence: Does Motor Competence Or Physical Activity Matter?**

Xiangli Gu<sup>1</sup>, Weiyun Chen<sup>2</sup>, Tao Zhang<sup>3</sup>. <sup>1</sup>University of Texas at Arlington, Arlington, TX. <sup>2</sup>University of Michigan, Ann Arbor, MI. <sup>3</sup>University of North Texas, Denton, TX.  
 Email: xiangli.gu@uta.edu

(No relevant relationships reported)

Physical activity (PA) and motor competence are closely related to each other since motor competence is mainly, although not entirely, determined by PA patterns (i.e., Light PA [LPA], Moderate PA [MPA], and Vigorous PA [VPA]) in adolescence (Stodden et al, 2009). How the development of the motor competence may be influenced by PA patterns and how the interaction of these two variables may be correlated with obesity in adolescent years are understudied. **PURPOSE:** The main purpose of this study was to investigate the relation among PA patterns including LPA, MPA, and VPA, motor competence, and obesity (body composition, waist circumference) in adolescents. The second purpose was to test the gender differences among the study variables. **METHODS:** Participants were 307 students ( $M_{age} = 12.5 \pm 0.9$ ; boys=142, girls = 165) randomly recruited from four middle schools in the U.S. Students' PA patterns were assessed using Actical monitors for 5 consecutive school days. Students' ball skill competence including volleyball, soccer, and ultimate Frisbee (PE Metrics™; NASPE, 2010) were assessed in PE classes. Body mass index (BMI) and waist circumference were used to represent indices of obesity in this study. **RESULTS:** Both LPA and VPA were significantly correlated with BMI and waist circumference ( $p < .05$ ). All three ball skills were significantly associated with both MPA and VPA ( $r$  ranges from .21 to .33). Regression analyses indicated that only VPA and soccer skill merged as significant predictors of BMI ( $\beta = -.16$ ;  $\beta = -.24$ ,  $p < .05$ ) and waist circumference ( $\beta = -.15$ ;  $\beta = -.15$ ,  $p < .05$ ), respectively. Structural equation modeling suggested a mediating role of motor competence in the relationship between

PA patterns and obesity. After controlling for all the covariates, MANCOVA indicated boys had higher levels of VPA than girls ( $p < .001$ ), but no significant differences were found for overall motor competence and MPA. Girls had higher waist circumference and LPA than boys. **CONCLUSION:** The findings indicate that engaging in at least vigorous PA may lead to higher and more accurate ball skill competence among adolescents. The potential "physical activity divide" may occur especially among girls between low-skilled adolescents and their skilled counterparts, which suggests a potential trajectory of obesity in adolescent years.

**3464** Board #285 May 29 1:30 PM - 3:00 PM  
**Accelerometer-measured Sedentary Patterns Are Related To Poorer Inhibitory Control In Obese-middle-aged Adults**

Dominika M. Pindus<sup>1</sup>, Caitlyn G. Edwards<sup>1</sup>, Anne D. Walk<sup>2</sup>, Sharon V. Thompson<sup>1</sup>, Ginger Reeser<sup>1</sup>, Nicholas A. Burd<sup>1</sup>, Hannah D. Holscher<sup>1</sup>, Naiman A. Khan<sup>1</sup>. <sup>1</sup>University of Illinois at Urbana-Champaign, Urbana, IL. <sup>2</sup>Eastern Illinois University, Charleston, IL. (Sponsor: Prof. Steve Petruzzello, FACSM)  
 Email: pindus@illinois.edu

(No relevant relationships reported)

Self-reported sedentary behaviors have been negatively related to executive functions (EFs) in older adults. However, the relationship of objectively measured sedentary time (ST) to EFs in adults with overweight and obesity is poorly understood. **PURPOSE:** To assess the relationship between accelerometer-measured ST and inhibitory control in middle-aged adults with overweight and obesity. **METHODS:** Pre-intervention data from 87 subjects (60 (67%) females,  $M_{age} = 35.0 \pm 5.9$  yrs, BMI=  $32.2 \pm 5.4$  kg/m<sup>2</sup>) participating in the *Persea Americana* for Total Health randomized controlled trial were analyzed. ST and physical activity were measured over 7 days with a hip-worn wGT3X-BT accelerometer. Valid wear time was defined as  $\geq 4$  days,  $\geq 10$  hrs/d. Daily ST (min/d), frequency, and time spent in sedentary bouts lasting  $\geq 5$ , 10, 20 and 30 consecutive min were estimated using a  $< 100$  counts per minute (CPM) cut point. Moderate-to-vigorous physical activity (MVPA) was defined using an NHANES cut point. Inhibitory control was expressed as accuracy (AC), reaction time (RT), and inverse efficiency (IE = AC/RT) on incongruent trials of a modified Eriksen flanker task; performance on congruent trials indexed controlled processes. Multiple hierarchical regression models controlling for age, sex, intelligence, % fat mass, MVPA and ST (for sedentary bouts) were used to assess relationships between ST, sedentary bouts, inhibitory control, and controlled processes. **RESULTS:** Frequency ( $bs \leq -0.22$ ,  $ts \geq 2.11$ ,  $Ps \leq 0.04$ ,  $Fs(6,86) \geq 3.25$ ,  $Ps \leq 0.007$ ) and time ( $bs \leq -0.22$ ,  $ts \geq 2.01$ ,  $Ps \leq 0.047$ ,  $Fs(6,86) \geq 3.17$ ,  $Ps \leq 0.008$ ) spent in sedentary bouts lasting  $\geq 20$  and 30 min were associated with lower AC during incongruent trials. While ST and time spent in sedentary bouts  $\geq 20$  min were related to faster RTs during congruent trials ( $bs \leq -0.23$ ,  $ts \geq 2.08$ ,  $Ps \leq 0.04$ ,  $Fs(6,86) \geq 3.04$ ,  $Ps \leq 0.01$ ), greater ST was related to lower IE on congruent and incongruent trials ( $bs \leq -0.43$ ,  $ts \geq 2.33$ ,  $Ps \leq 0.023$ ,  $Fs(7,86) \geq 2.76$ ,  $Ps \leq 0.01$ ). **CONCLUSION:** In adults with overweight and obesity, more prolonged ST was related to poorer inhibitory control and less efficient controlled processes as indicated by more impulsive responding. Our results reveal a novel relationship between sedentary patterns and an aspect of EFs that has been implicated in the maintenance of obesogenic behaviors.

**3465** Board #286 May 29 1:30 PM - 3:00 PM  
**The Role Of BMI On Cognition Following Acute Physical Activity In Preadolescent Children**

Lauren Raine<sup>1</sup>, Shih-Chun Kao<sup>2</sup>, Eric Drollette<sup>3</sup>, Matthew Pontifex<sup>4</sup>, Dominika Pindus<sup>5</sup>, Arthur Kramer<sup>1</sup>, Charles Hillman<sup>1</sup>. <sup>1</sup>Northeastern University, Boston, MA. <sup>2</sup>Purdue University, West Lafayette, IN. <sup>3</sup>University of North Carolina at Greensboro, Greensboro, NC. <sup>4</sup>Michigan State University, Lansing, MI. <sup>5</sup>University of Illinois at Urbana Champaign, Urbana, IL.  
 (No relevant relationships reported)

**PURPOSE:** There is an increasing prevalence of physical inactivity during childhood, concurrent with a rise in obesity rates (as measured by Body Mass Index, BMI), which is associated with a variety of health problems. However, the extent to which increased BMI influences acute physical activity (PA) benefits on cognition in childhood remains unknown. The aim of this study was to examine the relationship of BMI and acute PA on performance of a modified flanker task, which modulates inhibitory control. **METHODS:** In a sample of 116 children pooled from four prior studies (ages 8-11; 51 females), demographic measures of age, sex, IQ, socioeconomic status, and aerobic fitness were considered along with BMI. Children participated in a counterbalanced, randomized crossover study, whereby they completed two different interventions; 20 minutes of restful reading or treadmill walking (60-70% heart rate max). Following each intervention, children performed a modified flanker task to assess inhibitory control. Correlations were conducted to determine the influence of demographic variables, fitness, and BMI on inhibitory control following each intervention. Subsequent hierarchical regression analyses were performed with

significant demographic factors in the first step, aerobic fitness in the second step when significant, and BMI in the final step. **RESULTS:** Analyses indicated that children exhibited improved task performance ( $p \leq 0.001$ ) following the walking intervention, as well as decreased interference ( $p = 0.04$ ), indicating greater benefits following acute PA for the task condition requiring greater inhibitory control. Regression analyses were conducted to examine the influence of BMI on task performance following each intervention. Results revealed that increased BMI was related to decreased performance following acute PA ( $p = 0.001$ ), an effect not seen following restful reading ( $p \geq 0.11$ ). **CONCLUSIONS:** These findings indicate that the beneficial effects following an acute bout of PA on cognition are generalized across conditions of a flanker task, but are selectively greater for the task conditions requiring greater inhibitory control. However, the effects may be blunted in children with higher BMI. These results suggest that indices of inhibition are influenced by PA and adiposity in children.

3466 Board #287 May 29 1:30 PM - 3:00 PM

### An Investigation Of Exercise Motivation In Normal Weight And Obese Humans And Rodents

Julia C. Basso<sup>1</sup>, Medha K. Satyal<sup>1</sup>, Deborah J. Good<sup>1</sup>, Daniel F. English<sup>1</sup>, Warren K. Bickel<sup>2</sup>. <sup>1</sup>Virginia Tech, Blacksburg, VA. <sup>2</sup>Virginia Tech, Roanoke, VA.  
Email: jbasso@vt.edu

(No relevant relationships reported)

**PURPOSE:** The leading causes of morbidity and mortality stem from predetermined factors, but from maladaptive health behaviors that people have the ability to change. One primary example is physical inactivity, which is the fourth leading risk factor for global mortality and is a direct contributor to the global epidemic of obesity. Both the behavioral and neural mechanisms underlying sedentary behavior in healthy and obese populations are unknown, and constitute a major gap in our understanding of health behaviors. Understanding the mechanisms that regulate the motivation for exercise would allow us to devise treatments to target sedentary behaviors in both healthy and obese populations. As a precursor for these studies, the purpose here was to delineate levels of exercise motivation in both humans and a preclinical mouse model of obesity.

**METHODS:** Self-reported measurements of exercise motivation in humans ( $n=727$ ) was collected via Amazon Mechanical Turk. Voluntary wheel running data was collected in both wild type mice and mice with a targeted deletion of the basic helix-loop-helix (bHLH) gene *Nhlh2* (N2KO), which serve as a preclinical model of obesity. Wheel running data was collected continuously for a period of 21 days as well as after a 72-hour period of wheel deprivation (rebound running response, Basso & Morrell, 2015).

**RESULTS:** Here, we demonstrate that compared to normal weight controls, exercise motivation is significantly impaired in obese individuals, with normal weight controls reporting higher intrinsically regulated motivations to exercise, and obese individuals reporting higher externally regulated motivations to exercise. Further, we demonstrate that wheel running in rodents is highly motivating and that running motivation is significantly impaired in the N2KO mice.

**CONCLUSIONS:** Impairments in exercise motivation may be a driver of obese outcomes, which are demonstrated here in both human and preclinical models of obesity. Previous work from our lab has demonstrated that regions of the motivational circuitry including the medial prefrontal cortex regulate the motivation for voluntary wheel running in rodents. We are currently investigating in both wild type and N2KO mice the hypothesis that neural activity in the PFC, modulated by dopamine, regulates the motivation for exercise.

3467 Board #288 May 29 1:30 PM - 3:00 PM

### Sleep Parameters During A 12-month Behavioral Weight Loss Intervention With Varying Doses Of Physical Activity: The Heart Health Study

Christopher E. Kline, Renee J. Rogers, FACSM, Nalingna Yuan, John M. Jakicic, FACSM. *University of Pittsburgh, Pittsburgh, PA.*

Email: chriskline@pitt.edu

(No relevant relationships reported)

Obesity is associated with poor sleep. Weight loss following caloric restriction has been shown to improve sleep, but whether physical activity (PA) alongside caloric restriction can augment these improvements is unclear. **Purpose:** To examine whether self-reported sleep parameters improve as a result of a behavioral weight loss intervention that included varying doses of moderate-vigorous PA compared to a diet-only condition. **Methods:** 383 adults with overweight or obesity (age=46.2±7.7 years; BMI=32.1±3.8 kg/m<sup>2</sup>) participated in a 12-month behavioral weight loss intervention and were randomized to one of three conditions: diet alone (DIET; n=127); diet plus a moderate dose of MVPA (DIET+MODPA; n=129); diet plus a high dose of PA (DIET+HIGHPA; n=127). All intervention conditions were prescribed a diet that reduced caloric intake to 1200-1800 kcal/day and received behavioral counseling

targeting weight loss. DIET+MODPA and DIET+HIGHPA conditions were prescribed home-based MVPA that progressed to 150 and 250 min/wk, respectively. Weight and sleep measures were collected at 0, 6, and 12 months. Sleep measures included the Pittsburgh Sleep Quality Index (PSQI) and Epworth Sleepiness Scale (ESS). **Results:** Weight (LS mean [95% CI]) significantly decreased over time (0 months: 90.3 [89.0, 91.7] kg; 6 months: 81.7 [80.4, 83.0] kg; 12 months: 81.2 [79.8, 82.6] kg) ( $p < 0.001$ ), with no difference between groups (Group:  $p=0.29$ ; Group X Time:  $p=0.50$ ). PSQI scores (LS mean [95% CI]) were reduced (i.e., improved) (0 months: 3.0 [2.8, 3.2]; 6 months: 2.8 [2.5, 3.0]; 12 months: 2.8 [2.5, 3.0]) ( $p=0.08$ ), with no difference in the pattern of change by group (Group X Time:  $p=0.59$ ). ESS scores did not change over time ( $p=0.98$ ) in any group. Weight change (adjusting for intervention group) was associated with PSQI change at 6 months ( $P < .01$ ) and 12 months ( $P = .001$ ), but not ESS change at either time point ( $P \geq .41$ ). **Conclusion:** Improvements in sleep quality were primarily associated with weight change in this behavioral weight loss intervention. Physical activity did not result in any additive improvements in sleep quality. In adults with overweight or obesity, enhancing long-term weight loss may be an important target for improving sleep quality. **Support:** National Institutes of Health (R01HL103646)

### F-67 Free Communication/Poster - Smartphone and Behavior

Friday, May 29, 2020, 1:30 PM - 4:00 PM

Room: CC-Exhibit Hall

3468 Board #289 May 29 1:30 PM - 3:00 PM

### Analysis Of Physical Activity-Related Smartphone Apps For Behavior Change Potential

Kayla M. Gustek, Kimberly A. Reich. *High Point University, High Point, NC.*

Email: kgustek@highpoint.edu

(No relevant relationships reported)

The majority of Americans do not meet physical activity (PA) guidelines. Adoption and adherence may be improved with personalized intervention. Smartphone app use has increased exponentially in the past decade, extending to many areas of life and crossing socioeconomic status, ethnicity, and gender. Free smartphone apps that address habitual PA may be a useful tool, but their potential to support PA behavior change is not well understood. **PURPOSE:** To evaluate top-ranked free health and fitness apps for PA behavior change potential and to determine the relationship between this evaluation and consumer perceptions of quality, such as app store ranking and consumer ratings. **METHODS:** The top 100 "free" health and fitness apps in the US iOS app store were screened for inclusion. Apps were excluded if the descriptions did not address any aspects of PA or fitness; required an external device, purchase/subscription after a trial period, or a health club membership or specific health insurance. Apps were also excluded if their descriptions was not written in English. Two investigators downloaded and evaluated the remaining apps that met the inclusion criteria using the App Behavior Change Scale (ABACUS). Apps were scored on 21 strategies within 4 categories (knowledge/information, goals/planning, feedback/monitoring, and actions), and prevalence in the sample was calculated. Pearson correlations were estimated for the relationship between ABACUS total scores and relative app ranking, as well as consumer rating. Significance was set at  $p < 0.05$ . **RESULTS:** 23 apps met the inclusion criteria. 100% offered some form of personalization; 96% incorporated self-monitoring and/or rehearsal; and 70% included options for goal-setting. Only 13% recommended restructuring of the environment, and 4% provided advice on distraction or avoidance. There were no significant correlations between ABACUS score and store ranking ( $r^2 = -0.15$ ,  $p = 0.49$ ) or consumer rating ( $r^2 = -0.26$ ,  $p = 0.91$ ). **CONCLUSIONS:** Free apps may have the potential to support PA behavior change, especially in the areas of planning and self-monitoring. There is no correlation between the total number of evidence-based behavior change strategies and app popularity, however, so it may be beneficial for wellness professionals to counsel patients and clients on app choice.

3469 Board #290 May 29 1:30 PM - 3:00 PM

### Determining Participant Compliance In Completing Pre- And Post-exercise Surveys In Real Time Using Smartphones

Kelley Strohacker, FACSM, Paula-Marie M. Ferrara, Cory T. Beaumont. *University of Tennessee, Knoxville, TN.*

Email: kstrohac@utk.edu

(No relevant relationships reported)

Ecological momentary assessment of physical activity and its correlates is often implemented using mobile surveys distributed in a full coverage, semi-randomized

schedule. However, to gather accurate data of temporal dynamics of exercise, proximal pre/post-bout assessments are necessary. Active, smartphone-based self-monitoring is one option, but the feasibility of this approach is unknown. **PURPOSE:** Determine respondent reporting compliance with a one-time request to complete mobile surveys immediately before and after a single bout of exercise. **METHODS:** Enrolled individuals were at least 18 years old, owned a smartphone, and intended to exercise "in the near future." Participants received one email containing web links to a pre-exercise survey (PreS) and a post-exercise survey (PostS), with a request to complete them immediately before/after a bout using their smartphone Internet browser. The PostS contained items to self-report bout duration (SRBD) and lag time between bout completion and opening the PostS (SRLag). Variance in SRLag was assessed using descriptive and frequency analyses. Reporting accuracy was determined by comparing participant-estimated time intervals (PreS time+SRBD+SRLag) and actual time-stamped intervals (PostS time-PreS time) using a Wilcoxon signed-rank test. **RESULTS:** Participants (N=42, 36±13y, 68% women, 80% Caucasian) completed the PreS and PostS within a median of 3 days (interquartile range, IQR:1-6). The SRLag was ≤5-min for 26% of participants, and ≥30-min for 45%. Actual PreS-to-PostS time intervals appeared to be greater than those reported by participants (average rank of 17.48 vs. 13.32; Z=-.1990, p=.047). While the median absolute difference between reported and actual time intervals was 22-min (IQR:3-58), respondents were classified as having differences of <10-min (38%), 11-30-min (26%), and > 30-min (36%). **CONCLUSIONS:** Longer lag times between behavior and self-monitoring may introduce various biases (recall, mood-congruent memory), so it may be sensible to incorporate reminders for reporting goals. Additional research is necessary to explore sources of error regarding discrepancies between expected vs. actual PreS-to-PostS time intervals, as intentional deceit or unintentional misreporting may negatively impact subsequent data analysis.

**3470** Board #291 May 29 1:30 PM - 3:00 PM  
**Exploring Correlates Of Forecasted And Recalled Affective Responses To Acute Aerobic Exercise Using Mobile Surveys**  
 Cory T. Beaumont, Paula-Marie M. Ferrara, Kelley Strohacker, FACSM. *The University of Tennessee, Knoxville, Knoxville, TN.*  
*(No relevant relationships reported)*

**BACKGROUND:** Exercise-related affective valuations (feelings of pleasure/displeasure) purportedly impact exercise-related cognitions and future behavioral decisions. The majority of prior research is laboratory-based, and supports an inverse relationship between affect during exercise (i.e. in-task affect) and ratings of perceived exertion (RPE), both of which may be impacted by an individual's pre-exercise mental states. **PURPOSE:** To explore correlates of forecasted and recalled in-task affect to an acute bout of exercise in free-living conditions. **METHODS:** Participants (N=42, 71% female, 36±12y, body mass index=25±4 kg/m<sup>2</sup>) were asked to complete an electronic survey via their smartphone immediately before and after a single bout of ambulatory exercise. RPE was measured via Category-Ratio 10 scale, forecasted and recalled in-task affect was measured via 100mm Visual Analog Scale, and the Multidimensional Mood Questionnaire captured the affect circumplex (degrees of valence and arousal). Data for psycho-perceptual variables were non-normally distributed and analyzed with Spearman's rank correlations. **RESULTS:** Forecasted affect was moderately related to recalled in-task affect (p=.57, p<.001). Forecasted and recalled RPE had no significant correlations with forecasted or recalled in-task affect (p's ranged -.05 to -.01, all p's>.73). Forecasted affect was moderately related to pre-exercise ratings of Valence (p=.39, p=.01), Calmness (p=.36, p=.02), and Energetic Arousal (p=.39, p=.01). Low correlation was observed between recalled in-task affect and pre-exercise ratings of Valence (p=.16, p=.29), Calmness (p=.05, p=.76) or Energetic Arousal (p=.15, p=.53). **CONCLUSIONS:** The current data stands contrary to existing literature in that RPE was not significantly related to forecasted or recalled in-task affect. The voluntary, dynamic nature of exercise components in free-living conditions compared to the often-prescribed exercise components in laboratory settings may contribute to this discrepancy. Because individuals can opt to deviate from their initial exercise intentions by making alterations to the mode, duration, or intensity of exercise after beginning a bout, it may be important to create survey items capable of capturing and explaining such incongruencies.

**3471** Board #292 May 29 1:30 PM - 3:00 PM  
**Problematic Smartphone Use Is Negatively Related To Physical Activity In American College Students**  
 Andrew Lepp<sup>1</sup>, Jacob E. Barkley<sup>1</sup>, Takahiro Sato<sup>2</sup>, Koji Yamatsu<sup>3</sup>, Ellen Glickman, FACSM<sup>1</sup>. <sup>1</sup>*Kent State University, Kent, OH.* <sup>2</sup>*University of Tsukuba, Ibaraki, Japan.* <sup>3</sup>*Saga University, Saga, Japan.*  
 Email: alepp1@kent.edu  
*(No relevant relationships reported)*

Multiple studies from our research group examining American adults have conclusively identified smartphone use as a sedentary behavior (SB). However, the same work has repeatedly found no relationship between smartphone use and physical activity (PA). Typically, SB is negatively related to PA. This may not be true of smartphones as the device can displace PA (e.g., watching videos, social media) and also promote PA (e.g., fitness apps, mHealth). Thus, different smartphone behavioral patterns should be considered in relationship to PA. Researchers have recently identified problematic smartphone use as a behavioral pattern motivated by the recurrent craving to use a smartphone. It is an addiction-like behavior leading individuals to use their smartphone compulsively in inappropriate situations such as during classroom lectures, while driving a car, or perhaps in environments intended for PA or planned exercise. Therefore, while total use is not associated with PA, problematic smartphone use may interfere with PA. **PURPOSE:** To assess the relationship between total and problematic smartphone use to PA in a sample of American college students. **METHODS:** A sample of American college students (N = 471, 21.1 ± 2.8 years old) completed validated surveys assessing total daily smartphone use, PA, SB (both assessed via the International Physical Activity Questionnaire) and problematic smartphone use (assessed via the Mobile Phone Problem Use 10-item scale). Pearson's correlations were then performed. **RESULTS:** As in previous studies, there was a significant, positive relationship between total daily smartphone use and SB (r = 0.31, p < 0.001) and no relationship with PA (r = 0.05, p = 0.32). However, while problematic smartphone use was similarly significantly and positively related to SB (r = .26, p < .001) it was also significantly and negatively related to PA (r = -0.18, p < .001). **CONCLUSION:** While prior research and the current study has found no relationship between total smartphone use and PA, this is the first study to assess the relationship between problematic smartphone use and PA. Results suggest that, unlike total daily smartphone use, problematic smartphone use may occur at the expense of PA behavior.

**3472** Board #293 May 29 1:30 PM - 3:00 PM  
**The Relationship Between Cell Phone Use And Motivation To Exercise In College Students**  
 Tanis J. Walch<sup>1</sup>, Ryan E. Doree<sup>1</sup>, Jesse L. Rhoades<sup>1</sup>, Brianna Black<sup>1</sup>, Allison M. Barry<sup>2</sup>. <sup>1</sup>*University of North Dakota, Grand Forks, ND.* <sup>2</sup>*Pittsburg State University, Pittsburg, KS.* (Sponsor: James R. Whitehead, FACSM)  
 Email: tanis.walch@und.edu  
*(No relevant relationships reported)*

Previous research has shown that high cell phone usage is associated with sedentary behavior, poor physical fitness, and poor mental health. In today's era of technological advances, most individuals own a smartphone, but those who are college-aged have the highest rate of ownership (94%). Limited research exists on the relationship of smartphone usage on physical activity and mental health. **PURPOSE:** The purpose of this study was to examine the relationship between college students' smartphone usage, exercise motivation, mental health, and physical activity. **METHODS:** College students completed an electronic survey (n=157; female = 135; age = 20.01±1.49; BMI = 24.39 kg/m<sup>2</sup>, SD = 5.7; smartphone use=218.1 min/day, SD = 122.9) that assessed exercise motivation (BREQ-3), physical activity (IPAQ-short), smartphone addiction (SAS-SV), daily smartphone use, height and weight, depression, anxiety, stress (DASS) and fear of missing out (FoMO). Data were analyzed with Pearson correlation and independent t-tests using SPSS. **RESULTS:** Low and high cell phone usage levels were established by splitting participants into two groups based on median usage (180 min/day). Overall, high cell phone users had greater BMI (23.2 vs. 25.5) and depression scores (10.2 vs. 7.1), and lower physical activity (2597.5 vs. 3616.6 min/wk) compared to low cell phone users (p<0.01). Sedentary minutes per week (r=0.24, p<0.01), amotivation (r=0.19, p<0.01), and smartphone addiction risk (r = 0.24, p<0.01) were positively associated to smartphone usage. Introjected (r = -.24, p<0.01), identified (r = -0.28, p<0.001), integrated (r = -0.31, p<0.001), and intrinsic motivation (r = -0.24, p < 0.01) was negatively associated with smartphone usage. High cell phone users had greater amotivation to exercise (t=-3.9, p<0.001), whereas low cell phone users had higher integrated regulation (t=5.3, p<0.001). **CONCLUSIONS:** This study has shown that smartphone usage is related to exercise motivation. Integrated regulation has been shown to be one of the strongest predictors

of exercise duration, which may help to explain why low cell phone users engaged in more weekly physical activity. Future research should examine whether limiting cell phone use will increase motivation to exercise to improve overall quality of life.

**3473** Board #294 May 29 1:30 PM - 3:00 PM  
**Sedentary Behavior And Associations To Portable Screen-Based Device Use And Parental Influence In Rural Children**

Jonathan B. Naylor, Beth J. Patton. *Ashland University, Ashland, OH.* (Sponsor: Ronald Otterstetter, Ph.D., FACSM)  
 Email: jnaylor2@ashland.edu  
 (No relevant relationships reported)

Previous studies from our research group have examined the potential link between portable screen-based devices (i.e., smartphones and tablet computers) and sedentary behavior/physical activity in a primarily suburban population of young children and their parents. It was determined child sedentary behavior was related to portable screen-based device use while physical activity was not. While such relationships were found in a suburban population, rural demographic groups have been shown to differ in both their screen-based device use and physical activity variables suggesting the corresponding associations may also differ.

**PURPOSE:** To examine screen-based media device (smartphone, tablet, television, video games, computer) use in children and parents from a rural population in relation to sedentary behavior and physical activity.

**METHODS:** Parents ( $N = 7$ ,  $33.57 \pm 3.95$  years old) completed validated questionnaires assessing average daily total screen use (smartphone, tablet, television, video games, computer), portable screen-based device use (smartphone, tablet), sedentary behavior, and physical activity for both themselves and their children ( $N = 7$ ,  $7.00 \pm 1.15$  years old). Four standard regression models were used to assess the relationship between criterion variables and the following predictor variables: child age, child sex, child average daily sedentary time, and child physical activity. Criterion variables included (a) child portable screen-based device use (Model 1), (b) child total screen use (Model 2), (c) parent portable screen-based device use (Model 3), and (d) parent total screen use (Model 4).

**RESULTS:** Child sedentary time was significantly ( $\beta = 0.92$ ,  $t = 4.65$ ,  $p = 0.04$ ) and positively associated with parent screen-based device use. Child age, sex, and physical activity were not significantly ( $p > 0.05$ ) related to either parent or child portable or total device use.

**CONCLUSION:** Contrary to findings in young children from suburban populations, the current results from this limited sample suggest child sedentary behavior was not found to be related to portable screen-based device use in rural children. Furthermore, the data confirms previous findings that parental screen-based device use was predictive of sitting in their children.

**3474** Board #295 May 29 1:30 PM - 3:00 PM  
**Associations Between Screen-time And Depressive Symptoms: Results From CSPPA-2**

Chloe Forte<sup>1</sup>, Cillian P. McDowell<sup>2</sup>, Sarah Jane Belton<sup>3</sup>, Wesley O'Brien<sup>4</sup>, Marie Murphy, FACSM<sup>5</sup>, Cormac Powell<sup>1</sup>, Catherine Woods<sup>1</sup>, Matthew P. Herring, FACSM<sup>1</sup>. <sup>1</sup>University of Limerick, Limerick, Ireland. <sup>2</sup>Trinity College Dublin, Dublin, Ireland. <sup>3</sup>Dublin City University, Dublin, Ireland. <sup>4</sup>University College Cork, Cork, Ireland. <sup>5</sup>Ulster University, Belfast, Ireland.  
 (Sponsor: Dr. Matthew Herring, FACSM)  
 (No relevant relationships reported)

Screen-time (e.g., television, phone, tablet use) has been linked to increased depression and sedentary behaviour. A better understanding of associations between screen-time and depression is critical due to increased levels of screen-time and sedentary behaviour. **Purpose:** As part of a large nationally-representative observational study, the cross-sectional study reported here examined associations between self-reported screen-time and depressive symptoms among 396 adolescents ( $13.43 \pm 0.87$ y; 115 female) in primary and second level schools in the Republic of Ireland. **Methods:** Participants completed the Quick Inventory of Depressive Symptomatology and reported the number of days during the prior seven days that spent watching television, on a computer, and on a tablet or smartphone, and, on average, the number of hours spent on these devices on each reported day. One-way ANOVA examined potential sex-related differences in screen-time and depressive symptoms. Linear regression quantified crude and adjusted associations between total weekly hours of screen-time and depressive symptoms. Age, sex, waist circumference, functional disabilities, moderate-to-vigorous physical activity (MVPA), and school status (i.e., whether the school is in a government identified economically disadvantaged location) were included covariates. **Results:** Mean $\pm$ SD hours of screen-time per week and depressive symptoms were  $17.33 \pm 18.53$  and  $5.47 \pm 4.27$ , respectively. Males ( $18.10 \pm 18.73$ ) reported more screen-time than females ( $15.19 \pm 17.77$ ;  $p = 0.084$ ). Depressive symptoms did not differ by sex ( $p = 0.99$ ). Total weekly hours of screen-time was significantly, positively associated with depressive symptoms ( $\beta = 0.10$ ,  $p \leq 0.05$ ). After adjustment

for age, sex, waist circumference, functional disabilities, MVPA, and school status, screen-time was significantly, positively associated with depressive symptoms ( $\beta = 0.14$ ,  $p \leq 0.006$ ). MVPA was the only statistically significant covariate in the model ( $\beta = 0.11$ ,  $p < 0.04$ ). **Conclusions:** Screen-time was significantly associated with greater depressive symptoms in Irish adolescents. Lower levels of screen-time and sedentary behaviour should be encouraged to reduce depressive symptoms among adolescents.

**F-68** Free Communication/Poster - Hydration/Fluid Balance

Friday, May 29, 2020, 1:30 PM - 4:00 PM  
 Room: CC-Exhibit Hall

**3475** Board #296 May 29 2:30 PM - 4:00 PM  
**Hypohydration And Endurance Performance: A Meta-analysis**

Jessica E. Sudock<sup>1</sup>, Elizabeth M. Mullin<sup>2</sup>. <sup>1</sup>Shenandoah University, Winchester, VA. <sup>2</sup>Springfield College, Springfield, MA.  
 (No relevant relationships reported)

**PURPOSE:** The primary purpose of this meta-analysis was to systematically evaluate the differences in endurance performance while in a hypohydrated state achieved through varying dehydration methods. A secondary purpose was to evaluate the moderation between types of hypohydration (fluid restricted vs. exercise-induced) and changes in heart rate and core temperature.

**METHODS:** A systematic literature search of databases and specific journals relating to the subject, as well as a forward search with relevant researchers was performed to identify research papers meeting the inclusion criteria.

**RESULTS:** Eleven total studies met the inclusion criteria including a minimum of 2% hypohydration. All 11 included articles measured heart rate and 6 included articles measured core temperature. The meta-analysis using a random effects model indicated a hypohydration had a significant impact of hydration on heart rate ( $ES = -0.42$ ,  $p < .00$ ) and core temperature ( $ES = -0.6$ ,  $p = .017$ ). Method of dehydration did not significantly moderate the change in heart rate ( $p = .59$ ) or core temperature ( $p = .37$ ).

**CONCLUSIONS:** Heart rate and core temperature are elevated in a hypohydrated state. Current literature does not suggest that the method of dehydration impacts the elevation of heart rate and core temperature.

**3476** Board #297 May 29 2:30 PM - 4:00 PM  
**Mild Hypohydration Following 24-hour Water Intake Reduction Does Not Affect Anaerobic Power Performance**

Peter A. Hosick, Arielle Sheris, Jacklyn S. Alenciewicz, Evan L. Matthews. *Montclair State University, Montclair, NJ.*  
 Email: hosickp@montclair.edu  
 (No relevant relationships reported)

Hypohydration is common among athletes and can be the result of a failure to maintain hydration between exercise bouts. The negative impact of hypohydration on aerobic performance is well characterized. However, little is known about the effect of hypohydration on anaerobic performance particularly when the hypohydration is the result of insufficient water intake prior to the onset of exercise, not water loss due to body temperature regulation. **PURPOSE:** The purpose of this study was to examine the effect of hypohydration on anaerobic performance following voluntary water intake reduction. **METHODS:** Fifteen healthy adults (8 women, 7 men) completed two exercise sessions, euhydrated (EUD) and hypohydrated (HYP). Subjects were asked to voluntarily limit water intake during the 24-hours prior to the hypohydrated trial. Sessions consisted of baseline anthropometric and blood lactate measurement followed by a 30-second Wingate test and 3 maximum vertical jump trials. The vertical jump trials were completed approximately 1 minute after finishing the 30-second Wingate test and used to measure anaerobic performance in an anaerobically challenged state. Additional blood lactate measurements were taken immediately and at 5, 10, and 15-min post Wingate test. **RESULTS:** The hypohydration protocol resulted in a significant 1.5% reduction in body mass (EUD  $69.1 \pm 17.2$ kg, HYP  $68.1 \pm 16.6$ kg,  $p = 0.039$ ). The 30-sec Wingate peak power (EUD  $971 \pm 302$ W, HYP  $960 \pm 316$ W,  $p = 0.578$ ) was not different between conditions, nor was maximum vertical jump height (EUH  $26.4 \pm 4.5$ cm, HYP  $26.6 \pm 3.6$ cm,  $p = 0.778$ ). Blood lactate ( $p \leq 0.001$ ) was elevated immediately following the 30-sec Wingate test and remained elevated throughout the remainder of the trial. There were no differences in blood lactate between conditions. **CONCLUSIONS:** Acute anaerobic power and exercise performance are not negatively affected by mild voluntary hypohydration during and following a single 30-second Wingate test.

**3477** Board #298 May 29 2:30 PM - 4:00 PM  
**Effects Of Cold Water Intake During A Short Exercise In Heat On Cognitive Function**

Somi Yun, Yunbin Lee, Heejin Lee, Jae Gu Hwang, Ah-Reum Jung, Dae Taek Lee. *Kookmin Univ., Seoul, Korea, Republic of.*  
 Email: ysmysm7@naver.com  
 (No relevant relationships reported)

**PURPOSE:** This study evaluated the effect of cold water intakes before and during exercise in the heat on the cognitive function in healthy young man. **METHODS:** Ten men (26.3±4.4 yrs, 176.2±5.8 cm, 77.2±14.6 kg) who participated in vigorous exercises at least twice in a week and maximal oxygen capacity estimated by Rockport's 1-mile test was over 32.7 ml/kg/min were recruited. They underwent three testing sessions with different conditions in separate days; cold water (CW, 4 °C), neutral temperature water (AW, 36 °C), and no water conditions (NW). Testing order was randomly assigned and balanced. In each session, they were asked to ingest a prescribed amount of tap water (10 ml/body weight) at rest (1/3 of the total amount) and during exercise (2/3 of the total amount). After resting, they ran on a treadmill for 20 min in a hot environment (39.2±2.1 °C, 41.7±9.4 % relative humidity) at their predicted 75% of maximal heart rate. At 6, 12, and 18 min of exercise of CW and AW, they drank water. Cognitive test was performed 3 times; at rest, immediately after exercise, and after 20 min of recovery, by using Stroop color-word test (SCWT). During resting and exercise, their temperature, heart rate (HR), ratings of perceived exertion (RPE), naked body weight changes, and water intakes were measured. **RESULTS:** The average ear temperature during exercise was 37.2±0.6, 37.5±0.6, and 37.2±0.5 °C, and mean skin temperature was 34.8±2.3, 35.3±1.6, and 34.9±1.2 °C at CW, AW, and NW, respectively (p>0.05). Average HR and RPE was 148.3±14.1, 150.8±15.6, and 149.9±12.7 bpm and 13.3±0.7, 13.0±0.9, and 12.7±1.4 at CW, AW, and NW, respectively (p>0.05). They drank a total of 813±133 ml at CW and 812±130 ml at AW. They lost weight by sweating 493±145, 507±257, and 390±139 ml at CW, AW, and NW, respectively. The reliability of cognitive test was 0.909. The cognition score was 23.5±16.2, 24.3±15.5, and 22.0±11.8 in CW, 24.2±13.5, 28.1±10.4, and 25.1±9.7 in AW, and 17.5±8.3, 22.3±10.6, and 21.1±7.9 in NW, at resting, immediately after exercise, and after recovery, respectively (p>0.05). **CONCLUSIONS:** No advantage of cold water drinking before and during a short bout of exercise in the heat was evident for the cognitive function. The mode, intensity, and duration of exercise may be responsible for the outcomes.

**3478** Board #299 May 29 2:30 PM - 4:00 PM  
**Body Mass And Urinary Hydration Measures During Preseason High School Football Practices In The Heat**

Rebecca M. Lopez, Priscila Lamadrid, Candi D. Ashley, Amanda J. Tritsch, Erin M. Moore, Brock Ackerman, Jose Guzman-Ramos, Trey Johnson. *University of South Florida, Tampa, FL.*  
 (Sponsor: Douglas J. Casa, FACSM)  
 (No relevant relationships reported)

Hydration assessment is an important measure to help reduce the risk of exertional heat illness. Maintaining adequate hydration can be problematic for football players practicing in the heat on consecutive days. **PURPOSE:** To examine day to day differences and the relationships between urinary markers of urine color ( $U_{col}$ ) and urine specific gravity ( $U_{SG}$ ), and percent body mass loss (%BML) during football practices in the heat. **METHODS:** Thirty-one male high school football players (16 ± 1 years; 181.2 ± 12.0 cm; 68.1 ± 5.4 kg; BMI: 20.8 ± 1.8 km/m<sup>2</sup>) volunteered to participate in this study. Before and after each practice, players were weighed (in shorts) and provided a urine sample. Urine was assessed for  $U_{col}$  and  $U_{SG}$  and was assessed by the same person. Correlations assessed relationships, while t-tests assessed differences between both pre-post differences and subsequent days. P value was significant at P<.05. **RESULTS:** Mean wet-bulb globe temperature across 8 practices was 30.6 ± 2.5°C. There were significant correlations between pre- $U_{col}$  and pre- $U_{SG}$  ( $r = 0.73$ ,  $p = 0.00$ ,  $n = 209$ ) and post- $U_{col}$  and post- $U_{SG}$  ( $r = 0.66$ ,  $p = 0.00$ ,  $n = 209$ ). Post- $U_{col}$  (5 ± 1) was significantly greater than pre- $U_{col}$  (4 ± 2;  $p = 0.00$ ). Post- $U_{SG}$  (1.022 ± 0.008) was significantly greater than pre- $U_{SG}$  (1.020 ± 0.008;  $p = 0.00$ ). Post body mass measures were significantly lower than pre-body mass resulting in 0.9 ± 1.1%BML. Post-practice body mass and  $U_{SG}$  were not significantly different from the next day's pre-practice measures ( $p > 0.05$ ); however, post- $U_{col}$  was significantly higher (5 ± 2) compared to the next day's pre-practice  $U_{col}$  (4 ± 1;  $p = 0.000$ ). **CONCLUSION:** Although the football players' body mass measures were similar on subsequent days, their  $U_{col}$  was lighter before the next day's practice. We also found a strong relationship between  $U_{col}$  and  $U_{SG}$ , suggesting  $U_{col}$  is an acceptable hydration measure where  $U_{SG}$  is not feasible in field settings. Due to individual variability in these hydration measures, clinicians should provide individualized recommendations to ensure adequate hydration during practices in the heat as well as from one day to the next. *This study was fully funded by the National Athletic Trainers' Association Research & Education Foundation.*

**3479** Board #300 May 29 2:30 PM - 4:00 PM  
**Association Between Free-living Weekday 24-hour Urinary Hydration Markers And Weekend Sleep Measures**

Mitchell E. Zaplatosch, Travis Anderson, Eleni M. Karras, Stacey L. Walton, William M. Adams. *University of North Carolina at Greensboro, Greensboro, NC.*  
 Email: mezaplat@uncg.edu  
 (No relevant relationships reported)

**PURPOSE:** Inadequate sleep and underhydration have been independently associated with adverse health outcomes. However, the relation between hydration status and sleep has yet to be investigated over the course of several days in young adults. Thus, the purpose of this study was to assess the association between 24h urinary hydration markers and both perceived and objective sleep quality. **METHODS:** Eighteen participants (female, n=7; age, 23±3; height, 174.6±15.3cm; body mass, 73.5±15.9kg; body fat, 19.4± 9.4%) provided a 24h urine sample on seven consecutive days for measures of urine volume ( $U_{VOL}$ ), urine osmolality ( $U_{OSMO}$ ), urine specific gravity ( $U_{SG}$ ) and urine color ( $U_{COL}$ ). Objective sleep metrics (wrist-worn actigraphy) and subjective sleep assessments (Karolinska Sleep Diary) were recorded each day. Actigraph measures included periods of wakefulness after defined sleep onset (WASO), sleep time, wake time, and sleep efficiency. The Karolinska Sleep Diary included nine questions used to assess perceived sleep quality from the previous night. Mean values were calculated for each participant for all variables on weekdays (Monday-Friday) and weekend days (Saturday/Sunday). **RESULTS:** Higher weekday  $U_{SG}$  and darker  $U_{COL}$  were both associated with greater weekend time spent sleeping ( $U_{SG}$ , adj  $R^2 = 0.203$ ,  $p = 0.024$ ;  $U_{COL}$ , adj  $R^2 = 0.274$ ,  $p = 0.015$ ). Decreased weekday  $U_{VOL}$  was associated with increased weekend time spent sleeping (adj  $R^2 = 0.220$ ,  $p = 0.028$ ). Higher weekday  $U_{OSMO}$  was associated with greater weekend WASO actigraph measures (adj  $R^2 = 0.205$ ,  $p = 0.045$ ). **CONCLUSIONS:** Mean 24-hour urinary hydration markers depicting a state of underhydration (elevated  $U_{SG}$  and reduced  $U_{VOL}$ ) across weekdays were associated with an increased number of awakenings during the weekend nights, albeit, having a longer sleep time. Determining how day-to-day variations in hydration status and other general health behaviors influence sleep has yet to be explained.

**3480** Board #301 May 29 2:30 PM - 4:00 PM  
**Change In Physiological Strain And Cognitive Processing Following Electrolyte And Carbohydrate Supplementation**

Nathan Deming, Jennifer Richards. *Colorado State University, Fort Collins, CO.*  
 Email: nate.deming@colostate.edu  
 (No relevant relationships reported)

**PURPOSE:** The purpose of this study was to examine the effects of 3 different fluid conditions on hydration, physiological strain index (PSI), and cognitive processing speed during and following a simulated wildland firefighter (WLFF) ingress hike. **METHODS:** 7 subjects (27.4±4yrs, 5M/2F) performed 3 visits of 2hrs of treadmill walking at 3mph/7% grade in an environmental chamber set to 33°C/10% relative humidity. In random order, subjects consumed either water (W), water+electrolyte (GZ), or water+electrolyte+sugar (G) at each visit. Throughout exercise (EX), subjects wore fire-retardant attire, carried a 50lb pack, and drank *ad libitum* to mimic WLFF conditions. Pre and post EX, body mass (BM), fluid consumption, and plasma osmolality (pOsm) were measured. PSI, an calculated index of cardiovascular (CV) and thermal strain, and core temperature ( $T_C$ ) were recorded every 15mins during EX. Plasma glucose (GLU) was measured every 30mins. Cognitive processing speed, measured via the Stroop Color and Word Test (SCWT), was measured post EX and compared to baseline (BL) values. **RESULTS:** There were no significant differences between fluid conditions (W, GZ, and G) for BM ( $\Delta 0.6\pm 0.2$ ,  $0.9\pm 0.3$ , and  $0.8\pm 0.2$  Kg), fluid consumption ( $1.9\pm 0.3$ ,  $2.2\pm 0.2$ , and  $1.9\pm 0.3$  L), pOsm ( $\Delta 1.2\pm 5.1$ ,  $9.5\pm 5.4$ , and  $8.1\pm 2.1$  mmol/L), peak PSI ( $7.6\pm 0.6$ ,  $7.8\pm 0.5$ , and  $8.6\pm 0.7$ ) and peak  $T_C$  ( $38.8\pm 0.2$ ,  $38.9\pm 0.2$ , and  $39.1\pm 0.2$  °C). Compared to W and GZ, GLU significantly increased in the G condition ( $107\pm 14$ ,  $107\pm 13$ , and  $113\pm 11$  mg/dL at 60, 90, and 120mins,  $P < 0.05$ ). Compared to BL, SCWT performance significantly decreased in all conditions ( $204.2\pm 21$ ,  $213\pm 24$ , and  $222\pm 21$  ms,  $P < 0.05$ ). **CONCLUSION:** Fluid condition had no effect on hydration status or physiological strain. Following EX, there was a similar decrease in SCWT in all fluid conditions, indicating a decreased ability to inhibit cognitive interference. Additionally, PSI was higher than previously reported, suggesting that the ingress hike may lead to dangerously high CV and thermal strain in WLFFs. PSI should be monitored (HR and  $T_C$ ) during ingress hikes by medical staff or supervisors, especially when conditions yield high ambient temperatures. This could aid in reducing the amount of WLFFs that succumb to heat related illness each year. **Grant Funding:** The project was funded by the US Forest Service.

3481 Board #302 May 29 2:30 PM - 4:00 PM

**Exploration Of Hydration Practices And Prolonged Endurance Exercise Effects On Plasma Apelin Concentration**

Colleen X. Munoz<sup>1</sup>, Alex Acosta<sup>1</sup>, Logan Edwards<sup>1</sup>, Evan C. Johnson<sup>2</sup>, Laura J. Kunces<sup>3</sup>, Jakob L. Vingren, FACSM<sup>4</sup>, Lawrence E. Armstrong, FACSM<sup>5</sup>, Elaine C. Lee<sup>5</sup>, Jenna M. Bartley<sup>6</sup>. <sup>1</sup>University of Hartford, West Hartford, CT. <sup>2</sup>University of Wyoming, Laramie, WY. <sup>3</sup>Thorne Research, Summerville, SC. <sup>4</sup>University of North Texas, Denton, TX. <sup>5</sup>University of Connecticut, Storrs, CT. <sup>6</sup>University of Connecticut Health, Farmington, CT. (Sponsor: Jakob Vingren, FACSM)

(No relevant relationships reported)

Reduced circulating concentrations of the endogenous peptide apelin is implicated in many negative health conditions, and apelin administration can reverse sarcopenia processes. While acute and chronic exercise elicits greater circulating apelin concentrations, little attention has been given to apelin's water regulatory roles (i.e., AVP opposition) and manipulation by water intake to enhance human health. **PURPOSE:** We investigated the impact of hydration status and process on plasma apelin following prolonged endurance exercise and after a subsequent water challenge. **METHODS:** Twenty-two male cyclists (age median=54y and range=29-72y) completed a 161km event (mean=26°C, 76%RH; maximum=30°C, 93%RH; mean finish time = 372 ± 93min). Participants were interviewed for dietary intake in the morning and during the ride. Hydration biomarkers included body mass change (BMA), urine specific gravity ( $U_{sg}$ ) and color ( $U_{col}$ ), plasma osmolality ( $P_{osm}$ ) and copeptin ( $P_{cop}$ ), and apelin ( $P_{ap}$ ), which were collected before (PRE), immediately after the ride (POST), and 1h following a 650mL water bolus (POST1h). **RESULTS:**  $P_{ap}$  paradoxically decreased after exercise (PRE = 1.19 ± 0.29, POST = 1.02 ± 0.27 ng/mL;  $p = 0.04$ ). It is plausible that hypohydration at POST (according to -1.96% BMA and  $P_{cop}$ ,  $U_{sg}$ ,  $U_{col}$  ( $p < 0.05$ ), but not  $P_{osm}$  ( $p = 0.31$ )) masked any drive of acute exercise to increase  $P_{ap}$ , or that prolonged endurance exercise differentially affects  $P_{ap}$ , although POST and POST1h  $P_{ap}$  did not correlate with finish time ( $p = 0.76$  and 0.31, respectively). Interestingly, the water bolus did not alter  $P_{ap}$  concentrations versus POST (POST1h = 1.0 ± 0.29 ng/mL;  $p = 0.66$ ). POST  $P_{ap}$  correlated with PRE  $P_{osm}$  ( $r = -0.47$ ), and POST1h  $P_{ap}$  with PRE  $U_{col}$  ( $r = -0.46$ ; both  $p < 0.05$ ), suggesting baseline hydration might alter  $P_{ap}$  responses. Despite previous reports,  $P_{ap}$  was not significantly correlated with age at any time point ( $p = 0.36$  to 0.73) perhaps due to chronic exercise practices of these cyclists. **CONCLUSIONS:** This real-world scenario demonstrated complex relationships among plasma apelin, exercise, and hydration. Our data suggests insufficient baseline hydration might mitigate the acute exercise-induced  $P_{ap}$  elevation. As an increasingly valuable modulator of chronic health, further research should address complexities of  $P_{ap}$  responses.

3482 Board #303 May 29 2:30 PM - 4:00 PM

**Effects Of Fluid Restriction On Muscular Strength And Fatigue**

Sadie L. LaMay, Emily K. Summers, Cory L. Butts. Weber State University, Ogden, UT. (Sponsor: Dr. Brendon P. McDermott, FACSM)

Email: sadielamay@mail.weber.edu

(No relevant relationships reported)

Fluid restriction (FR) is commonly performed by athletes competing in weight-class sports, but the effects of fluid restriction on strength performance remain controversial. **PURPOSE:** To assess the effects of fluid restriction on muscular strength performance and fatigue. **METHODS:** Six participants (age 24 ± 2 y, body mass 87 ± 16 kg, ht 1.7 ± 0.1 m, body fat 18 ± 8%) randomly completed two experimental trials (euhydrated, EU, or FR). FR consisted of three days of graded decreases in fluid intake (1.5 L three days prior, 0.5 L two days prior, and 0.5 L the day prior to the trial). For each trial, participants cycled at 50 W for 10 minutes on cycle ergometer and completed a standardized dynamic warm-up. Participants then performed strength testing on an isokinetic dynamometer involving three repetitions of isometric knee flexion and extension at 70° and 90° and isokinetic contractions at 50 and 150°/sec. Next, a fatigue protocol of 30 maximal effort repetitions of isokinetic contractions at 180°/sec was performed, followed by the initial strength testing protocol. **RESULTS:** Body mass was reduced 1.9 ± 1.3% with FR compared to EU (mean difference: 1.8 ± 1.5 kg,  $P = 0.02$ ). Urine specific gravity was increased following FR (1.025 ± 0.005) compared to EU (1.015 ± 0.008,  $P = 0.02$ ). Perceived thirst was greater in the FR trial (grand mean, 3.4 ± 1.4) compared to the EU (grand mean, 7.2 ± 0.9,  $P < 0.001$ ) and rating of perceived exertion tended to be increased in the FR trial (16.1 ± 1.8) compared to the EU (15.1 ± 1.9,  $P = 0.06$ ,  $d = 0.87$ ). Isometric strength was not different between conditions for extension at 70° ( $P = 0.44$ ,  $\eta_p = 0.12$ ) and 90° ( $P = 0.75$ ,  $\eta_p = 0.02$ ). Isokinetic strength was also not different between conditions at 50°/sec (EU 198.4 ± 50.7, FR 184.8 ± 38.7 Nm,  $P = 0.26$ ,  $\eta_p = 0.24$ ) and 150°/sec (EU 136.2 ± 35.8, FR 129.0 ± 41.9 Nm,  $P = 0.20$ ,  $\eta_p = 0.31$ ). During the fatigue protocol, total work completed was not different between conditions (EU 2656 ± 794, FR 2689 ± 902 Nm,

$P = 0.63$ ), but, average power demonstrated a moderate-large effect ( $d = 0.71$ ) for reduction in the FR condition (182.6 ± 65.0 W) compared to EU (206.5 ± 58.8 W,  $P = 0.14$ ). **CONCLUSIONS:** These preliminary results suggest FR does not alter muscular strength or fatigue. However, perceptual strain (thirst, exertion) may be increased, requiring a greater effort to produce similar performance.

3483 Board #304 May 29 2:30 PM - 4:00 PM

**The Relationship Between Whole-body Heat Exchange And Thermoregulatory Responses During Exercise In The Heat In A Dehydrated State**

Margaret C. Morrissey, Gabrielle E.W Giersch, Cody R. Butler, Douglas J. Casa, FACSM. Korey Stringer Institute, University of Connecticut, Storrs, CT. (Sponsor: Douglas Casa, FACSM)

Email: MARGARET.MORRISSEY@UCONN.EDU

(No relevant relationships reported)

Whole-body heat loss has been extensively examined during exercise in hot environments. Interestingly, the relationship between predicted heat balance parameters and thermoregulatory strain have been limited to individuals in a euhydrated state. As dehydration has been shown to exacerbate thermal and cardiovascular strain, it is imperative to examine whether dehydration modulates heat exchange during exercise in the heat and its relationship to physiological responses to exercise in the heat. **PURPOSE:** to examine whether predicted heat balance parameters explain variance in core temperature ( $T_{core}$ ) and heart rate (HR) responses to exercise in the heat following 24 h of fluid restriction. **METHODS:** 8 participants (4 males and 4 females; age: 19±2yrs;  $VO_{2max}$ : 47.4±6.5ml/kg/min; body mass: 61.5±9.4kg; height: 166.7±7.5cm) performed a 30-min bout of treadmill running and walking in the heat (32°C, 55% relative humidity) under two conditions: 1) 24 h of fluid restriction (DEH) and 2) euhydration (EUH). Participants exercised at 11W/kg for 15 min followed by 7W/kg for 15 min, which were derived via indirect calorimetry.  $T_{core}$  was continuously assessed through rectal thermometry and HR was measured at the end of each intensity. Metabolic heat production (M-W), dry heat loss (DHL), and evaporative requirement ( $E_{req}$ ) were calculated for both exercise intensities. Pearson correlation coefficients were utilized to examine the relationship between M-W, DHL,  $E_{req}$  and  $T_{core}$ , change in  $T_{core}$  ( $\Delta T_{core}$ ), HR, and change in HR (HR) under DEH and EUH. Linear regressions were performed for all significant correlations. Statistical significance was set at  $p \leq 0.05$ . **RESULTS:** M-W and DHL were not correlated with  $T_{core}$ ,  $\Delta T_{core}$ , HR, or HR in DEH or EUH at 11W/kg. At 7W/kg under DEH, DHL was negatively correlated with  $T_{core}$  ( $R^2=0.54$ ,  $p=0.05$ ) and HR ( $R^2=0.67$ ,  $p=0.024$ ). All other heat balance parameters were not correlated with physiological responses at 7W/kg in DEH or EUH. **CONCLUSION:** In this preliminary dataset,  $E_{req}$  and M-W did not explain variance in physiological responses during DEH. DHL under DEH explained 67% of the variance in post HR and 54% of the variance in  $T_{core}$  at 7W/kg. Therefore, DHL may contribute to the variation in physiological strain during low intensity exercise in the heat under DEH.

3484 Board #305 May 29 2:30 PM - 4:00 PM

**Sex Differences In Response To Passive Dehydration Via 24-h Fluid Restriction**

Gabrielle E. W. Giersch, Margaret C. Morrissey, Cody R. Butler, Douglas J. Casa, FACSM. University of Connecticut, Storrs, CT. (Sponsor: Douglas Casa, FACSM)

Email: gabrielle.giersch@uconn.edu

(No relevant relationships reported)

Dehydration is a known stressor on the human body. It has been previously observed that a proportion of individuals may live in a chronic state of mild dehydration, either due to physical activity and lack of proper rehydration, or due to low habitual fluid consumption. This state of chronic dehydration propagated by low fluid consumption can be simulated via passive dehydration and fluid restriction. Physiological responses to fluid restriction have previously been investigated in men, leaving sex differences or unique responses in women uninvestigated. **Purpose:** The purpose of this investigation was to assess differences in response to 24-h fluid restriction (FR) between men and women. **Methods:** Eleven participants (n=5 male: 21 ± 3 y, 69.97 ± 8.4 kg, 172.4 ± 3.8 m; n=6 female: 20 ± 2 y, 57.04 ± 3.62 kg, 163 ± 4.9 m) underwent passive dehydration via 24-h FR one time for men, and twice for women. Females were tested in the late follicular and mid-luteal phases of the menstrual cycle (days 12-14 and 19-21, respectively). Body mass loss assessed via nude body mass, plasma osmolality ( $P_{osm}$ ), and blood pressure were assessed pre- and post-FR. During FR participants also collected their urine which was assessed for urine color ( $U_{col}$ ), urine specific gravity (USG), osmolality ( $U_{osm}$ ), and volume (L). **Results:** No differences were found in this preliminary data set between men and women for body mass loss (%BML; male: 1.28 ± 1.14, female: .68 ± 1.2,  $p=.407$ ), plasma osmolality post-FR (male: 291 ± 4 mOsmo·kg<sup>-1</sup>, female: 294 ± 3 mOsmo·kg<sup>-1</sup>,  $p=.319$ ),  $U_{col}$  (male: 5 ± 2, female: 6 ± 1,  $p=.594$ ), USG (male: 1.026 ± 0, female: 1.027 ± 0,  $p=.862$ ), urine volume (male: 0.30 ± .47 L, female: 0.16 ± 0.20 L,  $p=.501$ ), or  $U_{osm}$  (male: 805 ± 313 mOsmo·kg<sup>-1</sup>, female: 740 ± 115 mOsmo·kg<sup>-1</sup>,  $p=.621$ ). The only differences present between male

and female participants were in pre-FR P<sub>osm</sub> (male: 293 ± 4 mOsmo·kg<sup>-1</sup>, female: 286 ± 3 mOsmo·kg<sup>-1</sup>, p=0.05). **Conclusion:** These preliminary data show no sex differences in response to 24-h FR, but this ongoing investigation and full dataset seeks to fully elucidate possible differences in response to FR simulating chronic mild dehydration that can affect young physically active, as well as elderly populations. Character Count: 1885/2000

**3485** Board #306 May 29 2:30 PM - 4:00 PM  
**Renal Stress Responses To Work In The Heat  
 Comparing Different Hydration Regimens**

Rachel A. Backes, Whitley C. Atkins, Samantha L. Thomas, Colin E. Glenny, Abby L. Flynn, Rachel M. Held, Brendon P. McDermott, FACSM. *University of Arkansas, Fayetteville, AR.* Email: rbackes@uark.edu  
 (No relevant relationships reported)

Workplace safety organizations recommend that workers predicted to incur heavy sweat loss should consume a 'sport drink' during work. These sugar-sweetened beverages (SSB) often include fructose, which can lead to acute kidney injury (AKI), especially when combined with hypohydration. **PURPOSE:** Investigate the effect of SSB on renal stress in response to simulated industrial work in the heat, while maintaining euhydration. **METHODS:** Twenty male participants (24 ± 2y, 179 ± 6cm, 24.7 ± 9.0% body fat) completed two randomized, matched trials of simulated industrial work (2-hr total; two 45-min work and two 15-min rest bouts) in the heat (30°C, 55% RH). Equal amounts of SSB or placebo were provided during rest and within 2-hr of completing work. Urine specific gravity (USG), heart rate (HR), and rectal temperature (T<sub>rec</sub>) were monitored throughout trials. Serum [Na<sup>+</sup>], hemoglobin, and hematocrit levels were measured at baseline, pre- and post-work, and 16-hr post-work. Urinary kidney injury molecule-1 (uKIM-1) and urinary neutrophil gelatinase-associated lipocalin (uNGAL) were measured pre- and post-work, 3-hr and 16-hr post-work. Total urine volume was measured for 16-hrs following work. Change in plasma volume (ΔPV) was calculated using the Dill & Costill equation. **RESULTS:** There was no significant trial difference in USG (p=.277) or HR (p=.209), but post-work (p≤.011) and 16-hr post-work USG were elevated compared to baseline (p=.043) and 3-hr post-work (p=.001). There was no difference in maximum T<sub>rec</sub> achieved between trials (SSB 38.84 ± 0.52°C; placebo 38.68 ± 0.40°C; p=.330). Serum [Na<sup>+</sup>] was elevated post-work compared to baseline and 16-hr post-work (p=.006), but there was no trial difference (p=.612). There was no trial difference in hemoglobin (p=.650) or hematocrit (p=.637). uKIM-1 was elevated post-work and 16-hr post-work compared to baseline (p≤.028) and 3-hr post-work (p≤.009), but showed no trial difference (p=.126). uNGAL 3-hr post-work was significantly lower than baseline (p=.011), but showed no trial difference (p=.992). There was no significant trial difference in total urine volume (p=.277) or ΔPV (p=.098). **CONCLUSION:** These findings indicate that beverage type did not affect renal stress biomarkers following simulated industrial work in the heat when euhydration was maintained.

**3486** Board #307 May 29 2:30 PM - 4:00 PM  
**No Relation Between Short-term Sodium Intake And  
 Whole Body Sweat Sodium Concentration During  
 Exercise-heat Stress**

Ryan P. Nuccio, Meagan O'Connor, Corey T. Ungaro, Kelly A. Barnes, Adam J. Reimel, Shyretha D. Brown, Lindsay B. Baker, FACSM. *Gatorade Sports Science Institute, Barrington, IL.* Email: ryan.nuccio1@pepsico.com

*Reported Relationships: R.P. Nuccio: Salary; Gatorade Sports Science Institute, PepsiCo Inc. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc.. Ownership/interest/stock; Gatorade Sports Science Institute, PepsiCo Inc. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc..*

Research has been limited and mixed with regards to the effect of normal, short-term dietary sodium (Na) intake on sweat Na concentration ([Na]) and total sweat Na losses during exercise.

**Purpose:**

To determine the relation between dietary Na intake during exercise and up to 48-h before exercise on whole-body (WB) sweat [Na] and total sweat Na loss during 90 min of moderate-intensity cycling in the heat.

**Methods:**

Forty-nine recreational athletes (34 men, 15 women; 34 ± 4 years; 75 ± 12 kg) cycled for 90 min at 78 ± 5% HR<sub>max</sub> in the heat (32°C, 25-50% RH). The WB washdown technique was used to collect sweat electrolytes during exercise and ion chromatography analysis was used to determine sweat [Na]. Total sweat Na loss was the product of WB sweat [Na] and WB sweat loss. Subjects were instructed to consume their normal diet before their trials. Upon arriving to the lab, each subject turned in a diet log, which included specific portion sizes and brand/type for all foods,

fluids, and dietary supplements consumed in the previous 48 h. The investigators reviewed the diet logs for completeness with the subjects. Na intake was determined by Registered Dietitians using a computer based dietary analysis tool. Na intake during the trial was determined from the volume of 6% carbohydrate electrolyte (38 mmol/L Na) solution consumed *ad libitum*. Pearson correlation analysis was used to determine the relation between Na intake versus WB sweat [Na] and total sweat Na loss. Data are shown as mean ± SD.

**Results:**

WB sweat [Na] was 41.1 ± 15.6 mmol/L and total sweat Na losses were 60.9 ± 35.3 mmol. Na intake during exercise, 24-h and 48-h before exercise were 32.4 ± 18.0 mmol, 188 ± 102 mmol, and 350 ± 159 mmol. There were no significant correlations between dietary Na intake and WB sweat [Na] (r = -0.002 to 0.02, p=0.90-0.99) or total sweat Na losses (r = 0.07 to 0.19, p=0.20-0.61) for any of the comparisons.

**Conclusion:**

There were no correlations between normal dietary Na intake during and up to 48 h before exercise versus WB sweat [Na] or total sweat Na losses. These results suggest that short-term Na intake does not play a significant role in explaining the inter-individual differences in WB sweat Na during exercise.

**3487** Board #308 May 29 2:30 PM - 4:00 PM  
**Exogenous Fluid Delivery Schedule And Composition  
 On Fluid Balance And Substrate Use In The Heat**

Alejandro M. Rosales, Walter S. Hailes, Alexander N. Marks, Patrick S. Dodds, Brent C. Ruby, FACSM. *University of Montana, Missoula, MT.*

(No relevant relationships reported)

Hydration position stands outline suggested volume considerations but remain somewhat ambiguous regarding frequency parameters. **PURPOSE:** To determine the effects of micro-dosing or bolus-dosing plain water (MW, BW, respectively) or a carbohydrate-electrolyte solution (MCE, BCE, respectively) on fluid retention and carbohydrate oxidation during exercise in the heat. **METHODS:** In a repeated measures cross-over design, males (n=8, 80.3 ± 11.8 kg, VO<sub>2</sub> peak 53 ± 5.0 ml·kg<sup>-1</sup>·min<sup>-1</sup>) completed four 2-hour trials (treadmill, 1.3 m·s<sup>-1</sup> at a 5% grade) in a heat chamber (33°C and 30% RH) with a 15 kg pack. Fluids were delivered to equal 100% of a pre-determined hourly fluid loss familiarization trial. Micro-dosed fluids were provided at 22 doses·h<sup>-1</sup> (49 ± 13 ml·dose<sup>-1</sup>), while bolus-dosed fluids were provided at 1 dose·h<sup>-1</sup> (1075 ± 274 ml·dose<sup>-1</sup>). CE trials delivered 67 ± 17 g CHO·hr<sup>-1</sup> and 939 ± 239 mg Na<sup>+</sup>·hr<sup>-1</sup>. Nude body weight, urine volume, and urine specific gravity (USG) were recorded during and 1-hour post exercise. Steady state expired air samples were collected to evaluate rates of carbohydrate oxidation. A two-way ANOVA with repeated measures was used to determine differences. Statistical significance was established at p < 0.05. **RESULTS:** Total body weight loss was similar across all four trials (-0.60 ± 0.25, -0.53 ± 0.17, -0.67 ± 0.34, and -0.50 ± 0.27 kg, for the BCE, MCE, BW, and MW trials, respectively, p > 0.05). Cumulative urine output was similar across all four trials (725 ± 478, 779 ± 494, 818 ± 507, 718 ± 446 ml, for the BCE, MCE, BW, and MW trials, respectively, p > 0.05). USG was additionally similar across all trials at 0, 60, 120, and 180 minutes (n=7, 1.008 ± 0.006, 1.008 ± 0.007, 1.007 ± 0.007, 1.008 ± 0.006, p > 0.05). Carbohydrate oxidation was significantly higher in the CE trials when compared to the W trials (1.5 ± 0.3 and 0.8 ± 0.2, g·min<sup>-1</sup>, p < 0.05) but was not different between dosing styles of the same composition (1.6 ± 0.3 and 1.5 ± 0.3 g·min<sup>-1</sup> for BCE and MCE; 0.8 ± 0.2 and 0.8 ± 0.3 g·min<sup>-1</sup> for BW and MW, p > 0.05). **CONCLUSION:** These data demonstrate minimal differences in overall fluid retention and substrate oxidation during exercise in the heat across varied fluid composition and delivery intervals. Supported by the United States Forest Service (USFS), National Technology and Development Program

**F-69** Free Communication/Poster -  
**Thermoregulation/Hyperthermia**

Friday, May 29, 2020, 1:30 PM - 4:00 PM  
 Room: CC-Exhibit Hall

**3488** Board #309 May 29 2:30 PM - 4:00 PM  
**Heat Load, Cooling Methods And Hydration Of Sailors  
 During Summer Training Camp In Japan**

Dalya Navot Mintzer, Eyal Shargal, Rotem Kislev Cohen. *Wingate, Netanya, Israel.* (Sponsor: Naama Constantini, FACSM)

Email: mmayan@yahoo.com

(No relevant relationships reported)

**Purpose:** Weather forecasts for the upcoming Olympic Games in Tokyo predict hot and humid conditions, which have a negative effect on performance. Our aim was to

estimate the heat load sensation and efficacy of cooling methods using self-reports, and by measuring parameters of hydration status of Olympic-level 470 sailors and windsurfers, during a training camp in the summer of 2019 in Japan.

**Methods:** Seven females (4 windsurfers, 3 sailors 470) and 4 males (470 sailors), age 21.17y ±1.4, used cooling vests, plates, and collars before and in-between training races. Weather conditions were measured using Kestrel 5500. Athletes scored their heat load sensation on a scale of 1 – “comfortable” to 5 – “unbearably hot” after each practice. Following the use of different cooling accessories, the athletes were asked to rate cooling method efficiency between 1 – “not efficient” to 5 – “very efficient”. Hydration status, was assessed by urine specific gravity (USG) prior to each training, body weight change and fluid intake measure during training sessions.

**Results:** During the 8 training days the average weather conditions were: heat index 26.3°C ±3.7; humidity 84% ±7%; and temperature 27.7°C ±1.5°C. Average sea training duration was 221min±66 for sailing and 177min ±34for windsurfing. Although the heat index did not change, the heat load sensation rating was affected by wind speed – rated as 2.5 when the wind speed was above 8 knots and 4 with lower wind speed (P<0.002). Using cooling vests before and between races was rated as efficient (4). Cooling plates (inserted under the life vests) and a cooling collar were somewhat less efficient (3.5 and 3.1 respectively). Athletes were well hydrated before training (average USG 1.009±0.007), and maintained good hydration during training (average fluid consumption of 2Lit ±0.9 and average weight loss of 0.05Kg ±0.55).

**Conclusions:** High humidity with a moderate heat index was measured at the area of the Tokyo Olympic Sailing Arena during July 2019. The athletes reported high heat load sensation during training and found different cooling methods efficient. Higher wind speed decreased the heat load sensation, probably due to the acceleration of sweat evaporation. High awareness and prior training in a hot environment like Israel may contribute to improved drinking behavior and hydration status.

**3489** Board #310 May 29 2:30 PM - 4:00 PM  
**Sweat Rate Variability Between Training Sessions**  
 JohnEric W. Smith, Marissa L. Bello, Brandon D. Shepherd, Payton L. Williamson. *Mississippi State University, Mississippi State, MS.* (Sponsor: Stanley Brown, FACSM)  
 Email: johneric.smith@msstate.edu  
*(No relevant relationships reported)*

Practitioners regularly develop hydration plans for athletes based on measured sweat rate. Often times, this is a single measure utilized over various training sessions without consideration for sweat rate variability.

**PURPOSE:** The purpose of this study was to investigate sweat rate variation in self-selected training sessions to assess the potential error that might be seen when determining sweat rate.

**METHODS:** Eleven endurance trained runners (7 competitive and 4 recreational) arrived at the research facility once a week over four weeks. Upon arrival, researchers recorded athlete’s body mass. Athletes then completed a running workout lasting a minimum of 30 minutes exercise time. Pace and distance were left to the individual runner’s preference for the training session. Immediately upon run completion, researchers reassessed the runners’ body mass. Difference in body mass pre- to post-run was reported as sweat rate as no fluid or beverage were ingested during the run. The highest and lowest sweat rate recorded for each individual during the four-week period were used for comparison. Paired sample t-tests were used to compare run duration, run distance, running pace, WBGT, and sweat rate with significance set a priori at P < 0.05.

**RESULTS:** There were no differences in run duration (41.3 ± 11.0 min; p = 0.68), run distance (8.13 ± 2.85 km; p = 0.94), run pace (5.11 ± 0.78 min/km; p = 0.07), or WBGT (21.9 ± 1.4°C; p = 0.41) between trials. Participants highest sweat rate recorded during the four-week period was significantly higher 1.08 ± 0.39 l/h compared to the lowest of 0.89 ± 0.32 l/h, (p = 0.003).

**CONCLUSIONS:** Assessing sweat rate is a useful tool for aiding in the determination of fluid intake during exercise however, a single point assessment may not accurately capture an individual’s typical rate. Caution needs to be taken when relying on a single assessment or extrapolating to longer training sessions even in similar conditions.

**3490** Board #311 May 29 2:30 PM - 4:00 PM  
**Elite Female Rugby Sevens Tournament Match-Play - Core Temperature Changes**  
 Lee Taylor, FACSM<sup>1</sup>, Bryna CR Christmas<sup>2</sup>, Christopher J. Stevens<sup>3</sup>, Aaron J. Coutts<sup>4</sup>, Mitchell J. Henderson<sup>5</sup>.  
<sup>1</sup>Loughborough University, Loughborough, United Kingdom.  
<sup>2</sup>Qatar University, Doha, Qatar. <sup>3</sup>Southern Cross University, Coffs Harbour, Australia. <sup>4</sup>University of Technology Sydney, Sydney, Australia. <sup>5</sup>Rugby Australia, Sydney, Australia.  
 Email: l.taylor2@lboro.ac.uk  
*(No relevant relationships reported)*

**PURPOSE:** Characterise player core temperature (Tc) across a World Rugby Women’s Sevens Series (WRWSS) tournament day and determine the efficacy of commonly

employed cold water immersion (CWI) protocols. **METHODS:** Tc was measured in twelve elite female rugby sevens athletes across 3 games (G1-3) from day 1 of the Sydney WRWSS tournament. Exertional heat illness symptoms, perceptual scales, CWI details, playing minutes, external load data (measured by Global Positioning Systems) and wet globe temperature (range: 18.5–20.1°C) were also collected. Linear mixed models and magnitude-based inferences were used to assess differences in Tc between periods [G1-3 and warm-ups (WU)]. **RESULTS:** Average Tc was very likely lower (ES; ±90% CL, -0.33; ±0.18) in G1 compared to G2. Peak Tc was very likely (0.71; ±0.28) associated with increased playing time. CWI did not remove the accumulated Tc due to WU and match-play activity (~1–2°C rise in Tc still present compared to Tc at WU onset for players ≥ 6 min match-play). **CONCLUSIONS:** Elite female WRWSS athletes experienced high Tc during WU (Tc peak 37.9–39.0°C) and matches (Tc peak 37.9–39.8°C), a magnitude known to reduce intermittent high-intensity physical performance (≥39°C). The CWI protocol resulted in players (≥ 6 min match-play) with a ~1–2°C raised Tc compared to Tc at WU onset.

**3491** Board #312 May 29 2:30 PM - 4:00 PM  
**Patch Application Timing And Adherence Duration Effects On Local Sweating Rate And Sweat Electrolyte Concentrations**  
 Kelly A. Barnes<sup>1</sup>, Ryan P. Nuccio<sup>1</sup>, Shyretha Brown<sup>1</sup>, Adam J. Reimel<sup>1</sup>, Corey T. Ungaro<sup>1</sup>, Peter J.D. De Chavez<sup>2</sup>, Lindsay B. Baker, FACSM<sup>1</sup>. <sup>1</sup>Gatorade Sports Science Institute, PepsiCo, Inc, Barrington, IL. <sup>2</sup>PepsiCo R&D, Barrington, IL.  
 Email: kelly.barnes1@pepsico.com  
*Reported Relationships: K.A. Barnes: Salary; PepsiCo, Inc. Ownership/ interest/stock; PepsiCo, Inc. Other (please describe); This study was funded by the Gatorade Sports Science Institute, a division of PepsiCo, Inc. The views herein are those of the authors and do not necessarily reflect the position or policy of PepsiCo.*

Sweat testing is often conducted to assist with electrolyte replacement plans for athletes. However, the effect of patch application timing and on-skin duration on local sweating rate (LSR) and sweat electrolyte concentrations is unclear. **Purpose:** To determine the effect of patch application timing and on-skin duration on LSR and local sweat [Na<sup>+</sup>], [K<sup>+</sup>], and [Cl<sup>-</sup>]. **Methods:** Thirty-nine recreationally trained (VO<sub>2</sub> max: 47.1±7.8 ml/kg/min) athletes (27 M, 12 F; 75.4±12.4 kg) cycled at ~80% HR<sub>max</sub> in the heat (32°C, 39% rh). Prior to (PRE) and 15 min into exercise (EX), two sweat patches were applied to the left and right mid-back, respectively. The patches were removed after a skin adherence duration of 30 (SHORT) or 70 (LONG) min. LSR was equated from sweat mass over patch surface area (11.9 cm<sup>2</sup>) and duration. Sweat was centrifuged and analyzed for [Na<sup>+</sup>], [K<sup>+</sup>], and [Cl<sup>-</sup>] by ion chromatography. A two-way repeated measures ANOVA was used to determine the effect of patch application timing (PRE vs. EX), duration (SHORT vs. LONG), and interaction effects on each variable, followed by Tukey post-hoc where main effects were found. Significance was set at p<0.05. **Results:** There was an interaction effect with EX LONG and EX SHORT > PRE LONG > PRE SHORT for [Na<sup>+</sup>] (56.8±21.6, 58.5±22.3 > 50.7±20.1 > 46.8±19.6 mmol/L, p<0.0001), [Cl<sup>-</sup>] (55.2±23.5, 53.5±25.1 > 38.2±21.7 mmol/L, p<0.0001), and LSR (1.4±0.3, 1.6±0.6 > 1.1±0.3 > 0.8±0.4 mg/cm<sup>2</sup>/min, p<0.0001). There were no significant differences for [K<sup>+</sup>] between EX LONG, EX SHORT, PRE LONG, AND PRE SHORT (3.8±0.6, 4.0±0.9, 3.6±0.6, 3.3±0.6 mmol/L, p=0.79). **Conclusion:** The on-skin duration did not affect sweat [Na<sup>+</sup>] and [Cl<sup>-</sup>] when patches were applied during exercise. However, applying patches prior to exercise resulted in lower sweat [Na<sup>+</sup>] and [Cl<sup>-</sup>], especially when removed after a short duration. This was likely due to lower LSR during the ramp up to steady state sweating. Therefore, practitioners should take patch application timing into account when interpreting sweat electrolyte results. Local sweat [Na<sup>+</sup>] and [Cl<sup>-</sup>] measured from patches applied prior to exercise may not be representative of concentrations during the full bout of exercise. However, more research is needed to determine the impact of patch timing in the context of whole body sweat [Na<sup>+</sup>] and [Cl<sup>-</sup>] estimations.

**3492** Board #313 May 29 2:30 PM - 4:00 PM  
**Cross-validation Of Whole Body Sweat Sodium Prediction Equations**  
 Lindsay B. Baker, FACSM<sup>1</sup>, Ryan P. Nuccio<sup>1</sup>, Adam J. Reimel<sup>1</sup>, Shyretha Brown<sup>1</sup>, Corey T. Ungaro<sup>1</sup>, Peter JD De Chavez<sup>2</sup>, Kelly A. Barnes<sup>1</sup>. <sup>1</sup>Gatorade Sports Science Institute, Barrington, IL. <sup>2</sup>PepsiCo R&D, Barrington, IL.  
 Email: lindsay.baker@pepsico.com  
*Reported Relationships: L.B. Baker: Salary; Gatorade Sports Science Institute, PepsiCo Inc. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc..*

We have previously published regression equations to estimate whole body (WB) sweat sodium concentration ([Na]) from regional (REG) measures; however, a cross-validation is needed to corroborate the applicability of these prediction equations

between studies. **PURPOSE:** To determine the validity of published regression equations (Baker et al. 2018) in predicting WB sweat [Na] from REG measures when applied to a new data set. **METHODS:** Forty-nine recreational athletes (34 men, 15 women; 75±12 kg) cycled for 90 min while WB sweat [Na] was measured using the washdown technique. Exercise intensity (82% HR<sub>max</sub>) and environmental conditions (32°C, 39% rh, 2.4 m/s air flow) were similar to the 2018 study in which the prediction equations were developed. REG sweat [Na] was measured from seven regions using absorbent patches (3M Tegaderm+Pad, 10 cm<sup>2</sup>). Regression equations from Baker et al. 2018 were applied to REG sweat [Na] to determine predicted WB sweat [Na]. Bland-Altman analysis of mean bias (raw and predicted minus measured) and 95% limits of agreement (LOA) were used to compare raw (uncorrected) REG sweat [Na] and predicted WB sweat [Na] to measured WB sweat [Na]. **RESULTS:** Mean±SD WB sweating rate was 0.94±0.32 L/h and measured WB sweat [Na] was 41±16 mmol/L. Mean bias (±95% LOA) between raw REG sweat [Na] and measured WB sweat [Na] was 10(±20), 0(±19), 9(±20), 22(±25), 23(±24), 0(±15), -4(±18) mmol/L for the dorsal forearm, ventral forearm, upper arm, chest, upper back, thigh, and calf, respectively. The mean bias (±95% LOA) between predicted WB sweat [Na] and measured WB sweat [Na] was 3(±14), 4(±12), 0(±14), 2(±17), -2(±16), 5(±13), 4(±15) mmol/L for the dorsal forearm, ventral forearm, upper arm, chest, upper back, thigh, and calf, respectively. **CONCLUSIONS:** The use of regression equations enables prediction of WB sweat [Na] within a mean bias of 0-5 mmol/L and within a 95% LOA of ±12-17 mmol/L across all sites. By contrast, the use of raw REG [Na] increases the mean bias to 9-23 mmol/L for the dorsal forearm, upper arm, chest, and upper back, and increases the 95% LOA to ±15-25 mmol/L across all sites. Regression equations improve the accuracy of estimating WB sweat [Na] from REG measures and are therefore recommended for use in Na balance studies and field tests to determine individualized sweat electrolyte losses.

**3493 Board #314 May 29 2:30 PM - 4:00 PM**  
**Gender Differences Of Sweat Rates In Endurance Trained Athletes**

Marissa L. Bello, Brandon D. Shepherd, Ffion G. Price, Peyton L. Williamson, JohnEric W. Smith. *Mississippi State University, Mississippi State, MS.* (Sponsor: Stanley P. Brown, FACSM)  
*(No relevant relationships reported)*

Adequate fluid replacement around exercise is an important consideration for endurance athletes. While sex-based differences in maximal sweat rate have been identified, sex-based differences in sweat rate variability between training sessions is less understood. **PURPOSE:** The purpose of this study was to observe differences in sweat rate in endurance-trained males and females. **METHODS:** Endurance-trained males (n=4) and females (n=14) completed training sessions lasting a minimum of 30 minutes once per week. Body mass was collected before and immediately after exercise. Total sweat loss (TSL) was calculated from changes in body mass. TSL and duration of exercise were used to calculate absolute sweat rate (ASR), and subsequently relative sweat rate (RSR). Heat stress was recorded using a WBGT, with temperatures ranging from 9.21-23.65°C. Data were analyzed using two-sample T-tests to evaluate differences between the maximum ASR and RSR between male and female runners. Significance was set a priori at P<0.05. **RESULTS:** Males had a significantly higher ASR than females (1.46±0.36 vs. 0.89±0.21 L/h; p<0.001). Males and females did not differ for RSR (0.018±0.004 vs. 0.014±0.004 L/kg/h; p=0.116). **CONCLUSION:** This observational study indicates males had a significantly higher ASR compared to females but similar RSR. Despite lack of significance in RSR, these results correspond with previous studies demonstrating sex differences due to differences in total body surface area. These results suggest sex should be a consideration when implementing different hydration strategies.

**3494 Board #315 May 29 2:30 PM - 4:00 PM**  
**Thermoregulatory Impairments Imposed By Men's Lacrosse Equipment In The Heat**

Whitley C. Atkins, Ikuo Kato, Mahendran Balasubramanian, Brendon P. McDermott, FACSM. *University of Arkansas, Fayetteville, AR.* (Sponsor: Brendon P. McDermott, FACSM)  
*(No relevant relationships reported)*

Exertional heat illness remains one of the leading causes of death in sport, especially in hot and humid conditions. Previous research has shown an impairment in thermoregulation while wearing American football and hockey equipment. However, the effects of men's lacrosse protective equipment have yet to be determined. **PURPOSE:** Investigate the effect of men's lacrosse equipment on thermoregulatory responses during simulated lacrosse exercise in the heat (30°C, 50% RH). **METHODS:** Sixteen male volunteers (21.8 ± 3.2y, 76.2 ± 8.9kg, 181.3 ± 6.1cm) with previous equipment intensive sport experience completed one trial while wearing protective lacrosse equipment (shoulder and elbow pads, gloves and helmet; EQ) and one trial without equipment (shorts and jersey; NEQ). Trials included 60-min of simulated lacrosse exercise separated into four 12-min sessions, each separated by four-min of rest. Hydration status was maintained by replenishing fluid loss throughout

trials. Rectal temperature (T<sub>rec</sub>), heart rate (HR), mean weighted skin temperature (T<sub>skin</sub>), rating of perceived exertion (RPE), and thermal sensation (TS) were assessed during rest breaks. Physiological strain index (PSI) was calculated as previously described. Paired samples t-tests or repeated measures analyses of variance, with Bonferroni post-hoc testing were used to identify significant differences (p≤0.05). **RESULTS:** There was no significant difference in T<sub>rec</sub> between trials (p=0.084), however, maximum T<sub>rec</sub> achieved was greater in EQ (39.3 ± 0.7°C) compared to NEQ (39.0 ± 0.7°C; p=0.016). Regardless of time point, HR (p≤0.001) and PSI (p=0.004) were significantly greater in EQ compared to NEQ. T<sub>skin</sub> was significantly elevated in EQ compared to NEQ throughout trials (p≤0.001). Perceptually, EQ increased RPE (p=0.003) and TS (p=0.012) compared to NEQ throughout trials. Urine specific gravity (USG) following trials was not significantly different between trials (p=0.151). **CONCLUSION:** Trial differences in T<sub>rec</sub>, HR and perceptual measures suggest a greater impairment in thermoregulation while wearing men's lacrosse equipment in the heat. Supervising entities for men's lacrosse should mandate heat acclimatization periods similar to those in place for American football to ensure athlete safety.

**3495 Board #316 May 29 2:30 PM - 4:00 PM**  
**Measured Versus Heart Rate-Derived Core Temperature During Outdoor Work In The Southeastern United States**

Anne M. Mulholland, Hillary A. Yoder, Zackary S. Ciccone, Jonathan E. Wingo, FACSM. *The University of Alabama, Tuscaloosa, AL.* (Sponsor: Jonathan E. Wingo, FACSM)  
*(No relevant relationships reported)*

Climate change is increasing the number of hot days to which outdoor workers are exposed, thereby increasing their risk of heat illness. Currently, continuous monitoring of core temperature (T<sub>c</sub>) is expensive, invasive, and impractical. The BioModule is a non-invasive physiological monitor that uses heart rate to provide an estimation of T<sub>c</sub>, but its accuracy is unknown. **PURPOSE:** To test the association between measured gastrointestinal temperature (T<sub>GI</sub>) and estimated core temperature (T<sub>c-est</sub>) from the BioModule device during outdoor work in a hot environment. **METHODS:** Twenty groundskeepers (18 men; mean±SD age = 38±8 y, body mass index = 31.5±7.5 kg/m<sup>2</sup>) swallowed an ingestible temperature sensor and strapped on a BioModule before work. T<sub>GI</sub> was collected every 15 minutes during the workday; T<sub>c-est</sub> was determined by a 1-min average from the same time of day. Data collection occurred in Alabama during July and August (31.4±3.1 °C WBGT). Relationship between T<sub>GI</sub> and T<sub>c-est</sub> was quantified using the repeated measures correlation coefficient (r<sub>rm</sub>). Agreement (bias±1.96 SD) between T<sub>GI</sub> and T<sub>c-est</sub> was evaluated using the Bland-Altman method for repeated observations. **RESULTS:** There was a moderate, positive relationship between T<sub>GI</sub> and T<sub>c-est</sub> (r<sub>rm</sub> = 0.56, p < 0.001). Agreement analysis indicated that T<sub>c-est</sub> overestimated T<sub>GI</sub> (0.28±0.58 °C). The error between T<sub>c-est</sub> and T<sub>GI</sub> was larger at lower temperatures, as indicated by a strong negative trend (Pearson's r = -0.73). **CONCLUSION:** The BioModule provides an estimation of T<sub>c</sub> that may be helpful as a guide during outdoor work in hot environments but should not be used for safety considerations or measurement of T<sub>c</sub>. Funded by the Deep South Center for Occupational Safety and Health, a National Institute for Occupational Safety and Health Education and Research Center.

**3496 Board #317 May 29 2:30 PM - 4:00 PM**  
**Sweat Electrolytes: Influence Of Environment, Sex And Exercise Intensity**

Melinda Millard-Stafford, FACSM, Michael L. Jones, Teresa Snow, Nicholas W. Shea. *Georgia Institute of Technology, Atlanta, GA.*  
 Email: mindy.millardstafford@ap.gatech.edu  
*Reported Relationships: M. Millard-Stafford: Consulting Fee; The Coca-Cola Company. Industry contracted research; Study was funded by The Coca-Cola Company.*

**Sweat electrolytes: Influence of environment, sex and exercise intensity.** Mindy Millard-Stafford FACSM, Michael L. Jones, Teresa K. Snow, and Nicholas W. Shea. School of Biological Sciences, Georgia Institute of Technology, Atlanta, GA. Sweat rate and electrolyte loss are highly variable among individuals; but sources of intra-individual variability due to test conditions remain to be quantified. **PURPOSE:** To determine the impact of exercise intensity and environment on sweat electrolyte losses in men and women. **METHODS:** Twenty adult women and men completed two sessions during summer months: 3 x 20 min intermittent cycling beginning at low intensity (50/75 Watts) with 25 W increases in work rate under hot-humid (35°C, 60%RH) or hot-dry (35°C, 20%RH) conditions. Whole body sweat rate, regional sweat [Na<sup>+</sup>] and [K<sup>+</sup>] were obtained at each work rate. Sweat was acquired via Opsite (Brisson method) on the scapula. Electrolytes were measured using Horiba LAQUATwin Ion meters. **RESULTS:** Sweat rate and [Na<sup>+</sup>] was significantly higher (p<0.001) due to increased RH in the heat and incremental changes in exercise intensity. Compared to low exercise intensity, sweat [Na<sup>+</sup>] increased by 26 (72%) and 39 mmol (108%) with successive 25W increases, similar in relative magnitude to

sweat rate increases of 0.4 l/min (67%) and 0.6 l/min (100%) compared to low exercise intensity. However,  $[Na^+]$  difference due to greater %RH of environment (60% vs. 20%RH) was only 7.7 mmol (14%) higher for all bouts combined. Sweat  $[K^+]$  was not different ( $p=0.4$ ) based on environment, but significantly higher ( $p=0.003$ ) under low intensity exercise compared to higher work rates ( $6.9 \pm 1.9 > 6.0 \pm 1.4$  mmol). When work rate was matched (75W) under humid conditions, no differences between men and women were observed in sweat rate ( $0.8 \pm 0.3$  l/min) or sweat sodium ( $49.2 \pm 17.2$  vs.  $52.7 \pm 30.0$  mmol, respectively). **CONCLUSION:** At matched low intensity exercise, sex differences in sweat sodium and rate were not observed. Intra-individual variability in sweat sodium is influenced more by modest incremental changes (25 W) in exercise intensity than the ambient humidity in hot conditions. Sweat testing of athletes using field techniques should carefully consider the intensity of the training session to accurately translate results.

Supported by a grant from The Coca-Cola Company

**3497** Board #318 May 29 2:30 PM - 4:00 PM  
**Abstract Withdrawn**

**3498** Board #319 May 29 2:30 PM - 4:00 PM  
**Core Temperature And Blood Lactate Kinetics After Graded Exercise Testing In The Heat**

J. Luke Pryor<sup>1</sup>, Robert G. Leija<sup>2</sup>, Peter Lao<sup>3</sup>, Canelaria Cruz<sup>2</sup>, Sergio Perez, Jr<sup>2</sup>, Jacobo Morales<sup>2</sup>, Kristen Cochrane-Snyman<sup>3</sup>.  
<sup>1</sup>University at Buffalo, Buffalo, NY. <sup>2</sup>California State University, Fresno, Fresno, CA. <sup>3</sup>Concordia University, Chicago, IL.  
(No relevant relationships reported)

Utility of a verification trial to confirm maximal oxygen intake ( $VO_{2max}$ ) in the heat is unclear and initial studies are needed to explore recovery duration between the initial graded exercise test (GXT) and the verification trial to ensure verification trial fidelity.

**PURPOSE:** To compare the recovery kinetics of gastrointestinal temperature (T<sub>gi</sub>) and blood lactate (BLA) after a GXT in the heat between trained and untrained cyclists. **METHODS:** Trained ( $n=10$ ; age:  $22.6 \pm 2.2$  y; body fat:  $15.4 \pm 5.8\%$ ) and untrained ( $n=11$ ; age:  $23.4 \pm 2.9$  y, body fat:  $21.1 \pm 5.8\%$ ) male cyclists volunteered. T<sub>gi</sub>, BLA (finger prick), expired gases, and power output (watts; W) were continuously measured during the GXT in a heated chamber (39°C, 31%RH). After the GXT, subjects exited the chamber and rested in a temperate room (22°C, 40%RH) until T<sub>gi</sub> returned to pre-GXT values (defined as "recovery") at which point BLA was re-assessed. Separate independent t-tests assessed differences in W,  $VO_{2max}$ , and recovery duration between groups. Separate 2 by 3 (training status [trained vs. untrained] time [pre-GXT, post-GXT, recovery]) repeated measures ANOVAs evaluated changes in T<sub>gi</sub> and BLA with Tukey post hoc tests ( $\alpha = 0.05$ ). **RESULTS:** As expected, the trained cyclists GXT was longer ( $709 \pm 81$  vs.  $610 \pm 98$  s;  $p=0.02$ ) and achieved greater peak power output ( $278 \pm 32$  vs.  $238 \pm 32$  W;  $p=0.009$ ) and  $VO_{2max}$  ( $57.2 \pm 7.7$  vs.  $40.5 \pm 5.5$  mL/kg/min;  $p<0.001$ ) than untrained. Recovery time was longer for trained subjects ( $50 \pm 5.4$  vs.  $43.5 \pm 10.2$  min;  $p=0.10$ ) but this difference did not reach significance. Pre-GXT and recovery T<sub>gi</sub> was higher in untrained ( $37.5 \pm 0.3$  and  $37.4 \pm 0.2^\circ\text{C}$ ) versus trained ( $37.1 \pm 0.2$  and  $37.2 \pm 0.2^\circ\text{C}$ ;  $p<0.01$ ) with both groups achieving similar post-GXT values (untrained:  $37.8 \pm 0.2$ ; trained:  $37.7 \pm 0.2^\circ\text{C}$ ;  $p=0.37$ ). BLA at recovery (trained:  $6.2 \pm 0.7$ ; untrained  $7.0 \pm 2.4$  mmol/L) was lower than Post-GXT (trained:  $12.8 \pm 1.9$ ; untrained  $13.3 \pm 2.9$  mmol/L) but remained higher than Pre-GXT (trained:  $2.3 \pm 0.3$ ; untrained  $3.3 \pm 1.5$  mmol/L) in both groups ( $p<0.001$ ) with no group main effects ( $p \geq 0.08$ ). **CONCLUSIONS:** The thermoregulatory system managed the GXT-induced thermal load faster than the metabolic system cleared BLA. If verification trials in the heat are employed, extended recovery durations appear necessary regardless of training status.

**3499** Board #320 May 29 2:30 PM - 4:00 PM  
**New Zealand Blackcurrant Extract Modulates Peripheral Blood Mononuclear Cell Response To Exertional Heat Stress**

Luke D. Greisler<sup>1</sup>, Ben J. Lee<sup>2</sup>, Tessa R. Flood<sup>2</sup>, Ania M. Hiles<sup>2</sup>, Mark ET Willems<sup>2</sup>, Ella F. Walker<sup>2</sup>, Garrett W. Hill<sup>1</sup>, Phebe A. Romano<sup>1</sup>, Matthew R. Kuennen<sup>1</sup>. <sup>1</sup>High Point University, High Point, NC. <sup>2</sup>University of Chichester, Chichester, United Kingdom.  
Email: mkuennen@highpoint.edu  
(No relevant relationships reported)

**Background.** We have previously shown that 7d of New Zealand Blackcurrant (NZBC) supplementation reduces the gastrointestinal barrier permeability response that normally accompanies exertional heat stress. **Purpose.** To determine the effect of NZBC supplementation on inflammatory capacity and apoptotic drive in peripheral blood mononuclear cells (PBMC) collected before and after exertional heat stress. **Methods.** Twelve men (Age:  $28 \pm 6$  years, Stature:  $1.81 \pm 0.07$  m, Mass:  $80.5 \pm 9.8$  kg,  $VO_{2max}$ :  $56 \pm 6$  mL $\cdot$ kg $^{-1}$  $\cdot$ min $^{-1}$ ) ingested 2 capsules of CurraNZ™ (210 mg anthocyanin

day $^{-1}$ ) or a visually matched placebo (microcrystalline cellulose) for 7d prior to a 1h treadmill run (65%  $VO_{2max}$ ) in hot ambient conditions (34°C / 40% RH). PBMC were isolated from EDTA plasma samples that were collected before (Pre), after (Post), 1h after (1-Post) and 4h after (4-Post) exercise. Inflammatory capacity was calculated as the ratio between phosphorylated and total NF- $\kappa$ B content in cell lysates. Apoptotic drive was calculated as the ratio between BAX and BCL-2 in cell lysates. Caspase 9 was measured to provide additional confirmation. Western blot data were analysed with two-way (Condition x Time) RM-ANOVA with Duncan post-hocs. **Results.** The p-NF- $\kappa$ B:NF- $\kappa$ B ratio was reduced following 7d NZBC supplementation (-46%,  $p=0.03$ ). Post hoc analysis indicated p-NF- $\kappa$ B:NF- $\kappa$ B content at 4-Post had fallen below values at Post (-24%,  $p=0.02$ ) and 1-Post (-60%,  $p=0.04$ ). The BAX:BCL-2 ratio was increased following 7d NZBC supplementation (+106%,  $p<0.01$ ). Post hoc analysis indicated the BAX:BCL-2 ratio increased from Pre to Post exercise (+119%,  $p=0.01$ ) in NZBC and remained elevated (above Pre) at 1-Post (+77%,  $p=0.04$ ) and 4-Post (+59%,  $p=0.04$ ). Caspase 9 content also increased following 7d NZBC supplementation ( $p<0.05$ ). Post hoc analysis indicated elevated Caspase 9 content at PRE in NZBC (+86%,  $p<0.01$ ), with differences between conditions being resolved by 4-Post exercise ( $p=0.94$ ). **Conclusions.** Study data suggest 7d NZBC supplementation may reduce inflammatory capacity and increase apoptotic drive in PBMC. This might call nascent leukocytes into circulation to ensure maintenance of the putative inflammatory response that accompanies exertional heat stress. However, the exact physiologic relevance of these changes remains to be determined.

**3500** Board #321 May 29 2:30 PM - 4:00 PM  
**Muscle Temperature During Exercise Under Whole-body Heating And Limb Heating Conditions**

Jian Cui, Cheryl Blaha, Samuel Pai, Jonathan Carter Luck, Lawrence I. Sinoway. Pennsylvania State University College of Medicine, Hershey, PA.  
Email: jcui@pennstatehealth.psu.edu  
(No relevant relationships reported)

Prior studies suggest that moderate whole-body heating (WBH), which raises internal temperature (T<sub>core</sub>) ~0.6-1.0 deg C, alters the exercise pressor reflex. It is speculated that elevated muscle temperature (T<sub>muscle</sub>) alters the sensitivity of muscle afferents. However, less is known about the effects of passive WBH on the limb T<sub>muscle</sub> during exercise. **PURPOSE:** To determine limb T<sub>muscle</sub> during exercise under passive WBH and limb heating conditions. **METHODS:** Forearm T<sub>muscle</sub> was measured with a needle probe (thermocouple) in 8 healthy subjects (57 ± 3 yrs). Mean skin temperature (T<sub>sk</sub>), T<sub>core</sub> (telemetric pill), the arm skin temperature (T<sub>armskin</sub>, not covered by suits), blood pressure (BP) and heart rate (HR) were measured during WBH with water perfused suits. After T<sub>core</sub> rose ~0.6 deg C, subjects performed a fatiguing handgrip exercise followed by post exercise circulatory occlusion (PECO). In a separate visit, the forearm was heated with a water perfused sleeve. After the T<sub>muscle</sub> rose ~1 deg C (i.e. similar to that seen during WBH), the exercise paradigm was repeated. **RESULTS:** Passive WBH significantly raised T<sub>sk</sub> ( $3.2 \pm 0.3$  deg C), T<sub>armskin</sub> ( $1.9 \pm 1.0$  deg C), T<sub>muscle</sub> ( $0.96 \pm 0.15$  deg C) and HR. The increases in T<sub>muscle</sub> were positively correlated with the increases in T<sub>core</sub> ( $R = 0.75$ ,  $P < 0.05$ ). Limb heating raised T<sub>muscle</sub> ( $0.98 \pm 0.11$  deg C), T<sub>armskin</sub> ( $2.3 \pm 0.6$  deg C), and did not alter T<sub>sk</sub>, T<sub>core</sub> or HR. There was no significant difference in the grip force, grip time, or the change in HR with handgrip between the trials. The increases in T<sub>muscle</sub> during the last min of grip ( $0.37 \pm 0.07$  vs.  $0.92 \pm 0.17$  deg C,  $P < 0.03$ ) and PECO ( $P = 0.01$ ) were significantly lower during WBH than during the limb heating trial. **CONCLUSION:** Although local limb heating and WBH induced similar elevations in T<sub>muscle</sub>, the responses in T<sub>muscle</sub> to exercise were different between these two heating conditions. Supported by NIH R01 HL141198 (Li and Cui) and UL1 TR002014 (Sinoway), and AHA Award #15GRNT24480051 (Cui).

**3501** Board #322 May 29 2:30 PM - 4:00 PM  
**Verification Bout Criteria In The Heat: A Training Status Comparison**

Kristen Cecilia Cochrane-Snyman<sup>1</sup>, Peter Lao<sup>2</sup>, Robert Leija<sup>3</sup>, Candelaria Cruz<sup>2</sup>, Sergio Perez Jr.<sup>2</sup>, J. Luke Pryor<sup>1</sup>. <sup>1</sup>Concordia University Chicago, River Forest, IL. <sup>2</sup>Fresno State, Fresno, CA. <sup>3</sup>University of California, Berkeley, Berkeley, CA. <sup>4</sup>University at Buffalo, Buffalo, NY.  
(No relevant relationships reported)

The use of verification bouts (VRF) to confirm maximal oxygen consumption ( $VO_{2max}$ ) in thermoneutral conditions is well established. Less is known about the utility of VRF in the heat. The impact of a hot environment may affect trained and untrained subjects differently. Data demonstrating the impact of heat on repeat bouts of high-intensity exercise may be useful for individuals performing an unaccustomed activity in the heat. **PURPOSE:** To compare  $VO_{2max}$ , heart rate (HR), and rating of perceived exertion (RPE) from a graded exercise test (GXT) vs. VRF in trained vs. untrained subjects. **METHODS:** Aerobically trained (T) ( $n=10$ ) and untrained (UT) ( $n=11$ ) college-aged males volunteered. Baseline gastrointestinal temperature (T<sub>gi</sub>)

and resting  $\dot{V}O_2$ , RPE, and HR values were collected then subjects rested in a heated chamber (39°C, 31% relative humidity) for 20 min before completing the GXT. Post-GXT, subjects exited the chamber and rested in a thermoneutral room (22°C, 40%RH) until Tgi returned to baseline. Subjects re-entered chamber and repeated pre-GXT procedures prior to VRF. For VRF, subjects warmed-up cycled at 60% maximal wattage ( $W_{max}$ ) from GXT and then cycled at 110%  $W_{max}$  until exhaustion.  $\dot{V}O_2$ , HR, and RPE values from the last complete min were used for comparison. A  $2 \times 2$  [(T vs. UT)  $\times$  (GXT vs. VRF)] mixed-factor ANOVA with Bonferroni post hoc tests and an alpha of 0.05 was used for analysis. **RESULTS:**  $\dot{V}O_2$ : trained cyclists  $\dot{V}O_{2max}$  was greater than untrained (56.4 $\pm$ 8.6 vs. 40.1 $\pm$ 5.9 mL $\cdot$ kg $^{-1}$  $\cdot$ min $^{-1}$ ,  $p < 0.001$ );  $\dot{V}O_2$  during GXT was greater than VRF for both groups ( $p = 0.013$ ,  $\eta^2 = 0.29$ ). HR: subjects had significantly higher HR during GXT vs. VRF (T:188 vs. 178 bpm; UT:189 vs. 181 bpm;  $p < 0.001$ ,  $\eta^2 = 0.74$ ) and HR was not significantly different between groups ( $p = 0.77$ ). RPE: There was a significant trial $\times$ training interaction ( $p = 0.04$ ,  $\eta^2 = 0.21$ ), and a significant main effect for training status with trained cyclists expressing higher RPE than untrained in GXT & VRF (19 vs. 18; 19 vs. 17;  $p = 0.002$ ). **CONCLUSION:** The results indicated that RPE may be tied to  $\dot{V}O_2$  more than HR in the heat in trained subjects.  $\dot{V}O_2$  during VRF in the heat was less than  $\dot{V}O_{2max}$  in all subjects during GXT which may confirm  $\dot{V}O_{2max}$  or indicate premature fatigue due to heat. Thus, a VRF may not be necessary for the determination of  $\dot{V}O_{2max}$  in the heat for untrained subjects.

3502 Board #323 May 29 2:30 PM - 4:00 PM

### Post-exercise Passive Heating Strategies Improve $\dot{V}O_{2max}$ , Running Economy, And Lactate Threshold

Bryant R. Byrd<sup>1</sup>, Joyce S. Ramos<sup>2</sup>, Claire Drummond<sup>2</sup>, Jonathan W. Specht<sup>1</sup>, Angelo K. Valenciana<sup>1</sup>, Lance C. Dalleck<sup>1</sup>. <sup>1</sup>Western Colorado University, Gunnison, CO. <sup>2</sup>Flinders University, Adelaide, Australia.  
Email: bbyrd@western.edu  
(No relevant relationships reported)

$\dot{V}O_{2max}$ , running economy, and lactate threshold have long been established as physiological determinants of endurance performance. Strategies to optimally improve these parameters have therefore been of much interest to endurance athletes. **PURPOSE:** To determine the effects of post-exercise passive heating strategies with hot water immersion and sauna suits on  $\dot{V}O_{2max}$ , running economy, and lactate threshold. **METHODS:** Participants (see table for physical characteristics) were randomized into three standardized 3wk exercise training groups: 1) exercise training alone - control (N=10), 2) exercise training with immediate post-exercise hot water immersion (N=10), and exercise training with immediate post-exercise sauna suit (N=10). At baseline and post-program participants completed a running economy protocol and maximal exercise testing protocol to measure  $\dot{V}O_{2max}$  and lactate threshold. The running economy protocol consisted of three consecutive 5-minute stages: stage 1 = 4.6 mph, stage 2 = 5.0 mph, and stage 3 = 5.4 mph. **RESULTS:** After 3wk, mean  $\dot{V}O_{2max}$  and lactate threshold changes in the sauna suit and hot water immersion groups were significantly greater ( $p < 0.05$ ) when compared to the control group (see table). The hot water immersion group showed significant within-group improvements ( $p < 0.05$ ) in economy between baseline and 3wk for all three stages (see table), although there were no between group differences ( $p > 0.05$ ). **CONCLUSION:** Both post-exercise passive heating strategies were equally effective at increasing  $\dot{V}O_{2max}$  and lactate threshold values. Additionally, despite the absence of between-group statistical significance, preliminary evidence suggest post-exercise hot water immersion may be a more effective strategy at improving running economy relative to wearing a sauna suit after exercise.

Table. Physical and physiological characteristics at baseline and 3wk for control, sauna suit, and hot water immersion groups. (Values are mean  $\pm$  SD).

| Parameter  | Control group (N=8) |                 | Sauna suit group (N=7) |                   | Hot water immersion group (N=9) |                  |
|--|---------------------|-----------------|------------------------|-------------------|---------------------------------|------------------|
|  | Baseline            | 3wk             | Baseline               | 3wk               | Baseline                        | 3wk              |
| Age (yr)   | 26.6 $\pm$ 11       | —               | 24.8 $\pm$ 17          | —                 | 22.9 $\pm$ 11                   | —                |
| Height (cm)  | 165 $\pm$ 29        | —               | 168.6 $\pm$ 30         | —                 | 177.7 $\pm$ 3                   | —                |
| Body mass (kg)   | 64.7 $\pm$ 30.2     | 64.7 $\pm$ 31.7 | 65.1 $\pm$ 38.8        | 64.3 $\pm$ 36.7   | 72.9 $\pm$ 39.4                 | 72.8 $\pm$ 36.4  |
| Economy - stage 1 (mL $\cdot$ kg $^{-1}$ $\cdot$ min $^{-1}$ ) | 24.3 $\pm$ 2.3      | 23.1 $\pm$ 4.4  | 24.5 $\pm$ 3.4         | 24.0 $\pm$ 2.4    | 24.8 $\pm$ 1.8                  | 22.3 $\pm$ 3.8*  |
| Economy - stage 2 (mL $\cdot$ kg $^{-1}$ $\cdot$ min $^{-1}$ ) | 27.6 $\pm$ 3.9      | 26.5 $\pm$ 4.5  | 28.2 $\pm$ 2.4         | 27.3 $\pm$ 3.0    | 28.0 $\pm$ 1.9                  | 26.1 $\pm$ 3.4*  |
| Economy - stage 3 (mL $\cdot$ kg $^{-1}$ $\cdot$ min $^{-1}$ ) | 29.7 $\pm$ 3.8      | 29.0 $\pm$ 5.8  | 31.2 $\pm$ 1.7         | 29.6 $\pm$ 3.5    | 30.2 $\pm$ 2.2                  | 28.1 $\pm$ 3.5*  |
| Lactate threshold (% $\dot{V}O_{2max}$ )                       | 59.8 $\pm$ 4.4      | 62.8 $\pm$ 5.4* | 57.3 $\pm$ 4.0         | 65.2 $\pm$ 4.7**  | 58.6 $\pm$ 6.9                  | 67.0 $\pm$ 7.7** |
| $\dot{V}O_{2max}$ (mL $\cdot$ kg $^{-1}$ $\cdot$ min $^{-1}$ ) | 39.4 $\pm$ 15.2     | 40.5 $\pm$ 15.9 | 42.2 $\pm$ 10.6        | 45.5 $\pm$ 12.9** | 46.3 $\pm$ 25.4                 | 49.7 $\pm$ 26**  |

\* Within-group change is significantly different from baseline,  $p < 0.05$ ; \*\* Change from baseline is significantly different from control group,  $p < 0.05$ .

3503 Board #324 May 29 2:30 PM - 4:00 PM

### Endurance Exercise Capacity & Heat-loss Responses Are Greater In The Late Evening Than Morning

Hidegori Otani<sup>1</sup>, Mitsuharu Kaya<sup>2</sup>, Heita Goto<sup>3</sup>, Akira Tamaki<sup>2</sup>. <sup>1</sup>Himeji Dokkyo University, Himeji, Japan. <sup>2</sup>Hyogo University of Health Sciences, Kobe, Japan. <sup>3</sup>Kyushu Kyoritsu University, Kitakyushu, Japan.  
Email: hotani@himeji-du.ac.jp  
(No relevant relationships reported)

Various major sporting events in the heat of summer start from not only in the morning but also in the late evening. However, to date rationales for differences in endurance exercise capacity and thermoregulatory responses to exercise in the heat between morning and late evening have not been reported. **PURPOSE:** The current study investigated the diurnal effects of exercise in the late morning and evening on endurance exercise capacity and thermoregulatory responses during a time-to-exhaustion test in the heat. **METHODS:** Ten male participants cycled at 70% peak oxygen uptake until exhaustion in the heat (30°C, 50% relative humidity). Participants commenced exercise in the late morning at 10:00 h (AM) or evening at 21:00 h (PM). Upon cessation of exercise, participants completed a 30 min post-exercise recovery. **RESULTS:** Time to exhaustion was 28 $\pm$ 13% (mean $\pm$ SD) longer in PM (49.1 $\pm$ 16.3 min) than AM (38.7 $\pm$ 14.6 min;  $P < 0.001$ ). Rectal temperature before and during exercise were higher in PM than AM (both  $P < 0.01$ ) in accordance with the diurnal variation of core temperature ( $T_c$ ). The rates of rise in rectal temperature (AM 0.030 $\pm$ 0.012°C/min; PM 0.021 $\pm$ 0.008°C/min), mean skin temperature (AM 0.095 $\pm$ 0.042°C/min; PM 0.068 $\pm$ 0.028°C/min), thermal sensation and rating of perceived exertion during exercise were slower in PM than AM (all  $P < 0.05$ ). Rectal temperature at the point of exhaustion was not different by time-of-day (AM 38.3 $\pm$ 0.4°C; PM 38.6 $\pm$ 0.5°C). Dry and evaporative heat losses and an increase in skin blood flow during exercise were greater in PM than AM (all  $P < 0.05$ ). During 30-min post-exercise recovery, the rates of fall in rectal temperature (AM 0.013 $\pm$ 0.004°C/min; PM 0.019 $\pm$ 0.010°C/min) and skin blood flow were faster and thermal sensation was lower in PM than AM (all  $P < 0.05$ ). Heart rate during exercise and recovery were not different between trials. **CONCLUSION:** This study indicates that endurance exercise capacity is greater and heat-loss responses to control  $T_c$  during and following exercise in the heat are more effective in the late evening than morning. Moreover, perceived fatigue during exercise and thermal perception during and following exercise are lower in the late evening than morning.

3504 Board #325 May 29 2:30 PM - 4:00 PM

### Effect Of Heat On Serum And Plasma Brain-derived Neurotrophic Factor During Aerobic Exercise

Tori D. Hargett, Ryan T. Wiet, Elliot Arroyo, Emily C. Tagesen, Ellen L. Glickman, FACSM, Adam R. Jajtner. Kent State University, Kent, OH. (Sponsor: Ellen L. Glickman, FACSM)  
(No relevant relationships reported)

Exercise has been found to promote the release of brain-derived neurotrophic factor (BDNF). Literature suggests that BDNF is upregulated in the periphery post aerobic exercise. There is evidence that shows BDNF plays a role in temperature regulation, however, it is still unclear if BDNF will rise in the heat as compared to thermoneutral conditions following aerobic exercise. Evidence has also shown that plasma and serum BDNF may be independent of each other. Therefore, investigating this difference may lead to a better understanding of the post aerobic exercise BDNF response. **Purpose:** The purpose of this study was to examine temperature related effects on BDNF during aerobic exercise in different environmental conditions along with differences between serum and plasma BDNF. **Methods:** Six recreationally active college aged men (26  $\pm$  3 years) completed a  $\dot{V}O_{2max}$  test (48.6  $\pm$  5.7 mL/kg/min) and performed experimental trials in 35°C at 45% humidity (HT/MH) and 22°C at 45% humidity (MT/MH). During each trial, participants cycled for 60-minutes at 60% of  $\dot{V}O_{2max}$ , rested for 15-minutes, cycled until exhaustion at 90%  $\dot{V}O_{2max}$ , then recovered for 60-minutes. Blood was obtained before exercise (PRE), after 60 minutes of cycling (60), after the TTE (90), and after recovery (REC). Serum and plasma BDNF were assessed via ELISA, while data was analyzed using a mixed model regression, with significance defined as  $\alpha < 0.05$ . **Results:** There was no significant condition by time interaction ( $F = 0.602$ ,  $p = 0.618$ ) nor main effect of condition ( $F = 1.792$ ,  $p = 0.189$ ) or time ( $F = 1.949$ ,  $p = 0.139$ ) for serum BDNF concentrations. There was also no significant condition by time interaction ( $F = 0.272$ ,  $p = 0.845$ ) nor main effect of condition ( $F = 0.415$ ,  $p = 0.523$ ) or time ( $F = 1.070$ ,  $p = 0.373$ ) for plasma BDNF concentrations. **Conclusions:** This data suggests high temperature does not have an effect on the BDNF response in serum or plasma concentrations. Nor does this study give evidence to an upregulation of BDNF concentrations due to aerobic exercise, though further work is warranted. *This study was partially funded by the Kent State University Research Council.*

3505 Board #326 May 29 2:30 PM - 4:00 PM

**The Effect Of Hydration Status And Ice Water Dousing On Heart Rate Variability Prior To And During Intermittent Exercise In The Heat**

Yasuki Sekiguchi, Courtney L. Benjamin, Cody R. Butler, Margaret C. Morrissey, Erica M. Filep, Rebecca L. Stearns, Douglas J. Casa, FACSM. *Korey Stringer Institute, University of Connecticut, Storrs, CT.* (Sponsor: Douglas J. Casa, FACSM)  
Email: yasuki.sekiguchi@uconn.edu  
(No relevant relationships reported)

**PURPOSE:** Determine the effect of hydration status and ice water dousing on heart rate variability (HRV) prior to and during intermittent exercise in the heat.

**METHODS:** Ten team sport athletes (mean [M]± standard deviation [SD]; age, 21±1; body mass, 69.8±7.7kg; height, 175.0±7.3cm;  $VO_{2max}$ , 54.5±6.8ml·kg<sup>-1</sup>·min<sup>-1</sup>) performed a soccer simulated intermittent exercise treadmill protocol in the heat (ambient temperature, 33°C; relative humidity, 50%) with four conditions: Euhydrated without dousing (EuND), Dehydrated without dousing (DeND), Euhydrated with dousing (EuD), and Dehydrated with dousing (DeD). Resting HRV (LnRMSSD) was measured prior to (PRE) and between intermittent exercise (MID) for 5 min. Repeated measures ANOVA was used to examine the differences of HRV in each condition followed by post-hoc with LSD. 95% confidence intervals (95%CI) were calculated. Significance was set a-priori p<0.05.

**RESULTS:** Percent body mass loss for each condition at MID was MID-EuND (-0.9±1.8%), MID-DeND (-3.3±1.7%), MID-EuD (-0.8±1.1%), and MID-DeD (-2.4±2.2%). There were no differences between PRE-EuND (M±SD, 1.7±0.5 ln ms), PRE-DeND (M±SD, 1.8±0.9 ln ms), PRE-EuD (M±SD, 2.0±0.6 ln ms), and PRE-DeD (M±SD, 19.7±0.2 ln ms) (p>0.05). However, MID-EuND (M±SD, 1.9±0.8 ln ms) was significantly lower than MID-EuD (M±SD, 2.8±0.6 ln ms, 95%CI=-1.7- -0.2, p=0.021) and MID-DeND (M±SD, 1.6±0.5 ln ms) was significantly lower than MID-DeD (M±SD, 2.8±0.7 ln ms, 95%CI=-1.8 - -0.6, p=0.002). Furthermore, MID-DeND was significantly lower than MID-EuD (95%CI=-1.8 - -0.7, p=0.001) and MID-EuND was significantly lower than MID-DeD (95%CI=-1.9 - -0.1, p=0.037). **CONCLUSIONS:** There were no differences in HRV between euhydration and dehydration prior to exercise. However, ice water dousing increased HRV regardless of hydration status at the middle of intermittent exercise. Thus, ice water dousing, which is practical and time efficient, might lead to improved recovery at the middle of intermittent exercise in the heat.

3506 Board #327 May 29 2:30 PM - 4:00 PM

**INFLUENCE OF HYDRATION STATUS ON RUNNING PERFORMANCE IN HIGH SCHOOL CROSS COUNTRY RUNNERS**

Joshua Granger, Nathan Lemoine, Derek Calvert, Arnold Nelson, FACSM, Neil Johannsen, Guillaume Spielmann. *Louisiana State University, Baton Rouge, LA.* (Sponsor: Arnold Nelson, FACSM)  
Email: jgrang6@lsu.edu  
(No relevant relationships reported)

Adequate hydration is crucial for athlete's health and performance. Although the impact of hypohydration on professional athletes have been well characterized, there is a dearth of information on the effect of hypohydration on younger populations, such as high school athletes, specifically cross-country runners in a hot and humid environment. **Purpose:** To characterize the effects of hydration status on running performance in high school cross-country runners and determine if a simple hydration plan can improve hydration status. **Methods:** 15 high school cross-country runners (9 males, 6 females; 15.5 ± 1.2 yrs) participated in this study. The study took place over a two-week period with baseline testing (V1, V3) and a 5km running performance trials (V2, V4) occurring after school during normal practice hours, with V1 (V3) and V2 (V4) separated by 3 days. A simple hydration strategy of 32oz. of water in the morning and evening preceding the 5km performance trial was implemented to enhance the hydration status of the athletes. Changes in performance between V2 and V4 were determined by 5km completion time, and hydration status was determined by pre- and post-run urine specific gravity using a spectral refractometer. Changes in core temperatures in response to 5km runs were measured on V2 and V4 using core temperature pills. **Results:** Participants were significantly hypohydrated at rest (USG; V1 = 1.031 ± 0.008, V2 = 1.033 ± 0.006, V3 = 1.030 ± 0.007), but the simple hydration strategy implemented after V3 significantly improved hydration in V4 (resting USG = 1.024 ± 0.008; p<0.001). The average 5km performance times were not significantly different between V2 and V4 (V2:1613.3±224.4 sec, V4:1716.2±176.1 sec), however changes in resting hydration status between V2 and V4 were significantly correlated with improvements in 5km performance time (p=0.02, Pearson's r=0.63). Changes in core temperature from pre- to post-practice was significantly lower in V2 than V4 (V2:+0.79±0.7 °C, V4:+0.86±1.35 °C; p=0.04). **Conclusion:** High school cross-country runners are hypohydrated, and a simple

hydration plan can improve hydration status. Improved hydration was correlated to lower performance times in our cohort of young athletes. The findings support that high school athlete's hydration status is of concern and should be monitored.

3507 Board #328 May 29 2:30 PM - 4:00 PM

**The Effects Of Acute Thermoneutral And Hot Water Immersion On Cerebrovascular Reactivity**

Emma L. Reed<sup>1</sup>, Morgan L. Worley<sup>1</sup>, Nathan J. Klaes<sup>1</sup>, Jacqueline C. Dirr<sup>2</sup>, Dziana Vertsiakhoukaya<sup>1</sup>, Manjot Sandhur<sup>1</sup>, Zachary J. Schlader<sup>3</sup>, Blair D. Johnson, FACSM<sup>1</sup>. <sup>1</sup>The University at Buffalo, Buffalo, NY. <sup>2</sup>Loyola University Chicago, Chicago, IL. <sup>3</sup>Indiana University, Bloomington, IN. (Sponsor: Blair Johnson, FACSM)  
(No relevant relationships reported)

Repetitive hot head-out water immersion increases peripheral vascular function and non-immersion cerebral artery blood velocity. However, it is not known if an acute bout of hot head-out water immersion (HOWI) improves cerebrovascular function (i.e., cerebrovascular reactivity (CVR)). **PURPOSE:** We tested the hypothesis that CVR is greater during and following hot (HOT) vs. thermoneutral (TN) HOWI. **METHODS:** Twelve healthy participants (age: 22±2 y, 6 females) completed two randomized trials which consisted of 30 min of HOT (39°C) or TN (35°C) HOWI. Beat-to-beat blood pressure (MAP), middle cerebral artery blood velocity (MCAv), and the partial pressure of end-tidal CO<sub>2</sub> (PETCO<sub>2</sub>) were recorded continuously. After 5 min of seated baseline, participants breathed hypercapnic gas (3, 5, and 7% CO<sub>2</sub> for 3 min each) in a stepwise fashion. CVR testing was completed pre, 30 min into HOWI (during), and immediately post-HOWI. CVR was calculated as the slope of the linear regression line by plotting MCAv versus PETCO<sub>2</sub>. **RESULTS:** MAP (HOT: 84±6 vs. TN: 83±9 mmHg; P=0.95), MCAv (HOT: 66±10 vs. TN: 66±14 cm/s; P=0.50), PETCO<sub>2</sub> (HOT: 43±2 vs. TN: 43±3 mmHg; P=0.41) and CVR (HOT: 1.66±0.30 vs. TN: 1.82±0.50 cm/s/mmHg; P=0.16) were not different between HOT and TN at baseline. MAP was different between HOT and TN during (HOT: 80±9 vs. TN: 89±12 mmHg; P<0.01) and post (HOT: 84±9 vs. TN: 95±9 mmHg; P<0.01). MCAv was not different between HOT and TN during (HOT: 64±12 vs. TN: 71±13 cm/s; P=0.48) and post (HOT: 67±13 vs. TN: 70±15 cm/s; P=0.79). PETCO<sub>2</sub> was not different between HOT and TN during (HOT: 44±3 vs. TN: 45±3 mmHg; P=0.69) or post (HOT: 43±3 vs. TN: 43±3 mmHg; P=0.74). CVR was not different between HOT and TN during (HOT: 1.62±0.4 vs. TN: 2.01±0.61 cm/s/mmHg; P=0.22) and during post (HOT: 1.51±0.69 vs. TN: 1.77±0.64 cm/s/mmHg; P=0.43). **CONCLUSION:** These preliminary data indicate that cerebrovascular reactivity is not improved during an acute bout of hot water immersion compared to thermoneutral water immersion. Further investigations should examine if repetitive hot water immersion improves cerebrovascular reactivity. Supported by Office of Naval Research Award N00014-17-1-2665

3508 Board #329 May 29 2:30 PM - 4:00 PM

**Cerebral Autoregulation Is Not Different Between Hot And Thermoneutral Head-Out Water Immersion In Healthy Participants**

Morgan L. Worley<sup>1</sup>, Emma L. Reed<sup>1</sup>, Jacqueline C. Dirr<sup>2</sup>, Zachary J. Schlader, FACSM<sup>3</sup>, Blair D. Johnson, FACSM<sup>1</sup>. <sup>1</sup>University at Buffalo, Buffalo, NY. <sup>2</sup>Loyola University Chicago, Chicago, IL. <sup>3</sup>Indiana University, Bloomington, IN. (Sponsor: Blair D. Johnson, FACSM)  
(No relevant relationships reported)

Recurring hot head-out water immersion (HOWI) enhances peripheral vascular function and cerebral blood velocity during non-immersion conditions (i.e., rest, aerobic exercise, and heat stress). However, it is not known if an acute bout of hot HOWI alters cerebrovascular function (i.e., cerebral autoregulation). **PURPOSE:** We tested the hypothesis that dynamic cerebral autoregulation is improved during and following an acute bout of hot (HOT) vs. thermoneutral (TN) HOWI. **METHODS:** Seventeen healthy participants (age: 23±2 y, 5 females) completed two randomized trials which consisted of 30 min of HOT (39°C) or TN (35°C) HOWI. Beat-to-beat blood pressure (MAP), middle cerebral artery blood velocity (MCAv), and end-tidal CO<sub>2</sub> tension (PETCO<sub>2</sub>) were recorded continuously. After 5 min of seated rest, participants breathed through a respiratory impedance device for 5 min while maintaining PETCO<sub>2</sub> values to assess cerebral autoregulation using Fourier transformation (n = 11). Cerebral autoregulation testing was completed pre, 30 min into HOWI (during), and immediately post HOWI. Values are reported as a change from baseline (α: mean ± SD). **RESULTS:** MAP, MCAv, PETCO<sub>2</sub>, gain, and phase were not different between HOT and TN at pre (P > 0.23 for all). αMAP was lower in HOT vs. TN during (-3±6 vs. 9±5 mmHg; P<0.01) and post (0±5 vs. 10±7 mmHg; P<0.01). αMCAv was lower in HOT vs. TN during (-3±5 vs. 4±4 cm/s; P<0.01) and post (-5±7 vs. 0±5 cm/s; P<0.01). αPETCO<sub>2</sub> was lower in HOT vs. TN during (1±2 vs. 2±2 mmHg; P<0.01) and post (-3±2 vs. -1±2 mmHg; P<0.01). αGain was not different between HOT and TN during (HOT: -0.03±0.15 vs. TN: -0.08±0.05 cm/s/mmHg; P=0.18) or post (HOT: 0.04±0.12 vs. TN: -0.03±0.07 cm/s/mmHg; P=0.18). αPhase

was not different between HOT and TN during (HOT:  $2.9 \pm 9.0$  vs. TN:  $1.0 \pm 8.8^\circ$ ;  $P=0.74$ ) or post (HOT:  $-1.2 \pm 12.8$  vs. TN:  $-2.0 \pm 9.7^\circ$ ;  $P=0.74$ ) **CONCLUSION:** These data indicate that an acute bout of hot water immersion attenuates cerebral blood velocity vs. thermoneutral water immersion. This response is likely due to the differences in arterial blood pressure and/or arterial carbon dioxide between conditions. However, cerebral autoregulation during and following hot water immersion is not different compared to thermoneutral water immersion in healthy participants. Supported by Office of Naval Research Award N00014-17-1-2665

**3509** Board #330 May 29 2:30 PM - 4:00 PM  
**Do The National Institute Of Occupational Safety And Health Recommendations Prevent Hyperthermia And Dehydration?**

Nate E. Bartman<sup>1</sup>, Jonathan R. Larson<sup>1</sup>, Zachary J. Schlader, FACSM<sup>2</sup>, Blair D. Johnson, FACSM<sup>1</sup>, David Hostler, FACSM<sup>1</sup>, Riana R. Pryor<sup>1</sup>. <sup>1</sup>University at Buffalo, SUNY, Buffalo, NY. <sup>2</sup>Indiana University, Bloomington, IN.  
 (No relevant relationships reported)

The National Institute of Occupational Safety and Health (NIOSH) recommendations for work in the heat suggest consuming 237 mL of water every 15-20 min and rest intervals are not necessary for work if conditions are not extreme. The efficacy of these recommendations to protect against hyperthermia (rise in core temperature) and dehydration (percent body mass loss) has not been tested. **PURPOSE:** To test the effectiveness of the NIOSH guidelines to prevent body temperature from exceeding  $38.0^\circ\text{C}$  and dehydration greater than 2% of body mass. **METHODS:** Seven men walked for 2 hours at 6.4 kph in the highest thermal stress NIOSH allows before recommending work-to-rest ratios ( $34^\circ\text{C}$ , 30% relative humidity). Participants drank 237 mL of water every 20 minutes while rectal temperature ( $T_{\text{re}}$ ) monitored. Body mass and urine specific gravity (USG) were measured before and after exertion.  $T_{\text{re}}$  was extrapolated out to four- and eight-hour workdays based on the rate of  $T_{\text{re}}$  rise in the last hour of exertion. Percent dehydration was extrapolated out to four- and eight-hour workdays based on body mass lost and planned hydration during exertion. **RESULTS:**  $T_{\text{re}}$  rose from baseline ( $36.8 \pm 0.3^\circ\text{C}$ ) to the completion of exertion ( $38.1 \pm 0.6^\circ\text{C}$ ,  $p < 0.001$ ), with two subjects reaching the  $38^\circ\text{C}$  threshold. Four- and eight-hour predicted  $T_{\text{re}}$  were  $38.6 \pm 1.1^\circ\text{C}$  and  $39.6 \pm 2.1^\circ\text{C}$ , respectively, with 5 subjects predicted to exceed  $T_{\text{re}}$  threshold at 4hr and 6 subjects at 8hr. Subjects began work euhydrated (USG:  $1.013 \pm 0.005$ ) and dehydrated  $0.03 \pm 0.48\%$  during the work protocol, with no subjects reaching 2% dehydration. Four- and eight-hour predicted percent dehydration were  $0.05 \pm 0.95\%$  and  $0.10 \pm 1.90\%$ , respectively. **CONCLUSIONS:** Adherence to the NIOSH recommendations may be insufficient to prevent workers from reaching the hyperthermia threshold but would protect against dehydration during heavy intensity work in the heat. Adjustments to NIOSH work-to-rest ratio recommendations should be explored to maintain worker safety.

**3510** Board #331 May 29 2:30 PM - 4:00 PM  
**Human Intestinal Microbiota Heat Production Is An Unmeasured Quantity In Thermal And Metabolic Studies**

Lawrence E. Armstrong, FACSM<sup>1</sup>, Douglas J. Casa, FACSM<sup>1</sup>, Luke N. Belval<sup>2</sup>. <sup>1</sup>University of Connecticut, Storrs, CT. <sup>2</sup>Institute for Exercise and Environmental Medicine, Dallas, TX. Email: lawrence.armstrong@uconn.edu  
 (No relevant relationships reported)

The human intestinal microbiota (IM) contains a diverse array of micro-organisms from more than 1,000 species that inhabit the surface and contents of the gastrointestinal tract. The number of bacterial cells ( $10^{13}$  -  $10^{14}$ ) is approximately the number of cells in the entire human body. Most research ignores the contributions of this biomass to human metabolic and physiologic responses. **PURPOSE:** To examine influences of the IM on research measurements of metabolism and calculations of heat balance. **METHODS:** This prospective study combined data from 9 IM, 4 small animal, and 6 human peer-reviewed publications. Our analyses compared IM versus human metabolism and heat production. **RESULTS:** We calculated the rate of IM heat production in the human colon to be 32 kcal/h for fecal bacteria (based on 46 g dry weight of colonic fecal bacteria and a median *Lactobacillus* heat production of 800mW/g dry weight during anaerobic fermentation). This calculated rate of IM heat production is considerable, when compared to both the resting metabolic rate (RMR) of men (42% of 76 kcal/h) and women (52% of 62 kcal/h), as well as the 24-h energy expenditure (RMR + energy expenditure during activities) of men (23% of 140 kcal/h) and women (34% of 94 kcal/h). The heat production of bacteria residing within the intestinal mucosa is unknown and adds to that of fecal bacteria. Diet contents (e.g., resistant starch) are primary determinants of IM heat production. Considering Acceptable Macronutrient Distribution Ranges published by the National Academy of Sciences, USA, the fermentation of plant material generates 69.3 - 264.6 Kcal/24h during metabolism of a 2200 kcal/24h diet. **CONCLUSIONS:** Because IM metabolic and thermal effects are sufficiently large to have a measurable impact on research, we

conclude that the IM represents an uncontrolled, unmeasured factor in the experimental design of human studies. Resting experimental protocols will incur a larger percent error than protocols involving exercise and elevated metabolic rate. Finally, researchers should acknowledge the IM as a study limitation and control those factors which strongly affect IM metabolism such as exercise, antibiotics, diet, and prebiotics.

**3511** Board #332 May 29 2:30 PM - 4:00 PM  
**Wearable Technologies For Real-time Monitoring Of Body Core Temperature Under Heat Stress Conditions**

Ken Tokizawa<sup>1</sup>, Toru Shimuta<sup>2</sup>, Hirofumi Tsuchimoto<sup>2</sup>. <sup>1</sup>National Institute of Occupational Safety and Health, Japan, Kawasaki, Japan. <sup>2</sup>Murata Manufacturing Co., Yasu, Japan. Email: tokizawa@tbp.t-com.ne.jp  
 (No relevant relationships reported)

Athletes and workers are at risk of heat illness whenever they work for a prolonged duration in outdoor extreme temperatures due to their metabolic demands. Safe performance limits under heat stress conditions are currently determined using predictive models for ambient temperature and exercise intensity. Wearable technology is now being adopted, but a system that accurately measures core temperature using wearable devices has yet to be reported. **PURPOSE:** To develop a new wearable patch-type sensor system that predicts core temperature based on heat-flux data from the chest. **METHODS:** We performed experiments that compared our predicted temperatures ( $T_{\text{pre}}$ , using a revised algorithm from the dual-heat-flux method), with the actual temperatures in both esophageal ( $T_{\text{es}}$ ) and rectal ( $T_{\text{rec}}$ ) sites during exercise in three heat conditions. Thirty-two volunteers walked for 60 min at 4-5 km/h at  $30^\circ\text{C}$ ,  $35^\circ\text{C}$ , or  $40^\circ\text{C}$ .  $T_{\text{pre}}$  was monitored using a smartphone application receiving wirelessly transmitted data from the patch-type sensors ( $65 \times 45 \times 8$  mm) on the chest. **RESULTS:** In the  $40^\circ\text{C}$  condition,  $T_{\text{es}}$ ,  $T_{\text{rec}}$ , and  $T_{\text{pre}}$  increased from  $37.2 \pm 0.2^\circ\text{C}$ ,  $36.9 \pm 0.2^\circ\text{C}$ , and  $37.3 \pm 0.2^\circ\text{C}$  to  $38.2 \pm 0.3^\circ\text{C}$ ,  $37.9 \pm 0.3^\circ\text{C}$ , and  $38.0 \pm 0.2^\circ\text{C}$  (mean  $\pm$  standard deviation), respectively, during exercise. The difference between  $T_{\text{pre}}$  and  $T_{\text{es}}$  was  $-0.10 \pm 0.15^\circ\text{C}$  and that between  $T_{\text{pre}}$  and  $T_{\text{rec}}$  was  $0.02 \pm 0.19^\circ\text{C}$ , using data sampled at 5-min intervals during exercise. In the  $35^\circ\text{C}$  condition,  $T_{\text{es}}$ ,  $T_{\text{rec}}$ , and  $T_{\text{pre}}$  increased to  $37.9 \pm 0.3^\circ\text{C}$ ,  $37.8 \pm 0.3^\circ\text{C}$ , and  $37.9 \pm 0.2^\circ\text{C}$  after exercise. In this case, the difference between  $T_{\text{pre}}$  and  $T_{\text{es}}$  was  $-0.06 \pm 0.17^\circ\text{C}$  and that between  $T_{\text{pre}}$  and  $T_{\text{rec}}$  was  $0.04 \pm 0.14^\circ\text{C}$ . In the  $30^\circ\text{C}$  condition, the differences were  $-0.13 \pm 0.24^\circ\text{C}$  ( $T_{\text{pre}} - T_{\text{es}}$ ) and  $0.06 \pm 0.25^\circ\text{C}$  ( $T_{\text{pre}} - T_{\text{rec}}$ ). Body mass, fat percentage, and sex did not affect the  $T_{\text{pre}}$  algorithm, but skin temperature changes during exercise yielded errors. **CONCLUSIONS:** The error ranges for our system are slightly superior to those in previous studies involving noninvasive core temperature measurements. Our system uses simple wearable devices and can provide real-time, subject-specific, and accurate body core temperature estimates under heat stress conditions. In combination with other physiological and environmental parameters, this early warning system will reduce the risk of heat illness.

**3512** Board #333 May 29 2:30 PM - 4:00 PM  
**Abstract Withdrawn**

**3513** Board #334 May 29 2:30 PM - 4:00 PM  
**Effects Of Polyester Wicking Versus Cotton Fabric T-shirt On Sweat Rate In Obese Males**

Abdulaziz A. Masoud<sup>1</sup>, Alberto Friedmann<sup>2</sup>, Alfred E. Finch<sup>2</sup>. <sup>1</sup>University of New Mexico, Albuquerque, NM. <sup>2</sup>Indiana State University, Terre Haute, IN.  
 (No relevant relationships reported)

The effects of different t-shirt fabrics on thermoregulation during exercise remain to be elucidated. **PURPOSE:** This crossover study investigated the effects of cotton (C) versus polyester (P) t-shirts on sweat rate and skin temperature at the torso (chest, back) and peripheral (forearm, forehead) regions of physically active, obese males. **METHODS:** Seven participants ( $21.7 \pm 1.7$  yr;  $35.7 \pm 6.7$  kg  $\text{m}^{-2}$ ) completed 4 visits (separated by 48 hrs); visit 1 was to complete the informed consent, ACSM health questionnaire, PAR-Q, and body composition assessment using air displacement plethysmography. Visit 2 was a  $\text{VO}_{2\text{max}}$  test (30-sec averaging for expired gas analysis), followed by two treadmill walking sessions (30 min at  $30 - 39\%$   $\text{VO}_{2\text{serv}}$ ) in either C or P t-shirt (randomized, counterbalanced sequence) on the third and fourth visits. Exercise was performed in a hot and dry ( $27^\circ\text{C}$ ,  $10 \pm 2\%$  relative humidity) environment. Sweat rate was determined as  $\Delta$  nude body weight (pre- minus post-exercise body weight) using a digital scale. Skin temperature was measured during exercise using a skin thermometer. Torso skin temperature ( $T_{\text{skin,torso}}$ ) was the sum of  $0.5T_{\text{chest}} + 0.5T_{\text{back}}$ . Peripheral site skin temperatures were analyzed separately. A dependent t-test was used to compare sweat rates. Separate two-way ANOVAs were performed to investigate fabric type, time, and their interactions on skin temperature by body region. **RESULTS:** On average, participants'  $\text{VO}_{2\text{max}}$  and body fat were  $36.8 \pm 8.7$  mL  $\cdot$  kg $^{-1}$   $\cdot$  min $^{-1}$  and  $34.7 \pm 4.3\%$ , respectively. There was no difference between C and P conditions in sweat rates ( $\Delta$  body weight =  $-35 \pm .11$  kg;  $-37 \pm .20$  kg,

respectively,  $p = .754$ ). A significant interaction effect was detected between  $T_{skinoso}$  and fabric ( $p = .022$ ) with  $C > P$ . Interaction effects of skin temperature in the peripheral regions (forearm,  $p = .195$ ; forehead,  $p = .057$ ) were nonsignificant. **CONCLUSION:** Though the sweat rate was similar across cotton and polyester trials, polyester appears to be effective for temperature regulation, especially in the torso region during low intensity aerobic exercises in young, obese males. Future research should explore the impact of C vs. P fabric on sweat rate and skin temperature during different intensities and modalities of exercise.

**3514** Board #335 May 29 2:30 PM - 4:00 PM  
**Upper Body Heat Dissipation Wearing A Novel Synthetic Material Shirt During Exercise In The Heat**  
 Haoyan Wang, Louisiana State University, Baton Rouge, LA.  
 Email: hwang56@lsu.edu  
 (No relevant relationships reported)

Sports clothing potentially limits evaporation from the skin due to an inhibitory microclimate between the skin and the environment. New materials and aeration systems are being developed to negate this limitation from current clothing.

**PURPOSE:** To determine the effects of t-shirt fabric (standard vs. novel) material on body temperature during exercise in a warm environment with and without simulated wind (fan vs. novel ventilated vest).

**METHODS:** Eight healthy male participants were recruited in the study (age:  $25 \pm 3$ yr; height:  $171.6 \pm 7.4$ cm; weight:  $79.2 \pm 14.2$ kg). Participants performed 4 exercise trials in a cross-over randomized design: standard+fan (S+F), novel+fan (N+F), standard+vest (S+V), and novel+vest (N+V). Participants exercised for 60-min on a cycle ergometer in a heated, humidity-controlled chamber ( $29.4 \pm 0.4^\circ\text{C}$  and  $32.0 \pm 2.6\%$  RH; temperature and RH  $p > 0.05$  for all trials). During the first 30min, participants exercised in the trial specific shirt with no external wind. In the second 30min, the fan was used to simulate wind speed equivalent to 2m/s applied to the chest or the vest was worn to simulate wind to chest and back. Heart rate (HR), skin temperature ( $T_{skin}$ ), and core temperature ( $T_{core}$ ) were recorded every 5min.  $T_{core}$  was measured by ingestible sensor 4-5 hours before exercise and  $T_{skin}$  was assessed at 5 sites: upper chest, mid-chest, forearm, upper back, and mid-back. The vest had  $10 \times 15$ cm ventilation area that covered mid-chest and mid-back. Rating of perceived exertion (RPE) and feeling (+5 good; -5 bad) were assessed every 5min.

**RESULTS:** Mean weighted  $T_{skin}$  was lowest in N+F ( $31.3 \pm 1.2^\circ\text{C}$ ) compared to other trials in final 30min.  $T_{skin}$  of averaged mid-chest and mid-back was lower in the final 30min ( $32.1 \pm 1.9^\circ\text{C}$ ) exercise compared to the first 30min in N+V ( $33.0 \pm 1.3^\circ\text{C}$ ;  $p < .001$ ). However,  $T_{skin}$  of averaged upper chest and back (outside of ventilation area) remained the same in final 30min as first 30min ( $\sim 34^\circ\text{C}$ ). No significant differences were found in  $T_{core}$  and HR across the trials. N+F had lowest RPE and best overall feeling compared with other trials in the final 30min.

**CONCLUSIONS:** N+F had greatest impact on upper body heat dissipation, mainly appearing in lower chest  $T_{skin}$  and RPE. In addition, novel ventilation vest successfully decreased the  $T_{skin}$  of mid-chest and back in final 30min exercise.

**3515** Board #336 May 29 2:30 PM - 4:00 PM  
**Abstract Withdrawn**

## F-70 Free Communication/Poster - Medical Management and Injury Risk

Friday, May 29, 2020, 1:30 PM - 4:00 PM  
 Room: CC-Exhibit Hall

**3516** Board #337 May 29 2:30 PM - 4:00 PM  
**Novel Factors Associated With Adverse Mental Health In Elite Para Athletes In South Africa**  
 Wayne Elton Derman, FACSM, Phoebe Runciman, James Brown, Marelise Badenhorst. Stellenbosch University, Cape Town, South Africa.  
 Email: ewderman@iafrica.com  
 (No relevant relationships reported)

Para-athletes (PA) may have specific mental health (MH) challenges that, together with the demands of high-level sport performance, could put them at risk for MH disorders. However, research in this population is limited. **PURPOSE:** To investigate factors associated with MH in South African PA. **METHODS:** In this descriptive, cross-sectional study, 124 athletes (93 males; 31 females) with a mean age  $26.7 (\pm 9.2)$  competing in the 2019 National Champs were recruited. Demographic, medical history and sleep-related variables were included in bivariate analyses to assess their association with MH. Between-group differences were analysed using the Mann-Whitney U or T-tests. Variables significantly associated in the bivariate analyses

were included in multiple regression analyses for mental health. Mental health was measured with the State/Trait Anxiety Inventory (STAI) and the Kessler Psychological Distress Scale (K-10 Questionnaire). Sleep quality, sleepiness and chronotype were measured with the Pittsburgh Sleep Quality Index (PSQI), the Epworth Sleepiness scale and Morningness-Eveningness Questionnaire (MEQ-SA). **RESULTS:** The model explained 40% of the variance in MH ( $F = 12.04$ ,  $p < 0.001$ ). Compared to athletes with 'good' sleep quality, K-10 and STAI scores were significantly higher (indicating poorer MH) in athletes with 'poor' sleep quality ( $U = 2.6$ ,  $p < 0.001$ ;  $t(116.8) = -4.30$ ,  $p < 0.001$ ). 'Poor' sleep quality (B:0.8; 95%CI 0.4 to 1.3), moderate to severe daytime sleepiness (B:4.2; 95%CI 1.1 to 7.3) intermediate (B:3.5 95%CI 0.4 to 6.6) and evening chronotypes (B:12.0 95%CI 5.0 to 19.1), the presence of allergies (B:3.9 95%CI 0.1 to 7.6) and male gender (B:3.3 95%CI 0.1 to 6.5) were most strongly associated with high STAI scores. **CONCLUSIONS:** This study identified novel factors associated with adverse MH in elite PA. As some of these factors are modifiable, further research towards prevention strategies is warranted.

**3517** Board #338 May 29 2:30 PM - 4:00 PM  
**Investigating The Effect Of Mouth Guard Use On Aerobic Performance In Amateur Boxers.**  
 Irfan Ahmed, Courtney Kippes, Peter Fine. UCL, London, United Kingdom. (Sponsor: Dr James Hull, FACSM)  
 Email: irfan.ahmed5@nhs.uk  
 (No relevant relationships reported)

**Purpose** – To assess if wearing a mouth guard effects maximal aerobic capacity in amateur boxers.

**Methods** – 13 amateur boxers took part in a prospective crossover study to assess maximal aerobic capacity achieved during the 20m Multi Stage Fitness Test (MSFT). Each participant completed the MSFT 7 days apart, under control (no mouth guard – C) and intervention conditions (mouth guard – MG). The order of tests was determined via a coin toss on day 1, and two primary outcomes measures were recorded: (1) the estimated maximum oxygen uptake ( $\text{VO}_2 \text{max}$  – kg/mL/min) and (2) distance run (meters – m). Data on height, weight, and type of mouth guard were recorded. Complete datasets on Rate of Perceived Exertion (RPE) were available for 10 boxers. **Results** – Mouth guard use was shown to reduce estimated  $\text{VO}_2 \text{max}$  and distance run during the 20m MSFT from  $56.31 \text{ kg/mL/min}$  to  $54.12 \text{ kg/mL/min}$  and  $2572 \text{ m}$  to  $2380 \text{ m}$  respectively, ( $P > 0.05$ ). All 13 participants recorded lower  $\text{VO}_2 \text{max}$  scores when wearing a mouth guard, (Mean =  $-2.43 \text{ mL/kg/min}$ , Range =  $4.2-0.9 \text{ mL/kg/min}$ ). 10 participants submitted data on RPE and reported a 32.3% increase in mean RPE scores when completing the MSFT in mouth guards compared to control conditions, ( $P > 0.05$ ).

**Conclusions** – Mouth guard use was shown to significantly reduce aerobic performance in amateur boxers and increase the perceived rate of exertion during the 20m MSFT.

**3518** Board #339 May 29 2:30 PM - 4:00 PM  
**The Relationship Between Flourishing, Pain, And Injury In Collegiate Athletes**  
 Garrett Bullock<sup>1</sup>, Shefali Christopher<sup>2</sup>, Bryanna J. Veroneau<sup>2</sup>, Bailey A. Tadlock<sup>2</sup>, Amy Knab<sup>3</sup>, Chris Harnish<sup>4</sup>, Srikant Vallabhajosula<sup>2</sup>. <sup>1</sup>University of Oxford, Oxford, United Kingdom. <sup>2</sup>Elon University, Elon, NC. <sup>3</sup>Queens University of Charlotte, Charlotte, NC. <sup>4</sup>Mary Baldwin College, Staunton, VA. (Sponsor: Dr. Stephen Bailey, FACSM)  
 Email: garrettbullock@gmail.com  
 (No relevant relationships reported)

Flourishing encompasses a holistic representation of physical, psychological, and social health. However, pain and injury can negatively affect health. Currently, there is little research on flourishing within collegiate athletes.

**Purpose:** To evaluate the relationship of pain and injury with flourishing in NCAA athletes and to compare by division.

**Methods:** NCAA division 1 (D1), 2 (D2), and 3 (D3) athletes were given a questionnaire incorporating the flourishing scale and the Oslo Sports Trauma Research Center Overuse Injury Questionnaire (OSTRC). Athletes were further classified by OSTRC scores into overuse and substantial overuse injuries. Multivariable regressions with logarithmic transformations and ANCOVAs were performed to investigate the relationship between flourishing and OSTRC pain and flourishing, overuse and substantial overuse injury. Confounders controlled for included age, gender, history of orthopaedic surgery and major injury, hours of sleep, and non-steroidal anti-inflammatory use. Unadjusted and adjusted effect size and 95% confidence intervals (95% CI) were reported.

**Results:** 253 athletes (Age: 19.43 (1.18) years; Male: 70; D1: 102, D2: 74, D3: 77; 7-8 hours of sleep: 157) participated. Mean flourishing scores were D1: 48.59 (10.43), D2: 50.08 (5.31), and D3: 48.58 (8.09). The median OSTRC score was 0 (0-22). 124 reported an overuse injury and 47 a substantial overuse injury. There was a unadjusted negative relationship between OSTRC total score and flourishing (-5.2%

(95% CI: -10%, 1%),  $p=0.037$ ); however there was no relationship after controlling for confounders (0.1% (95% CI: -2.6%, 2.7%),  $p=0.989$ ). There was no relationship between overuse injury and flourishing (-0.23 (95% CI: -2.57, 2.11),  $p=0.848$ ). There was an unadjusted negative relationship between substantial overuse injuries and flourishing (-2.77 (95% CI: -5.43, -0.12),  $p=0.042$ ), but there was no relationship after controlling for confounders (1.97 (95% CI: -4.95, 1.01),  $p=0.196$ ). These relationships were similar by division.

**Conclusion:** College athletes have high flourishing, and have similar flourishing between all NCAA divisions. Pain and injury have a negative relationship to flourishing; however, these relationships are confounded by surgical and injury history, and lifestyle.

**3519** Board #340 May 29 2:30 PM - 4:00 PM  
**Characterization Of Normal Biomarkers Of Muscle Damage In Collegiate Athletes**

Heather Quiariarte<sup>1</sup>, Nathan Lemoine<sup>1</sup>, Haoyan Wang<sup>1</sup>, Matthew Martone<sup>1</sup>, Rachel Matthews<sup>1</sup>, Derek Calvert<sup>1</sup>, Jack Marucci<sup>1</sup>, Stephen Etheredge<sup>2</sup>, Guillaume Spielmann<sup>1</sup>, Brian Irving, FACSM<sup>1</sup>, Neil Johannsen<sup>1</sup>. <sup>1</sup>Louisiana State University, Baton Rouge, LA. <sup>2</sup>Baton Rouge Orthopedic Clinic, Baton Rouge, LA. (Sponsor: Brian Irving, FACSM)  
 Email: hquiariarte1@lsu.edu  
 (No relevant relationships reported)

Exertional rhabdomyolysis is a serious clinical condition in which skeletal muscle is rapidly broken down, potentially leading to life-threatening systemic complications. Clinicians often diagnose rhabdomyolysis based on elevations in circulating creatine phosphokinase (CPK) and symptomatology. Normal CPK and other biomarker concentrations following intense exercise are unknown. **Purpose:** This study aimed to determine reference concentrations for selected biomarkers that suggest muscle damage in athletes and examine the time-course of muscle damage biomarker responses after strenuous exertion. **Methods:** 20 collegiate NCAA I football players were enrolled in the study. Serum and urine samples were collected immediately and 24 hours post strenuous practice (0h and 24h, resp). Serum samples were analyzed for biomarkers of muscle damage including a Chem26 metabolic and chemistry panel and myoglobin. Urine samples were analyzed for creatinine and myoglobin concentrations. Participants were also given Physical Symptoms Questionnaires to obtain subjective measures of symptoms that may be related to severe muscle damage, or rhabdomyolysis. **Results:** A total of 28 samples were collected with 9 repeats. CPK levels were elevated at 0h ( $958.2 \pm 544.1$  IU/L), but trended down 24h post practice ( $751.0 \pm 410.5$  IU/L,  $p=0.059$ ). LDH was acutely elevated at 0h ( $217.9 \pm 30.6$  IU/L) compared to the 24h timepoint ( $170.3 \pm 35.5$  IU/L,  $p<0.0001$ ). Average serum myoglobin was higher post-practice ( $1.31 \pm 1.57$  ng/mL), but decreased 24 h post-exercise ( $0.36 \pm 0.71$  ng/mL,  $p<0.001$ ). Similarly, urine creatinine concentrations were higher 0h post practice ( $390.1 \pm 164.2$  mg/mL), and decreased 24h post ( $214.2 \pm 99.4$  mg/dL,  $p<0.0001$ ). Urine myoglobin was also elevated at 0h post practice ( $18.18 \pm 36.7$  ng/mL), but decreased 24h post ( $0.66 \pm 1.43$  ng/mL,  $p=0.001$ ). The Physical Symptoms Questionnaires did not reveal any symptoms related to severe muscle damage. **Conclusion:** Biomarkers of muscle damage were elevated immediately post strenuous exercise, but dropped 24 hours post-practice. Serum and urine biomarkers of muscle damage collected immediately post strenuous exercise are unlikely to be specific markers of rhabdomyolysis, but rather of transient exercise-induced muscle damage in a highly trained athletic population.

**3520** Board #341 May 29 2:30 PM - 4:00 PM  
**Abstract Withdrawn**

**3521** Board #342 May 29 2:30 PM - 4:00 PM  
**The Effectiveness Of Warmup Programs For Lower Extremity Injury Prevention In Basketball: A Systematic Review**

Anna C. Davis<sup>1</sup>, Nicholas Emptage<sup>2</sup>, Robert Sallis<sup>3</sup>, Manuel G. Romero<sup>4</sup>, Donna Woo<sup>1</sup>, Dana Pounds<sup>1</sup>, Stacy Park<sup>1</sup>, Adam L. Sharp<sup>1</sup>. <sup>1</sup>Kaiser Permanente, Pasadena, CA. <sup>2</sup>Kaiser Permanente, Portland, OR. <sup>3</sup>Kaiser Permanente, Fontana, CA. <sup>4</sup>California State University of Sacramento, Sacramento, CA. (Sponsor: Robert Sallis, FACSM)  
 Reported Relationships: A.C. Davis: Industry contracted research; National Basketball Association.

**PURPOSE:** Given the many benefits of sports participation, leading experts have called for attention to factors that might inhibit youth participation. Basketball is the most popular team sport among youth in the US; the popularity of basketball translates to a large absolute number of basketball related injuries. The objective of this review is to evaluate the evidence to support the effectiveness of neuromuscular warmup-based strategies for preventing lower extremity injuries (LEIs) in basketball. **METHODS:**

We conducted a systematic review of the literature. We searched the PubMed and Cochrane Library databases, and focused on English-language randomized controlled trials, non-randomized comparative trials, and prospective cohort studies. We included studies that tested neuromuscular and/or balance-focused warmup interventions among basketball players, and that assessed at least one type of LEI as a primary outcome. We critically appraised the quality of the included studies and abstracted data on the interventions, populations, exposures and outcomes. We contacted the authors of five of the studies to obtain details about the interventions or outcome data specific to basketball athletes. **RESULTS:** Thirteen studies testing neuromuscular interventions for LEI prevention in basketball athletes were included in this review. They reported significant protective effects for the following LEIs: ankle injuries (significant in 4/9 studies that assessed this outcome); ACL injuries (2/4 studies); a general knee injury outcome (1/5 studies); and overall LEIs (composite; 5/7 studies). Non-significant results were almost universally directionally favorable. **CONCLUSIONS:** Neuromuscular interventions that require minimal equipment are an appealing injury prevention strategy in youth sports. In soccer, the FIFA 11+ warmup program has been rigorously studied and proven effective when adoption and adherence is strong. Overall, the evidence is supportive of warmups for LEI prevention in basketball. However, most studies are underpowered, intervention components are varied, and adoption and adherence is often low. More work is needed to validate the necessary and sufficient warmup activities, and to maximize adoption and sustained adherence to these strategies over time.

**3522** Board #343 May 29 2:30 PM - 4:00 PM  
**Time Course Of The Acute Effects Of Static Stretching On Passive Stiffness In Elderly Men**

Ty B. Palmer, Ahalee C. Farrow, Chinonye C. Agu-Udema, Ethan A. Mitchell. Texas Tech University, Lubbock, TX. (Sponsor: C. Roger James, FACSM)  
 (No relevant relationships reported)

The time course of passive stiffness responses after an acute bout of static stretching has received little research attention, particularly in older adults. **PURPOSE:** To determine the time course of the acute effects of static stretching on hamstring passive stiffness in elderly men. **METHODS:** Fifteen elderly men ( $70 \pm 7$  yrs.) underwent one passive straight-leg raise (SLR) assessment before (Pre) and at 0 (Post0), 5 (Post5), and 10 (Post10) min after two randomized conditions that included a control treatment (quiet resting for 2 min) and a stretching treatment. During the SLR, participants laid in a supine position with the knee braced in full extension. Each SLR was administered manually by the primary investigator who applied force against a load cell attached to the heel, while the leg was moved toward the head. All SLR assessments were performed on the right leg to the point of discomfort, but not pain as indicated by the participant, which was regarded as the max range of motion (ROM). An electrogoniometer was used to measure the hip joint angle. For the stretching treatment, four 15-s SLR static stretches were completed in the same manner as the SLR assessments; however, when max ROM was reached, the leg was held at this position for 15 s. Each 15-s stretch was separated by 15 s of rest. Passive stiffness was calculated during each SLR assessment as the slopes of the initial and final phases of the angle-torque curve. **RESULTS:** Passive stiffness (collapsed across phase) was lower at Post0 ( $0.92 \pm 0.27$  Nm<sup>-0.1</sup>;  $P=0.029$ ) and Post5 ( $0.95 \pm 0.19$  Nm<sup>-0.1</sup>;  $P=0.042$ ) but not Post10 ( $1.03 \pm 0.26$  Nm<sup>-0.1</sup>;  $P>0.999$ ) compared to Pre ( $1.07 \pm 0.23$  Nm<sup>-0.1</sup>) for the stretching treatment. There were no significant differences ( $P>0.999$ ) in passive stiffness between any of the time points (Pre =  $1.07 \pm 0.25$  Nm<sup>-0.1</sup>; Post0 =  $1.10 \pm 0.36$  Nm<sup>-0.1</sup>; Post5 =  $1.09 \pm 0.24$  Nm<sup>-0.1</sup>; Post10 =  $1.06 \pm 0.24$  Nm<sup>-0.1</sup>) for the control. **CONCLUSION:** These findings showed that hamstring passive stiffness in elderly men decreased after four 15-s SLR static stretches but returned to baseline values within 5-10 min. Given the transient nature of these changes in stiffness, we recommend that acute bouts of SLR static stretching be performed on older adults 5 to 10 min prior to physical activity or exercise, as this may ensure lower stiffness and perhaps, greater performance at the start of the event.

**3523** Board #344 May 29 2:30 PM - 4:00 PM  
**The Effect Of Injuries And Pain On Athletic Identity Across NCAA Divisions**

Bryanna Veroneau<sup>1</sup>, Bailey Tadlock<sup>1</sup>, Shefali Christopher<sup>1</sup>, Srikant Vallabhajosula<sup>1</sup>, Amy Knab<sup>2</sup>, Chris Harnish<sup>3</sup>, Garrett Bullock<sup>4</sup>. <sup>1</sup>Elon University, Elon, NC. <sup>2</sup>Queens University of Charlotte, Charlotte, NC. <sup>3</sup>Mary Baldwin College, Staunton, VA. <sup>4</sup>University of Oxford, Oxford, United Kingdom. (Sponsor: Dr. Stephen Bailey, FACSM)  
 Email: bveroneau@elon.edu  
 (No relevant relationships reported)

There is a high prevalence of pain and injury in collegiate athletes, which can affect playing time and performance. Previous studies have observed that surgery and concussions can affect athletic identity. Currently, there is a paucity of research investigating how current pain and injury affect athletic identity.

**Purpose:** To determine how current collegiate athlete pain and injury affect athletic identity and how these relationships differ across NCAA divisions. **Methods:** NCAA division I (D1), 2 (D2), and 3 (D3) athletes were administered a questionnaire through an encrypted database. The Athletic Identity Questionnaire (AIM) and Oslo Sports Trauma Research Center Overuse Injury Questionnaire (OSTRC) were used within the survey. AIM estimates self-perceived athletic identity while OSTRC measures level of participation, training volume, performance, and pain. Athletes were further classified by OSTRC scores into overuse and substantial overuse injuries. Multivariable and logistic regressions assessed the relationship between Aim, OSTRC scores, and overuse injury. Models were adjusted for age, gender, NCAA division, history of orthopedic surgery, and history of major injury, with unadjusted and adjusted coefficients and Odds Ratios (OR) with 95% confidence intervals (95% CI). **Results:** 252 athletes (age of 19.4 years (1.2); female: 181, male: 70; D1: 101, D2: 74, D3: 77) participated. Mean AIM scores were D1: 37.98 (7.61), D2: 37.03 (37.03), and D3: 38.86 (6.98). The OSTRC median score was 0 (IQR: 0-22). 127 (50%) athletes had an overuse injury while 47 (19%) had a substantial overuse injury. Adjusted total OSTRC score was -0.67 (95% CI: -2.4, 1.1; p=0.474). Adjusted OR for OSTRC overuse injury was 1.00 (95% CI: 0.97, 1.04; p=0.589) and substantial overuse injury was 0.95 (95% CI: 0.91, 0.99; p=0.036). Similar results were observed between gender and division subgroups. **Conclusion:** After adjusting for confounding variables, it was determined that substantial overuse injuries negatively affected athletic identity, regardless of gender or NCAA division. Sports medicine professionals need to consider the possibility of lost athletic identity when an athlete sustains an injury. Measures should be taken to ensure that athletes continue to have meaningful contribution to sport following pain or injury.

**3524** Board #345 May 29 2:30 PM - 4:00 PM  
**Subjective Well-Being Outcomes Before, During, And After In-Season Competitive Soccer Matches**  
 Brett Pexa, Audrey E. Westbrook, Justin P. Waxman, Kevin R. Ford, FACSM. *High Point University, High Point, NC.* (Sponsor: Kevin Ford, FACSM)  
 Email: bpexa@highpoint.edu  
*(No relevant relationships reported)*

Subjective well-being is related to injury in soccer athletes, but little is known about how these variables change around a single athletic competition. Continued athletic participation combined with negative well-being may lead to tissue overload and subsequent injury. **Purpose:** The purpose of this study was to identify the differences in daily well-being measures before, during and after the day of each match. **Methods:** Thirty female soccer (age: 19.8 ± 1.1 years, height: 1.6 ± 0.05 m, mass: 64.9 ± 6.6 kg) players provided daily measures of readiness, physical fatigue, mental stress, and soreness intensity over the course of a competitive season. Subjective well-being was taken on standard practice days (P), game days (D0), and on days one (D1) two (D2) following games. One-way within subject analysis of variance was used to compare the subjective well-being variables between each time point. Post-hoc analysis was performed with a Bonferroni adjustments. **Results:** A significant main effect was present for readiness (F=52.96, P<0.01). Post-hoc testing revealed readiness on D1(68.5 ± 12.4) was significantly more negative than readiness on P (77.9 ± 8.0, p<0.01), D0 (83.4, 8.9, p<0.01), and D2 (77.1 ± 8.8, P<0.01). A significant main effect was present for fatigue (F=41.8, p<0.01). Post-hoc testing revealed fatigue on D1 (0.5 ± 1.6) was significantly more negative than fatigue on P (1.7 ± 1.4, P=0.01), D0 (2.3 ± 1.4, p<0.01), and D2 (1.7 ± 1.5, p=0.01). A significant main effect was present for stress (F=3.8, p=0.01) and soreness (F=15.1, p=0.01), but after accounting for multiple comparisons, there was no differences between times. **Conclusions:** Self-reported readiness to train and physical fatigue are decreased for a full day following competitive soccer competition. Coaches, strength coaches, and athletic trainers may use this information to tailor training programs to promote recovery and limit injury risk, as previous literature indicates that negative outcomes on subjective scales may be indicative of injury. Future research should incorporate training load assessments into this analysis to understand if these changes are correlated to the frequency, intensity, or volume of soccer training and participation.

**3525** Board #346 May 29 2:30 PM - 4:00 PM  
**Reduction Of Injury And Related Costs After Implementation Of An Injury Prevention System In Division I Athletes**  
 Marisa PONTILLO, Brian Sennett. *University of Pennsylvania Health System, Philadelphia, PA.*  
 Email: pontillo77@gmail.com  
*Reported Relationships: M. Pontillo: Salary: University of Pennsylvania.*

**Purpose:** At the collegiate level, the estimated cost per year from sports injuries has been reported to be in the billions in the United States. Injury prevention programs are often assessed by injury reduction; there is little evidence on the associated reduction

in health care cost. The purpose of this study is to investigate the change in health care costs at a Division I university from sports injuries after the implementation of an injury prevention system.

**Methods:** Data was obtained from 3 academics years prior and 2 years after the implementation of an injury surveillance and prevention system (Sparta Science). This system assesses kinematic variables gathered from vertical jumps; this information is used to flag athletes who are at higher risk of sustaining an injury, which guides intervention. Teams were designated as "users" (U) versus "non-users" (NU) based on their utilization of the surveillance system. Total number of injuries, total cost of injuries, and volume and cost by discipline (surgery, physician office visits, imaging, and physical therapy (PT)) was compared for the U versus the NU groups.

**Results:** Total injuries decreased from 179 to 177 for the U group, and total charges decreased by 19%; the NU group had a 12% increase in injuries and 8% increase in total charges. The U group demonstrated a 29% reduction in the number of surgeries and a 45% decrease in surgery charges; the NU group had a 3% reduction in surgeries, but a 33% increase in surgery charges. The U group had a 23% reduction in office visits and an associated 48% reduction in charges; the NU group showed a 14% increase in visits, but no change in charges. The U group had a 7% reduction in the quantity of imaging ordered, and a 1% reduction in imaging costs; the NU group had no change in the quantity of imaging, but an 83% increase in imaging charges. There was a 6% increase in PT courses of care and 13% increase in PT charges for the U group, versus a 33% and 35% increase in courses of care and charges, respectively, for the NU group.

**Conclusion:** A reduction was seen in total billed claims, surgery costs, and office costs in the U group. This group also demonstrated a decrease in the number of surgeries, number of office visits, number of imaging procedures.

**3526** Board #347 May 29 2:30 PM - 4:00 PM  
**Abstract Withdrawn**

**3527** Board #348 May 29 2:30 PM - 4:00 PM  
**Sport Players Exhibit Less Muscle And Bone Mineral Content With Higher Body Fat Than Controls**  
 Joanne Donoghue, William G. Werner, Peter Douris, Hallie Zwibel. *New York Institute of Technology, Old Westbury, NY.*  
 Email: jdonogh@nyit.edu  
*(No relevant relationships reported)*

**PURPOSE:** To investigate activity levels, body composition, and bone mineral content in collegiate eSports players as compared to age-matched controls. **METHODS:** Twenty-four male collegiate eSport players and non-eSport players between 18-25 years of age underwent body composition and bone mineral content testing using a GE DXA absorptiometry scan. Daily activity (step count) and sleep duration were measured for two weeks using a Fitbit Charge™ and a questionnaire assessing their physical activities and computer usage was administered. Body mass index (BMI) was calculated on all subjects. **RESULTS:** The step count in the eSports players was significantly lower than the age matched controls (p=.0004; 6040.2 ± 3028.6 to 12843.8 ± 5661.1). ESport players exhibited greater body fat percentage (p=.05), less lean body mass (p=.003) and less bone mineral content (p=.03), despite no difference in BMI between the eSport and non-eSport players. **CONCLUSION:** As compared to non-eSport players, collegiate eSport team players were significantly less active and had a higher body fat percentage with lower lean body mass and bone mineral content. BMI is a common marker of health and obesity, yet this index showed no difference between the two groups. Considering the eSport athletes displayed significantly worse numbers, which are all correlated with potential health issues, use of the BMI is not capturing this difference and should not be considered an accurate measure of health in competitive eSport players.

**F-71 Free Communication/Poster - Function and Cancer**

Friday, May 29, 2020, 1:30 PM - 4:00 PM  
 Room: CC-Exhibit Hall

**3528 Board #349 May 29 2:30 PM - 4:00 PM**  
**Balance And Functionality In Breast Cancer Survivors: Does Improvement In Balance After Exercise Intervention Improve Functional Test Outcomes?**

Dean Amatuli, Chad W. Wagoner, Jordan T. Lee, Kirsten A. Nyrop, Hyman B. Muss, Brian C. Jensen, Claudio L. Battaglini, FACSM. *UNC-Chapel Hill, Chapel Hill, NC.* (Sponsor: Claudio Battaglini, FACSM)  
*(No relevant relationships reported)*

Balance and Functionality in Breast Cancer Survivors: Does Improvement in Balance After Exercise Intervention Improve Functional Test Outcomes?

Dean J. Amatuli, Jordan T. Lee, Chad W. Wagoner, Kirsten A. Nyrop, Hyman B. Muss, Brian C. Jensen, Claudio L. Battaglini, FACSM. University of North Carolina, Chapel Hill, Chapel Hill, NC.

**PURPOSE:** Postural control is necessary for proper functionality, independence, and quality of life. Breast cancer survivors (BCS) is a population that has displayed challenges in postural control post-treatment (Wampler et al. 2007). This study evaluated changes in balance and functionality following an exercise intervention which included balance training. **METHODS:** BCS who completed major anti-cancer treatments within the past year participated in an intervention including aerobic, strength and balance exercises, 3 days/week for 16 weeks. Training progressed in intensity and volume and incorporated movements that challenged whole-body balance. Functionality was measured using the 6 Minute Walk Test (6MWT), dynamic balance using Timed Up and Go (TUG), and balance using the NeuroCom Sensory Organization Task (SOT). Dependent samples t-test using pre and post intervention scores were used to evaluate the impact of exercise on functionality and balance. Pearson correlations were used to assess the relationship between physical function and balance outcomes. **RESULTS:** Thirty-two BCS (54±12 years) participated. 6MWT distance significantly increased (34.7±48.9m, p<.001) & TUG times significantly improved (-.55±1.0s, p = .005) from pre/post intervention. SOT composite balance scores also improved (4.0±9.3, p=.025). There was a strong correlation between pre-testing scores of TUG & 6MWT (r = -.703, p<.001). **CONCLUSION:** A 16-week exercise intervention improves physical function evaluated using 6MWT and TUG and balance using SOT composite scores. However, no relationship was observed between improvements in physical function and balance; possibly due to the differences in the dynamic nature of the physical function and static assessment of balance. Future studies should consider the evaluation of balance using dynamic tasks in order to further examine the relationship between physical function and balance in BCS. Funded by Breast Cancer Research Foundation (New York, NY)

**3529 Board #350 May 29 2:30 PM - 4:00 PM**  
**Effects Of A Lifestyle Intervention On Simulated Activity Of Daily Living Performance In Prostate Cancer Patients Undergoing Androgen Deprivation Therapy**

Brian C. Focht, FACSM<sup>1</sup>, Alexander R. Lucas<sup>2</sup>, Elizabeth Grainger<sup>1</sup>, Christina Simpson<sup>1</sup>, Ciaran M. Fairman<sup>3</sup>, Jessica Bowman<sup>1</sup>, Victoria R. DeScenza<sup>1</sup>, Zachary L. Chaplow<sup>1</sup>, Kathryn Dispennette<sup>1</sup>, Marcy Haynam<sup>1</sup>, Xiaochen Zhang<sup>1</sup>, Steven K. Clinton<sup>1</sup>. <sup>1</sup>The Ohio State University, Columbus, OH. <sup>2</sup>Virginia Commonwealth University, Richmond, VA. <sup>3</sup>Edith Cowan University, Perth, Australia.  
*(No relevant relationships reported)*

The adverse effects accompanying androgen deprivation therapy (ADT) compromise prostate cancer (PCa) patients' ability to complete activities of daily living (ADL) requiring muscular strength and mobility. Although emerging evidence suggests lifestyle interventions combining modification of exercise and dietary intake (EX+D) result in improvements in mobility in PCa patients undergoing ADT, the effects of EX+D interventions upon simulated ADL performance has yet to be delineated. **PURPOSE:** The purpose of the single-blind, randomized controlled Individualized Diet and Exercise Adherence-Pilot (IDEA-P) trial is to evaluate the preliminary efficacy of a lifestyle EX+D intervention, implementing a group-mediated cognitive behavioral (GMCB) approach, relative to standard of care (SC) among PCa patients undergoing ADT. In the current study, we evaluated the effects of the EX+D intervention on performance of a simulated ADL task at the end of the intensive phase of the intervention. **METHODS:** A total of 32 PCa patients (M age = 65 years) on ADT were randomly assigned to the EX+D (n = 16) or SC (n = 16) interventions.

Assessments of simulated ADL performance, measured using a lift and carry task, were obtained at baseline and 2 month follow-up assessments. **RESULTS:** A total of 32 PCa patients (M age = 65 years) on ADT were randomly assigned to the EX+D (n = 16) or SC (n = 16) interventions. Assessments of simulated ADL performance, measured using a lift and carry task, were obtained at baseline and 2 month follow-up assessments. **RESULTS:** Results of intention to treat ANCOVA analysis of residualized change scores yielded a significant Treatment main effect for (p<0.01) demonstrating that the EX+D intervention resulted in superior improvements in lift and carry performance (d = 1.01) relative to the SC intervention at 2 months. **CONCLUSIONS:** Findings from the IDEA-P trial suggest that the intensive phase of the EX+D intervention, implementing a GMCB approach designed to promote adoption and adherence to lifestyle behavior change, resulted in superior changes in a simulated ADL performance task relative to SC. These results underscore the utility of lifestyle interventions promoting change in both exercise and dietary behavior for preserving mobility and functional health among PCa patients undergoing ADT.

**3530 Board #351 May 29 2:30 PM - 4:00 PM**  
**Effects Of High Intensity Interval Training On Patient-reported Outcomes And Physical Function During Anthracycline Chemotherapy**

Kyuwan Lee<sup>1</sup>, Ellice Wang<sup>1</sup>, Christina Dieli-Conwright, FACSM<sup>2</sup>. <sup>1</sup>U of Southern California, Los Angeles, CA. <sup>2</sup>City of Hope National Medical Center, Duarte, CA. (Sponsor: Christina Dieli-Conwright, FACSM)  
 Email: kyuwanle@usc.edu  
*(No relevant relationships reported)*

**PURPOSE:** Breast cancer patients treated with anthracycline chemotherapy experience negative anthracycline-related side effects, including poor quality of life and impaired physical function. However, it is unclear whether high intensity interval training (HIIT) improves quality of life and physical function in breast cancer patients undergoing anthracycline-based chemotherapy. The purpose of this study was to examine the effects of HIIT on patient-reported outcomes and physical function in breast cancer patients with anthracycline-based chemotherapy. **METHODS:** Thirty breast cancer patients were recruited prior to initiating anthracycline-based chemotherapy and randomized into the HIIT group (n=15) or control (CON) group (n=15). The HIIT group attended the HIIT session for 3 days per week for 8 weeks. The CON group was asked to maintain their current level of physical activity and offered the same HIIT intervention after the 8-week study period. Patient-reported outcomes were assessed by the Functional Assessment of Cancer Therapy-Breast Cancer (FACT-B), Multidimensional Fatigue Inventory with 20 questions (MFI-20), and the 15-item Five-Facet Mindfulness Questionnaire (FFMQ-15). Physical function was assessed using the timed up and go (TUG), 30-second sit-to-stand (30STS), Margaria-Kalamen stair climb test, and 6-minute walk test (6MWT). Repeated measures ANCOVA and paired t-tests were performed to assess changes in the outcome measures. **RESULTS:** Thirty breast cancer patients completed the 8-week study with 82.3% adherence to the intervention among the HIIT group. Post-intervention, significant improvements were found for the functional Margaria-Kalamen Power Test (-3.39%; P=0.013) and 6MWT (+11.6%; P=0.008) in the HIIT group compared baseline and to the CON group. No changes in patient-reported outcomes, TUG, and 30STS were found following the 8-week study period in both groups (P>0.05). **CONCLUSIONS:** HIIT may be an effective strategy to improve physical function and possibly maintain quality of life in breast cancer patients undergoing the anthracycline-based chemotherapy.

**3531 Board #352 May 29 2:30 PM - 4:00 PM**  
**Effects Of Exercise On Disablement Process Outcomes In Prostate Cancer Patients Undergoing Androgen Deprivation Therapy: An Updated Systematic Review**

Zachary L. Chaplow, Jessica Bowman, Victoria R. DeScenza, Kathryn Dispennette, Marcy Haynam, Stephanie Hohn, Xiaochen Zhang, Brian C. Focht, FACSM. *The Ohio State University, Columbus, OH.* (Sponsor: Brian C Focht, FACSM)  
*(No relevant relationships reported)*

Although androgen-deprivation therapy (ADT) is a foundation of treatment for prostate cancer (PCa) patients, adverse effects of ADT may accelerate functional decline. Whereas exercise improves muscular strength and functional performance in PCa patients, evidence of the benefits of exercise for alternative disablement process outcomes remain equivocal. **PURPOSE:** To update the findings of our previous systematic review of the effects of exercise on disablement process outcomes in PCa patients undergoing ADT. The purpose of this study is to determine the extent to which exercise interventions produce meaningful improvements in the specific impairment domain outcome of body composition (BC) in PCa patients on ADT. **METHODS:** A comprehensive literature search was conducted of all relevant published studies

from December 2013-present. Data were extracted on BC outcomes from 8 published exercise intervention studies involving 307 PCa patients on ADT. The magnitude of pre- to post-intervention change was examined. To isolate the effects of exercise, studies combining other interventions were excluded. Weighted, bias-corrected Cohen's *d* effect sizes were calculated for change in each outcome and averaged across included studies. **RESULTS:** Results revealed that exercise yielded small average improvements in lean body mass ( $d = 0.09$ ), appendicular lean mass ( $d = 0.08$ ), trunk fat mass ( $d = -0.03$ ) and visceral fat mass ( $d = -0.11$ ). All other measures of whole-body and regional BC showed negligible average effects of exercise. **CONCLUSIONS:** The findings of this updated systematic review suggest that while exercise attenuates the established adverse effects of ADT on BC, the magnitude of exercise-induced improvements in BC outcomes is small and inconsistent across studies. These findings have important implications for delineating the effect of exercise on disablement process outcomes and underscore the potential utility of complementing exercise with targeted nutritional approaches in the supportive care of PCa patients on ADT.

**3532 Board #353 May 29 2:30 PM - 4:00 PM**  
**Dynapenic Obesity: Strength, Body Composition, And Physical Function In Women Diagnosed With Breast Cancer**

Lindsey L. Hanson<sup>1</sup>, Diane K. Ehlers<sup>1</sup>, Gregory Russell<sup>2</sup>, Edward Levine<sup>2</sup>, Marissa M. Howard-McNatt<sup>2</sup>, Shannon L. Mihalko<sup>3</sup>.  
<sup>1</sup>University of Nebraska Medical Center, Omaha, NE. <sup>2</sup>Wake Forest School of Medicine, Winston-Salem, NC. <sup>3</sup>Wake Forest University, Winston-Salem, NC.  
 (No relevant relationships reported)

**Background:** Breast cancer survivors (BCS) report more limitations performing activities requiring strength compared to women without a cancer history. Combined with obesity, BCS with dynapenia (poor muscle strength) may have greater risk of physical function (PF) difficulties; however, the prevalence and impact of dynapenic obesity (DO) in BCS remains unknown. **Purpose:** This study aimed to: 1) prospectively determine the prevalence of DO; 2) evaluate associations among DO, clinical factors, and resistance training (RT); and 3) determine if DO predicts PF in BCS from diagnosis to 2-year follow-up. **Methods:** DO was operationalized as waist circumference (WC)  $\geq 88$  cm and poor grip strength, measured via dynamometry and categorized using ACSM normative values. RT participation was determined via interview and categorized as meeting/not meeting RT guidelines for cancer survivors. PF was self-reported as level of difficulty with tasks including standing in place, walking 2 blocks, and lifting objects. Assessments were conducted at diagnosis and repeated at 1- and 2-years post-surgery during scheduled oncology visits. Data were analyzed using descriptive statistics and linear regression. **Results:** BCS (N=396,  $Age=57.1 \pm 11.6$  years,  $MBMI=29.2 \pm 6.2$  kg/m<sup>2</sup>) had a mean WC of  $96.2 \pm 17.6$  cm and combined grip strength of  $50.0 \pm 11.5$  kg. The prevalence of DO was 18.3% at diagnosis, 28.2% at 1-year, and 34.5% at 2-year follow-up. DO was not associated with clinical factors (e.g., diagnosis stage, receipt of chemotherapy) at diagnosis. A weak, positive association between DO and age was observed at baseline ( $p=.009$ ). Meeting RT guidelines at diagnosis was inversely associated with DO at baseline ( $p=.008$ ) and 1-year ( $p=.05$ ). Controlling for age and RT participation, DO at diagnosis significantly predicted PF difficulty at 1-year ( $\beta=.26$ ,  $p=.007$ ) and significantly predicted PF difficulty at 2-year follow-up ( $\beta=.15$ ,  $p=.09$ ). **Conclusions:** A significant proportion of BCS had high central adiposity and poor muscle strength from diagnosis to 1- and 2-year follow-up. DO significantly predicted PF difficulty after surgery, indicating the importance of strength and body composition prior to treatment. RT may be protective against DO; therefore, greater efforts to increase RT engagement in BCS are critically needed.

**3533 Board #354 May 29 2:30 PM - 4:00 PM**  
**Manual Therapy And Dynamic Splint Use For Trismus In Head And Neck Cancer Survivors**

Joni Nedeljak<sup>1</sup>, Suresh Nayar<sup>2</sup>, Susan Armijo Olivo<sup>3</sup>, Ivonne Hernandez<sup>1</sup>, Margaret McNeely<sup>1</sup>. <sup>1</sup>University of Alberta, Edmonton, AB, Canada. <sup>2</sup>Institute for Reconstructive Sciences in Medicine, Edmonton, AB, Canada. <sup>3</sup>University of Applied Science, Osnabrück, Germany.  
 Email: jnedelja@ualberta.ca  
 (No relevant relationships reported)

Head and neck cancer (HNC) accounts for 3-5% of cancer cases in the United States. A known complication of oncological treatments for HNC is trismus, defined as limited mouth opening of less than 35mm. Trismus occurs in 6-86% of survivors. There is no standardized treatment for trismus, however, commonly used conservative interventions include manual therapy (MT), active exercises and assistive stretching devices. These interventions have shown promise as means to improve jaw mobility and alleviate symptoms. Without early detection and intervention, trismus is often chronic and progressive in nature. **PURPOSE:** To determine the feasibility of study

processes, including recruitment rate, completion rate, adherence to protocol, and to establish processes for the dynamic splint mouthpiece fitting and intervention protocol. **METHODS:** A single subject design was used in this pilot feasibility study. Participants underwent a treatment protocol involving MT, exercises, and use of a dynamic splint at home for eight weeks. Multiple maximal interincisal opening (MIO) measures were performed at baseline testing, before and after each treatment session, and at the end of the intervention period. Researchers documented participant adherence to supervised sessions and dynamic splint use, and subjective responses to treatment after each session. **RESULTS:** 70% of participants had an improvement in their MIO after eight weeks, with an average increase of 3.0mm (range: -2.0 to 7.5mm). 90% of participants had 100% adherence to supervised sessions and 70% adherence to home use of the dynamic splint. Two participants were unable to be fitted with a dynamic splint mouthpiece due to insufficient mouth opening and, therefore used the flat plate of the device. Two participants required special adaptation of the mouthpiece, one due to dental pain and the other due to being edentulous. Treatment protocols required tailoring to facilitate comfort and adherence. **CONCLUSION:** Home use of a dynamic splint with MT shows promise as an intervention to address trismus in HNC survivors. The need for adaptations to the mouthpiece and treatment protocol should be anticipated, and a longer intervention period is recommended to optimize outcomes. Supported by: Faculty of Rehabilitation Medicine

**3534 Board #355 May 29 2:30 PM - 4:00 PM**  
**BODY COMPOSITION, PHYSICAL FUNCTION AND QUALITY OF LIFE ACROSS DIFFERENT STAGES OF PROSTATE CANCER: A CROSS-SECTIONAL ANALYSIS**

Cameron K. Stopforth<sup>1</sup>, Mohamdod Alzer<sup>1</sup>, Jack Carver<sup>1</sup>, Alexander Lucas<sup>2</sup>, Young Whang<sup>1</sup>, Matthew Milowsky<sup>1</sup>, David B. Bartlett<sup>3</sup>, Michael Harrison<sup>3</sup>, Alan Hayes<sup>4</sup>, Rhonda L. Bitting<sup>2</sup>, Anthony C. Hackney<sup>1</sup>, Claudio L. Battaglini, FACSM<sup>1</sup>, Erik D. Hanson<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. <sup>4</sup>Victoria University, Melbourne, Australia. (Sponsor: Claudio Battaglini, FACSM)  
 Email: cstopfor@live.unc.edu  
 (No relevant relationships reported)

**PURPOSE:** Androgen deprivation therapy (ADT) has detrimental side effects, but changes between localized and advanced prostate cancer are unclear. The purpose is to determine body composition, physical function, and quality of life (QoL) differences across progressive stages of men with PCa on ADT. **METHODS:** Men with localized (PC, n=43, age  $67 \pm 6.4$ y) or metastatic castration-resistant prostate cancer (mPC, n=21, age  $72 \pm 8.3$ y) and non-cancer controls (CON, n=37, age  $69 \pm 6.1$ y) completed total body DXA scans (% fat, lean and fat mass), physical function testing (6m walk, chair stands, timed up and go (TUG), stair climb), and QoL questionnaires (FACT-P). **RESULTS:** Percent fat differed between all groups, along with greater fat mass in mPC vs. CON. Both stair climb and TUG were slower in mPC compared to both CON and PC, whereas chair stands and 6m walk were only slower in mPC vs. CON. There were trends for lower QoL scores in mPC and PC vs. CON for overall FACT-P, Social Well-Being, and Trial Outcome Index vs. CON. Total length of ADT was similar between mPC and PC (mPC:  $30 \pm 34$  months, PC:  $37 \pm 38$  months,  $p=0.536$ ). **CONCLUSIONS:** Body composition and physical function appear to deteriorate in advanced prostate cancer. As the length of ADT is similar between groups, this suggests that the additional forms of ADT for mPC appear to be influencing these changes. However, increases in body fat and reduced functional capacity with ADT do not translate into lower QoL for mPC. Exercise interventions targeting these outcomes are warranted to minimize the side effects of anti-cancer therapy.

**Table 1. Between group differences in body composition, functional tasks, and quality of life questionnaires in men with various stages of prostate cancer**

|                         | CON (n=37)   | PCa (n=42)              | mPC (n=21)               | P Value |
|-------------------------|--------------|-------------------------|--------------------------|---------|
| <b>Body Composition</b> |              |                         |                          |         |
| % Fat                   | 26.1 (5.6)   | 29.9 (8.9) <sup>^</sup> | 34.5 (5.6) <sup>^#</sup> | <0.001  |
| Total Fat Mass (kg)     | 22.2 (7.8)   | 27.9 (12.1)             | 32.2 (11.7) <sup>*</sup> | 0.003   |
| <b>Functional Tasks</b> |              |                         |                          |         |
| Stair Climb (sec)       | 4.7 (1.0)    | 4.8 (1.0)               | 6.1 (2.4) <sup>^#</sup>  | 0.006   |
| TUG (sec)               | 6.1 (1.3)    | 6.0 (1.5)               | 10.4 (9.0) <sup>^#</sup> | 0.011   |
| Chair Stands (sec)      | 9.3 (2.2)    | 10.6 (3.1)              | 12.8 (4.9) <sup>*</sup>  | 0.007   |
| 6m Walk (sec)           | 3.9 (0.7)    | 3.9 (0.4)               | 4.7 (1.5) <sup>*</sup>   | 0.018   |
| <b>Quality of Life</b>  |              |                         |                          |         |
| FACT-P                  | 138.6 (13.3) | 121.8 (20.7)            | 120.0 (18.5)             | 0.050   |
| Social Well-Being       | 27.0 (5.1)   | 21.8 (4.4) <sup>^</sup> | 22.9 (3.4)               | 0.006   |
| Trial Outcome Index     | 91.8 (6.9)   | 80.2 (14.8)             | 77.6 (3.7) <sup>*</sup>  | 0.044   |

Data reported are mean (standard deviation)  
 Indicate significant results ( $p < 0.05$ ):  
<sup>\*</sup>mPC vs. CON; <sup>#</sup>mPC vs. PCa; <sup>^</sup>PCa vs. CON

**3535** Board #356 May 29 2:30 PM - 4:00 PM  
**Cancer Patients Who Exercise In Pairs Gain Greater Fitness Compared To Individually Trained Patients**  
 Paulette M. Yamada Tamashiro<sup>1</sup>, Cheri Teranishi-Hashimoto<sup>2</sup>, Erin O'Carroll Bantum<sup>3</sup>, Sash-sha Collier<sup>1</sup>, Ariimana Temanaha<sup>1</sup>.  
<sup>1</sup>University of Hawaii, Manoa, Honolulu, HI. <sup>2</sup>Rehabilitation Hospital of the Pacific, Honolulu, HI. <sup>3</sup>University of Hawaii Cancer Center, Honolulu, HI.  
 Email: pyamada@hawaii.edu  
 (No relevant relationships reported)

While individualized exercise training improves physical and psychosocial health, paired exercise training may result in similar improvements at a reduced patient-to-staff ratio. **PURPOSE:** To compare the effect of paired vs. individualized exercise training on physical and psychosocial health in cancer patients. **METHODS:** Twenty-five female cancer patients (mean±SD: 62±8 years) were assigned to exercise in pairs (n=13) or individually (n=12). They completed 36, 90-min sessions consisting of cardiovascular, resistance, balance and flexibility training according to standardized guidelines. Cardiorespiratory fitness (VO<sub>2peak</sub>), muscular strength (1-repetition max), endurance (chair squat test), balance (single leg stance), and flexibility (sit-and-reach) were measured pre- and post-exercise. Psychosocial health was assessed pre-, mid- and post-intervention (Functional Assessment of Cancer Therapy-General (FACT-G), Insomnia Index, Brief Fatigue Index, Patient Health Questionnaire-9). Two-way ANOVAs (Factors: Group, Time) were used to identify main effects or interactions; differences were detected with *post-hoc* tests. Significance was set at p<0.05. **RESULTS:** Improvements in physical fitness were similar between paired (P) and singly (S) trained patients. VO<sub>2peak</sub> significantly increased from 26.6±9.2 to 31.0±7.2 ml·kg<sup>-1</sup>·min<sup>-1</sup> (S) and 26.0±6.3 to 29.1±7.1 ml·kg<sup>-1</sup>·min<sup>-1</sup> (P). Upper and lower body strength increased by 20.0% (S) and 19.6% (P); 15.9% (S) and 20.8% (P), respectively. Paired patients exhibited larger improvements in lower body endurance (S: 24.0% vs. P: 52.3%), flexibility (S: 5.3% vs. P: 11.0%), and balance (S: 17.8% vs. P: 36.8%). A significant main effect (Time) was detected in the functional dimension (FACT-G) but not in social (p=0.200), emotional (p=0.054), or physical well-being (p=0.075). Time (main effect) was not significant for insomnia for either group (p=0.0778), but paired patients had significant improvements in sleep from pre- to mid-intervention (9.8±6.9 vs. 7.2±6.3). **CONCLUSION:** The social aspect associated with paired exercise sessions may have increased motivation, resulting in enhanced improvements in fitness and mental well-being in the paired group. These data suggest that exercising in pairs is a promising approach to cancer rehabilitation.

**3536** Board #357 May 29 2:30 PM - 4:00 PM  
**Relationship Of Health-related Quality Of Life To Functional Fitness In Rural Cancer Survivors**  
 Jared R. Heitzenrater, Nicole M. Svendsen, Kristopher S. Wisniewski. Saint Francis University, Loretto, PA.  
 Email: jaredheitzenrater@gmail.com  
 (No relevant relationships reported)

Health-related quality of life (HRQoL) is of high interest in exercise oncology due to decreases in HRQoL during and following cancer treatments. Functional fitness assessments (FFA) are also commonly assessed in this population due to the treatment-related side effects that may impact the patient's ability to perform activities of daily living (ADLs). However, the relationship between these variables has not been previously explored. **Purpose:** To examine the relationship between HRQoL and FFA in a group of rural cancer survivors. **Methods:** Fifteen (Females, n=8; Males, n=7) subjects with a previous diagnosis of cancer aged 62.0 ± 8.5 years and BMI of 21.8 ± 7.9 kg/m<sup>2</sup> were assessed in several areas of FFA including waist circumference, body fat percentage, fat free mass (FFM), timed up and go (TUG), and 30 second chair stand (30CS). They were also given the Functional Assessment of Chronic Illness-Fatigue (FACIT-F) with subscales in physical well-being (PWB), social/family well-being (SWB), emotional well-being (EWB), functional well-being (FWB), and fatigue. The types of cancer and staging were diverse. Treatment types included chemotherapy, radiation, and surgery. FFA were completed and the FACIT-F completed at home and returned at the following session. **Results:** Pearson Correlations were significant between SWB and TUG (r = -0.844, p = 0.000), SWB and 30CS (r = 0.715, p = 0.003), and between fatigue and FFM (r = 0.668, p = 0.006). A correlation trending toward significance was seen between FWB and TUG (r = -0.504, p = 0.055). No other significant correlations were found. **Conclusion:** Moderate-to-strong relationships were observed between SWB, TUG time, and 30CS. This shows cancer survivors who are more mobile may have a greater ability to engage in social tasks and ADLs. In addition, higher amounts of FFM were moderately correlated with having less fatigue meaning cancer survivors with more FFM may have less fatigue.

**3537** Board #358 May 29 2:30 PM - 4:00 PM  
**Role Of Joint Loosening Yoga In Management Of Aromatase Inhibitor-Induced Arthralgia In Breast Cancer Survivors**  
 Leigh Leibel<sup>1</sup>, Kashinath Metri<sup>2</sup>, Rajendra Prasad<sup>2</sup>, Greg Mears<sup>1</sup>.  
<sup>1</sup>Columbia University Medical Center, New York, NY. <sup>2</sup>S-Iyasa University, Bangalore, India.  
 Email: LL3125@cumc.columbia.edu  
 (No relevant relationships reported)

**PURPOSE:** Aromatase inhibitor hormonal therapy causes joint pain in up to half of women, and up to 20% become non-compliant with the 5-10 year treatment schedule due to pain and discomfort. Non-compliance affects patient prognosis and survival. This pilot study investigated the efficacy of joint loosening yoga in improving aromatase inhibitor-induced joint pain and evaluated the feasibility of delivering the intervention on Facebook. **METHODS:** Breast cancer patients undergoing treatment with aromatase inhibitors with self-reported arthralgia were recruited via an IRB-approved announcement posted in two closed breast cancer support groups on Facebook to participate in a yoga study delivered on Facebook. Participants completed BPI, DASH, PRAI and WOMAC questionnaires online before and after the study. Intervention consisted of 12 joint loosening exercises performed in a chair, once daily for 12 minutes, Monday-Friday for 4 weeks. Asynchronous video demonstrations were available in a secret Facebook group and viewing confirmed by typing "done" (time-stamped) in comments. **RESULTS:** 200 women responded. 38 met the inclusion criteria/consent, 26 completed the online consent, interventions and pre/post questionnaires. Participants were based in US, Canada and UK. Paired simple t tests results showed significant (P < 0.05) improvement in all the pain measures and quality of life parameters after yoga intervention compared to baseline. **CONCLUSIONS:** This study provides the first evidence that it is feasible to teach joint loosening yoga to patients on Facebook and that the intervention significantly improves aromatase inhibitor-induced arthralgia. Teaching yoga via social media may provide better access to this therapeutic modality to patients at all points in the cancer care continuum globally.

| Variable | Pre Mean    | Post Mean   | % Change | P Value |
|----------|-------------|-------------|----------|---------|
| BPI_PSS  | 4.26±1.79   | 2.3±1.45    | -46.00%  | P<.05   |
| BPI_PIS  | 3.9±2.32    | 1.81±2.00   | -53.58%  | P<.05   |
| DASH     | 30.54±15.26 | 13.72±14.86 | -55.07%  | P<.05   |
| PRAI     | 2.69±1.55   | 1.36±1.13   | -49.44%  | P<.05   |
| WOMAC 1  | 6.76±3.67   | 3.24±2.20   | -52.07%  | P<.05   |
| WOMAC 2  | 4.04±1.76   | 2.40±1.15   | -40.59%  | P<.05   |
| WOMAC 3  | 22.64±13.11 | 13.±8.83    | -42.57%  | P<.05   |

**3538** Board #359 May 29 2:30 PM - 4:00 PM  
**The Impact Of Sports Science-based Prehabilitation On Spontaneous Physical Activity After Major Abdominal Cancer Surgery**  
 Savannah V. Wooten, J. Stuart Wolf, John B. Bartholomew, FACSM, Diana Mendoza, Philip R. Stanforth, FACSM, Dixie Stanforth, FACSM, Ladia M. Hernandez, Cathy T. Nguyen, Joseph R. Carneglia, Hirofumi Tanaka, FACSM, R. Y. Declan Fleming. The University of Texas at Austin, Austin, TX.  
 (Sponsor: Hirofumi Tanaka, FACSM)  
 Email: svwooten@utexas.edu  
 (No relevant relationships reported)

Complex surgery for abdominal cancer often leads to postoperative complications that may prevent post-surgical rehabilitation in old, frail, or malnourished patients. Prehabilitation is an emerging alternative strategy that has the potential to speed recovery and may be analogous to athletic preparations for gamaday. For optimal physiological improvement to occur in a limited time period prior to the surgery, cancer patients undergoing prehabilitation interventions must work closer to their maximal physiological capacity (albeit a very low level) in a manner similar to that of competitive athletes. **PURPOSE:** To determine the effect of a 4-week sports science-based prehabilitation program on spontaneous physical activity in cancer patients who undergo major abdominal surgery. **METHODS:** Twenty-two cancer patients (63±11 years) who underwent major abdominal surgery were studied. Fourteen patients participated in a 4-week exercise and nutrition prehabilitation program prior to abdominal surgery. The sport-science based program comprised of an interdisciplinary approach, including blood flow restriction exercise and a daily sports nutrition supplement containing L-citrulline, creatine monohydrate, and whey protein. The remaining 8 patients served as controls. Physical activity of both groups was monitored

for 5 days after surgery. Accelerometers were used to quantify number of steps, energy expenditure, and sedentary time. **RESULTS:** The prehabilitation group recorded 47.4% more total steps for 5 days after abdominal surgery than the control group (16,032±5,194 vs. 10,877±5,182 total steps/5 days,  $p=0.037$ ). The prehabilitation group had a greater amount of total energy expenditure than the control group (5,555±3,400 vs. 2,971±1,572 total kcal/5 days,  $p=0.028$ ). There was no significant difference in total sedentary time between the two groups (5,064±597 vs. 5,414±514 min/5 days). **CONCLUSIONS:** This prehabilitation program composed of cutting-edge sports science practices significantly improved spontaneous physical activity after major surgery in older patients with abdominal cancers.

**3539** Board #360 May 29 2:30 PM - 4:00 PM

### Improved Physical Function And Quality Of Life In People With Blood Cancer After An Exercise Intervention

Jennifer L. Nicol<sup>1</sup>, Michelle M. Hill<sup>2</sup>, Mary Smith<sup>3</sup>, Molly Shevill<sup>3</sup>, Deb Pickersgill<sup>3</sup>, Dane Larsen<sup>3</sup>, Amanda Donaghue<sup>3</sup>, Alice Pashley<sup>1</sup>, Caroline Pollard<sup>4</sup>, Maryanne Skarparis<sup>4</sup>, Michele Leis<sup>4</sup>, Tina L. Skinner<sup>1</sup>. <sup>1</sup>The University of Queensland, Brisbane, Australia. <sup>2</sup>QIMR Berghofer Medical Research Institute, Brisbane, Australia. <sup>3</sup>Aspire Fitness and Rehabilitation, Brisbane, Australia. <sup>4</sup>The Leukaemia Foundation of Australia, Brisbane, Australia.

(No relevant relationships reported)

In blood cancer, aerobic physical activity may improve fatigue and depression, though its effect on quality of life and physical function is less clear. Assessment of Fit to Thrive (FTT), a community-based individualised, supervised exercise program for people with blood cancer, may assist with future recommendations.

**Purpose:** To assess the effect of the FTT program on physical function and quality of life (QoL) in people with blood cancer.

#### Methods:

The 12-week FTT program utilised progressive aerobic and resistance training, supervised by an Accredited Exercise Physiologist, in small groups ( $n=6$ ), twice weekly, for 8 weeks, with associated psychosocial and peer support. Physical function was assessed via the six minute walk (6MW), functional forward reach (FFR) and 5 times-sit-to-stand (5TSTS) tests. QoL was measured using the 36-item Short Form Survey Instrument (SF-36) and the Functional Assessment of Cancer Therapy General (FACT-G). Minimally important differences (MID) involved a change of 2 points for the SF-36, 3 points for the FACT-G and +50m for 6MW.

#### Results:

Participants ( $n=106$ ) who attended the FTT program between 2014 and 2016 were included. Significant improvements in functional measures were observed for 6MW (+54.7m [95% CI 40.5, 69.0]  $p<0.001$ ), 5TSTS (-1.9 sec [95% CI -2.5, -1.2]  $p<0.001$ ) and FFR (+2.7cm [95% CI 1.5, 4.0]  $p<0.001$ ), with the MID achieved by 56% for the 6MW. The SF-36 physical component summary (PCS) significantly increased (+4.99 [95% CI 3.29, 6.68]  $p<0.001$ ) immediately following the intervention, with 68% ( $n=72$ ) achieving the MID. The improvement in the SF-36 mental component summary (MCS) also achieved statistical significance (+2.81 [95% CI 0.54, 5.08]  $p=0.02$ ), with 51% ( $n=54$ ) achieving the MID. FACT-G scores improved significantly from pre- to post-intervention (+5.50 [95% CI 2.52, 8.47],  $p<0.001$ ) with 58% ( $n=62$ ) meeting the MID. MID improvements in PCS and FACT-G were maintained in 77% ( $n=20/26$ ) and 95% ( $n=19/20$ ) of participants 3 months following completion of the program.

#### Conclusion:

The FTT program was effective in improving physical function and QoL, with some evidence for long-term effects. An individually-prescribed exercise program supervised by an Accredited Exercise Physiologist should be considered as part of standard care in people with stable blood cancer.

## F-72 Free Communication/Poster - Human Studies: Mechanisms in Exercise Oncology

Friday, May 29, 2020, 1:30 PM - 4:00 PM

Room: CC-Exhibit Hall

**3540** Board #361 May 29 2:30 PM - 4:00 PM

### Novel Biomarkers Of Treatment-Induced Muscle Damage, Exercise And Fatigue: An RCT In Breast Cancer Patients

Karen M. Mustian, Po-Ju Lin, Eva Culakova, Ann Colasurdo, Richard F. Dunne, Chunkit Fung, Nikesha J. Gilmore, Charles E. Heckler, Julia E. Inglis, Michelle C. Janelins, Charles S. Kamen, Amber S. Kleckner, Ian R. Kleckner, Kah Poh Loh, Gilberto Lopez, Luke J. Peppone, Michelle Porto, Erika Ramsdale, Gary Morrow. *University of Rochester Medical Center, Rochester, NY*

Email: karen\_mustian@urmc.rochester.edu

(No relevant relationships reported)

Radiation and hormone therapy may damage skeletal muscle and lead to cancer-related fatigue (CRF). Developmental myosin light chain 5 (MYL5) and myosin heavy chain 8 (MYH8) are required for normal muscle regeneration. Up-regulated serum levels of MYL5 and MYH8 resulting from radiation and hormone therapy may increase muscle degradation and lead to CRF, especially physical CRF—one of the multidimensional subcomponents of overall CRF. **PURPOSE:** To investigate the effect of a 6-week aerobic and anaerobic exercise intervention, called Exercise for Cancer Patients (EXCAP), on (1) CRF (overall and physical), (2) serum protein levels of MYL5 and MYH8, and (3) the association of CRF (overall and physical) with these novel biomarkers. **METHODS:** Ninety sedentary breast cancer patients (55.5±9.6 years, 79% white, 52% receiving radiation therapy, 48% receiving hormone therapy) were consented and participated in this phase II RCT. Patients were randomized into two arms: (1) standard cancer treatment (Control) or (2) standard cancer treatment plus EXCAP. Serum levels of MYL5 and MYH8 by ELISA assays and CRF (total and physical) by patient-report via the Multidimensional Fatigue Symptom Inventory were assessed pre- and post-intervention. **RESULTS:** T-tests showed significant reductions in overall CRF and physical CRF among exercisers (overall CRF: -4.9±2.6,  $p=0.07$ , physical CRF: -1.0±0.5,  $p=0.05$ ) but not in controls, with significant group differences (overall CRF: -7.9±3.4,  $p=0.02$ ; physical CRF: -1.9±0.7,  $p<0.01$ ). T-tests also revealed statistical trends for down-regulation of MYL5 (-0.5±0.3,  $p=0.17$ ) and MYH8 (-0.4±0.3,  $p=0.17$ ) serum protein levels from pre- to post-intervention in exercisers, but not in controls. Spearman correlations also reveal statistical trends, in exercisers, where decreases in MYL5 and MYH8 serum protein levels are directly associated with decreases in total CRF (MYL5  $r=0.23$ ,  $p=0.17$ ; MYH8  $r=0.30$ ,  $p=0.07$ ) and physical CRF (MYL5  $r=0.29$ ,  $p=0.08$ ; MYH8  $r=0.39$ ,  $p=0.02$ ). **CONCLUSIONS:** EXCAP improves overall and physical CRF. EXCAP may also protect against cancer treatment-induced skeletal muscle damage via its effects on MYL5 and MYH8. Changes in these novel biomarkers may mediate changes in overall and physical CRF. Further phase III RCTs are needed to confirm these findings.

**3541** Board #362 May 29 2:30 PM - 4:00 PM

### The Influence Of Physical Activity And Body Composition On Gene Expression In Breast Adipose Tissue

Hannah K. Schulte<sup>1</sup>, Sarah E. Neil-Sztramko<sup>2</sup>, Nagarajan Kannan<sup>3</sup>, Gift Nyamundanda<sup>4</sup>, Anguraj Sadanandam<sup>4</sup>, Jonathan P. Little<sup>5</sup>, James D. Johnson<sup>1</sup>, Ilona Csizmadia<sup>6</sup>, Kelcey Bland<sup>7</sup>, Kristin L. Campbell, FACSM<sup>1</sup>. <sup>1</sup>University of British Columbia, Vancouver, BC, Canada. <sup>2</sup>McMaster University, Hamilton, ON, Canada. <sup>3</sup>Mayo Clinic, Rochester, MN. <sup>4</sup>The Institute of Cancer Research, London, United Kingdom. <sup>5</sup>University of British Columbia Okanagan, Kelowna, BC, Canada. <sup>6</sup>Cedars-Sinai Medical Centre, Los Angeles, CA. <sup>7</sup>Australian Catholic University, Melbourne, Australia.

Email: hannah.schulte@ubc.ca

(No relevant relationships reported)

Higher physical activity levels and healthy body weights are associated with a lower risk of postmenopausal breast cancer. Little is known about the biological mechanisms underlying this association, but the microenvironment created in the breast tissue is of interest. Adipose tissue is recognized as an endocrine organ, responding to the local and systemic environment. **PURPOSE:** To explore the association between self-reported lifestyles factors, and breast adipose tissue and the microenvironment it creates. **METHODS:** Using a cross-sectional design, women undergoing reduction mammoplasty surgery were recruited. Participants completed standard questionnaires

about their usual physical activity, weight history, reproductive history, and past-year dietary intake. Body weight was abstracted from medical records. A sample of breast tissue was collected during surgery. An adipose-rich section was isolated under sterile conditions. Part of the sample was formalin fixed (sectioned at 7  $\mu$ m thickness for measurement of mean adipocyte size with Image J) and part was flash frozen for RNA isolation. Associations between mean adipocyte size and lifestyle variables were examined by multivariate analysis to determine associations between genes and lifestyle variables. **RESULTS:** Of 72 women recruited, RNA was isolated from 65 samples. Participants were a mean age of 43 years (range 19-70) and had a mean body mass index of 27.0 kg/m<sup>2</sup> (SD 5.0). BMI was positively associated with adipocyte size ( $\beta = 0.06$ ,  $p < 0.01$ ) and transportation physical activity was negatively associated with adipocyte size ( $\beta = -0.25$ ,  $p = 0.02$ ). Six genes, namely *SLC27A2*, *TTC36*, *WHSC1L1*, *AASS*, *MOCSI*, *GLYCK*, were found to be associated with adipocyte size. **CONCLUSION:** Adipose tissue biology is associated with lifestyle exposures in normal breast tissue. Our findings provide directions for future research into the impact of lifestyle on the microenvironment of healthy breast tissue.

**3542** Board #363 May 29 2:30 PM - 4:00 PM  
**MICROVASCULAR OXYGENATION RESPONSE DURING PADDLING GRADED EXERCISE TEST IN BREAST CANCER SURVIVOR DRAGON BOAT RACERS**  
 Brooklyn E. Herbert, Trent E. Cayot, Riggs J. Klika, FACSM.  
*University of Indianapolis, Indianapolis, IN.* (Sponsor: Riggs J. Klika, FACSM)  
*(No relevant relationships reported)*

Cancer treatment is associated with numerous peripheral pathologies including altered blood flow and vascular dysfunction. A pilot study was conducted to measure the peripheral microvascular oxygenation response during maximal exercise in a group of cancer survivors. **PURPOSE:** To investigate the differences that paddling side (paddling side, PS; non-paddling side, NPS) and treatment side (treatment side, TREAT; healthy side, HEAL) has on the near-infrared spectroscopy (NIRS) responses during a unilateral paddling graded exercise test in breast cancer survivor dragon boat racers. **METHODS:** Thirteen breast cancer survivors/racers (56  $\pm$  9 years, 1.65  $\pm$  0.06 m, 76.5  $\pm$  11.0 kg) performed a unilateral, discontinuous graded exercise test (2-minute exercise, 1-minute rest) on a stationary rowing ergometer to volitional fatigue. Tissue oxygenation saturation (StO<sub>2</sub>) and total hemoglobin concentration ([THC]) were measured via NIRS from the posterior deltoid muscles during the graded exercise test. StO<sub>2</sub> and [THC] responses were averaged during the last 30 seconds of each exercise stage and normalized to baseline exercising data. Paired t-tests were used to examine if treatment side had an effect on StO<sub>2</sub> or [THC] and if paddling side had an effect on [THC] responses at maximal intensity. Due to non-normally distributed data, a Wilcoxon Signed Rank Test was used to determine if paddling side had an effect on StO<sub>2</sub> at maximal intensity. Significance was established *a priori* at  $p < 0.05$ . **RESULTS:** Paddling side did not significantly affect the StO<sub>2</sub> (PS = -5.2  $\pm$  15.7%, NPS = -13.5  $\pm$  21.7%,  $p = 0.094$ ) or [THC] (PS = 0.14  $\pm$  0.19, NPS = 0.15  $\pm$  0.21,  $p = 0.425$ ) responses. Treatment side had a significant, moderate (ES = 1.12) effect on the StO<sub>2</sub> response (TREAT = -0.006  $\pm$  16.1%, HEAL = -18.7  $\pm$  17.3%,  $p = 0.008$ ). Treatment side did not significantly affect the [THC] response (TREAT = 0.13  $\pm$  0.20, HEAL = 0.16  $\pm$  0.19,  $p = 0.313$ ). **CONCLUSION:** Based upon the pilot results, it would suggest that the exercising muscles on the breast cancer treatment side may have a residual impaired ability to use oxygen for energy production during maximal intensity exercise.

**3543** Board #364 May 29 2:30 PM - 4:00 PM  
**The Role Of Aerobic Physical Training On Colon Tumor Metabolic Reprogramming**  
 Joao Lucas Penteado Gomes. *University of Sao Paulo, Sao Paulo, Brazil.*  
 Email: joao.gomes@usp.br  
*(No relevant relationships reported)*

**PURPOSE:** Tumor cells are known for marked growth and proliferation, however adequate energy support is required to sustain the growth and proliferation of cancer cells. Therefore, tumors have a large change in energy metabolism, for example, the glycolysis pathway is overactivated. These phenomena are linked to changes in metabolic genes expression, such as microRNA-33a and its gene target SIRT6. On the other hand, aerobic physical training (APT) is known to increase cellular respiration in tissues such as cardiac and skeletal muscle, unlike cancer. APT, also contributes to decreased tumor progression.

**METHODS:** We first evaluated if a longer training time prior colon cancer cell inoculation (CT26) contributes to lower tumor progression, we observed that the time of APT is not a major factor since all cancer trained mice have lower tumor progression compared to the sedentary cancer group (SC). Thus, we proceeded to evaluate two groups: 1) group with cancer and 8-weeks training prior to inoculum (TR8), 2) and SC and 3) Wild type (WT). **RESULTS:** TR8 group presented longer survival ( $p = 0.007$ ), cancer promoted decrease of fat mass (WT-7.3 $\pm$ 0.7; SC-1.4 $\pm$ 0.8; TR8-3.6 $\pm$ 2.8;  $p = 0.01$ )

and increase of liver mass (WT-62 $\pm$ 7.9; SC-91.7 $\pm$ 11.9; TR8-81.5 $\pm$ 11;  $p = 0.01$ ) in sedentary e trained group compared with WT. SIRT6 (SC-100 $\pm$ 12.1; TR8-88.8 $\pm$ 27.9) and the microRNA-33a (SC-100 $\pm$ 42.9; TR8-78.2 $\pm$ 30.6) expression in tumor tissue was not different between the groups. However, we observed differences in HIF1a expression (SC-100 $\pm$ 21.4; TR8-74 $\pm$ 13.4 -  $p = 0.01$ ), which was decreased due to APT, as well as the GLUT1 (SC-100 $\pm$ 32.4; TR8-69.6 $\pm$ 36.2;  $p = 0.07$ ), PDK (SC-100 $\pm$ 20.9; TR8-76.8 $\pm$ 22.6;  $p = 0.05$ ), LDHa (SC-100 $\pm$ 26.2; TR8-65.4 $\pm$ 35.7  $p = 0.03$ ) expression also decreased due to APT. **CONCLUSIONS:** Our results show that APT decreases tumor progression and increases survival. Also, our results suggest that APT plays an important role in metabolic reprogramming. In conclusion, we showed that APT decreases the glycolytic pathway enzymes gene expression that is related to increased proliferation and malignancy of colon cancer.

**3544** Board #365 May 29 2:30 PM - 4:00 PM  
**Combined Aerobic And Strength Exercise Maintains Circulating Fgf-21 In Asian Breast Cancer Patients**  
 Jorming Goh<sup>1</sup>, Lina Lim<sup>1</sup>, Brian Kennedy<sup>1</sup>, Soo Chin Lee<sup>2</sup>.  
<sup>1</sup>National University of Singapore, Singapore, Singapore.  
<sup>2</sup>National University Cancer Institute, Singapore, Singapore.  
 Email: jorming@nus.edu.sg  
*(No relevant relationships reported)*

#### PURPOSE

Combined aerobic and resistance training improves systemic inflammation and muscle mass in breast cancer survivors. However, whether combined exercise modulates novel metabolic hormones and alarmins is unknown. FGF-21 was reported to modulate glucose metabolism in physically active adults, while IL-33, a recently discovered alarmin, is prognostic for breast cancer outcomes. This study aimed to determine the effects of 3 months of combined aerobic and strength exercise on systemic FGF-21, FGF-23, IL-33 and cytokines in Asian breast cancer patients.

#### METHODS

Patients with early stage (I-II) breast cancer underwent curative breast surgery and were randomized into a combined aerobic and strength exercise group (Age: 55.3  $\pm$  9.2 years; BMI: 26.7  $\pm$  3.8; N = 23) or observation group (Age: 49.3  $\pm$  8.7 years; BMI: 24.7  $\pm$  4.6; N = 20) that spanned 3 months. Antecubital blood was collected at baseline, 3 months and 6 months. Serum concentration of cytokines (IL-10, IL-12, IL-33, IFN- $\gamma$ , TNF- $\alpha$ ) and myokines (FGF-21, FGF-23) were quantified using a customized magnetic bead panel (Milliplex®) and read with a Luminex 200™ instrument. Biomarker data were assessed by a 2-way [group (exercise vs. observation) by time (baseline, 3 months, 6 months)] analysis of variance (ANOVA). Data are reported as means  $\pm$  SD, with significance set at  $P < 0.05$ .

#### RESULTS

A significant main effect of intervention was observed for FGF-21 ( $P < 0.01$ ), with patients in the exercise group presenting with higher FGF-21 at 3 months (73.16  $\pm$  54.05 pg/mL vs. 46.47  $\pm$  25.33 pg/mL) and 6 months (66.67  $\pm$  50.03 pg/mL vs. 41.79  $\pm$  33.81 pg/mL), compared with the observation group. A significant main effect of exercise on IFN- $\gamma$  ( $P < 0.05$ ) was observed, with lower serum IFN- $\gamma$  in the exercise group at 3 months (3.85  $\pm$  4.34 pg/mL vs. 5.43  $\pm$  7.28 pg/mL) and 6 months (3.89  $\pm$  4.58 pg/mL vs. 5.32  $\pm$  8.1 pg/mL), compared with controls. No significant differences were observed between groups in other outcome measures.

#### CONCLUSIONS

A 3-month aerobic and strength exercise program preserves serum FGF-21, possibly associated with better glucose control in breast cancer patients. Lower serum IFN- $\gamma$  after exercise training may suggest an attenuated pro-inflammatory response, which may be linked to better immune outcomes.

**3545** Board #366 May 29 2:30 PM - 4:00 PM  
**Acute Inflammation And Hormonal Response To Strength Training In Breast Cancer Survivors: A Preliminary Study**

Sandro N. Chaves<sup>1</sup>, Brenda L. Burtuli Perondi<sup>1</sup>, Filipe Dinato de Lima<sup>1</sup>, Martim Bottaro<sup>1</sup>, Filipe Rodrigues Beltrão<sup>2</sup>, Claudio L. Battaglini, FACSM<sup>3</sup>, Ricardo Jacó Oliveira<sup>1</sup>. <sup>1</sup>Universidade de Brasilia-UnB, Brasilia, Brazil. <sup>2</sup>Integrated College IESGO, Formosa, Brazil. <sup>3</sup>University of North Carolina, Chapel Hill, NC. (Sponsor: Claudio L. Battaglini, FACSM)  
 Email: sandronobrec@gmail.com  
*(No relevant relationships reported)*

There is increasing interest in the use of strength training (ST) exercise in cancer survivors. Aside from the direct beneficial effects on muscle, ST has the potential to chronically attenuate some of the negative alterations commonly seeing in the immunological and hormonal physiology of cancer survivors. However, the acute effects of a high intensity ST session on hormonal and inflammatory responses have not been well documented. **PURPOSE:** To examine the acute hormonal and inflammatory responses of one high intensity traditional ST session in breast cancer survivors (BCS). **METHODS:** Eight BCS (47 $\pm$ 6 years; 67.75 $\pm$ 5.90 kg; 169.5 $\pm$ 6.28cm)

participated in this study. BCS completed one traditional session of ST consisting of 3 sets of 10-12 repetitions to maximal concentric failure with 120 seconds of rest between sets. The exercises included: 1) leg extension, 2) deadlift, 3) leg press, 4) machine bench press, 5) latpull down, and 6) sit ups. Venous blood samples were obtained to assess biomarkers of exercise-induced inflammation (C-reactive protein), and hormonal response (Cortisol, and IGF-1). Measurements were assessed before and immediately after the ST session. Dependent samples t-tests were used to compare pre and post blood biomarkers.

**RESULTS:** No significant changes in C-reactive protein (pre  $2.61 \pm 2.78$ , post  $2.46 \pm 2.99$  mg/L,  $p=0.056$ ), cortisol (pre  $9.55 \pm 3.12$ , post  $7.61 \pm 1.90$   $\mu$ g/dL,  $p=0.062$ ), and IGF-1 (pre  $150.38 \pm 37.913$ , post  $154.88 \pm 40.336$  ng/mL,  $p=0.125$ ) were observed after one session of traditional ST.

**CONCLUSIONS:** Although in healthy people one-time high intensity strength training has been associated with increases on different inflammatory and hormonal biomarkers, our results showed that in BCS one session of ST does not appear to significantly increase C-reactive protein, cortisol or IGF-1 concentration levels. These results may be attributed to the lower absolute force production and physiological stress during the ST session in this population. Furthermore, selective estrogen receptor modulators (SERMs), a class of drugs often used to treat certain types of breast cancer can have a suppressive effect on adrenal corticosteroid release, suggesting disrupted HPA-axis feedback inhibition processes contributing to low cortisol release during exercise.

**3546** Board #367 May 29 2:30 PM - 4:00 PM

### Combined HIT/HIRT Induces Beneficial Molecular Adaptations In BRCA1-mutation Carriers: A Pilot Study

Daniel A. Bizjak, Sebastian VW Schulz, Stephanie Otto, Stefanie H. Andreß, Tim Graf, Uwe A. Schumann, Jürgen M. Steinacker, FACSM. *University Hospital Ulm, Ulm, Germany.*

(No relevant relationships reported)

**PURPOSE:** BRCA gene mutation carriers have a 55-60% higher incidence to develop breast cancer than non-mutation carriers, whereas exercise is able to reduce cancer risk in BRCA competent women. Because of growing evidence that BRCA also plays a pivotal role in the regulation of skeletal muscle metabolism and the response to anti-oxidative stress, we examined the influence of regular exercise in human BRCA gene mutation carriers on BRCA1 gene/protein expression and inflammatory/oxidative response.

**METHODS:** 16 BRCA-mutation carriers without clinical manifestation (13 w, 3 m) were either assigned to an intervention (IG,  $n=10$ ,  $35.5 \pm 10.5$  yrs) or control group (CG,  $n=6$ ,  $46.3 \pm 5.3$  yrs). IG received a six-week long combination of high intensity (interval) strength and endurance training (HIRT/HIT), whereas CG only did low intensity activity. Before (T0) and at the end of the intervention (T1), muscle biopsy, physiological performance, blood withdrawal and anthropometry were determined. Parameters included: muscle BRCA1 gene and protein expression, inflammatory and oxidative stress (i.e. cytokine and malondialdehyde (MDA)), anti-oxidative capacity (i.e. Thiol status, C-reactive protein (CRP)), peak oxygen capacity ( $VO_{2peak}$ ) and 1-repetition maximum (1-RM) at six different training machines. Data were analysed by 1-way ANOVA with repeated measures and t-test to determine statistical significance and effect size (ES).

**RESULTS:**  $VO_{2peak}$  ( $p=0.001$ ) and 1-RM ( $p_{mean}=0.007$ ) of IG were increased at T1 compared to T0, whereas CG performance parameters remained unchanged. BRCA1 protein concentration increased in IG from  $46.32 \pm 18.78$  to  $64.83 \pm 22.53$  pg/ml ( $p<0.001$ ) with small ES as well as anti-oxidative capacity (CRP  $p=0.05$ ; Thiol  $p=0.009$ ) with medium ES, whereas gene expression was unaltered. IG inflammatory and oxidative damage reflected by cytokine and MDA formation, respectively, did not differ between time points. CG physiological and molecular parameters remained unchanged during the intervention.

**CONCLUSIONS:** Combined HIRT/HIT training increases the performance of BRCA-mutation carriers with positive influence on BRCA1 protein expression as well as anti-oxidative status without increased inflammatory response and thus might be a prospective prevention method to reduce long-term cancer risk.

**3547** Board #368 May 29 2:30 PM - 4:00 PM

### Association Between Systemic Inflammation And Skeletal Muscle Mass Following Exercise In Breast Cancer Survivors

Kaylie Zapanta<sup>1</sup>, Kyuwan Lee<sup>2</sup>, Nathalie Sami<sup>3</sup>, Christina Dieli-Conwright, FACSM<sup>4</sup>. <sup>1</sup>University of Southern Ca, Los Angeles, CA. <sup>2</sup>Children's Hospital Los Angeles, Los Angeles, CA. <sup>3</sup>University of Southern California, Los Angeles, CA. <sup>4</sup>City of Hope Comprehensive Cancer Center, Duarte, CA. (Sponsor: Christina Dieli-Conwright, FACSM)

Email: kzapanta@usc.edu

(No relevant relationships reported)

**INTRODUCTION:** Reductions in skeletal muscle mass contribute to reduced physical function and poorer prognosis among breast cancer survivors (BCS). Elevated pro-inflammatory markers stimulate catabolic pathways in skeletal muscle, and have been associated with muscle loss in overweight individuals and older adults. This evidence suggests that elevated pro-inflammatory markers such as IL-6, TNF-alpha, and C-reactive protein (CRP) may explain subsequent muscle loss in BCS. While we previously found exercise reduces inflammation and increases skeletal muscle mass in overweight or obese BCS, an associative investigation is warranted. **PURPOSE:** The purpose of this secondary analysis was to determine whether associations between post-exercise inflammatory markers and skeletal muscle mass exist among overweight/obese BCS. **METHODS:** Sedentary, overweight/obese BCS ( $BMI \geq 25$  kg/m<sup>2</sup>; Stages I-III) were randomized to exercise (EX;  $n=50$ ) and control (CON;  $n=50$ ) groups. EX participated in a supervised 16-week moderate-vigorous intensity aerobic and resistance exercise intervention. CON was asked to maintain current levels of activity. Appendicular Skeletal Muscle Index (ASMI), calculated as  $\sum$ extremity lean mass (kg)/height (m<sup>2</sup>), was obtained from a whole-body scan using Dual Energy X-Ray Absorptiometry. CRP, IL-6, and TNF- $\alpha$  were measured using enzyme-linked immunosorbent assays from fasting blood samples. Pearson's correlations assessed associations between post-exercise ASMI and inflammatory biomarkers. **RESULTS:** On average, BCS were  $53.5 \pm 10.4$  years old, postmenopausal (60%), and Hispanic (55%) with a BMI of  $33.5 \pm 5.5$  kg/m<sup>2</sup>. Post-intervention, EX experienced an increase in ASMI (8.3%;  $p=0.001$ ), and reductions in CRP (-47.8%;  $p=0.001$ ) IL-6 (-73.6%;  $p=0.001$ ) and TNF- $\alpha$  (-25.1%;  $p=0.001$ ). No significant changes were seen in CON ( $p>0.01$ ). There were significant correlations between ASMI and IL-6 ( $r=-0.78$ ;  $p=0.02$ ), CRP ( $r=-0.91$ ;  $p=0.01$ ), and TNF-alpha ( $r=-0.82$ ;  $p=0.03$ ). **CONCLUSIONS:** This secondary analysis provides preliminary evidence to support the relation between changes in skeletal muscle mass and inflammation among BCS, and supports the implementation of exercise to maintain muscle mass during survivorship.

**3548** Board #369 May 29 2:30 PM - 4:00 PM

### Physical Fitness As A Determinant Of Leukemia Cell Biology In Treatment-Naïve Chronic Lymphocytic Leukemia (CLL)

David B. Bartlett<sup>1</sup>, Andrea Sitlinger<sup>1</sup>, Michael Deal<sup>1</sup>, Margery A. Connelly<sup>2</sup>, Tiffany Stewart<sup>1</sup>, Eross Guadalupe<sup>1</sup>, Grace MacDonald<sup>1</sup>, William E. Kraus, FACSM<sup>1</sup>, J Brice Weinberg<sup>1</sup>, Danielle B. Brander<sup>1</sup>. <sup>1</sup>Duke University, Durham, NC.

<sup>2</sup>LipoScience, Morrisville, NC. (Sponsor: William E. Kraus, FACSM)

Email: david.bartlett@duke.edu

(No relevant relationships reported)

**PURPOSE:** Chronic lymphocytic leukemia (CLL) is the most common leukemia in older adults. CLL patients are at an increased risk of frailty, secondary malignancies, and infectious diseases. The aim of this study was to determine the role of physical fitness and function on biological mediators of tumor control and progression. **METHODS:** We collected blood from sixty two ( $68 \pm 11$  yrs.) men and women with treatment naïve CLL [CLL-IPI: median 1.5 (range: 0-7)] and were asked to complete a comprehensive battery of physical fitness and functional tests. The 10 most fit (FIT: estimated  $VO_{2peak}$   $34 \pm 3$  mL/kg/min) and 10 least fit (UNFIT:  $25 \pm 3$  mL/kg/min) adults were matched on age and gender. We completed immunophenotyping of blood leukocytes, NMR-spectroscopy of lipoprotein particles, and sequencing of exosomal micro-RNA (miRNA). The human CLL-like OSU-CLL cell line was co-cultured with autologous plasma and assessed for cell growth and death. **RESULTS:** The FIT group had 6% fewer CD4+ ( $p=0.019$ ) and 4% fewer CD8+ ( $p=0.015$ ) T-cells than the UNFIT group. The FIT group had 15% fewer NKG2A+ NK-cells ( $p=0.032$ ), and 10% more cytotoxic NKG2A-/KIR+ NK-cells capable of recognizing HLA+ tumor cells. The FIT group had 63% lower concentrations of triglycerides ( $p=0.025$ ), and 250% fewer large triglyceride rich lipoproteins ( $p=0.011$ ), and 20% more HDL cholesterol ( $p=0.04$ ), with no differences for LDL cholesterol. Greater concentrations of triglycerides and large lipoproteins were associated with increased OSU-CLL cell counts ( $r=0.497$ ,  $p=0.03$ ) and less OSU-CLL cell death ( $r=-0.632$ ,  $p=0.003$ ). A total of 32 miRNA signatures were significantly different between FIT and UNFIT groups (all  $p<0.05$ ). Of these, 7 distinct miRNAs were positively

correlated with OSU-CLL tumor cell growth (e.g. miR-451a:  $r=0.606$ ,  $p<0.001$ ), and 6 miRNAs negatively correlated with OSU-CLL tumor cell growth (e.g. miR-24:  $r=-0.669$ ,  $p=0.002$ ).

**CONCLUSIONS:** Physical fitness in CLL patients appears to beneficially modify T-cells and NK-cells, plasma lipoproteins and exosomal miRNAs. Certain lipoproteins and miRNAs are associated with tumor cell growth and death. Further studies will hope to define the possible beneficial effects of exercise training for CLL patients.

*Supported by Internal Duke Funds*